22AGX03 - HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To Apply ergonomic principles to evaluate and improve agricultural practices, focusing on human metabolism, energy expenditure, and physical function to optimize work efficiency and reduce fatigue. • To Design ergonomic solutions and safety measures tailored to agricultural tools and equipment, ensuring better alignment with human physical capabilities and enhancing overall safety and productivity.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the anthropometric data to design and modify agricultural tools and equipment, ensuring they fit the physical dimensions of users and improve comfort and efficiency.	An	20%
CO2	Develop and Implement safety protocols and safety gadgets for agricultural machinery and operations, in accordance with regulations and best practices, to minimize risk and enhance worker safety.	Ap	20%
CO3	Evaluate the impact of physiological functions, including muscle structure and function, on work efficiency and ergonomics, taking into account age and individual differences.	E	20%
CO4	Apply ergonomic concepts to analyze and improve human workload management in agricultural tasks, considering factors such as energy expenditure and physiological stress.	An	20%
CO5	Develop the ergonomic interventions for specific agricultural operations, such as spraying and weeding, to optimize body movements, strength, and endurance, while ensuring speed and accuracy.	Ap	20%

UNIT I- ERGONOMICS	(9)
Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metabolism- energy requirements at work - acceptable work load.	
UNIT II - PHYSIOLOGICAL FUNCTION	(9)
Human Skeletal system - muscle - structure and function - Physiological stress - Efficiency of work -Physical functions - Age and individual differences in physical functions- Physiological and operational criteria of physical activity.	
UNIT III - ENERGY EXPENDITURE	(9)
Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of Spraying Weeding operations - Movements of body members- Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time.	

UNIT IV - ANTHROPOMETRY	(9)
Anthropometry - introduction - Types of data - Principles of applied anthrophometry - concept of percentile - Normal distribution - Estimating the range - Minimum and Maximum dimensions- Cost benefit analysis - applications of anthropometric data- Anthropometric consideration in tool - equipment design.	
UNIT V – HUMAN SAFETY	(9)
Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Sanders,M.S. and McComack,EJ. Human factors in Engineering and Des ign. Tata McGraw Hill, New York, 1992
2. Obome, David.J. Engieering Work. John Wiley and Sons Ltd., 1982

REFERENCES:

1. Astand, P.P. and Rodaid,K. Text book of Work Physiology, McGraw Hill Book Company,New York, 1970
2. Grandjean,E. Fitting the Track of the Man, Taylor and France Ltd., U.K.,1981

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2							2					3	
2			3					2						
3				3									3	
4		3					2							3
5			2		3									3
CO (W.A)	2	3	3	3	3		2	2					3	3

22AGX04 - DESIGN OF AGRICULTURAL MACHINERY (Use of the PSG Design Data Book is permitted in the examination)				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To learn design considerations and their applications in agricultural • To understand the standards and procedures for design of agricultural machinery components. • To analyze factor affecting of gears and bearing • To Recognize the standards and procedures for design of power transmission system • To understand the standards and procedures for design of agricultural machinery

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design and drawing of basic machine components.	Ap	20%
CO2	Examine the design considerations of Agricultural machinery components.	Ap	20%
CO3	Analyze the factors affecting design and construction of gears and bearings.	An	20%
CO4	Illustrate various machine components through drawings.	An	20%
CO5	Engage in independent study to select components for agricultural machinery applications	An	20%

UNIT I STRESSES IN MACHINE MEMBERS	**(6+3)**
Introduction to design process- factor influencing the machine design, selection of material based on mechanical properties- Direct, bending and torsional stress equations- calculation of Principal stresses for combined loading. Design thinking.	
UNIT II DESIGN OF POWER TRANSMISSION SYSTEMS	**(6+3)**
Selection of V-Belts and pulleys- selection of flat belts and pulleys- selection of transmission chains and sprockets. Design of pulleys and sprockets.	
UNIT III DESIGN OF SHAFTS AND COUPLINGS	**(6+3)**
Design of solid and hollow shafts based on strength and rigidity- Design of keys, keyways - Design of rigid and flexible couplings. -Design of knuckle joints.	
UNIT IV DESIGN OF GEARS	**(6+3)**
Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth.- Applications of different types of Gears	
UNIT V DESIGN OF BEARINGS	**(6+3)**
Bearing -Types of bearings – sliding contact and rolling contact types. – Bearing selection based on application - Lubrication in journal bearings – calculation of bearing dimensions.	
TOTAL (L:30 T :15) = 45 PERIODS	

TEXT BOOKS:

1. Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house,2020.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2017.

REFERENCES:

1. Norton R.L, Machine Design – An Integrated Approach, Pearson Publications, 6 th Edition, 2021.
2. Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.
3. Gary Krutz, Lester Thompson and Paul Clear., "Design of Agricultural Machinery", John Wiley and Sons, New York, 1984.
4. Handbook of Design Thinking: Tips & Tools for How to Design Thinking by Christian Mueller-Roterberg,2018.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2			3											
3		3											3	
4				3										
5									2					3
CO (W.A)	3	3	3	3					2				3	3

22AGX06 - PRECISION FARMING EQUIPMENT

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Analyze the integration of electronics in precision agriculture, including the use of GIS and GPS systems, to enhance farm machinery and equipment efficiency. • Evaluate the application and performance of sensors, microcontrollers, and actuators in precision farming to optimize site-specific management practices.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate the functionality and application of various sensors, microcontrollers like Arduino and Raspberry Pi, and actuators in agricultural practices.	Ap	20%
CO2	Apply the principles of precision agriculture and the tools required for its implementation, including GIS and GPS systems, to improve farm operations.	Ap	20%
CO3	Assess site-specific management techniques for nutrient, weed, and agro-chemical management, incorporating data analysis and decision-making processes.	E	20%
CO4	Evaluate the use of unmanned vehicles, including drones and IoT applications, in agriculture for tasks such as crop yield estimation, pest identification, pesticide spraying, and environmental monitoring.	E	20%
CO5	Investigate precision farming concepts, including map-based and real-time systems, and their application in site-specific management and precision tillage, planting, and harvesting.	An	20%

UNIT I- ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING	(9)
Electronics in precision agriculture- Basics of precision agriculture - tools for implementation of precision agriculture. Introduction of GIS/GPS positioning system for precision farming. Use of GIS and GPS in farm machinery and equipment.	
UNIT II - SENSORS, MICROCONTROLLER AND ACTUATOR FOR PRECISION AGRICULTURE	(9)
Types of sensors- principle and concept of different sensor like ultrasonic, proximity, PIR, IR, radar, pressure, gas, temperature, moisture, strain /weight, colour sensor etc. used in agriculture. Microcontroller: Arduino, Raspberry Pi and PLC Actuator: DC Motor, Pump, linear Actuator etc. - Basic input circuits and signal conditioning systems - amplifiers and filters.	
UNIT III - PRECISIONFARMING CONCEPTS AND PRECISION FARMING MACHINERY	(9)
Precision farming concepts-Map based system- Real time system - Combination Map and real time system - components of PF - Site specific management- Constraints of PF-Precision tillage, planting, intercultural, plant protection and harvesting equipment, laser guided leveller, power sprayer, straw chopper cum spreader, straw bailer, combine harvester.	

UNIT IV - SITE-SPECIFIC MANAGEMENTSYSTEM	(9)
Site-specific nutrient management- weeds management- Agro-chemicals and fertilizer management, data sources and decision making for site-specific management. Grain quality and yield. Yield monitoring and mapping, soil sampling and analysis.	
UNIT V – UNMANNED VEHICLES AND IOT IN AGRICULTURE UAV	(9)
Drones- Types - applications - rules and regulations - Autonomous ground vehicles - Robotic platforms and unmanned agricultural vehicles- IoT - crop yield estimates-threat identification- crop insurance-pesticides spraying, environmental monitoring- protected cultivation- food quality monitoring.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Krishna, K. R. Push Button Agriculture Robotics, Drones, Satellite-Guided Soil and Crop Management. Apple Academic Press. 2016
2. Kepner, R.A., Bainer, R. and Berger, E.L. Principles of Farm Machinery.AVI Publ. 1978.

REFERENCES:

1. Brase, T.A. Precision Agriculture. Thomson Delmar Learning, New York.2006 Total: 45 Hours
2. Hermann, J.H. Precision in Crop Farming, Site Specific Concepts and Sensing Methods: Applications and Results. Springer, Netherlands.2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2		3										3
3		2	2										3	
4	2												3	
5				3	2							2		3
CO (W.A)	3	2	2	3	2							2	3	3

22AGX08 - TRACTOR AND AUTOMOTIVE ENGINES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Understand the basic principles of IC Engines and Learn the differences between two-stroke and four-stroke engines • Understand the working and purpose of cooling system and lubrication system Transmission system in tractor engines. • Able to know the implements used in tractors and learn skill on structure of tractors

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge on IC engines, cooling and lubrication systems and Learn about different types of fuel systems	Ap	20%
CO2	Identify and explain the functions of various engine components, such as pistons, cylinders, crankshafts, camshafts, valves, fuel systems, and lubrication systems.	An	20%
CO3	Analyze engine performance parameters, including power, torque, efficiency, and fuel consumption and Understand factors affecting engine performance and methods to enhance efficiency..	Ap	20%
CO4	Select emission control technologies and regulations for reducing pollutants from engines for environment safety	Ap	20%
CO5	Develop troubleshooting skills to identify and resolve common engine problems also Understand the safety protocols and practices required when working with engines and related machinery.	Ap	20%

UNIT I- SOURCES OF FARM POWER AND ENGINE SYSTEM	**(9)**
Sources of farm power - conventional and non - conventional energy sources; principles of IC engine - CI and SI; engine - functional components and their construction, comparison, measurement of indicated horse power - theoretical and numerical method; valve mechanism valve timing diagram and valve clearance adjustment, air cleaning system; turbocharger; supercharger; emission characteristics of IC engine, biofuels in IC engine, modern trends in engine design.	
UNIT II - COOLING, LUBIRCATION, FUEL SUPPLY AND ELECTRICAL SYSTEM	**(9)**
Engine cooling system - pressurized cooling; anti - freeze solutions; lubrication system - types of lubricants and systems, fluid film theory and boundary layer theory, working principle; fuel supply system - fuels, properties of fuels, calculation of air - fuel ratio and calorific value; fuel test for SI and CI engines, detonation and knocking; carburetion system; fuel injection system; fuel injector nozzles; engine; ignition system of SI engines; electrical system	

UNIT III - TRANSMISSION SYSTEM	(9)
Clutch - construction and principle of operation; gear box - gearing theory, functional requirements and calculation for speed ratio; planetary gear system, torque converter; differential system; final drive and wheels; brake system; steering system, front axle and wheel alignment, ackerman steeringgeometry.	
UNIT IV - HYDRAULIC SYSTEMS AND TRACTOR MECHANICS	**(9)**
Hydraulic system - automatic draft and position control; tractor power outlets - PTO, PTO standards; wheels and tyres - construction and tyre specifications; tractor mechanics - forces acting on the tractor in static and dynamic mode; determination of CG of a tractor and moment of inertia of a tractor; tractor static equilibrium, tractor stability especially at turns.	
UNIT V – POWER TILLER AND TRACTOR TESTING	**(9)**
Power tiller - types, application, functional components and attachments; types of tests - test procedure - need for testing and evaluation of farm tractor and power tiller; test code for performance testing of tractors and power tillers - RNAM, BIS, etc	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.

2.Domkundwar A.V. A course in internal combustion engines. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi,1999.

REFERENCES:

1. Jain SC and CR Rai. Farm Tractor Maintenance and Repair, standard publishers,1999.

2.Liljedahl J B and Others. Tractors and Their Power Units., CBS Publisher, New Delhi,1997.

3. Michal AM and Ojha TP. Vol I. Principles of Agricultural Engineering. Jain Brothers, New Delhi,1996.

4.Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											2	3	
2	2											2	3	
3		3												3
4						3	2							
5	2													3
CO (W.A)	2.3	3				3	2					2	3	3

22AGX13 - SOLAR ENERGY ENGINEERING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To impart the basics of solar energy harnessing through thermal and photovoltaic systems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate solar angles and time	Ap	20%
CO2	Test the efficiency of solar focusing and non-focusing collectors	An	20%
CO3	Analyze the solar thermal energy conversion technologies	An	20%
CO4	Review different PV technologies available in the market	An	20%
CO5	Design solar photovoltaic systems	C	20%

UNIT I- BASICS OF SOLAR ENERGY	(9)
Thermal Radiation Fundamentals - Black-Body Radiation - Intensity of Radiation and Shape Factor - Sun–Earth Geometric Relationship - Solar Time and Angles - Extraterrestrial Solar Radiation - Instruments for Measuring Solar Radiation and Sunshine	
UNIT II –SOLAR THERMAL SYSTEMS AND NON – FOCUSSING COLLECTORS	(9)
Radiative Properties and Characteristics of Materials - Selective Surfaces - Reflecting Surfaces - Transparent Materials - Solar Water and air Heating Systems - Flat-Plate Collectors - Liquid-Type Collectors - Air-Type Collectors - Evacuated-Tube Collectors - Solar space heating and Cooling	
UNIT III –FOCUSSING COLLECTORS	(9)
Concentrating Solar Collectors - Thermodynamic Limits to Concentration - Concentrator Types - Fixed Concentrators - Parabolic Trough Concentrator - Paraboloidal Concentrators - Spherical Concentrators - Compound Parabolic Concentrator - Central Receiver Collector	
UNIT IV –FUNDAMENTALS OF SOLAR PV	(9)
Solar Cell and its function - Solar PV technologies - Solar Cell Parameters - Efficiency of Solar Cell - Solar PV Module - Connection of PV Module in Series and Parallel - Estimation and Measurement of PV Module Power – Types of solar cells	
UNIT V –SOLAR PV POWER GENERATION AND DESIGN	(9)
Types of Solar PV System, Design methodology for SPV system, Design of Grid connected PV systems, Case studies of SPV and Off grid Solar PV Systems	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Goswami, D. Yogi. Principles of solar engineering. CRC press, 2022.
2. S P Sukhatme and J K Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.
3. C S Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India, 2nd Edition, 2011.

REFERENCES:

1. G N Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2. K.R.Gopalakrishna., "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2			3											
3		3											3	
4				3										
5			3									2	3	
CO (W.A)	3	3	3	3								2	3	

22AGX14 - WIND ENERGY ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To explain the basic theory and principles involved in wind energy, wind turbine siting, installation and environmental aspects • To describe the types of wind turbine and estimation of power from wind and the electrical aspects of wind turbine			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate the power available in wind	Ap	20%
CO2	Illustrate the working principle of wind turbine blades	An	20%
CO3	Assess the wind power generation potential of different sites	An	20%
CO4	Design wind power systems	C	20%
CO5	Analyze the environmental aspects of wind turbine installation	An	20%

UNIT I- BASICS OF WIND ENERGY	**(9)**
Need, importance and scope of Wind Energy resources - History of Wind Energy - Sources and potentials - Wind Characteristics - Wind Data Analysis - Wind Prediction and Forecasting - Wind Measurement and Instrumentation.	
UNIT II –TYPES OF WIND TURBINE SYSTEMS AND POWER ESTIMATION	**(9)**
Wind turbine types and their construction - Drag and lift - principle of rotation of the wind turbine rotor - horizontal and vertical axis windmills - Wind Turbine Energy Production – Betz Coefficient	
UNIT III – AERODYNAMICS OF WIND TURBINES	**(9)**
Aerodynamics of Wind Turbines - Aerodynamics of Airfoils - Blade Design - Blade Element Theory - Wind Turbine Loads	
UNIT IV – ELECTRICAL ASPECTS AND STANDARDS	**(9)**
Electrical Aspects of Wind Turbines - Basic Concepts of Electrical Power - Electrical Machines Methods of Generating Synchronous Power - Induction Machine - Asynchronous Electrical generators - Permanent magnet generators - AC generators - self-excitation- Wind Turbine Standards, Technical Specifications	
UNIT V – INSTALLATION AND ENVIRONMENTAL ASPECTS	**(9)**
Wind Turbine Siting - Installation and Operation Issues - Wind Farms - Wind Energy Applications - Hybrid Power Systems - Environmental Aspects and Impacts - Wind Turbine Noise	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. J. F. Manwell, J.G. McGowan, A.L. Rogers, Wind Energy Explained, Theory, Design and Application, Wiley, 2012.

2. Gary Johnson, L., 2006. Wind Energy Systems, John Wisley& Sons Ltd, USA.

REFERENCES:

1. Tony Burt, Nick Jenkins, David Sharpe and Ervin Bossanyi, Wind Energy Handbook, John Wiley & Sons Ltd, 2011. Second Edn.

2. Sathyajith Mathew. 2006. Wind energy: fundamental, resources analysis and economics. Springer Berlin Heidelberg, The Netherlands. ISBN: 139783540309055.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3				2										
4			3										3	
5		3					2							
CO(W.A)	3	3	3	2			2						3	

22AGX15 - ALTERNATE ENERGY SOURCES

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To understand the basic theory and principles, involved in solar power generation, types of wind turbine and estimation of power from wind, geothermal, OTEC power generation, MHD systems and fuel cells.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate solar angles and time	Ap	20%
CO2	Estimate the power available in wind	Ap	20%
CO3	Assess the working principle of geothermal, OTEC, MHD and fuel cell systems	An	20%
CO4	Analyze the growth of renewable energy and the challenge of its integration	An	20%
CO5	Assess the challenges of transportation storage and use of hydrogen compared to other fuels	An	20%

UNIT I- ENERGY SOURCES	**(9)**
Major sources of energy - Renewable and Non-renewable - Primary and Secondary energy sources - Energy scenario - Need of alternate energy sources.	
UNIT II – SOLAR ENERGY	**(9)**
Solar radiations at earth's surface - solar radiation geometry – declination - hour angle - altitude angle - incident angle - zenith angle - solar azimuth angle - principle of conversion of solar energy into heat and electricity - applications	
UNIT III – WIND ENERGY	**(9)**
Wind power - wind power formulation - power coefficient - maximum power - principle of wind energy conversion - considerations in selecting a site for wind mills - advantages - limitations – classification – working – comparison - applications	
UNIT IV – GEOTHERMAL AND OTEC ENERGY	**(9)**
Geothermal energy - dry rock - wet rock - geo thermal power plant – function - principal parts – types of geothermal power systems – limitations – OTEC – Tidal and wave energy	
UNIT V –MAGNETO HYDRO DYNAMIC SYSTEMS AND FUEL CELLS	**(9)**
magneto hydro dynamic –principle - common gases – MHD power plant - components - limitations – applications – Fuel cells – types - Advantages - limitations – applications – Hydrogen production – types – applications	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Non conventional Energy sources - G.D.Rai. 2014
2. S P Sukhatme and J K Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.

REFERENCES:

1. Non conventional Energy sources – B. H. Khan. 2014

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3				2										
4		3											3	
5		3												
CO(W.A)	3	3		2									3	

22AGX23 - IRRIGATION WATER QUALITY AND WASTE WATER MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To equip students with a comprehensive understanding of water quality principles, including the physical and chemical properties of water, the impact of pollutants, and the methods for assessing, managing, and improving water quality for various uses, particularly in irrigation, pollution control, recycling, and reuse, ensuring sustainable water resource management.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply appropriate sampling and data collection methods to conduct comprehensive water quality investigations and utilize field kits and software packages for accurate analysis and inference.	Ap	20%
CO2	Analyze the physical and chemical properties of water to determine its suitability for various applications, including drinking, irrigation, and industrial uses.	An	20%
CO3	Evaluate the impact of organic and inorganic pollutants on water resources and develop strategies for pollution control and water treatment using advanced technologies.	An	20%
CO4	Assess and implement water recycling and reuse techniques in agricultural and industrial contexts, incorporating low-cost treatment technologies and modern methods to promote sustainable water management practices.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the water quality parameters by field sample analysis of the allotted area.	An	Internal Assessment

UNIT I - WATER QUALITY	(9)
Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers - Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages	
UNIT II - IRRIGATION WATER QUALITY	**(9)**
Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies	
UNIT III - WATER POLLUTION	**(9)**
Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.	
UNIT IV - RECYCLING AND REUSE OF WATER	**(9)**
Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation	
UNIT V - WATER QUALITY MANAGEMENT	**(9)**

Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Vladimir Novonty, Water Quality: Diffuse pollution and watershed Management, 2nd edition, John Wiley & Sons, , 2003
2. Mackenzie L Davis, David A Cornwell, Introduction to Environmental Engineering, McGraw-Hill 2006.

REFERENCES:

1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, 2002.
2. Stum, M and Morgan, A., Aquatic Chemistry, Plenum Publishing company, USA, 1985.
3. Lloyd, J.W. and Heathcote, J.A., Natural inorganic chemistry in relation to groundwater resources, Oxford University Press, Oxford, 1988.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3									3
2		3											3	
3	3		3											3
4					3									3
5									3	3				
CO (W.A)	3	3	3		3				3	3			3	3

22AGX24 - WATERSHED PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To enhance the awareness about watershed planning and management • To acquire knowledge about watershed management. • To practice the water budgeting and dry farming techniques. • To learn about integrated watershed management. • To study the watershed development programmes.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the watershed characteristics for their classification and prioritization.	Ap	20%
CO2	Execute the watershed planning activities based on the inventory and scope.	An	20%
CO3	Find the needs, methods and implementation strategies of watershed management projects	An	20%
CO4	Assess the watershed responses for suggesting suitable control measures	Ap	20%
CO5	Organize the selection of hydrologic models for watershed management	Ap	20%

UNIT I –INTRODUCTION	**(9)**
Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.	
UNIT II –WATERSHED MANAGEMENT	**(9)**
Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index.	
UNIT III – WATER BUDGETING	**(9)**
Water budgeting in a watershed. Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques- inter-terrace and inter-bund land management.	
UNIT IV – INTEGRATED WATERSHED MANAGEMENT	**(9)**
Integrated watershed management - concept, components, arable lands - agricultureand horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology.	

UNIT V – WATERSHED DEVELOPMENT PROGRAMMES	(9)
Watershed programme - execution, follow-up practices, maintenance, monitoring, and evaluation. Participatory watershed management - the role of watershed associations, user groups, and self-help groups. Planning and formulation of a project proposal for watershed management programme including a cost-benefit analysis.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi. .
2. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K.Mishra. 1995. Field Manual on Watershed Management. CRIDA,Hyderabad.

REFERENCES:

1. Singh, G.D., and T.C. Poonia. 2003. Fundamentals of Watershed ManagementTechnology. Yash Publishing House, Bikaner. .
2. Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi. .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2												2	
3			3										3	
4				2				1				1	3	
5													3	
CO (W.A)	2.5	3	3	2				1				1	3	

22AGX25 - GROUNDWATER WELLS AND PUMPS

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To provide students with an understanding of the principles of groundwater and its behavior. • To introduce the methods and technologies used in groundwater exploration, development, and management. • To familiarize students with the design and installation of wells and pumping systems. • To learn about groundwater quality. • To study the sustainable groundwater management.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the Identify the sources and availability of groundwater in a given area.	Ap	20%
CO2	Design and construct wells for accessing groundwater.	An	20%
CO3	Evaluate Assess the Select and operate pumps for groundwater extraction.	Ap	20%
CO4	Find the water quality of groundwater resources.	Ap	20%
CO5	Find sustainable management practices for groundwater resources.	Ap	20%

UNIT I –INTRODUCTION TO GROUNDWATER RESOURCES	**(9)**
Sources and availability of groundwater, groundwater exploration methods, hydrologic cycle and water budget, water quality parameters and their significance, water scarcity issues and solutions.	
UNIT II –WELLS	**(9)**
Types of wells, design principles and construction methods, logging and interpretation, well development, well rehabilitation, wellhead protection, well maintenance and troubleshooting.	
UNIT III – PUMPS	**(9)**
Types of pumps and their selection criteria, operating characteristics and performance evaluation, pump installation and operation, energy efficiency of pumps, pump maintenance and troubleshooting.	

UNIT IV –GROUNDWATER QUALITY	(9)
Parameters affecting water quality, water quality standards and guidelines, water quality testing methods, interpretation of water quality data, water treatment options, safe use and disposal of water.	
UNIT V – SUSTAINABLE GROUNDWATER MANAGEMENT	**(9)**
Groundwater management principles, groundwater monitoring and modeling, groundwater recharge techniques, conjunctive use of surface and groundwater resources, integrated water resources management, policies and regulations for sustainable groundwater management.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007 . .
2. Bhagu R. Chahar, Groundwater Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017

REFERENCES:

1. Subramanya K, Fluid Mechanics and Hydraulic Machines: Problems and Solutions, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2018. .
2. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014 .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2													
3			3											
4				3								1	3	
5													3	
CO (W.A)	**2.5**	**3**	**3**	**3**								**1**	**3**	

22AGX26 - WATER HARVESTING

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To enhance the awareness about water resources management and conservation. • To acquire knowledge about water harvesting techniques and their implementation. • To practice the design aspects of sustainable rainwater harvesting solutions for communities. • To learn about construction of flood water and groundwater harvesting. • To study the design aspects of water harvesting systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the basic concepts of water conservation and water harvesting based on watershed.	Ap	20%
CO2	Implement the methods of water harvesting and their design criteria based on the hydrogeology.	Ap	20%
CO3	Analyze various flood water and groundwater harvesting techniques..	An	20%
CO4	Find the suitable soil erosion control structures with their design criteria based on the flow hydraulics.	Ap	20%
CO5	Assess various water storage structures with detailed design criteria.	Ap	20%

UNIT I –WATER RESOURCES AND CONSERVATION CHALLENGES	**(9)**
Global water distribution – primary and secondary sources of water – technical social and cultural aspects; Global challenges in water and climate – water scarcity – water pollution – Indian scenario; Watershed – water resources management – public participation – integrated approach; Water governance – water sharing plans – policy, schemes and concerns.	
UNIT II –WATER HARVESTING CONCEPTS	**(9)**
Earthen embankments - functions - advantages and disadvantages -classification - hydraulic fill and rolled fill dams - basic design concepts - site selection - foundation requirements - grouting -harvesting principles - components - catchment and reservoir yield.	
UNIT III – WATER HARVESTING TECHNIQUES	**(9)**
Water harvesting principles for rural and urban – classification based on source, storage and use; Short-term and micro-level harvesting techniques for runoff – terracing and bunding – rock and ground catchments; Long-term and macro-level harvesting techniques for runoff – farm ponds.	

UNIT IV –FLOOD WATER AND GROUNDWATER HARVESTING	(9)
Floods – causes of urban floods and droughts – characteristics of water spread – impacts; Flood water harvesting – permeable rock dams – water spreading bunds – flood control reservoir; Groundwater harvesting – aquifer characteristics – subsurface techniques – infiltration wells – recharge wells – groundwater dams.	
UNIT V – DESIGN ASPECTS OF WATER HARVESTING SYSTEMS	**(9)**
Estimation of water quantity – selection of runoff coefficients – computation of rainwater runoff volume – hydrograph analysis; Design of drainage system – types – design criteria – filter design – causes of failures; Design of storage structures - storage capacity.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Theib YO, Dieter P, Ahmed YH, Rainwater Harvesting for Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012 . .
2. Lancaster, Brad. Rainwater Harvesting for Drylands and Beyond, Volume 1, 3 rd edition, Rain source Press. 2019

REFERENCES:

1. Das M, Open Channel Flow, Prentice Hall of India Pvt. Ltd., New Delhi, 2008 .
2. Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012.
3. Michael AM, Ojha TP, Principles of Agricultural Engineering, Volume II, 4th Edition, Jain Brothers, New Delhi, 2003 .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2														
3			3											
4				3				1				1		
5													3	
CO (W.A)	3	3	3	3				1				1	3	

22AGX32 - STORAGE AND PACKAGING TECHNOLOGY

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:

- To gain knowledge on different storage methods and understand the storage losses and types of spoilage.
- To discuss the functions, types and applications of different packaging materials

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Assess the importance of various storage systems	An	20%
CO2	Analyze food losses occurred during the storage	An	20%
CO3	Apply different control measures to prevent food spoilage	Ap	20%
CO4	Analyze novel food packaging technique and innovation in food packaging	An	20%
CO5	Propose a suitable packaging methodology depending on the requirement of the consumer	C	20%

UNIT I - SPOILAGE AND STORAGE LOSSES	**(9)**
Factors affecting shelf of food material during storage, spoilage mechanism during storage – intrinsic and extrinsic factors causing spoilage, infestation – Control measures	
UNIT II - STORAGE METHODS	**(9)**
Traditional, Improved and modern storage structures for food materials -temperature and moisture changes in storage structures	
UNIT III –BASICS OF PACKAGING MATERIALS	**(9)**
Definition, requirement, importance and scope of packaging of foods, types and classification of packaging system, advantage of modern packaging system	
UNIT IV –FORMS OF PACKAGING MATERIALS	**(9)**
Different forms of packaging, metal container, glass container,plastic container,flexible films,shrink packaging,vacuum & gas packaging, advanced packaging systems	
UNIT V - SELECTION OF PACKAGING TECHNIQUES	**(9)**
Packaging requirement & their selection for the raw & processed foods – Meat, Fish and seafoods, fruits and vegetables, milk	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=28
2. D.W.Hall 1990. Handling and Storage of Food grains in tropical and sub tro[pical areas. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Richard Coles, Derek Mcdowell and Mark J. Kirwan. 2003. Food Packaging Technology, CRC press, London. 2nd Edn
4. GordenL.Roberttson. 2006. Food Packaging-Principles and Practices. CRC

REFERENCES:

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi
3. Chakaraverty, A. 2000. Third edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co. Pvt. Ltd. New Delhi.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1				2										
2				2										
3	3													
4		3										2		3
5			3									2		3
CO (W.A)	3	3	3	2								2		3

22AGX37 - FOOD QUALITY AND SAFETY

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Apply quality assessment techniques to evaluate various food materials, including fruits, vegetables, cereals, legumes, dairy products, meat, poultry, eggs, and processed foods, ensuring that quality attributes meet industry standards. • Implement quality control and safety standards by understanding national and international food laws, regulations, and best practices, thereby contributing to the production and distribution of safe and high-quality food products.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the functions and importance of quality control in the food industry, including the implementation of standards and specifications.	An	20%
CO2	Apply quality assessment techniques to evaluate the quality of fruits, vegetables, cereals, legumes, dairy products, meat, poultry, eggs, and processed foods.	Ap	20%
CO3	Develop quality control measures for food storage, processing, and marketing to ensure compliance with international standards and quarantine requirements.	Ap	20%
CO4	Implement safety measures to prevent food spoilage, contamination, and adulteration, including the management of food additives and toxicants.	AP	20%
CO5	Evaluate the implications of various national and international food laws, standards, and certifications, including FSSAI, FDA, ISO, HACCP, and others.	E	20%

UNIT I- FOOD QUALITY AND QUALITY EVALUATION OF FOODS	(9)
Food Quality - its need and its role in Food Industry, Food Quality and Quality Attributes-Classification of Quality Attributes and their role in food Quality, Quality Assessment of Food materials -Fruits, vegetables, cereals, legumes, dairy products, meat, poultry, egg and processed food, Sensory Evaluation of Food Quality, Requirements for conducting Sensory Evaluation, Methods of Sensory Evaluation and Evaluation cards, Different methods of Quantitative descriptive analysis.	
UNIT II - QUALITY CONTROL	(9)
Objectives, Importance and Functions of Quality Control, Quality control specifications, training of food technologists for quality control, implementation of standards and specifications, Quality control, principles of quality control - raw material control, process control, finished product inspection, process control, quality problems and quality improvement techniques- mechanization, future of quality control, Total quality management, Objective/Instrumental analysis of Quality Control.	
UNIT III - NATIONAL AND INTERNATIONAL FOOD LAWS AND STANDARDS	(9)
Standards for food packaging and labelling - FSSAI, Bureau of Indian Standards (BIS), Agricultural Grading and Marketing (AGMARK), The Agricultural and Processed Food Product Export Development Authority (APEDA), MPEDA. Food and Drug Administration Act (FDA), International Organization for Standards (ISO)	

and its implication, generally recognized as safe (GRAS), European Council (EU), Codex Alimentarius Commission (CAC), Total Quality Management (TQM), Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), and Good Hygienic Practices (GHP), GMP, Hazard Analysis Critical Control Point (HACCP), FSMA, Legal Metrology Rules, Food Safety Standards for Organic foods, GFSi, HALAL and KOSHER.

UNIT IV - QUALITY CONTROL MEASURES IN INDUSTRIAL AND MARKETING CENTRES (9)

Quality control system in storage, Quality control aspects in food industries, Importance of quality control in marketing of Food products - domestic and export markets. International standards for export and quarantine requirements for export of Agricultural and Horticultural produce.

UNIT V – FOOD SAFETY (9)

Food safety - General principles of food safety. Characterization of food Hazards - physical, chemical and biological, Food spoilage and food borne infection hazards-sources of food spoilage and microorganisms-microbial problems in food safety-food toxicants and food poisoning – prevention, Cross contamination, Limits for pesticide and metal contamination of food. Adulteration, Food additives- types- usage, permissible limits, concept of safe food.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Manoranjan Kalia, "Food analysis and Quality control", Kalyani Publishers, Ludhiana, 2002.
2. Mehta, Rajesh and J. George, "Food Safety Regulation Concerns and Trade: The Developing Country Perspective", Macmillan, 2005.

REFERENCES:

1. P.A. Luning, F. Devlieghere and R. Verhe, "Safety in the agri - food chain", Wageningen Academic Publishers, Netherland, 2006.
2. Leo and M.L. Nollet, "Handbook of food analysis" - Methods and Instruments in applied food analysis, Marcel Dekker Inc., 2004

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1												3
2		3	2										3	
3			1		3									
4							2	2						3
5				3		3							3	
CO (W.A)	2	2	2	3	3	3	2	2					3	3

22AGX41 - AGRICULTURAL BUSINESS MANAGEMENT

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To understand the functions and planning of a business related to agricultural products in order to meet the global demands of agricultural marketing by effective utilization of the resources available.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Plan and exhibit agri business project to the marketing field	Ap	20%
CO2	Estimate the constraints involved in marketing agricultural products to reach the Indian Market	An	20%
CO3	Assess the management techniques involved for improving the business strategy in agricultural marketing	Ap	20%
CO4	Apply the principles of effective marketing strategy to achieve monetary benefit in agri business	An	20%
CO5	Analyse the concepts of business management for a wise decision process	An	20%

UNIT I - MANAGEMENT CONCEPTS & PRINCIPLE:	**(9)**
Basic Concepts of Management, Management and Manager, Managerial Environment, Decision Making Process, Management Functions- Planning, Organizing, Staffing, Leading and Leadership, Controlling.	
UNIT II - MARKETING MANAGEMENT:	**(9)**
Concepts of Marketing, Marketing Environment, Product Development and Product Lifecycle, Product Pricing and Pricing Strategies, Distribution Decisions, Promotional Decisions.	
UNIT III - CONCEPTS AND APPLICATION OF MANAGEMENT PRINCIPLES TO AGRIBUSINESS:	**(9)**
Nature and Characteristics of Agribusiness, Agro-based Industries in India, Agricultural Supply Chain Management, Strategic Management in Agribusiness, Risk Management in Agribusiness, Contract Farming, ICT in Agribusiness.	
UNIT IV - PRODUCTION, CONSUMPTION, PROCESSING AND MARKETING OF AGRICULTURAL PRODUCTS:	**(9)**
Agricultural Produce, Agricultural Marketing Functions, Classification of Markets, Agricultural Market Functionaries, Regulated Agricultural Markets , Cooperative Agricultural Marketing, Producer Surplus of Agricultural Commodities, Market Integration and Marketing Efficiency, Marketing cost-margins-price spreads, Food Processing Sector in India .	
UNIT V -MARKET PROMOTION AND HUMAN RESOURCES	**(9)**
Agricultural products – marketing promotion activities – product pricing methods. District Industries Centre – Consumer survey – Agricultural inputs retailing – Market potential assessment – types of distribution channels - Return on Investment – Personnel management. Recruitment, selection and training – Technology in Agri-business.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2005.
2. Smita Diwase, "Indian Agriculture and Agribusiness Management", Krishi resource Management Network, Pune 2004.
3. A.C Broadway, A. A Broadway ,"Agri-Business Management",Kalyani Publishers, Ludhiana/New Delhi
4. S. S Acharya, N. L Agarwal "Agricultural Marketing in India" Oxford & IBH Publishing Co., New Delhi.,

REFERENCES:

1. Chandra Prasanna, "Projects: Preparation, Appraisal, Budgeting and Implementation", Tata McGraw Hill Publications, New Delhi, 2001.
2. Kotler, P., "Marketing Management. Analysis, Planning and Control", Prentice Hall Inc., New York, 2001.
3. Rao, V.S.P., and Narayana, P.S., "Principles and Practices of Management", Konark Publishing Private Limited, New Delhi, 2001.
4. Tripathy, P.C., and Reddy, P.N., "Principles of Management", Tata McGraw Hill Publications, New Delhi, 2000.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3										3	3		
3	3										2		3	3
4		3									2		3	3
5		3				3			3		2		3	3
CO(W.A)	3	3				3			3		2.25		3	3

22AGX42 - ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

PRE - REQUISITE : NIL

Course Objective:

- To give a deep insight on Indian economy, international trade constraints in order to overcome the challenges encountered in the tenure of Entrepreneurship.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Analyze the business environment in the Indian economy, including factors influencing entrepreneurship.	Ap	20%
CO2	Understand the principles of international trade agreements in regulating trade in agricultural and food commodities.	An	20%
CO3	Enhance problem-solving skills essential for identifying, analyzing, and resolving challenges encountered in the entrepreneurial journey.	Ap	20%
CO4	Analyze entrepreneurial opportunities from an economic growth perspective	An	20%
CO5	Evaluate government schemes and incentives aimed at promoting entrepreneurship, including financial support	An	20%

UNIT I- ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT	**(9)**
Entrepreneur Development(ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics-Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.	
UNIT II - AGRIPRNEURSHIP IN GLOBAL ARENA	**(9)**
Legal perspective importance of agribusiness in Indian economy – International trade-WTO agreements-Provisions related to agreements in agricultural and food commodities – Agreements on Agriculture (AOA) - Domestic supply, market access, export subsidies agreements on Sanitary and Phyto - Sanitary (SPS) measures, Trade Related Intellectual Property Rights (TRIPS).	
UNIT III - ENTREPRENEURSHIP DEVELOPMENT	**(9)**
Programme Entrepreneurship Development Programme (EDPs) objectives, phases, Government policies and programmes and schemes EDP Process-Stages, Developing organizational skills (controlling, supervision, monitoring and evaluation) Achievement Motivation, Problem solving skills	
UNIT IV -ENTREPRENEURIAL OPPORTUNITIES	**(9)**
Economic Growth Perspective Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.	

UNIT V – ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT	(9)
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysisGovernment schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) – overview of agricultural engineering industry, characteristics of Indian farm machinery industry.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. S.S. Khanka, 2019, Entrepreneurship Development and Management, S.Chand& Company Ltd. ,India.
2. Robert D. Hisrich and Michael P. Peters, 2019 (2nd Edition), McGraw-Hill Education, USA.
3. Donald F. Kuratko and Richard M. Hodgetts, 2019 (9th Edition), Cengage Learning, India.

REFERENCES:

1. Mar J Dollinger, 1999, Entrepreneurship strategies and resources, Prentice -Hall, Upper Saddal Rover, New Jersey.
2. Thomas W Zimmer and Norman M Scarborough, 1996, Entrepreneurship, Prentice Hall, New Jersey.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2											3		
2		3												
3							3					3		3
4		3						3				3	3	3
5		3						3				3	3	3
CO (W.A)	**3**	**3**					**3**	**3**				**3**	**3**	**3**

22AGX43 - AGRICULTURAL MARKETING, TRADE AND PRICES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To gain insight on marketing functions of agricultural products which includes prices and promotion to reach successfully and competite in the world market

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Ensure the policy, pricing and promotion strategies are done ethically and economically for competiting in the market.	Ap	20%
CO2	Contrast the traditional and modern marketing system in order to determine the slack and surplus quantity of agricultural products.	An	20%
CO3	Analyse the risk involved in marketing agri products and lead a path towards future trading process.	Ap	40%
CO4	Analyse the reasons for increased amount of marketing strategy/advertising done for commercializing the products of agriculture.	An	20%
CO5	Demonstrate the trade policies as a part of team followed for agro products and to reduce the barriers	An	Internal Assessment

UNIT I- AGRICULTURAL MARKETING – NATURE AND SCOPE	**(9)**
Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, classification and characteristics of agricultural markets. - Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities. Modern marketing systems versus traditional agricultural marketing systems.	
UNIT II - MARKETING FUNCTIONS AND MARKETING EFFICIENCY	**(9)**
Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK).Definition and types of Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing, reasons for higher marketing costs of farm commodities.	
UNIT III –PRICING AND PROMOTION STRATEGIES	**(9)**
Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; Pricing andpromotion strategies: pricing considerations and approaches – cost based and competitionbased pricing; market promotion – advertising, personal selling, sales promotion.	
UNIT IV -TRADE IN AGRICULTURAL PRODUCTS	**(9)**
International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs - Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and nontariff barriers - Trade policy instruments – Terms of Trade-Free Trade Agreements.	

UNIT V – AGRICULTURAL PRICES AND RISK ANALYSIS	(9)
Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization. Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging - Forward and Futures trading: an overview of futures trading.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. G.S. Bhalla and G.K. Kshirsagar, 2018,Agricultural Marketing in India, Oxford University Press India,New Delhi.
2. VenkateshPanchapagesan ,2018 , Agricultural Marketing and Supply Chain Management in India, PHI Learning Pvt. Ltd.,India.
3. PradumanKumar ,2016 , Agricultural Marketing and Price Policies in India, Springer, USA.

REFERENCES:

1.Acharya.S.S.and Agarwal,N.L.,2011,Agricultural Marketing in India, Oxford and IBH Publishing Co .Pvt. Ltd., New Delhi.

2 .Jhingan , M.L.,2011. International Economics, Vrinda Publications (P) Ltd. New Delhi.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3				2		
2		3										2		
3	2	3										2		3
4	2	3										2		3
5	2								3			2	3	3
CO (W.A)	**2**	**3**				**3**		**3**	**3**			**2**	**3**	**3**

22AGX45 - COMMERCIAL AGRICULTURE				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with comprehensive knowledge in diverse agricultural practices and animal husbandry techniques, emphasizing sustainability, economic viability and environmental stewardship.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply practical skills and techniques learned in the fields of crop cultivation, animal husbandry, pest management and sustainable agricultural practices.	Ap	20%
CO2	Analyze various constraints, pest and disease management practices to enhance production technologies on commercial sectors of agriculture.	An	20%
CO3	Articulate effectively on species, rearing techniques, collection, production, processing, value addition and post harvest technologies.	Ap	40%
CO4	Evaluate the economic viability, environmental impacts and sustainability of agricultural practices and livestock management techniques.	An	20%
CO5	Summarize a report as a team member on the techniques and constraints, observed in the commercial agriculture practices by visiting various agriculture sectors.	An	Internal Assessment

UNIT I – SERICULTURE	**(9)**
Sericulture – importance - Mulberry cultivation – Rearing – Reeling – Twisting - Species of Silkworms - Rearing Equipment – marketing of cocoons - Economics of rearing - Pest and diseases of silkworm and their management	
UNIT II – APICULTURE	**(9)**
Importance and history of apiculture - Different species of honey bees - Morphology, anatomy, colony organization and lifecycle – Bee keeping equipment - Social behavior - Queen rearing - Collection and preservation of bee pasture - Seasonal management - Economics of beekeeping.	
UNIT III – MUSHROOM CULTIVATION	**(9)**
Mushroom cultivation - Scope and Importance - Types of mushroom - Life cycle of mushroom - Mother Spawn Production - mushroom bed preparation - Spawning, spawn running, harvesting - diseases, pests and nematodes, and their management - Postharvest technology and value addition of mushroom	
UNIT IV – LIVESTOCK PRODUCTION & MANAGEMENT	**(9)**
Importance of livestock - Important exotic and Indian breeds of cattle and buffalo - reproductive system and behaviour of cattle - Feeding and management - Cost of milk production, economical unit of cattle and buffalo.	

UNIT V - VERMICOMPOSTING	(9)
Waste material- Classification, segregation - processing- Bed preparation - earthworm collection and applications-Inspection of beds and watering - separation, air drying, sieving - storing	
TOTAL (L : 45) = 45 PERIODS	

TEXT BOOKS:

1. Sanjay Sarkar. 2022. A Text Book on Sericulture, Techno World, West Bengal.
2. Gautam, V. N. and Shraddha Shrivastava. 2017. A Text Book on Livestock Production and Management, Aavishkar Pulishers, Jaipur.

REFERENCES:

1. Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beekeeping, UAS Dharwad
2. Ganga, G. and Sulochana Chetty, J. 1997. An Introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
3. B.C. Suman and V.P.Sharma.2007. Mushroom cultivation in india. Daya Publishing House, New Delhi.179p
4. G. C. Banergee. 1999, Text Book of Animal Husbandry , 9th ed Oxford and IBH Publishers, New Delhi.
5. Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India)
6. V.N. Pathak, N. Yadav and M. Gaur. 2010. Mushroom production and processing technology. Published by Agrobios, Jodhpur
7. Khushbu, Rachna Gulati, Sushma and Komal Arya, 2022, Fundamentals of Vermicomposting, AkiNik Publications - 978-93-5570-365-1

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3					3								3	3
4				3										
5									3	3				
CO (W.A)	3	3		3	3				3	3			3	3

22AGX47 - ORNAMENTAL AND LANDSCAPE GARDENING	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with a comprehensive understanding of garden history, design principles, practical techniques, constructing and budgeting in ornamental and landscape horticulture, enabling them to effectively plan, design, and manage diverse landscapes.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of landscape design to create detailed garden plans that incorporate both softscape, hardscape and special elements.	Ap	20%
CO2	Analyze different types of gardens and landscaping features, evaluating their historical context, functional benefits, and suitability for various environmental conditions and client needs.	An	20%
CO3	Evaluate landscape drawings and construction plans, assessing the accuracy of scale, symbols, and design elements, and evaluating the feasibility and cost-effectiveness of proposed landscape projects.	An	20%
CO4	Articulate turf management techniques to establish, maintain, and rejuvenate turf areas, using appropriate species of grasses and management practices to address issues related to growth, pests, and soil conditions.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the constraints observed during establishment and maintenance of ornamental garden.	An	Internal Assessment

UNIT I - GARDEN HISTORY, TYPES AND ELEMENTS	**(9)**
Ornamental and Landscape Horticulture – Definition – Scope – Importance – History of Gardening – Types of Gardens – Softscape elements – Plants for special purposes – Hardscape elements – other ornamental structures – Planting and Designing Position.	
UNIT II – SPECIAL FEATURES IN LANDSCAPING	**(9)**
Water gardens – Floating plants – Oxygenating plant – Bog gardens – Vertical Garden - Roof Garden – Xeriscaping – Bonsai – Plants, Culture, Pruning and Bending Techniques – Terrarium – Gardening Equipments.	
UNIT III – TURFING AND TURF MANAGEMENT	**(9)**
Turfing – Uses – Importance and scope of turf industry – Species of grasses – Growth and Development of turf grasses – Factor affecting growth – Site selection – Land preparation – Methods of establishment – Turf quality – weed, pest, disease and nutrient managements – Repair and rejuvenation of old turf – Care and maintenance of equipments.	

UNIT IV – DESIGNING ELEMENTS, PRINCIPLES AND SITE ANALYSIS	**(9)**

Elements of Beauty – Form, Colour, Texture and Line – Fundamental Principles of landscape designing – Different Concepts of laying of special types of gardens – Site analysis – Cliental preferences -Selection of components.

UNIT V – LANDSCAPE DRAWINGS, CONSTRUCTION AND BUDGETING | **(9)**

Landscape drawing – manual and computer softwares –Fundamentals of drawing – scale, symbols, layout, plan view, elevation and perspective diagrams – Basics of establishment – leveling, gradient, filling, plastering, water proofing filters and aeration – Project report preparation – cost estimates – contract agreement and legal issues – terms and conditions for execution and payment.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Priyanka Kakkar, Surendar Lal, "Landscape and Ornamental Horticulture", Stella International Publication, Haryana, 2024.
2. Hemla Naik, B., Chandrasekhar, S. Y. and Jawaharlal, M., "Principles of Landscape Gardening", agrimoon.com, 2023.
3. Chadha, K. L. "Ornamental Horticulture in India", ICAR Krishi Bhavan, New Delhi, 1986.
4. Bose, T. K. and Mukerjee, D. "Gardening in India", Oxford and IBH Publication, 1977.

REFERENCES:

1. Roychowdhury, N. and Misra, H. P., "Text Book on Floriculture and Landscaping", Shyamal Ghosh Publication, Kolkata, 2001.
2. Nambisan, K. M. P., "Design elements of landscape gardening", Oxford and IBH Publication Co., (P) Ltd., New Delhi, 1992.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3										2	
4				3									2	
5														
CO (W.A)	3	3	3	3									2	

22AGX48 - SEED TECHNOLOGY APPLICATIONS

22AGX56 - INSTRUMENTATION AND CONTROL ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				

Course Objective:	• To increases production speed, consistency, and safety by minimizing human intervention. • To optimize process performance, ensuring stability and efficiency. • To ensure that instrumentation and control systems are safe, reliable, and compliant with industry standards. • To integrate advanced technologies such as AI, IoT, and machine learning into instrumentation and control systems. • To design systems that optimize energy use in industrial processes.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design, analyze, and implement various instrumentation systems, including sensors, transducers, and signal processing units.	Ap	20%
CO2	Diagnose and fix issues in instrumentation and control systems.	An	20%
CO3	Plan, execute, and manage projects related to instrumentation and control, ensuring they meet specifications and deadlines.	Ap	20%
CO4	Implement safety standards in the design and operation of control systems.	Ap	20%
CO5	Develop innovative solutions and improvements in instrumentation and control technologies.	An	20%

UNIT I - INTRODUCTION	**(9)**
Basic concepts of measurement system configuration. Concept of accuracy, precision error, resolution repeatability bias, calibration, range; Performance characteristics of Instruments- Zero, first and second order instrument systems and their response to different input signals (step, ramp etc) Specification and testing of dynamic response	
UNIT II - INSTRUMENTFOR VARIOUS USES	**(9)**
Different types of measuring instruments, their working principles, construction features, measurement of level, flow, temperature, pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour, viscosity, surface tension and composition. Indicating and recording type instruments, digital displays, transmitting and telemetering devices	
UNIT III - INTRODUCTIONTO CONTROL SYSTEM	**(9)**
Control system characteristics, purpose disturbances and stability Feed back and feed forward control strategies. Modelling the Dynamic and Static Behaviour of Process-Mathematical modelling for physical process control, state variables and state equations, modelling difficulties and considerations. Input-output models block diagram, degree of freedom, process controllers action, P, PI, PID controllers, final control system	
UNIT IV - ANALYSIS OF DYNAMIC BEHAVIOUR:	**(9)**

Linearization of systems, Deviation variables, Application of Laplace transform in mathematical modelling of process control. Transfer function; Transfer function matrix. for processes having multiple outputs, Poles and zeros of transfer function
UNIT V - QUALITATIVE ANALYSIS OF RESPONSEOF SYSTEM: **(9)**
Design of Feed Back System Block diagram, stability analysis, frequency response root locus analysis, Routh"s criteria, Nyquist plots and Bode diagrams. Control Systems for Various Uses Electronic pneumatic, hydraulic control system and their application in Farm machinery, food processing industry aquaculture, milk processing
TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Coughanowr, D.R. "Process Systems Analysis and Control", McGraw Hill, 1991
2. Patranabis. D. "Principles of Industrial Instrumentation", Tata McGraw Hill, 1995

REFERENCES:

1. Doeblin, D.O. "Measurement Systems; Application and Design". McGraw Hill, 1984
2. Considine T..M. "Process/Industrial Instruments and ControlsÃ‚Â· Handbook", McGraw Hill 1993

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2		3					1					1	3	
3	2									2	1			
4	2						1			1				
5				2										
CO (W.A)	**2**	**3**		**2**			**1**			**1.5**	**1**	**1**	**3**	

22AGX57 - IoT IN AGRICULTURAL SYSTEMS

22AGX58 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR AGRICULTURE

	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objective:	• To impart artificial intelligence principles, techniques and its history • To introduce basic concepts and techniques of Machine Learning • To select the unsupervised and supervised learning • To apply concept of AI and ML concepts in agricultural system • To analyze the applicability of AI and ML in Agriculture

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.	Ap	20%
CO2	Apply the machine learning algorithms to agricultural datasets for problem-solving	Ap	20%
CO3	Select appropriate unsupervised and supervised learning models to address specific challenges in agriculture	An	20%
CO4	Develop the AI and ML concepts in Agricultural application	Ap	20%
CO5	Analyze pest management strategies, integrating AI-based approaches for pest detection, monitoring, and control and use of ML for agricultural applications	An	20%

UNIT I- INTRODUCTION TO AI - INTELLIGENT AGENT AND UNINFORMED SEARCH	**(9)**
Introduction – Foundations of AI – History of AI – The state of the art – Risks and Benefits of AI - Intelligent Agents – Nature of Environment – Structure of Agent – Problem Solving Agents -Formulating Problems – Uninformed Search – Breadth First Search – Dijkstra's algorithm or uniform-cost search – Depth First Search – Depth Limited Search	
UNIT II - INTRODUCTION TO MACHINE LEARNING	**(9)**
Need for Machine Learning, Machine Learning Explained, and Machine Learning with respect to agriculture, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.	
UNIT III - UNSUPERVISED LEARNING	**(9)**
Unsupervised Learning – Principle Component Analysis – Neural Network: Fixed Weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Clustering: Definition – Types of Clustering – Hierarchical clustering algorithms – k-means algorithm.	
UNIT IV - SUPERVISED LEARNING	**(9)**
Neural Network: Introduction, Perceptron Networks – Adaline – Back propagation networks -Decision Tree:Entropy – Information gain – Gini Impurity – classification algorithm – Rule based Classification – Naive Bayesian classification – Support Vector Machines (SVM)	

UNIT V - APPLICATION OF AI AND ML FOR AGRICULTURE	(9)
Application of AI and ML for agriculture - Disease Classification - Pest detection and monitoring - Integrated pest management using AI - Early warning systems for pest outbreaks and Detection in Plants - Species Recognition in Flowers - Precision Farming - Use of ML For Portable Proximal Soil and Crop Sensors - Soil And Crop Image Processing - Digital Soil Mapping - General Overview - Digital Soil Mapping With Continuous Variables and Categorical Variables.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012
2. Dheepak Khemani, "A first course in Artificial Intelligence, McGraw Hill Education Pvt Ltd.," New Delhi, 2013.

REFERENCES:

1. Jason Bell, "Machine learning Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.
2. Ethem Alpaydin, "Introduction to Machine Learning 3e" (Adaptive Computation and Machine Learning series) Third Edition, MIT Press, 2014
3. Ric, E., Knight, K and Shankar, B. "Artificial Intelligence," 3rd edition, Tata McGraw, 2009

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													3
3		2			3								3	
4			3											
5			3		1							1		
CO (W.A)	3	2	3		2							1	3	3

22AGZ03 - WASTE WATER MANAGEMENT AND RECYCLING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To examine the sources, constituents and environmental concerns of waste water and treatment methods.. • To appraise various physical and chemical treatment processes. • To understand various biological treatment processes. • To explore various advanced treatment process and Zero Liquid Discharge systems. • To know the problems and recycle and reuse concepts.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the constituents and environmental concerns of waste water and treatment methods.	An	20%
CO2	Comprehend various physical and chemical treatment processes.	Ap	20%
CO3	Analyze various biological treatment processes.	An	20%
CO4	Assess the various advanced treatment process and Zero Liquid Discharge systems..	Ap	20%
CO5	Find the recycling and reuse of water technologies in global	An	20%

UNIT I – INTRODUCTION TO WASTE WATER TREATMENT	**(9)**
Wastewater Sources and types, physical and chemical properties - Constituents in waste water – Impact of wastewater -Health and Environment Concerns in waste water and environmental regulations, thermal treatment processes, Wastewater Reclamation and reuse	
UNIT II – PHYSICAL AND CHEMICAL TREATMENT PROCESSES	**(9)**
Physical and chemical properties of wastewater, Physical Unit Operations –Screening, Equalization, Flocculation, sedimentation, Clarification, Filtration, Flotation and Aeration Systems. Chemical Unit Process – Chemical Coagulation, Precipitation, Oxidation and Neutralization	
UNIT III – BIOLOGICAL TREATMENT PROCESS	**(9)**
Microbial metabolism – Bacterial growth– Aerobic and Anaerobic biological oxidation – Activated Sludge process – Trickling filters – Rotating biological contactors – Combined treatment processes – Chemical reactors and filters.	

UNIT IV – ADVANCED TREATMENT PROCESS	(9)
Need for Advanced Wastewater Treatment - Technologies used in advanced treatment – Depth Filtration – Surface Filtration – Membrane Separation Process- Absorption – Ion Exchange – Advanced oxidation process – ZLD Concept	
UNIT V – RECYCLING AND REUSE OF WATER	**(9)**
Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. "Industrial Waste Water Management, Treatment and Disposal-MOP FD-3", Water Environment Federation, 3rd Edition, Tata McGraw Hill Professional Publishing Company, New York, 2019.
2. Metcalf, Eddy and Tchobanoglous G., "Waste Water Engineering Treatment and Reuse", Tata McGraw Hill Company, 2nd Edition, NewYork, 2017.

George Tchobanoglous, Franklin Louis Burton, Metcalf and Eddy, H. David Stense, "Waste water Engineering: Treatment and Reuse", McGraw-Hill, 2012.

REFERENCES:

1. Arceivala S. J., "Wastewater Treatment for Pollution Control", 3rd Edition, McGraw-Hill, 2009.
2. Eckenfelder W. W., "Industrial Water Pollution Control", 2nd Edition, McGraw-Hill, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	3													2
3			3					1						
4												1		
5				3								1	3	
CO (W.A)	3	3	3	3				1				1	3	2

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B.Tech – Artificial Intelligence and Data Science [R22]

[CHOICE BASED CREDIT SYSTEM]

[This Curriculum and Syllabi are applicable to Students admitted of (2022-2026) and (2023-2027) Batches only]

JULY 2024

INSTITUTE VISION AND MISSION	
VISION	• To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	• To provide quality education to produce ethical and competent professionals with social Responsibility • To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. • To create a learner centric environment and improve continually to meet the changing global needs.

B.TECH – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	
VISION	• To emerge as a renowned department in providing quality Artificial Intelligence and Data Science education to meet the ever growing needs of the society.
MISSION	Artificial Intelligence and Data Science department is committed • To provide quality and value based education to produce Artificial Intelligence professionals with ethical and social responsibility. • To excel in the thrust areas of Artificial Intelligence, Machine Learning and Data Science by imparting programming knowledge and Mathematical skill set to solve real world problems. • To create a learner centric environment that motivates the students in adopting emerging technologies of the rapidly changing artificial intelligence and data science society.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	The graduates of Artificial intelligence and data science will be able: **PEO1: Core Competency:** To apply mathematical, scientific and engineering concepts for an artificial intelligence and data scientist to remit the various challenges using emerging AI technologies. **PEO2: Research, Innovation and Entrepreneurship:** To work productively in multidisciplinary teams and provide innovative ideas for real time problems through research. **PEO3: Ethics, Human values and Life-long learning:** To embrace lifelong learning with higher ethical standards and be the source for socio economic growth.
PROGRAMME SPECIFIC OUTCOMES (PSO)	**PSO1: Analytical Skill:** Ability to Design and develop innovative automated systems applying mathematical, analytical, programming and operational skills to meet society needs. **PSO2: Knowledge Proficiency:** Provide a tangible foundation and enhance the abilities to qualify for employment, higher studies and research inartificial intelligence and data science with ethical values.

PROGRAM OUTCOMES:

At the end of this programme the students will be able to

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d	Investigation of Complex Problems	PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work.	PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j	Communication	PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k	Project Management and Finance	PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l	Lifelong Learning	PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the Programme Outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
1	3	3	2	3	3	2	2	2	2	2	3	3
2	3	3	3	3	3	2	2	1	2	1	2	1
3	3	2	2	1	2	3	2	3	2	2	2	2

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Specific Objectives and the Programme Outcomes is given in the following table

PROGRAM SPECIFIC OUTCOMES	PROGRAMME OUTCOMES											
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
1	3	3	2	3	3	2	2	1	2	1	2	2
2	3	2	2	3	3	2	3	2	2	2	3	3

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – R22 CHOICE BASED CREDIT SYSTEM

B.TECH – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
I	22MAN01	Induction Programme	MC	-	-	-	-	-	-
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra*	BSC	-	4	3	1	0	4
4	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
5	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
6	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
7	22GYA01	தமிழர்மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
PRACTICAL									
8	22PYP01	Physics Laboratory*	BSC	-	2	0	0	2	1
9	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
10	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
11	22MAN02	Soft /Analytical Skills - I	MC	-	3	1	0	2	0
12	22MAN03	Yoga – I*	MC	-	1	0	0	1	0
				TOTAL	**32**	**16**	**1**	**15**	**22**

*Ratified by Eleventh Academic Council

SEMESTER: II									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
2	22MYB03	Statistics and Numerical Methods*	BSC	-	4	3	1	0	4
3	22AIC01	Data Structures using C*	ESC	22CSC01	3	3	0	0	3
4	22AIC02	Python Programming	ESC	-	3	3	0	0	3
5	22AIC03	Digital Principles and Computer Organization*	ESC	-	3	3	0	0	3
6	22GYA02	**தமிழரும்தொழில்நுட்பமும்**/Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22AIP01	Data structures Laboratory*	ESC	22CSP01	4	0	0	4	2
8	22AIP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN04	Soft/Analytical Skills - II	MC	-	3	1	0	2	0
11	22MAN05	Yoga – II*	MC	-	1	0	0	1	0
				TOTAL	**34**	**16**	**1**	**17**	**23**

*Ratified by Eleventh Academic Council

SEMESTER: III									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
2	22AIC04	Java programming	PCC	-	3	3	0	0	3
3	22AIC05	Artificial intelligence	PCC	-	3	3	0	0	3
4	22AIC06	Algorithms	PCC	22AIC01	3	3	0	0	3
5	22AIC07	Data Exploration and Visualization	PCC	-	5	3	0	2	4
PRACTICAL									
6	22AIP03	Java programming Laboratory	PCC	-	4	0	0	4	2
7	22AIP04	Artificial intelligence Laboratory	PCC	-	4	0	0	4	2
8	22AIP05	Algorithms Laboratory	PCC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
9	22MAN07# / 22MAN07R ##	Soft / Analytical Skills - III	MC	-	3	1	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**34**	**17**	**1**	**16**	**23**

Applicable for 2022-26 Batch only
Applicable for 2023-27 Batch only

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB08	Probability and statistics	BSC	-	4	3	1	0	4
2	22CYB07	Environmental science and engineering	BSC	-	3	3	0	0	3
3	22AIC08	Operating Systems	PCC	-	3	3	0	0	3
4	22AIC09	Database Design and Management	PCC	-	3	3	0	0	3
5	22AIC10	Machine Learning	PCC	-	3	3	0	0	3
6	22AIC11	Fundamentals of Data Science and Analytics	PCC	-	3	3	0	0	3
PRACTICAL									
7	22AIP06	Database Design and Management Laboratory	PCC	-	4	0	0	4	2
8	22AIP07	Machine Learning Laboratory	PCC	-	4	0	0	4	2
9	22AIP08	Data Science and Analytics Laboratory	PCC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
10	22MAN08#/ 22MAN08R##	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0
11	22GED01	Personality and Character Development	MC	-	1	0	0	1	0
				TOTAL	**35**	**19**	**1**	**15**	**25**

Applicable for 2022-26 Batch only
Applicable for 2023-27 Batch only

SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AIC12	Computer Networks	PCC	-	3	3	0	0	3
2	22AIC13	Deep Learning	PCC	-	3	3	0	0	3
3	22AIC14	Internet of Things and its Applications	ESC	-	3	3	0	0	3
4	E1	Elective (PEC)	PEC	-	3	3	0	0	3
5	E2	Elective (PEC)	PEC	-	3	3	0	0	3
6	E3	Elective (OEC/PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AIP09	Deep Learning Laboratory	PCC	-	4	0	0	4	2
8	22AIP10	Internet of Things and its Applications Laboratory	ESC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
9	22MAN10R	Communication and Quantitative Reasoning**	MC	-	3	1	0	2	0
				TOTAL	**29**	**19**	**0**	**10**	**22**

** Ratified by Twelfth Academic Council

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AIC15	Full Stack Development**	PCC	-	3	3	0	0	3
2	22AIC16	Big Data Analytics	PCC	-	3	3	0	0	3
3	E4	Elective (PEC)	PEC	-	3	3	0	0	3
4	E5	Elective (OEC)	OEC	-	3	3	0	0	3
5	E6	Elective (OEC/PEC)	PEC/OEC	-	3	3	0	0	3
6	E7	Elective (PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AIP11	Big Data Analytics Laboratory	PCC	-	4	0	0	4	2
				TOTAL	**22**	**18**	**0**	**4**	**20**

** Ratified by Twelfth Academic Council

SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	EM1	Elective - Management	HSMC	-	3	3	0	0	3
3	E8	Elective (PEC)	PEC	-	3	3	0	0	3
4	E9	Elective (OEC)	OEC	-	3	3	0	0	3
5	E10	Elective (OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
6	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
				TOTAL	**14**	**14**	**0**	**0**	**16**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22AID01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

REGULATIONS – 2022	CHOICE BASED CREDIT SYSTEM

(A) **HSMC, BSC, ESC and MC**

(a) Humanities and Social Sciences and Management Courses (HSMC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2.	22GYA01	தமிழர்மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
3.	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
4.	22GYA02	தமிழரும்தொழில்நுட்பமும்/Tamils and Technology	HSMC	-	1	1	0	0	1
5.	22GEA01	Universal Human values	HSMC	-	2	2	0	0	2
6.	EM1	Elective - Management	HSMC	-	3	3	0	0	3

(b) Basic Science Courses(BSC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MYB01	Calculus and Linear Algebra	BSC	-	4	3	1	0	4
2.	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
3.	22PYP01	Semiconductor Physics Laboratory	BSC	-	2	0	0	2	1
4.	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4
5.	22AIC03	Digital Principles and Computer Organization	BSC	-	3	3	0	0	3
6.	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
7.	22MYB08	Probability and statistics	BSC	-	4	3	1	0	4
8.	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3

(c) Engineering Science Courses (ESC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
2.	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
3.	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
4.	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
5.	22AIC01	Data structures using C	ESC	22CSC01	3	3	0	0	3

6.	22AIC02	Python Programming	ESC	-	3	3	0	0	3
7.	22AIP01	Data structures using C Laboratory	ESC	22CSP01	4	0	0	4	2
8.	22AIP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
9.	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
10.	22AIC14	Internet of Things and its Applications	ESC	-	3	3	0	0	3
11.	22AIP10	Internet of Things and its Applications Laboratory	ESC	-	4	0	0	4	2

(d) Mandatory Courses (MC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MAN01	Induction Programme	MC	-	0	0	0	0	0
2.	22MAN02	Soft/Analytical Skills - I	MC	-	3	1	0	2	0
3.	22MAN03	Yoga - I	MC	-	1	0	0	1	0
4.	22MAN04	Soft/Analytical Skills - II	MC	-	3	1	0	2	0
5.	22MAN05	Yoga - II	MC	-	1	0	0	1	0
6.	22MAN07 22MAN07R	Soft / Analytical Skills - III	MC	-	3	1	0	2	0
7.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
8.	22MAN08 22MAN08R	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0
9.	22GED01	Personality and Character Development	MC	-	1	0	0	1	0
10.	22MAN10R	Communication and Quantitative Reasoning	MC	-	3	1	0	2	0

(B) **Programme Core Courses (PCC)**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22AIC04	Java Programming	PCC	-	3	3	0	0	3
2	22AIC05	Artificial intelligence	PCC	-	3	3	0	0	3
3	22AIC06	Algorithms	PCC	22AIC01	3	3	0	0	3
4	22AIC07	Data Exploration and Visualization	PCC	-	5	3	0	2	4
5	22AIP03	Java Programming Laboratory	PCC	-	4	0	0	4	2

6	22AIP04	Artificial intelligence Laboratory	PCC	-	4	0	0	4	2
7	22AIP05	Algorithms Laboratory	PCC	-	4	0	0	4	2
8	22AIC08	Operating Systems	PCC	-	3	3	0	0	3
9	22AIC09	Database Design and Management	PCC	-	3	3	0	0	3
10	22AIC10	Machine Learning	PCC	-	3	3	0	0	3
11	22AIC11	Fundamentals of Data Science and Analytics	PCC	-	3	3	0	0	3
12	22AIP06	Database Design and Management Laboratory	PCC	-	4	0	0	4	2
13	22AIP07	Machine Learning Laboratory	PCC	-	4	0	0	4	2
14	22AIP08	Data Science and Analytics Laboratory	PCC	-	4	0	0	4	2
15	22AIC12	Computer Networks	PCC	-	3	3	0	0	3
16	22AIC13	Deep Learning	PCC	-	3	3	0	0	3
17	22AIP09	Deep Learning Laboratory	PCC	-	4	0	0	4	2
18	22AIC15	Full Stack Development	PCC	-	3	3	0	0	3
19	22AIC16	Big Data Analytics	PCC	-	3	3	0	0	3
20	22AIP11	Big Data Analytics Laboratory	PCC	-	4	0	0	4	2

(C) **Programme Elective Courses (PEC)**

Vertical I : Machine Intelligence

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX01	Knowledge Engineering	PEC		3	3	0	0	3
2	22AIX02	Recommender Systems	PEC		3	3	0	0	3
3	22AIX03	Soft Computing	PEC		3	3	0	0	3
4	22AIX04	Optimization Techniques	PEC		3	3	0	0	3
5	22AIX05	Computer vision	PEC		3	3	0	0	3
6	22AIX06	Ethics of AI	PEC		3	3	0	0	3
7	22AIX07	Business Intelligence	PEC		3	3	0	0	3
8	22AIX08	Robotic Process Automation	PEC		3	3	0	0	3

Vertical II : Data Analytics

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX11	Pattern Recognition	PEC		3	3	0	0	3
2	22AIX12	Text and Speech Analytics	PEC		3	3	0	0	3
3	22AIX13	Time Series Analysis and Forecasting	PEC		3	3	0	0	3
4	22AIX14	Health care Analytics	PEC		3	3	0	0	3
5	22AIX15	Predictive Analytics	PEC		3	3	0	0	3
6	22AIX16	Image and Video Analytics	PEC		3	3	0	0	3
7	22AIX17	Natural Language Processing	PEC		3	3	0	0	3
8	22AIX18	Augmented Reality and Virtual Reality	PEC		3	3	0	0	3

Vertical III : Cyber Security

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX21	Social Network Security	PEC		3	3	0	0	3
2	22AIX22	Biometric Security	PEC		3	3	0	0	3
3	22AIX23	Cloud Security	PEC		3	3	0	0	3
4	22AIX24	Data Privacy and Protection	PEC		3	3	0	0	3
5	22AIX25	Cyber Physical Systems	PEC		3	3	0	0	3
6	22AIX26	Mobile Device Security	PEC		3	3	0	0	3
7	22AIX27	Malware Analysis	PEC		3	3	0	0	3
8	22AIX28	Digital Forensics	PEC		3	3	0	0	3

Vertical IV : IoT

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX31	Industrial and Medical IoT	PEC		3	3	0	0	3
2	22AIX32	Blockchain Technology	PEC		3	3	0	0	3
3	22AIX33	Beyond 5G and IoT Technologies	PEC		3	3	0	0	3
4	22AIX34	Programming for IoT Boards	PEC		3	3	0	0	3
5	22AIX35	Privacy and Security in IoT	PEC		3	3	0	0	3
6	22AIX36	Wearable Computing	PEC		3	3	0	0	3
7	22AIX37	Fog and Edge computing	PEC		3	3	0	0	3
8	22AIX38	Mobile Application Development for IoT	PEC		3	3	0	0	3

Vertical V : Web Development

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX41	Cloud Computing	PEC		3	3	0	0	3
2	22AIX42	UI and UX design	PEC		3	3	0	0	3
3	22AIX43	DevOps	PEC		3	3	0	0	3
4	22AIX44	Principles of Programming Languages	PEC		3	3	0	0	3
5	22AIX45	MEAN Stack Development	PEC		3	3	0	0	3
6	22AIX46	Social and Information Networks	PEC		3	3	0	0	3
7	22AIX47	Web Mining	PEC		3	3	0	0	3
8	22AIX48	Multimedia Data Compression and Storage	PEC		3	3	0	0	3

Vertical VI : Software Development Engineering

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX51	Agile Methodologies	PEC		3	3	0	0	3
2	22AIX52	Software Defined Networks	PEC		3	3	0	0	3
3	22AIX53	Software Project Management	PEC		3	3	0	0	3
4	22AIX54	Software Testing Tools and Techniques	PEC		3	3	0	0	3
5	22AIX55	IT Operations	PEC		3	3	0	0	3
6	22AIX56	Software Quality Assurance	PEC		3	3	0	0	3
7	22AIX57	Service Oriented Architecture	PEC		3	3	0	0	3
8	22AIX58	Product Life cycle Management	PEC		3	3	0	0	3

(D) **Management Electives Courses (HSMC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
2	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
3	22GEA04	Professional Ethics	HSMC	-	3	3	0	0	3

(E) **Employability Enhancement Courses (EEC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
2	22AID01	Project Work	EEC	-	20	0	0	20	10

(F) **Open Electives Courses (OEC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIZ01	Fundamentals of Artificial Intelligence and Machine Learning	OEC	-	3	3	0	0	3
2	22AIZ02	Introduction to Business Analytics	OEC	-	3	3	0	0	3
3	22AIZ03	Fundamentals of Neural Networks	OEC	-	3	3	0	0	3
4	22AIZ04	Introduction to Robotics	OEC	-	3	3	0	0	3

(G) **Minor degree courses**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIM01	Introduction to Artificial Intelligence	PEC	-	3	3	0	0	3
2	22AIM02	Fundamentals of Machine Learning	PEC	-	3	3	0	0	3
3	22AIM03	Knowledge Representation and Reasoning	PEC	-	3	3	0	0	3
4	22AIM04	Neural Networks and Deep learning	PEC	-	3	3	0	0	3
5	22AIM05	Computer Vision Models	PEC	-	3	3	0	0	3
6	22AIM06	Industrial robotic technology	PEC	-	3	3	0	0	3
7	22AIM07	Virtual Reality Technology	PEC	-	3	3	0	0	3
8	22AIM08	Ethics and Social implication of AI	PEC	-	3	3	0	0	3

Semester/ Category	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	Total
I	4	8		10				22
II	4	7		12				23
III		4	19					23
IV		7	18					25
V			8	5		9		22
VI			8			9	3	20
VII	5				2	3	6	16
VIII					10			10
Total	13	28	53	25	12	21	9	161
%	8.1	17.4	32.9	15.5	7.5	13.0	5.6	
AICTE Credits Recommended	16	23	59	29	15	12	9	163
AICTE MODEL CURRI %	10%	14%	36%	18%	9%	7%	6%	

TOTAL CREDITS (22+23+23+25+22+20+16+10) = 161 CREDITS

22MAN01 INDUCTION PROGRAMME
(For Common To All Branches)

	L	T	P	C
	0	0	0	0

PRE-REQUISITE: NIL

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. "

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

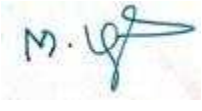
(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

REFERENCES:

1.Guide to Induction program from AICTE



22EYA01 - PROFESSIONAL COMMUNICATION - I (Common to All Branches)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To build essential English skills to address the challenges of communication • To enhance communication employing LSRW skills				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Communicate effectively in various work environments.	R	20%
CO2	Involve indiverse discourse forms utilizing LSRW Skills.	U	20%
CO3	Participate actively in communication activities that enhance the creative skill.	U	20%
CO4	Associate with the target audience and contexts using varied types of communication.	Ap	20%
CO5	Convey the ideas distinctly both in verbal and non-verbal communication in work culture.	U	20%

UNIT I –INTRODUCTORY SKILLS	(6+6)
Grammar – Parts of Speech – Verb (Auxiliaries – Primary & Modal, Main Verb) -**Listening** – Listening toShort Conversations or Monologues - Listening to Experiences – Listening to Descriptions- **Speaking** – Introducing Oneself – Exchanging Personal information - Talking about food and culture - **Reading**– Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II – LANGUAGE ACUMEN	(6+6)
Grammar – Word Formation – Tenses (Present Tense) – Synonyms & Antonyms - **Listening** – Listeningto Announcements – Listening to Interviews - Listening and Note-taking - **Speaking** – Talking aboutHolidays & Vacations – Narrating Unforgettable Anecdotes - **Reading** – Skimming – Scanning (Short Textsand Longer Passages) – Critical Reading - **Writing** – Instruction – Process Description	
UNIT III – COMMUNICATION ROOTERS	(6+6)
Grammar– Cause and Effect – Tenses (Past Tense) – Discourse Markers - **Listening** – Listening to Telephonic Conversations – Listening to Podcasts - **Speaking** – Talking about neoteric Technologies – Eliciting information to fill a form - **Reading** –Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - **Writing** – Checklist – Circular, Agenda & Minutes of the Meeting	

UNIT IV - DISCOURSE FORTE	(6+6)
Grammar – Tenses (Future Tense) –Yes/No & WH type questions – Negatives - **Listening** – Listening toTED/ Ink talks -**Speaking** – Participating in Short Conversations - **Reading** – Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing	
UNIT V - LINGUISTIC COMPETENCIES	(6+6)
Grammar – Articles – Homophones & Homonyms – Single line Definition – Phrasal Verb - **Listening** – Intensive listening to fill in the gapped text - **Speaking** –Expressing opinions through Situations & Role play - **Reading** – Cloze Texts - **Writing** – Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. **Grammar**
2. **Listening Skills**
3. **Speaking Skills**
4. **Reading Skills**
5. **Writing Skills**

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOKS:

1. Shoba K N., Deepa Mary Francis. *English for Engineers and Technologists.* Volume 1, 3rd Edition, Orient BlackSwanPvt.Ltd, Telangana, 2022.

REFERENCES:

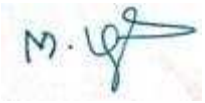
1. Koneru, Aruna. *English Language Skills.* Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings, M. *Advanced English Grammar.* Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor. *Interchange*. Cambridge University Press, New Delhi, 2015 (Reprint 2021).

WEB REFERENCE:

1. https://youtu.be/f0uqUzEf3A8?si=vyzu5KGIfbu35_IQ

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									**2**	**3**				



22MYB01-CALCULUS AND LINEAR ALGEBRA *(Common to All Branches)*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE-REQUISITE : NIL

Course Objective:	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNITI–MATRICES	**(9+3)**
Characteristic Equation-Eigen values and Eigen vectors of a matrix- Cayley Hamilton Theorem(excluding proof)and its applications-Quadratic Form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNITII–ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane–Angle between two planes–Equation of straight lines-Coplanar lines–Equation of sphere –Orthogonal spheres.	
UNITIII-GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature–Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNITIV-FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives-Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of Two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNITV-MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral-Triple Integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL(L:45+T:15) :60PERIODS	

LIST OF PROGRAMS USING MATLAB(Assignment/OnlineTest**)**:

1. Introduction to MATLAB
2. Matrix operations–Addition,Multiplication,Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Grewal,B.S.,"Higher Engineering Mathematics", Khanna publications,42nd Edition,2012.
2. ErwinKreyszig,"Advanced Engineering mathematics",JohnWiley&sons,9th Edition,2013.
3. Veerarajan,T.,"Engineering Mathematics of semesterI&II",TataMcGrawHill,3rd Edition,2016.

REFERENCES:

1. Bali,N.P.,ManishGoyal,"A Textbook of Engineering Mathematics-Sem-II",Laxmi Publications,6th Edition,2014.
2. Kandasamy,P.,Thilagavathy,K.,Gunavathy,K.,"Engineering Mathematics for first year",Scand&Co Ltd,9th Revised Edition,2013.
3. GlynJames,"Advanced Engineering Mathematics",Wiley India,7th Edition,2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2											3	
3		2												
4	3													3
5	3				2				3			2	3	3
CO (W.A)	**3**	**2**			**2**				**3**			**2**	**3**	**3**

22PYB01 - SEMICONDUCTOR PHYSICS (Common to CSE, CSE (CS), CSE (IoT), IT & AI&DS)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To expose the concepts of conducting materials and electrical properties of semiconductors. • To expand familiarity in the field of photo detectors and new engineering materials

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the properties of intrinsic semiconductor in photovoltaic cells.	Ap	20%
CO2	Compare various types of semiconducting materials to fabricate laptop circuits	An	20%
CO3	Implement the principles of laser in engineering and medical applications.	Ap	20%
CO4	Analyze proficient in photo doctors in device fabrications.	An	20%
CO5	Examine new engineering materials to assess their performance in electronic applications.	Ev	20%

UNIT I -INTRODUCTION TO CONDUCTING MATERIALS	(9)
Classical free electron theory – Expression for electrical conductivity – Thermal conductivity, expression – Wiedemann – Franz law- Success and failure – electrons in metals - Fermi- Dirac statistics – Density of energy states- - Particle in a three-dimensional box- degenerate states -Energy bands in solids- - Electron effective mass- concept of hole.	
UNIT II -ELECTRICAL PROPERTIES OF SEMICONDUCTORS	(9)
Elemental and compound semiconductors - Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – variation of Fermi level with temperature and impurity concentration – Hall effect –determination of Hall coefficient – Applications	
UNIT III -SEMICONDUCTOR LASER	(9)
Population of energy levels – Einstein's A and B coefficients derivation -Resonant cavity – Types of Semiconductor lasers: homo junction and hetero junction- Determination of particle size using laser - Holography – construction – reconstruction – Engineering applications of lasers -Medical field (Surgery).	
UNIT IV -PHOTO DETECTORS	(9)
Classification of optical materials- Carrier generation and recombination processes- Absorption, emission and scattering of light in metals, insulators and semiconductors (concept only)- Formation of P-N junction - Barrier potential and depletion layer – P-N junction diode-Solar cell–LED–organic LED- Laser diode – optical data storage technique.	

UNIT V -ADVANCED NEW ENGINEERING MATERIALS	(9)
Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): Characteristics, properties of NiTi alloy, application. Nano materials: Properties - Preparation – Pulsed laser deposition – chemical vapour deposition of nano particles and applications. Carbon nano tubes: fabrication – arc method – pulsed laser deposition –structure – properties and application.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. R. A. Serway and J.W. Jewett, "Physics for Scientists and Engineers", Ninth Edition. Cengage Learning, 2018.
2. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. V.Rajendran, — Engineering Physicsll, Tata McGraw-Hill. New Delhi.2019

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.

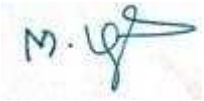
B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

WEB LINKS

1. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
2. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
3. https://zenodo.org/record/243407#.ZEgPZXZBzIU
4. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3	2												
3	3		2											
4	3													
5	3					2	2					2		
CO (W.A)	**3**	**2**	**2**			**2**	**2**					**2**		



22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to All Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To equip students with the essential skills and knowledge to solve computational problems using the C programming language.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply basic syntax and semantics of C language to write clear and structured code.	Ap	20%
CO2	Make use of both conditional statements and iterative control structures for developing applications.	Ap	20%
CO3	Apply knowledge of arrays and strings to solve computational problems.	Ap	20%
CO4	Identify modular solutions that integrate problem-solving techniques to solve complex computational problems.	An	20%
CO5	Analyze the performance implications using pointers and to manage file operations efficiently.	An	20%

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3	3											3	3	
4		3										3	3	
5		3											3	2
CO (W.A)	3	3										3	3	2

22ECC01 - BASICS OF ELECTRONICS ENGINEERING (Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT Branches)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objectives :	• To understand the basics of Electrical circuits and functions of transducers and measuring instruments. • To understand the working of electronic devices. • To analyze the DC and AC circuits using Network theorems.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the Ohm's law and Kirchhoff's law and investigates the behavior of electric circuits by analytical techniques.	Ap	30%
CO2	Apply the principles of operation of basic measuring and electronic instruments for specific measurements	Ap	30%
CO3	Apply logic design concepts to construct digital circuits.	Ap	20%
CO4	Analyze given electrical circuit through the Network theorems in DC to arrive at a suitable solution.	An	20%
CO5	Apply theoretical knowledge to present solutions to real-time problems involving circuits and demonstrate teamwork.	U	Internal Assessment

UNIT I - UNIT I - BASIC CIRCUITS ANALYSIS	**(9)**
Current, Voltage, Power – Nodes, Paths, Loops and Branches – Ohm's Law – Kirchhoff's laws – Single loop circuit – Series and parallel connected independent sources – Resistors in series and Parallel – Current and voltage division.	
UNIT II - NETWORK THEOREMS FOR DC CIRCUITS	**(9)**
Source transformation – Mesh Analysis-Node Analysis – Thevenins and Norton Theorem – Superposition Theorem – Maximum power transfer theorem.	
UNIT III - SEMICONDUCTOR DEVICES	**(9)**
PN junction diode, Characteristics – Diffusion and Drift Current – Zener diode, Characteristics – BJT: PNP and NPN, CE Configuration of BJT – JFET – MOSFET – UJT.	
UNIT IV - RECTIFIERS, FILTERS AND AMPLIFIERS	**(9)**
Transformers: Construction & Types – Rectifiers: Half Wave, Full Wave and Bridge – Filters: Induction, Capacitor, LC – Operational Amplifiers – Applications of Amplifier.	

UNIT V -TRANSDUCERS, MEASURING INSTRUMENTS AND DIGITAL CIRCUITS	(9)
LED – Piezo electric Transducers – LCD – Moving Coil and Moving Iron Instrument – CRO – Logic Gates: AND, OR, NOT and Universal Gates: NAND, NOR – Flip Flop: SR, JK.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", 8th Edition, Tata McGraw Hill publishers, New Delhi, 2013.
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGrawHill 4th Edition. 2017.

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
3. B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2	3												2	
3	3													2
4		3												2
5			1			2			2					
CO (W.A)	**3**	**3**	**1**			**2**			**2**				**2**	**2**

22PYP01 - PHYSICS LABORATORY (Common to All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

PRE-REQUISITE : NIL

Course Objective:	• To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory. • To introduce different experiments to test basics of physics concepts applied in optics and electronics

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Examine the effects of material type and loading conditions on the results of the non-uniform bending experiment.	An
CO2	Utilize principles of light interaction to determine the particle size of materials using laser diffraction techniques.	Ap
CO3	Evaluate the accuracy of the wavelength of different colors with the accepted values in the literature	Ev
CO4	Measure the effectiveness of the solar cell based on its V-I characteristics.	Ev
CO5	Analyze the principles underlying the Air wedge method for the determination of the thickness of a thin wire,	An

LIST OF EXPERIMENTS:

1. Determination of Young's modulus by non-uniform bending method
2. Determination of (a) wavelength and (b) particle size using Laser.
3. Determination of thermal conductivity of a bad conductor – Lee 's Disc method.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of band gap of a semiconductor.
6. Determination of thickness of a thin wire – Air wedge method.
7. Determination of V-I characteristics of solar cell.

TOTAL (P:30) = 30 PERIODS

*Ratified by Eleventh Academic Council

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3												
2	3											2		
3	3	3												
4	3											2		
5	3	3												
CO (W.A)	**3**	**3**										**2**		

*Ratified by Eleventh Academic Council

22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to All Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To develop programs to solve basic problems by understanding basic concepts in C language

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Formulate the algorithms for simple problems	Ap
CO2	Apply the concept of pointers of different types	Ap
CO3	Apply and manipulate data with arrays, strings and structures	Ap
CO4	Apply the concept of functions and dynamic memory allocation	Ap
CO5	Analyse and correct logical errors encountered during execution	An

LIST OF EXPERIMENTS:

1. Draw the flowchart for the following using Raptor tool.
    a) Simple interest calculation
    b) Greatest among three numbers
    c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3												
2	3											2		
3	3	3												
4	3											2		
5	3	3												
CO (W.A)	**3**	**3**										**2**		

22ECP01- BASICS OF ELECTRONICS ENGINEERING LABORATORY *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PRE-REQUISITE : NIL				
Course Objectives:	• To examine the basics of Semiconductor Devices and its characteristics. • To learn and practice with measurement of Electrical circuits and Amplifiers. • To design a digital circuits using various basic logic gates.			

Course Outcomes The student will be able to		**Cognitive Level**
CO1	Apply working principles and operations of Semiconductor Devices and plot the characteristics.	Ap
CO2	Apply the knowledge of network theorems and basic laws and investigate the behavior of electric circuits.	An
CO3	Apply the concepts of Boolean Algebra and verify the output of logic gates.	E
CO4	Analyze the characteristics of Semiconductor Devices and calculate the required parameters.	Ap
CO5	Involve in team learning, communicate effectively and maintain record for the experiments.	Ap

List of Experiments

(Cycle- I)
1.Plot the V-I Characteristics of PN junction diode and also find the forward and reverse resistance
2.Plot the V-I Characteristics of Zener diode and also find the forward and reverse resistance
3.Plot the Input-Output characteristics of Common Emitter Configuration(CE) using BJT
4.Find the Characteristics of FET and also plot the drain and transfer characteristics
5. Plot the V-I Characteristics of UJT
6.Construct the Half wave Rectifier & Full wave Rectifier and plot the graph
(Cycle- II)
1.Verification Kirchoff's Voltage Law (KVL) ,Kirchoff's Current Law(KCL)
2.Verfication of Thevenin's Theorem
3. Verfication of Norton's Theorem
4.Verification logic gates
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													3
3	3												3	
4		3											3	
5						1			2	2				3
CO (W.A)	**3**	**3**				**1**			**2**	**2**			**3**	**3**

22MAN02 - SOFT/ANALYTICAL SKILLS – I (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**
PRE-REQUISITE : NIL				
Course Objective:	• To understand the basic concepts of grammar and apply them in a structured Manner • To solve mathematical problems and thereby reducing the time taken for performing job functions			

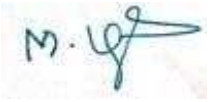
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Recognize and apply fundamental grammatical rules in both written and spoken contexts.	U	40%
CO2	Solve real-time problems for performing job functions easily.	Ap	30%
CO3	Enhance their aptitude round clearing ability in interview process.	An	30%

UNIT I – VERBAL ABILITY	(5+10)
Tenses - One Word Substitution- Articles - Preposition - Conjunction	
UNIT II – BASIC APTITUDE	(5+10)
Percentage - Ratio and Proportion - Blood Relations - Analogy	
UNIT III – LOGICAL REASONING	(5+10)
Probability - Profit and Loss - Syllogism - Statement Assumptions.	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN03 YOGA – I (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To make students in understanding the importance of yoga in shaping mental and physical wellness. • To provide awareness about the significance of leading a peaceful life by following yoga exercises and principles. • To develop mental wellbeing through meditation and breathing exercises. • To strengthen the body through physical exercises. • To inculcate the knowledge about different types of Asanas and their benefits

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understand the importance of yoga for physical and mental goodness.	U	Internal Assessment
CO2	Perform the yoga exercises for hand, leg, eye and sun salutation etc.	Ap	
CO3	Learn and practice meditation techniques for keeping good mental health	Ap	
CO4	Develop their body by performing yoga exercises.	Ap	
CO5	Demonstrate different types of yoga Asanas for improving their personal fitness.	Ap	

UNIT I – INTRODUCTION TO YOGA	(3)
Meaning and Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra.	
UNIT II - YOGA AND LIFE STYLE	(3)
Asanas as Preventive measures – Hypertension:Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana – Obesity: Procedure, Beneits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana – Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana - Diabetes: Procedure, Benefits and contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana – Asthema: Procedure, Benfits and contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	
UNIT III – MIND EXERCISES	(3)
Naadi sudhi – Thanduvada sudhi – Breathing meditation – Silent meditation – Relax meditation.	
UNIT IV – PHYSICAL EXERCISES (PART– I)	(3)
Hand Exercises – Leg Exercises – Eye Exercises – Sun Salutation.	

UNIT V – ASANAS (PART-I)	(3)
Asanas –Tadasana – Yegapadhasana – Chakrasana – Udkaddasana – Thirikosana – Thandasana – Paschimottanasana.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOKS/REFERENCES:
1. Light On Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								3	2			3		

*Ratified by Eleventh Academic Council

22EYA02- PROFESSIONAL COMMUNICATION- II (Common to All Branches)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRE-REQUISITE : 22EYA01					
Course Objective:	• To enhance the students with necessary English language skills • To enable students to communicate effectively in an academic setting				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Frame sentences both in written and spoken forms with accuracy and fluency.	R	20%
CO2	Use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.	U	20%
CO3	Gain essential competency to express one's thoughts orally and in writing in a meaningful way.	U	20%
CO4	Attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.	Ap	20%
CO5	Perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.	U	20%

UNIT I - LANGUAGE RUDIMENTS	(6+6)
Grammar – Active and Passive Voice – Impersonal Passive Voice – Numerical Expressions - Listening – Listening for Specific Information and Match / Choose / Fill in the texts - Speaking – Describing a Person - Making Plans -Reading – Intensive Reading -Writing – Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	(6+6)
Grammar – Reported Speech – Infinitive and Gerund - Listening – Listening to Iconic Speeches and making notes - Listening news / documentaries - Speaking –Talking over Phone – Narrating Incidents - Reading – Extensive Reading (Motivational Books) - Writing – Recommendation	
UNIT III - TECHNICAL CORRESPONDENCE	(6+6)
Grammar – If Conditionals – Blended Words - Listening – Listening to business conversation on audio and video of Short Films, News, Biographies - Speaking – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- Reading - Finding key information in a given text - Writing –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	(6+6)
Grammar – Concord – Compound Words - Listening – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - Speaking – Introduction to Technical Presentation - Story Telling - Reading – Reading and Understanding Technical Articles - Writing – Report Writing (Accident, Survey and feasibility)	

UNIT V - LANGUAGE BOOSTERS	(6+6)
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - Listening – Listening to different kinds of Interviews - Listening to Group Discussion - Speaking – Group Discussion - Reading – Reading and Interpreting Visual Materials - Writing – Analytical Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. **Grammar**
2. **Listening Skills**
3. **Speaking Skills**
4. **Reading Skills**
5. **Writing Skills**

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOKS:

1. Sudharshana, N.P and Saveetha.C. *English for Technical Communication*. Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf. *Effective Technical Communication.* Second Edition, McGraw Hill Education India PvtLtd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds. *A Student's Introduction to English Grammar.* Second Edition, Cambridge University Press, New Delhi, 2022.

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									**2**	**3**				

22MYB03 – STATISTICS AND NUMERICAL METHODS

(Common to AGRI, AI&DS,CSE,IT,IOT,CS(Cyber security)CIVIL,CHEMICAL,EEE,MECH Branches)

	L	T	P	C
	3	1	0	4

PRE-REQUISITE : NIL

Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t - distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(9+3)**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method – Iterative methods of Gauss Jacobi and Gauss Seidel Methods– Eigenvalues of a matrix by Power method .	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules - Romberg's Methods.	

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UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	(9+3)
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	
3		2											2	2
4	3													2
5	3				2				3			2		2
CO (W.A)	**3**	**2**			**2**				**3**			**2**	**2**	**2**

*Ratified by Eleventh Academic Council

22AIC01 –DATA STRUCTURES USING C *(Common to 22CSC02, 22CCC01, 22CIC01 and 22ITC01)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : 22CSC01					
Course Objective:	• To develop skills to apply appropriate data structures in problem solving. • To apply abstract data types (ADTs), recursion, algorithms for searching and sorting, and basic algorithm analysis.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply pointer and array concepts in functions.	Ap	20%
CO2	Solve problems using various implementations of linked list.	Ap	20%
CO3	Make use of ADTs like stack and queue for solving real world problems	Ap	20%
CO4	Analyze the tree traversal algorithms for various non-linear data structures.	An	20%
CO5	Analyze appropriate graph algorithms for computing problems	An	20%

UNIT I - POINTERS USING ARRAYS AND STRINGS	**(9)**
Pointers : Introduction – Pointers and arrays– passing an array to a function– returning an array from function – NULL pointers –Array of pointers – Pointer-to-pointer – Dangling Pointer. Function pointers: calling a function using function pointer- Using pointer as a function argument	
UNIT II - LIST	**(9)**
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT	
UNIT III - STACKS AND QUEUES	**(9)**
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressionsInfix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues	
UNIT IV - TREE	**(9)**
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.	
UNIT V - GRAPHS	**(9)**
Definitions – Representation of Graphs – Types of Graph – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph.	
TOTAL (L:45) : 45 PERIODS	

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TEXT BOOKS:

1. Sumitabha Das, "Computer Fundamentals &C Programming", McGraw Hill Education(India) Private Limited, 1st Edition, 2018.
2. Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.

REFERENCES:

1. Yashavant Kanetkar, "Pointers in C", BPP Publications, 4th Edition, 2017.
2. PradipDey, Manas Ghosh, "Programming in C", Oxford Higher Education, 2nd Edition, 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											3	3	
2	3											3	3	
3	3											3	3	
4		3										3	3	3
5		3										3	3	3
CO (W.A)	3	3										3	3	3

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22AIC02 - **PYTHON PROGRAMMING** ***(Common to 22CSC03, 22CCC02, 22CIC02 and 22ITC02)***				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To develop the logical thinking abilities and to propose novel solutions for real world problems through programming language constructs.

Course Outcomes		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of syntax and semantics of the Python programming to develop different applications	Ap	20%
CO2	Apply control statements and operators to solve basic programming problems	Ap	20%
CO3	Make use of string,list, dictionaries, tuples, and sets data structures for developing applications	Ap	20%
CO4	Develop modular code using functions and manage file operations efficiently	C	20%
CO5	Perform data manipulation with NumPy arrays	C	20%

UNIT I - INTRODUCTION TO PYTHON	**(9)**
Introduction to python: Features - Execution of python program – Flavors of Python – Comments - Data Types: Built-in data types– Sequences – Set - Literals– Operators – Input and Output Statements - Control Statements: if – if-else –if-else-if – while-For –Nested loops – the else suite - Break – Continue - pass - assert – return.	
UNIT II - STRINGS	**(9)**
Arrays: One Dimensional arrays - Multi Dimensional arrays - Strings and Characters: Creating - Length - Indexing - Slicing - Repeating - Concatenation - Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing - Splitting and Joining Strings - Changing Case - Checking Starting and Ending of a String – String Formatting - Working with Characters – Sorting and Searching Strings - Finding Number- Inserting sub string into a string.	
UNIT III - LISTS , TUPLES AND DICTIONARIES	**(9)**
Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a tuples. Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.	

UNIT IV - FUNCTIONS AND FILES	(9)
Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators. Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories.	
UNIT V - MODULES AND FRAMEWORKS	**(9)**
Modules: Importing module –Features – Built in functions. - Python Environment and Frameworks: NumPy: NumPy Arrays – Computation on NumPy Arrays – Aggregation – Sorting Arrays – Structured Arrays.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 2021 Edition.
2. Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1st Edition O'Reilly Publishers, 2016.

REFERENCES:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2018.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2013.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	
2	3	3											3	
3	3	3	3										3	3
4			3		3								3	3
5			3		3								3	3
CO (W.A)	**3**	**3**	**3**		**3**		**3**						**3**	**3**

22AIC03 - DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION *(Common to 22CSC04, 22CCC03, 22CIC03 and 22ITC03)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective: To make students familiar with the Principles and the Implementation of Computer Arithmetic, Memory System and I/O organization				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamentals of computer systems and analyze the execution of instruction.	Ap	20%
CO2	Analyze and design sequential and combinational logic circuits.	An	40%
CO3	Summarize the different types of control design and identify hazards.	Ap	20%
CO4	Use memory mapping techniques, interconnection standards and identifies different ways of communication with I/O devices and interfaces.	An	20%
CO5	Make an effective oral presentation on concepts related to computer organization and design.	An	Internal Assessment

UNIT I - COMBINATIONAL LOGIC	**(9)**
Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder –Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexer and Demultiplexers.	
UNIT II - SYNCHRONOUS SEQUENTIAL LOGIC	**(9)**
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis of clocked sequential circuits – Shift Registers – Counters – Mod Counter –Up/Down Counter.	
UNIT III - COMPUTER FUNDAMENTALS	**(9)**
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Design of Fast Address – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast multiplication.	
UNIT IV - PROCESSOR	**(9)**
Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.	
UNIT V - MEMORY AND I/O DEVICES	**(9)**
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping Techniques – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.	
TOTAL (L:45) : 45 PERIODS	

*Ratified by Eleventh Academic Council

TEXT BOOKS:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

REFERENCES:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", 6th Edition, Morgan Kaufmann/Elsevier, 2020
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2016.
3. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	
2		3	3										3	
3				3										3
4					3								3	
5										3				
CO (W.A)	**3**	**3**	**3**	**3**	**3**					**3**			**3**	**3**

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22AIP01– DATA STRUCTURES LABORATORY
(Common to22CSP02, 22CCP01, 22CIP01 and 22ITP01)

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : 22CSP01

Course Objective:	• To understand the fundamental concepts of data structures, including arrays, linked lists, stacks, queues, trees, and graphs.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Applying pointers and implement array operations	Ap
CO2	Analyze different steps on linked lists.	An
CO3	Capable of working with stack and queue principles.	An
CO4	Cable to creating and modifying a variety of tree operations.	C
CO5	Possible for executing numerous graph functions	Ap

LIST OF EXPERIMENTS:

1. Pointer using 1D, 2D array
2. Implementation of singly linked list and its operations
3. Implementation of doubly linked list and its operations
4. Implementation of circular linked list and its operations
5. Implementation of Infix to postfix conversion using stack ADT
6. Implement the application for evaluating postfix expressions using array of stack ADT
7. Implementation of reversing a queue using stack
8. Binary Search Tree
9. AVL Tree
10. Priority Queues (Heaps)
11. Implementation of Graph Traversals (BFS, DFS)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.

Software:

Compiler – C

TOTAL (P:60) : 60 PERIODS

*Ratified by Eleventh Academic Council

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3		3										3	
2	3	3		3										
3			3											3
4		3		3			3						3	
5			3	3					3				3	3
CO (W.A)	**3**	**3**	**3**				**3**		**3**				**3**	**3**

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22AIP02 - PYTHON PROGRAMMING LABORATORY

(Common to 22CSP03, 22CCP02, 22CIP02, and 22ITP02)

L	T	P	C
0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• Gain proficiency in Python programming by applying fundamental concepts and techniques in practical exercises.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of python programming concepts to solve basic computational problems.	AP
CO2	Implement functions and file handling problems using python..	AP
CO3	Develop GUI applications using python framework.	C
CO4	Perform data manipulation using NumPy	AP
CO5	Design a python program for given requirement.	C

LIST OF EXPERIMENTS:

1. Programs for demonstrating the use of different types of operators.
2. Programs for demonstrating control statements.
3. Programs to implement various string operations.
4. Programs for demonstrating the following
   i. Lists
   ii. Tuples
   iii. Dictionaries
5. Programs to demonstrate concepts using functions
6. Programs to implement applications using File handling
7. Programs to demonstrate modules.
8. Programs to implement applications using regular expression.
9. Program to demonstrate GUI.
10. Perform data manipulation using NumPy.

TOTAL (P:60) = 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 30 nodes (OR) Standalone PCs – 30 Nos, **Software:** OS – Windows / UNIX Clone Open Source Software – Python

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		3												
3			3		3									
4					3									
5			3											3
CO (W.A)	3	3	3		3									3

22MEP01 - ENGINEERING GRAPHICS LABORATORY

(Common to AI & DS, BME, CSE, CSE (IoT), CSE (CS), ECE and IT Branches)

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To Construct various plane curves drawing by Modeling software with dimensions • To Construct the concept of first angle projection of points, lines and plane drawing by Modeling software with dimensions • To Develop the projection of solids drawing by Modeling software with dimensions • To Solve problems in sectioning of solids and developing the surfaces drawing by Modeling software with dimension. • To Apply the concepts of orthographic and isometric drawing by Modeling software with dimensions

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the concept of Drawing standards in AutoCAD software,	Ap
CO2	Apply the drawing tools in AutoCAD software to create 2D drawing	Ap
CO3	Apply the drawing tools in AutoCAD software to draw the projections of solids	Ap
CO4	Apply the drawing tools in AutoCAD software to draw the Section and Development of surface	Ap
CO5	Apply the drawing tools in AutoCAD software to create 3D drawing	Ap

LIST OF THE EXPERIMENTS:

1. Study of basic tools, commands and coordinate systems (absolute, relative, polar, etc.) used in 2D software.
2. Draw the conic curves and special curves by using drafting software.
3. Draw the front view, top view, side view of objects from the given isometric view.
4. Draw the projections of straight line inclined to both the principal planes.
5. Draw the projections of polygonal surface.
6. Draw the projections of prism, pyramid inclined to anyone of the principal plane.
7. Draw the sectional view and the true shape of the given cylinder and cone.
8. Draw the development of surfaces like prism and pyramid.
9. Draw the isometric projections of cylinder and cone.
10. Draw the isometric projections of Prism and Pyramid.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3			3									3	2
2	3			3									3	2
3	3			3									3	2
4	3			3									3	2
5	3			3									3	2
CO (W.A)	**3**			**3**									**3**	**2**

22MAN04 - SOFT/ANALYTICAL SKILLS – II (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To acquire satisfactory competency in verbal reasoning. • To develop skill to meet the competitive examinations for better job opportunity.

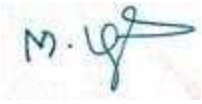
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment test**
CO1	Enhance vocabulary which in turn will help in developing language competency.	U	40%
CO2	Solve the problems easily by using Short-cut method with time management.	Ap	30%
CO3	Analyze the problems logically and approach the problems in a different manner.	An	30%

UNIT I - VERBAL COMPETENCY	(5+10)
Voice - Modal Verbs - Synonyms & Antonyms - Confusable Words	
UNIT II - NUMERICAL REPRESENTATION	(5+10)
Average - Data Interpretation - Simple Interest and Compound Interest - Venn Diagram.	
UNIT III - RESOLUTION TENDENCY	(5+10)
Time and Work - Pipes and Cistern - Number Series and Odd man Out - Cube Problems	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN05 - YOGA – II (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**
PRE-REQUISITE : 22MAN03				

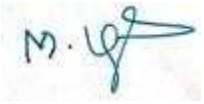
Course Objective:	• To strengthen the body through physical exercises. • To understand the importance of value system and ethics. • To know the life philosophy of yogis and maharishis. • To understand the nature laws, cause and effect theory. • To inculcate knowledge about different types of Asanas and their benefits.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Perform physical exercises like spine exercises, massage and acupressure.	Ap	Internal Assessment
CO2	Learn the human values, ethics, time management and the importance of introspection.	U	
CO3	Analyze various life philosophies of yogi's and rishi's.	An	
CO4	Understand life lessons and nature laws.	U	
CO5	Demonstrate different types of yoga Asanas and improve their personal fitness.	Ap	

UNIT I – PHYSICAL EXCERCISES (PART-II)	(3)
Breathing Exercises – Kapalapathi – Maharasanam (Spine Exerices) – Massage and Acupressure.	
UNIT II – HUMAN VALUE	(3)
Divine power – Life force (Bio magnetism) – Importance of Introspection – Time management – Punctuality – self confidence – mind control.	
UNIT III – PHILOSOPHY OF LIFE	(3)
Basic needs for life – Hunger and thirst – climatic/weather changes – Body wastes – pressure of excretory organs – safety measures – protection from natural disaster – protection from enmity – protection from accidents – ethics – morality – duty – charity – Wisdom of perfection stages – faith – understanding – realization.	
UNIT IV – NATURE'S LAW OF CAUSE AND EFFECT	(3)
Food transformation into seven minerals – Natural actions – pattern – precision – regularity – Required skills – planned work – awareness – introspection.	
UNIT V – ASANAS (PART-II)	(3)
Ustrasana – Vakrasana –Komugasana – Padmasana – Vajrasana – Sukhasana – Yogamudra – mahamudra.	

TEXT BOOKS/REFERENCES:
1. Light On Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								3	2			3		



*Ratified by Eleventh Academic Council

22GYA01 HERITAGE OF TAMILS *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

UNIT I - LANGUAGE AND LITERATURE	**(3)**
Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	
UNIT II - HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	**(3)**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	
UNIT III - FOLK AND MARTIAL ARTS	**(3)**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	
UNIT IV - THINAI CONCEPT OF TAMILS	**(3)**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	
UNIT V - CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	**(3)**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA01 தமிழர் மரபு (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	1	0	0	1
முன் தேவை: இல்லை				

அலகு 1 மொழி மற்றும் இலக்கியம்	(3)
இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை– சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு 2 மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை:	**(3)**
நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள்– தேர் செய்யும் கலை– சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	
அலகு 3 நாட்டுப்பறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**(3)**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டாம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	
அலகு 4 தமிழர்களின் திணைக் கோட்பாடுகள்:	**(3)**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளின் சோழர்களின் வெற்றி.	
அலகு 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**(3)**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் –இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ் புத்தக்களின் அச்சு வரலாறு.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA02 TAMILS AND TECHNOLOGY *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

UNIT I - WEAVING AND CERAMIC TECHNOLOGY	**(3)**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	
UNIT II - DESIGN AND CONSTRUCTION TECHNOLOGY	**(3)**
Designing and Structural construction House & Designs n household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	
UNIT III - MANUFACTURING TECHNOLOGY	**(3)**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.	
UNIT IV - AGRICULTURE AND IRRIGATION TECHNOLOGY	**(3)**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	
UNIT V - SCIENTIFIC TAMIL & TAMIL COMPUTING	**(3)**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA02 தமிழரும் தொழில்நுட்பமும் (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	I	0	0	I
முன் தேவை: இல்லை				

அலகு 1 நெசவு மற்றும் பானைத் தொழில்நுட்பம்:	(3)
சங்ககாலத்தில் நெசவுத்தொழில் – பானைத் தொழிலநுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.	
அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:	**(3)**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ–சாரோசெனிக் கட்டிடக் கலை.	
அலகு 3 உற்பத்தி தொழில் நுட்பம்:	**(3)**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
அலகு 4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்:	**(3)**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.	
அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	**(3)**
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22MYB05 – DISCRETE MATHEMATICS *(Common to CSE,IT,AI&DS,IOT,CS(Cyber security))*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE-REQUISITE : NIL

Course Objective:	• To understand the basic concepts of logic, properties of set theory and their applications in Algorithms. • To understand the ideas about Lattices and general counting methods involving permutations and combinations.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of logic to solve the problems in Artificial Intelligence.	Ap	20%
CO2	Calculate the applications of predicate logic used in data science.	An	20%
CO3	Solve different properties of injection, surjection, bijection, composition and inverse functions in software engineering.	Ap	20%
CO4	Determine the concepts of lattices, Permutations, Combinations and Mathematical induction in the experience of network theory and analysis of algorithms.	An	40%
CO5	Demonstrate the importance of lattice theory using the modern tools and solve the real time problems in various contexts.	Ap	Internal Assessment

UNIT I - PROPOSITIONAL CALCULUS	**(9+3)**
Propositions-Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables-Tautologies and Contradictions-LogicalEquivalences and implications – DeMorgan's Laws-Normal forms-Rules of inference-Arguments-Validity of arguments.	
UNIT II - PREDICATE CALCULUS	**(9+3)**
Predicates-Statement Function-Variables-free and bound variables-Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements-Theory of inference-The rules of universal specification and generalization-Validity of arguments.	
UNIT III - SET THEORY AND FUNCTIONS	**(9+3)**
Set Operations-Properties-Power set-Relations-Graph and matrix of a relation-Partial Ordering-Equivalence relation-Functions-Types of functions-Composition of relation and functions-Inverse functions.	
UNIT IV - COMBINATORICS	**(9+3)**
Basics of counting - Counting arguments - Pigeonhole Principle - Permutations and Combinations-Recursion and recurrence relations - Generating Functions - Mathematical Induction – Inclusion and Exclusion.	

UNIT V - LATTICES	(9+3)
Posets-Lattices as posets-Properties of lattices-Lattices as Algebraic systems – Sub lattices - Direct product and Homomorphism.	
TOTAL (L:45+ L:15) : 60 PERIODS	

TEXT BOOKS:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science " , Tata McGraw-Hill, New Delhi, Reprint 2010.
2. Veerarajan.T, "Discrete Mathematics with Graph Theory and Combinatorics", 4thedition, Tata McGraw Hill, New Delhi, 2008.
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5th edition, Tata McGraw Hill Publications, New Delhi, 2007.

REFERENCES:

1. Venkatraman M.K., "Discrete Mathematics" , the National Publishing Company, Chennai, 2007.
2. S.Santha, "Discrete Mathematics with Combinatorics and Graph Theory" ,Cengage Learning India Pvt. Ltd. 2010 .
3. Swapan Kumar Sarkar, "A Text Book of Discrete Mathematics" , S. Chand & Company Ltd., New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		2												
3	3													
4		2												2
5	3				2				3			2	2	2
CO (W.A)	3	2			2				3			2	2	2

22AIC04 - JAVA PROGRAMMING *(Common to 22CSC07, 22CCC06,22CIC06 and 22ITC06)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE: NIL				
Course Objective:	• To understand object-oriented programming concepts, and apply them in solving problems. • To introduce the design of Graphical User Interface using applets and swing controls.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of classes and objects to solve simple problems using Java	Ap	20%
CO2	Analyse how oops concepts like inheritance, polymorphism improves code organization and enhances flexibility.	An	20%
CO3	Build interactive applications using applets and swing	An	20%
CO4	Conduct practical experiments for demonstrating exception handling, multithreaded applications with synchronization.	An	40%
CO5	Build the Java Project for engineering applications and make an individual study being member of team.	An	Internal Assessment

UNIT I - INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	**(9)**
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Strings, Packages - JavaDoc comments.	
UNIT II - INHERITANCE AND INTERFACES	**(9)**
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods-Keywords: Static-final-this- final methods and classes – Method overloading-Method overriding-Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces	
UNIT – III EXCEPTION HANDLING AND I/O	**(9)**
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing File	

UNIT – IV –THREADS	(9)
Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads — Thread Priorities – Synchronization – Inter thread Communication – Suspending, Resuming, and Stopping Threads – Using Multithreading.	
UNIT – V EVENT DRIVEN PROGRAMMING	**(9)**
Graphics programming - Frame – Components Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019 for Units I, II, III, IV.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015 for Unit V.

REFERENCE:

1. Cay. S. Horstmann, Gary Cornell, "Core Java-JAVA Fundamentals", Prentice Hall, 10th ed., 2016.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.3. SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2		3												3
3			3		3								3	
4				3										
5					3				3		2	3		3
CO (W.A)	**3**	**3**	**3**		**3**				**3**		**2**	**3**	**3**	**3**

2AIC05 – ARTIFICIAL INTELLIGENCE				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge on the different types of AI agents, various AI search algorithms, fundamentals of knowledge representation. • To build simple knowledge-based systems and to apply knowledge representation, reasoning.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of agent architecture, searching and reasoning techniques for different applications.	Ap	40%
CO2	Analyze Searching and Inference Techniques.	An	20%
CO3	Analyze Game playing and Knowledge representation for the given specifications and data	An	20%
CO4	Apply various AI search Models and Generic search strategies to solve problems.	Ap	20%
CO5	Review the literature related to Artificial Intelligence and presents a report with example application.	C	Internal Assessment

UNIT I - Intelligent Agents	(9)
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.	
UNIT II - Problem Solving	(9)
Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.	
UNIT III - Game Playing and CSP	(9)
Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.	
UNIT IV - Logical Reasoning	(9)
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.	
UNIT V - Probabilistic Reasoning	(9)
Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007

REFERENCES:

1. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
2. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
4. http://nptel.ac.in/

Mapping of COs with POs / PSOs

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3		3		3										3
4	3			3	3								3	
5									3	3				
CO (W.A)	3	3		3	3				3	3			3	3

22AIC06 - ALGORITHMS
(Common to 22CSC05, 22CCC04,22CIC04 and 22ITC04)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : 22AIC01

Course Objective:	• To develop problem-solving skills through algorithms and prepare students to apply the skills in various domains such as software development, research, and engineering.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the time and space complexities of algorithms using asymptotic notations	An	20%
CO2	Apply algorithmic concepts and techniques to design and develop efficient solutions for real-world problems	Ap	40%
CO3	Apply the knowledge of complexity classes P, NP and NP-Completeness problem	An	20%
CO4	Design efficient algorithms to solve graph problems	Ap	20%
CO5	Optimized the existing algorithms by reducing the lines of code	An	Internal mode

UNIT I - INTRODUCTION (9)

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.

UNIT II - BRUTE FORCE AND DIVIDE-AND-CONQUER (9)

Brute Force – Computing an – String Matching - Selection Sort and Bubble Sort – Sequential Search - Closest- Pair and Convex-Hull Problems - Exhaustive Search: Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort –Closest- Pair and Convex - Hull Problems.

UNIT III - DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE (9)

Dynamic Programming : Computing a Binomial coefficient – Warshall's and Floyd's Algorithm – Optimal Binary Search trees - 0/1 Knapsack Problem. Greedy Technique: Prim's algorithm and Kruskal's Algorithm - Huffman Trees.

UNIT IV - ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER (9)

Iterative Improvement - The Simplex Method - The Maximum-Flow Problem- Maximum Matching in Bipartite Graphs. Limitations of Algorithm Power: Lower bound arguments – Decision trees – P, NP and NP complete Problems.

UNIT V - STATE SPACE SEARCH ALGORITHMS	(9)
Backtracking: N Queen's problem – Hamiltonian Circuit problem – Subset problem - Graph colouring problem. Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem – Travelling Salesman Problem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 3rd ed., 2017.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
2. S. Sridhar, "Design and Analysis of Algorithms ", Oxford university press, 2014.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	3
2	3												3	
3		3											3	
4	3												3	
5			3	3					3				3	3
CO (W.A)	**3**	**3**	**3**	**3**					**3**				**3**	**3**

22AIC07-DATA EXPLORATION AND VISUALIZATION				
	L	T	P	C
	3	0	2	4

PRE-REQUISITE : NIL

Course Objective:	• To implement data visualization using Matplotlib. • To perform univariate, bivariate and multi variate data exploration and analysis.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze and visualize the tools for exploratory data analysis.	Ap	20%
CO2	Analyze and design solutions for geographical datasets using tool/packages.	An	20%
CO3	Apply and analyze univariate.	An	20%
CO4	Apply and analyze bivariate using contingency table.	Ap	20%
CO5	Apply data cleaning and grouping concepts in dataset.	C	20%

UNIT I - EXPLORATORY DATA ANALYSIS	**(9)**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II – VISUALIZING USING MATPLOTLIB	**(9)**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT III - UNIVARIATE ANALYSIS	**(9)**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV - BIVARIATE ANALYSIS	**(9)**

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

UNIT V - MULTIVARIATE AND TIME SERIES ANALYSIS	**(9)**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

LIST OF EXPERIMENTS:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse
7. Rollover effect, user interaction, etc..
8. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
9. Perform EDA on Wine Quality Data Set.
10. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

HARDWARE:

Standalone Desktops with Linux OS

SOFTWARE:

Python

TOTAL (L:45+P:30) : 75 PERIODS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCE BOOKS:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3	3				3						3	
3	3	3											3	
4	3	3												3
5	3				3				3					
CO (W.A)	**3**	**3**	**3**		**3**		**3**		**3**				**3**	**3**

22AIP03 - JAVA PROGRAMMING LABORATORY *(Common to 22CSP06, 22CCP05,22CIP05 and 22ITP04)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To learn Java Programming concepts and develop applications based on Java.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Apply the concepts of Java to solve problems	Ap
CO2	Analyze the efficiency of using appropriate programming constructs.	An
CO3	Demonstrate the usage of different programming structures through example programs	Ap
CO4	Develop simple applications using swing.	C
CO5	Engage in independent study and learn to use Java for real time applications.	An

LIST OF EXPERIMENTS:

1. Write simple Java programs using operators, arrays and control statement
2. Programs using Static, final and this keywords.
3. Demonstrate the concepts of inheritance
4. Programs illustrating overloading and overriding methods in Java
5. Programs to use packages and Interfaces in Java.
6. Implement exception handling and creation of user defined exception.
7. Implement program to demonstrate multithreading and inter thread communication.
8. Write a program to perform file operations.
9. Develop applications using swing layouts

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 No's, Printers – 3 Nos.

Software:

- Java / Equivalent Compiler

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3		3			2									3
4			3		3								3	
5									3			3		
CO (W.A)	**3**	**3**	**3**		**3**				**3**			3	**3**	**3**

22AIP04 - ARTIFICIAL INTELLIGENCE LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To design and implement search strategies, CSP Techniques and logical reasoning agents. • To apply appropriate algorithms for solving given AI problems.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Design and implement search strategies.	Ap
CO2	Analyze appropriate algorithms for solving given AI problems.	An
CO3	Design and implement CSP Techniques.	Ap
CO4	Demonstrate knowledge about logical reasoning agents.	An
CO5	Create different Artificial Intelligence algorithms to solve real world problems	C

LIST OF EXPERIMENTS :

1 Implement basic search strategies – 8-Puzzle, 8 - Queens problem.
2. Implement A* and memory bounded A* algorithms
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
4. Implement simulated annealing algorithms for AI tasks
5. Implement backtracking algorithms for CSP
6. Implement local search algorithms for CSP
7. Build naïve Bayes models
8. Implement Bayesian networks and perform inferences
9. Mini-Project

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3		3										3	
2	3	3											3	
3		3	3											3
4			3										3	
5							3		3		3	3	3	3
CO (W.A)	**3**	**3**	**3**				**3**		**3**		**3**	**3**	**3**	**3**

22AIP05 - ALGORITHMS LABORATORY *(Common to 22CSP04, 22CCP03, 22CIP03, and 22ITP03)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To learn and apply important algorithmic design paradigms and methods of analysis.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Implement basic algorithms such as brute force, string matching, sorting, and sequential search.	Ap
CO2	Apply algorithmic thinking to break down problems into manageable steps.	Ap
CO3	Apply dynamic programming techniques to solve complex computational problems.	Ap
CO4	Apply the greedy approach used in algorithm for finding minimum spanning trees in weighted undirected graphs.	Ap
CO5	Implement backtracking algorithms to solve a variety of combinatorial problems efficiently.	Ap

LIST OF EXPERIMENTS:

1. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
2. Sort a given set of elements using the Insertion sort, Selection sort and Bubble sort
3. Implementation of Linear Search.
4. Implementation of Recursive Binary Search
5. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
6. Develop a program to sort the numbers using Merge and Quick sort .
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
10. Implement N Queens problem using Backtracking.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:
LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,.
Software:
C/C++/JAVA/ Python

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2	3		3											
3	3		3				3							
4	3		3			3	3							
5	3		3											
CO (W.A)	**3**		**3**			**3**	**3**						**3**	

22MAN07-SOFT / ANALYTICAL SKILLS – III (Common to All Branches and Applicable for (2022-2026) Batch only)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• Improving overall language proficiency for personal or professional reasons • To develop problem solving skills across all levels

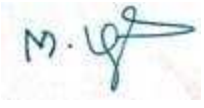
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Write grammatically correct and coherent sentences.	U	40%
CO2	Develop problem solving skills across all levels.	Ap	30%
CO3	Solve reasoning problems with ease.	An	30%

UNIT I - VERBAL COMPETENCY	(5+10)
Sentence Selection - Paragraph Formation - Sentence Correction - Spellings	
UNIT II - APTITUDE	(5+10)
Clocks - Calendar- Age Problems - Problem on Trains - Problems on Numbers - Partnerships	
UNIT III - LOGICAL & REASONING	(5+10)
Coding & Decoding - Logical Equivalent - Venn Diagram Problem	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN07R - SOFT/ANALYTICAL SKILLS – III *(Common to All Branches and Applicable for (2023-2027) Batch only)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To improve language proficiency for personal or professional reasons • To enhance students' mathematical problem-solving and critical thinking skills

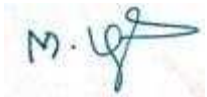
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Demonstrate effective communication skills by listening actively, speaking clearly, reading critically, and writing coherently in contexts.	U	40%
CO2	Develop proficiency in applying mathematical concepts of time, speed, distance, and financial calculations involving simple and compound interest.	Ap	30%
CO3	Analyse logical reasoning skills through various forms of statements.	An	30%

UNIT I – VERBAL ABILITY	**(5+10)**
Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.	
UNIT II – APTITUDE	**(5+10)**
Simple and Compound Interest - Time, Speed and Distance - Problems on Trains - Boats and Streams - Chain Rule - Time and Work - Pipe and Cisterns.	
UNIT III - REASONING	**(5+10)**
Seating Arrangements - Syllogism - Statement and Conclusion - Statement and Assumption - Statement and Course of Action.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN09 - INDIAN CONSTITUTION (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**0**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To educate students to learn about the Constitutional Law of India. • To motivate students to understand the role of Union Government. • To make students to understand about State Government. • To understand about District Administration, Municipal Corporation and Zila Panchayat. • To encourage students to Understand about the election commission.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain Knowledge about the Constitutional Law of India.	U	Internal Assessment
CO2	Know the Union Government and role of President and Prime Minister.	R	
CO3	Gain knowledge about State Government and role of Governor, Chief Minister.	U	
CO4	Understand the District Administration, Municipal Corporation and Zila Panchayat.	U	
CO5	Understand the role and function of election commission.	U	

UNIT I - THE CONSTITUTION INTRODUCTION	(3)
The History of the Making of the Indian Constitution - Preamble and the Basic Structure, and its interpretation - Fundamental Rights and Duties and their interpretation - State Policy Principles.	
UNIT II - UNION GOVERNMENT	(3)
Structure of the Indian Union - President - Role and Power - Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha	
UNIT III - STATE GOVERNMENT	(3)
Governor - Role and Power - Chief Minister and Council of Ministers - State Secretariat	
UNIT IV - LOCAL ADMINISTRATION	(3)
District Administration - Municipal Corporation - Zila Panchayat	
UNIT V - ELECTION COMMISSION	(3)
Role and Functioning - Chief Election Commissioner - State Election Commission	
TOTAL (L:15) : 15 PERIODS	

TEXT BOOKS:

1. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2. B.L. Fadia, "The Constitution of India", Sahitya Bhawan; New edition (2017).
3. DD Basu, "Introduction to the Constitution of India", Lexis Nexis; Twenty-Third 2018 edition.

REFERENCES:

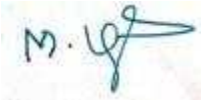
1. Steve Blank and Bob Dorf, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K & S Ranch ISBN – 978-0984999392
2. Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" , Penguin UK ISBN - 978-0670921607
3. Adrian J. Slywotzky with Karl Weber, "Demand: Creating What People Love Before They Know They Want It", Headline Book Publishing ISBN - 978-0755388974
4. Clayton M. Christensen, "The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business", Harvard business ISBN: 978-142219602.

REFERENCES: Web link

1. https://www.fundable.com/learn/resources/guides/startup
2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3		2		3		
2						3		3		2		3		
3						3		3		2		3		
4						3		3		2		3		
5						3		3		2		3		
CO (W.A)						**3**		**3**		**2**		**3**		



22MYBO8– PROBABILITY AND STATISTICS				
	L	T	P	C
	3	1	0	4

PRE-REQUISITE : NIL

Course Objective:	• To understand the mathematical concept of probability and random variable in various distributions. • To understand the concepts of testing the hypothesis of large and small samples and statistical quality control.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the axioms of probability and the moments of discrete and continuous random variables to engineering problems.	Ap	20%
CO2	Solve the concepts of discrete probability distributions including requirements of mean and variance fordecision making in algorithms.	Ap	20%
CO3	Determine the correlation and linear regression with respect to random variables in data science.	An	20%
CO4	Analyze large and small sample tests to perform non-parametric tests in machine learning and quality control.	An	40%
CO5	Demonstrate the statistical methods to solve the real life problems by using modern techniques.	Ap	Internal Assessment

UNIT I -PROBABILITY AND RANDOM VARIABLES	**(9+3)**
Probability: Random variable – Probability mass function – Probability density functions -Properties-Moments-Moments generating functions.	
UNIT II - STANDARD DISTRIBUTIONS	**(9+3)**
Discrete distributions: Binomial, Poisson and Geometric- Continuous distribution: Uniform, Exponential and normal distributions.	
UNIT III- TWO-DIMENSIONAL RANDOM VARIABLES	**(9+3)**
Joint distributions-Marginal and conditional distributions-Covariance-Correlation and linear regression.	
UNIT IV –ESTIMATION THEORY AND NON-PARAMETRIC TESTS	**(9+3)**
Differences between means, variations and ratio of two variances- Non-parametric Tests: Introduction-The sign test-The signed – Rank test- Rank-sum tests-The U test-The H test.	
UNIT V – STATISTICAL QUALITY CONTROL	**(9+3)**
Control charts for measurements ($\overline{X}$ and R-charts)-Control charts for attributes(p,c and np charts)-Tolerance limits-Acceptance sampling.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T, "Probability, Statistics and Random Processes with Queuing Theory and Queuing Networks",4ed. ,Tata McGraw-Hill, New Delhi 2018.
2. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12thedition,Sultan Chand & Sons, New Delhi- 2020.
3. Johnson.R.A., Miller.I.RandFreud.J.E,"Miller and Freund's Probability and Statistics for Engineers",Pearson Education,Asia,9 th edition,2016.

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1. Allen, 0. Arnold, "Probability, Statistics and Queuing Theory with Computer Applications ", 2nd ed., Elsevier, New Delhi, 1990.
2. Taha, H.A., "Operations Research -An Introduction", 8th ed., Pearson Education, New Delhi, 2008.
3. Trivedi, S.K, "Probability and Statistics with Reliability, Queuing and Computer Science applications", 2ndEd. John Wiley & Sons, New Delhi, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	
3		2											2	2
4		2											2	2
5	3				2				2			2		2
CO (W.A)	**3**	**2**			**2**				**2**			**2**	**2**	**2**

22CYB07 ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to AI&DS, CSE, CSE-CS, CSE-IOT and IT)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Produce the renewable and non-renewable resources and preserve them for future generations.	Ap	20%
CO4	Inspect the different methods of management of e-waste and apply them for suitable technological advancement and societal development.	An	20%
CO5	Evaluate the recycling of battery, cell phone , laptop and PCB	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	(9)
Environment - scope and importance - Eco-system- Structure and function of an ecosystem-types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(9)
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(9)
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	

UNIT IV – E- WASTE AND ITS MANAGEMENT	(9)
E-waste – sources of e-waste – hazardous substance in e-waste – chlorinated compounds – heavy metals - need for e-waste management – management of e-waste –Inventory management – production process – modification- Disposal treatment of e –waste – Incineration –acid baths – landfills.	
UNIT V – BATTERIES AND RECYCLING OF E-WASTE	(9)
Battery – types – Lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – process of recycling battery – lead acid battery – lithium ion battery – benefits of recycling battery – recycling of computing devices - mobile phones - PCB and servers.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

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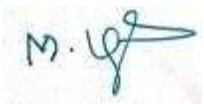
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3							
5						3			2			2		
CO (W.A)	2	2	2			3	3	2	2			2		



22AIC08 - OPERATING SYSTEMS *(Common to 22CSC08, 22CIC07, and 22ITC05)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To provide understanding about the fundamental concepts, design principles, and functionalities of operating systems.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the different concepts and functionalities of operating system	Ap	20%
CO2	Analyze the efficient scheduling algorithms in process management	An	30%
CO3	Develop solutions using the paging and virtual memory management strategies	Ap	40%
CO4	Manage concurrent access to shared resources in operating systems	An	10%
CO5	Collaborate and compare the various file system structures	An	Internal Assessment

UNIT I - FUNDAMENTALS	**(9)**
Introduction - System Architecture - Operating System Structure - Operations - Process Management - Memory Management - Storage Management - System Structure - User Operating System Interface - System Calls - Types - System Programs - Operating System Design and Implementation - Virtual machines.	
UNIT II - PROCESS MANAGEMENT	**(9)**
Process Concept - Process Scheduling - Operations on Processes- Inter Process Communication - Shared Memory and Message Passing Systems - CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Threads Overview - Thread Scheduling.	
UNIT III - PROCESS SYNCHRONIZATION	**(9)**
Synchronization: The Critical-Section Problem - Peterson's solution - Hardware support for Synchronization - Mutex – Semaphores - Deadlocks: Deadlock Characterization - Methods for handling deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.	
UNIT IV - MEMORY MANAGEMENT	**(9)**
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Segmentation - Virtual Memory - Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing,	

UNIT V - SECONDARY STORAGE MANAGEMENT	(9)
Secondary Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap Space Management - File System - File Concepts: Access Methods - Directory Structure - File System Mounting - File System Implementation - Structure – Implementation - Directory Implementation - Allocation Methods -Free Space Management - I/O Systems - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

REFERENCES:

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall of India Pvt., 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			2										2	
4				3	2									3
5								2	2					
CO (W.A)	**3**	**3**	**2**	**3**	**2**			**2**	**2**				**2**	**3**

22AIC09 – DATABASE DESIGN AND MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To impart knowledge on the different types data models, database design using conceptual mapping and normalization. • To build simple database system using SQL, querying in object relational and No SQL databases.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of database management system for various applications.	Ap	40%
CO2	Analyze database concepts for a given problem.	An	20%
CO3	Design conceptual data model for database applications.	Ap	20%
CO4	Analyze normalization concepts to design relational database.	An	20%
CO5	Demonstrate SQL commands to create, manipulate and query data in a database.	C	Internal Assessment

UNIT I - Database System Concept	(9)
Purpose of Database System – Views of data – Data Models – Database System Architecture – EntityRelationship model – E-R Diagrams – Enhanced-ER Model.	
UNIT II - Relational Database	(9)
Introduction to relational databases-Integrity constraints-Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL–Dynamic SQL-Triggers.	
UNIT III - Database Design	(9)
Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	
UNIT IV - Transaction Management	(9)
Transaction concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques. Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.	
UNIT V - Object Relational and NO-SQL Databases	(9)
Overview- Complex Data Types- Object-Identity and Reference Types in SQL- Object-Oriented versus Object-Relational-Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model; Column-based: Hbase data model.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2017.

REFERENCES:

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "Database Modeling and Design - Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.
3. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
5. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

Mapping of COs with POs / PSOs

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3		3		3										3
4	3			3	3								3	
5									3	3				
CO (W.A)	**3**	**3**		**3**	**3**				**3**	**3**			**3**	**3**

22AIC10 - MACHINE LEARNING				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To apply various machine learning models. • To design and analyze machine learning experiments.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate the basic concepts of machine learning.	Ap	20%
CO2	Examine supervised learning models.	Ap	20%
CO3	Apply unsupervised learning algorithms.	Ap	20%
CO4	Evaluate and compare different models	An	20%
CO5	Analyze machine learning experiments for various testing.	An	20%

UNIT I - INTRODUCTION TO MACHINE LEARNING	**(9)**
Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.	
UNIT II - SUPERVISED LEARNING	**(9)**
Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes,– Support vector machine, Decision Tree, Random Forests	
UNIT III - UNSUPERVISED LEARNING	**(9)**
Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.	
UNIT IV - ENSEMBLE TECHNIQUES AND NEURAL NETWORKS	**(9)**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Multilayer perceptron, activation functions, network training – gradient descent optimization – error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.	
UNIT V - DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS	**(9)**
Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013. (UNIT-I and II)
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3	3												3	
4		3		3										3
5		3		3										3
CO (W.A)	3	3		3									3	3

22AIC11-FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To understand the data analysis with an available data set.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of basic inferential statistics and sampling distribution	Ap	20%
CO2	Apply the knowledge to derive hypotheses for given data	Ap	20%
CO3	Analysis a case study with any available sample data sets.	An	20%
CO4	Apply the techniques of analysis of variance.	Ap	20%
CO5	Create knowledge in predictive analytics techniques	C	Internal Assessment

UNIT I – INFERENTIAL STATISTICS I	**(9)**
Populations–samples–randomsampling–probabilityandstatisticsSamplingdistribution–creatinga sampling distribution –mean of all sample means –standard error of the mean –other sampling distributions Hypothesis testing– z-test– z-test procedure–statement of the problem–null hypothesis– alternatehypotheses–decisionrule–calculations–decisions-interpretations	
UNIT II – INFERENTIALSTATISTICS II	**(9)**
Why hypothesis tests?–Strong or weak decisions–one-tailed and two-tailed tests–case studies Influence of samplesize –power and sample sizeEstimation – point estimate –confidence interval – level of confidence – effect of samplesize	
UNIT III - T-TEST	**(9)**
t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error–case studies t-test for two independent samples–statistical hypotheses–sampling distribution–test procedure–p-value–statistical significance–estimating effect size–meta analysis t-test for two related samples	
UNIT IV – ANALYSIS OF VARIANCE	**(9)**
F-test–ANOVA–estimatingeffectsize–multiplecomparisons–casestudiesAnalysisofvariancewith repeated measures Two-factor experiments –three f-tests –two-factor ANOVA –other types of ANOVA Introduction to chi-square tests	
UNIT V – PREDICTIVE ANALYTICS	**(9)**
Linear least squares–implementation –goodness of fit –testing a linear model–weighted resampling Regression using StatsModels –multiple regression –nonlinear relationships –logistic regression – estimating parameters– accuracy Time series analysis– moving averages – missing values –serial correlation–autocorrelation Introduction to survival analysis	
TOTAL = 45 PERIODS	

TEXT BOOKS

1. Robert S.Witte and John S.Witte, "Statistics",Eleventh Edition,Wiley Publications,2017.
2. Allen B.Downey, "ThinkStats:Exploratory Data Analysis in Python", Green Tea Press,2014.[UnitV]

REFERENCES

1. David Spiegel halter, "TheArtofStatistics:LearningfromData",PelicanBooks,2020.
2. Peter Bruce, Andrew Bruce ,and Peter Gedek, "Practical Statistics for Data Scientists" ,Second Edition, O'Reilly Publishers, 2020.
3. Charles R.Severance, "Python for Everybody: Exploring Data in Python3", Shroff Publishers, 2017.
4. Bradley Efron and Trevor Hastie, "Computer Age Statistical Inference", Cambridge University Press, 2016.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	2				3								3	2
3			2		3								3	
4			3		2								3	
5			3		2								3	
CO (W.A)	3		3		3								3	3

22AIP06 - DATABASE DESIGN AND MANAGEMENT LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To design and implement search strategies, CSP Techniques and logical reasoning agents. • To apply appropriate algorithms for solving given AI problems.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Demonstrate SQL commands to create, manipulate and query data in a database.	An
CO2	Implement various Pl/SQL objects	Ap
CO3	Design a database application for real time scenarios.	Ap
CO4	Analyze normalization concepts to design relational database.	An
CO5	Create database system for real time problems	C

LIST OF EXPERIMENTS :

1 Database design using Conceptual modeling (ER-EER) – top-down approach
2. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
3. Create a set of tables, add foreign key constraints and incorporate referential integrity.
4. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
5. Query the database tables and explore sub queries and simple join operations.
6. Write user defined functions and stored procedures in SQL.
7. Database design using Normalization - Bottom-up approach
8. Create Document and column based data using NOSQL database tools.
9. Write SQL Triggers for insert, delete, and update operations in a database table.
10. Case Study using any of the real life database applications from the following list
a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance
● Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
● Apply Normalization rules in designing the tables in scope.
● Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
● Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
11. Develop a simple GUI based database application and incorporate all the above-mentioned features

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1			3		3								3	
2			3											3
3			3		3								3	
4		3											3	
5					3									
CO (W.A)		**3**	**3**		**3**		**3**						**3**	**3**

22AIP07 - MACHINE LEARNING LABORATORY				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide hands-on experience in applying machine learning algorithms for real world problems.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply suitable algorithms for selecting the appropriate features for analysis.	Ap
CO2	Implement supervised and unsupervised machine learning algorithms on standard datasets and evaluate the performance.	Ap
CO3	Conduct investigations on real time data sets.	An
CO4	Build the graph based learning models for standard data sets.	C
CO5	Assess and compare the performance of different ML algorithms and select the suitable one based on the application.	An

LIST OF EXPERIMENTS :

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.
3. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
8. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
9. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

TOTAL (P:60) = 60 PERIODS

List of Equipments:(30 Students per Batch)

The programs can be implemented in either Python or R.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3		3										3	
3		3		3										3
4					3							3		3
5		3											3	
CO (W.A)	**3**	**3**	**3**	**3**	**3**						**3**		**3**	**3**

22AIP08-DATA SCIENCE AND ANALYTICS LABORATORY

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To apply data analytics and data visualization using python.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply python Programs to handle data using NumPy and pandas	Ap	20%
CO2	Analysis descriptive analytics	An	20%
CO3	Creating data exploration using Matplotlib.	C	20%
CO4	Evaluating Inferential data analysis.	An	20%
CO5	Create of predictive analytics	C	20%

LISTOF EXPERIMENTS:

1. Working with NumPy arrays
2. Working with Pandas dataframes
3. Frequency distributions, Averages, Variability
4. Normal curves, Correlation and scatter plots
5. Regression
6. Random Sampling
7. Z-test case study
8. T-test case studies
9. ANOVA case studies
10. Logistic Regression
11. Time series Analysis

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LANSystemwith33nodes(OR)StandalonePCs–33Nos,Printers–3Nos.

Software:

Tools: Python, NumPy, SciPy, Matplotlib, Pandas, statsmodels, Seaborn, Plotly, Bokeh

TOTAL(P:60)=60PERIODS

Mapping of Cos with Pos / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3					3						3	3		3
4		3		3								3	3	
5		3			3							3		3
CO (W.A)	**3**	**3**		**3**	**3**						**3**	**3**	**3**	**3**

22MAN08- SOFT / ANALYTICAL SKILLS – IV *(Common to All Branches and Applicable for (2022-2026) Batch only)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To recollect the functional understanding of basic grammar and its structure • To enrich their knowledge and to develop their logical reasoning ability

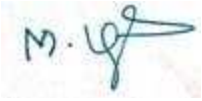
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment test**
CO1	Construct the sentences with basic grammar.	U	40%
CO2	Analyze quantitative aptitude problems and find solutions.	Ap	30%
CO3	Develop the ability to solve problems through logical reasoning.	An	30%

UNIT I - VERBAL	(5+10)
Articles - Fill in the blanks - Grammatical Error - Sentence improvement	
UNIT II - APTITUDE	(5+10)
Speed and Distance-Time and Work- Mixture And Alligations- Permutation and Combinations	
UNIT III - LOGICAL AND REASONING	(5+10)
Seating Arrangement- Directions and Distance- Non verbal Reasoning	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN08R - SOFT/ANALYTICAL SKILLS – IV *(Common to All Branches and Applicable for (2023-2027 Batch only)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts. • To develop quantitative aptitude and analytical reasoning skills.

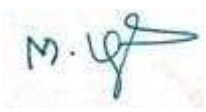
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I – VERBAL ABILITY	**(10+5)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II – APTITUDE	**(10+5)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(10+5)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

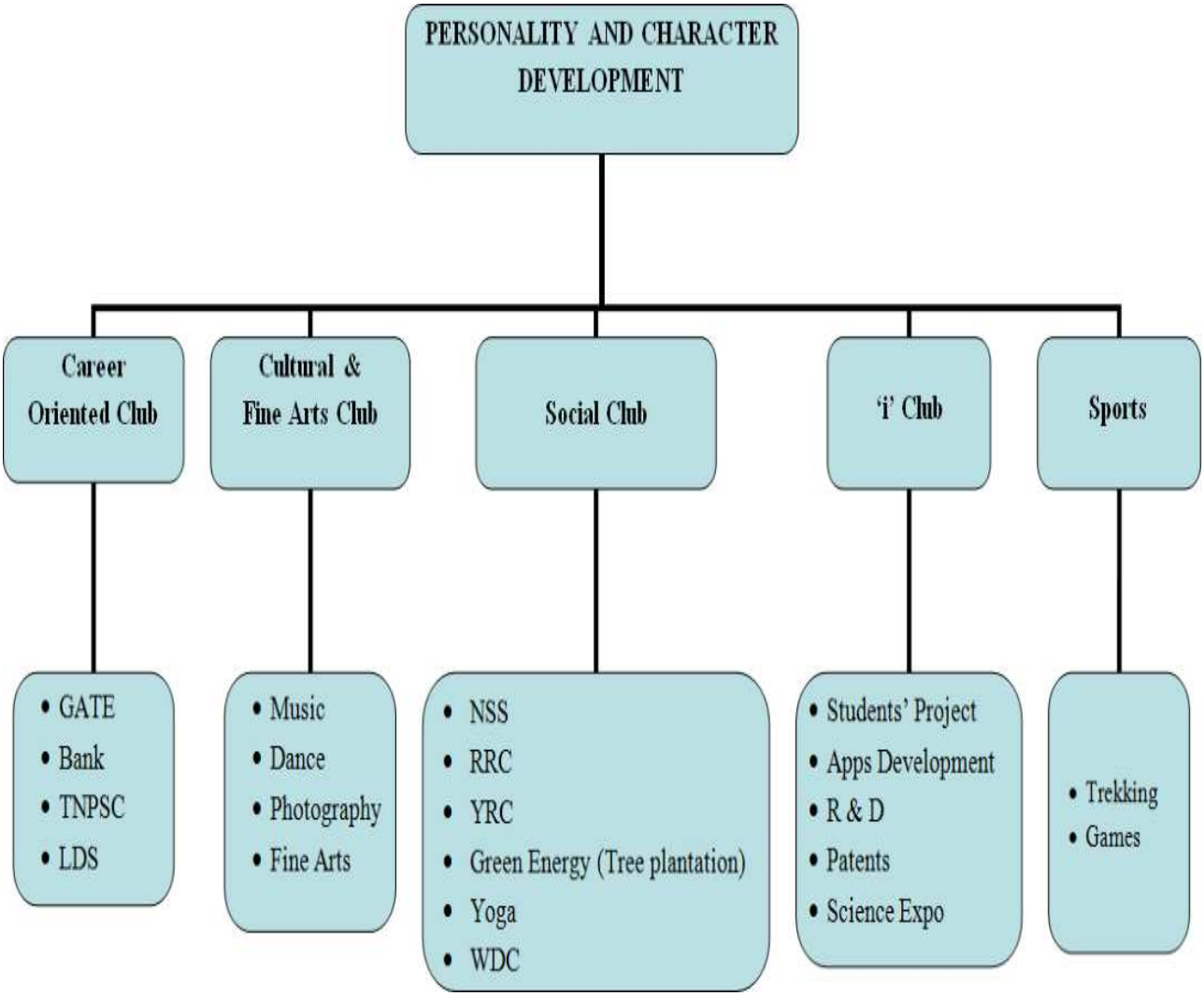
REFERENCES:

1. Rizvi, M.Ashraf. "Effective Technical Communication", Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. "Quantitative Aptitude for Competitive Examinations", S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. "How to Prepare for Quantitative Aptitude for the CAT", Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



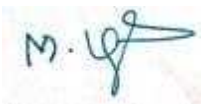
22GED01 – PERSONALITY AND CHARACTER DEVELOPMENT				
	L	T	P	C
	0	0	I	0
PRE-REQUISITE: NIL				



OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
providesupport foridentifying career interestsand career providesupport for preparing for competitive exams	•To bring out the hidden talent of students in music, dance and other fine arts. •To promote photography skill among the students •To develop and enhance the performance of students by participating in various events •To inculcate managerial capabilities such as event management and stage organization	•To create social awareness and develop a sense of social and civic responsibility •To inculcate socially and environmentally sound practices and be aware of the benefits •To encourage the students to work along with the peoplein rural areas, thereby developing their character, social consciousness, commitment, discipline and beinghelpful towards thecommunity.	•To inculcate the basic concepts of innovation •To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities •To enrich the academic experience, build competencies and relationships beyond the classroom	•To provide opportunities to excel at sports •To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. •To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. •To develop leadership skills and nurture the team building qualities. **Trekking:** •To provide opportunities to explore nature and educating about the purityof nature •To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events • Develop team spirit, leadership and managerial qualities	• Develop socially responsive qualities by applying acquired knowledge • Build character, social consciousness, commitment and discipline	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs • Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS
(Cumulatively for Two Semesters)



22AIC12 - COMPUTER NETWORKS *(Common to 22CSC06, 22CCC05,22CIC09 and 22ITC07)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Develop expertise in networking fundamentals, protocols, security mechanisms, and network management for effective operational efficiency.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamental concepts of communication in networking technologies.	Ap	30%
CO2	Analyze network performance metrics and optimize network configurations.	An	20%
CO3	Develop solutions for network routing algorithms and traffic management strategies.	Ap	30%
CO4	Manage network security protocols and evaluate their effectiveness in protecting network resources.	An	20%
CO5	Collaborate to design and deploy network infrastructures and services	C	Internal Assessment

UNIT I - INTERNET AND DATA COMMUNICATIONS	**(9)**
Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.	
UNIT II - DATA LINK LAYER	**(9)**
Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – Media Access Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.	
UNIT III - NETWORK LAYER	**(9)**
IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-State Routing, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.	
UNIT IV - TRANSPORT LAYER	**(9)**
Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.	
UNIT V - APPLICATION LAYER	**(9)**
Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022.

REFERENCES:

1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3										3	
4		3	3							3				3
5					3			3				3		3
CO (W.A)	**3**	**3**	**3**		3			**3**		**3**		**3**		**3**

22AIC13 - DEEP LEARNING
(Common to 22CSX01,22ITX01,22CIX13)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To understand and apply deep learning techniques to support real-time applications.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of neural networks and deep learning.	Ap	20%
CO2	Categorize the types of autoencoders in frameworks.	An	20%
CO3	Demonstrate the hardware support and frameworks (Keras - PyTorch) in Boltzmann machines model.	Ap	20%
CO4	Apply the concepts of CNN and RNN.	An	40%
CO5	Build the Recurrent Neural Network to model the sequence data.	C	Internal Assessment

UNIT I –NEURAL NETWORKS	**(9)**
Introduction – Basic Architecture of Neural Networks – Training Neural Network with Backpropagation – Practical Issues in Neural Network Training - Power of Function Composition – Common Neural Architectures – Neural Architectures : Binary Classification Models – Multiclass Models.Introduction to Deep Learning	
UNIT II –AUTOENCODER AND FRAMEWORKS	**(9)**
Introduction to Autoencoder – Features of Autoencoder - Types of Auto Encoder: Vanilla Autoencoder – Multilayer Autoencoder – Stacked Autoencoder – Deep Autoencoder – Denoising Autoencoder - Convolutional Autoencoder – Regularization in Autoencoder – Open Source Frameworks: SciPy – TensorFlow – Keras - PyTorch	
UNIT III – BOLTZMANN MACHINES AND HARDWARE SUPPORT	**(9)**
Boltzmann Machine: Relation to Hopfield Networks. RBM Architecture: Energy Based Model – Gibbs Distribution – Gibbs Sampler – Contrastive Divergence – Example – Types of RBM – Hardware support for Deep Learning.	
UNIT IV – CONVOLUTION NEURAL NETWORKS	**(9)**
Convolution Network – Components of CNN Architecture - Rectified Linear Unit(ReLU)Layer-Exponential Linear Unit (ELU or SELU) - Unique Propertied of CNN - Architectures of CNN – Application of CNN – Case studies: Image Classification using CNN - Visual Speech Recognition using 3D-CNN	

UNIT V – RECURRENT NEURAL NETWORKS	(9)
RNN versus CNN – Feedforward Neural Network versus RNN. - Simple Recurrent Neural Network : training an RNN – Backpropagation Through time (BPTT) – RNN Topology – Challenges with Vanishing Gradients – Bidirectional and Stateful RNNs – Long Short term memory(LSTM) – LSTM Implementation – Gated Recurrent Unit (GRU) – Deep Recurrent Neural Network.- Case studies: Stock Market Prediction Using RNN – Next Word Prediction Using RNN-LSTM.- Tamil Handwritten Character Optical Recognition Using CRNN	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Aggarwal, Charu C, "Neural Networks and Deep learning", 2ndEdition, Springer Cham, 2023.
2. Lovelyn, S., Rose, L. Ashok kumar, D. KarthikaRenuka, Deep Learning using Python, Wiley India Pvt. Ltd., First Edition, 2019.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, "Deep Learning", I st Edition, MIT Press, USA, 2018.
2. Josh Patterson and Adam Gibson,"Deep Learning–A Practitioner"s Approach",1st Edition,O"ReillySeries,August2017.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3			3									3
3	3		3		3									
4	3												3	
5					3				3	3				
CO (W.A)	3	3	3		3				3	3			3	3

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS

(Common to 22CIC05, 22ITC16,22CSC17)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To provide an understanding of the technologies and the standards relating to the Internet of Things. • To review about IoT protocols and arduino processor with underlying technologies, limitations, and challenges.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify various characteristics and deployment levels of IoT.	Ap	40%
CO2	Analyze the concepts of M2M and IoT architecture.	An	20%
CO3	Implement Various IoT communication protocols like MQTT,CoAP, and HTTP in developing IoT applications.	Ap	20%
CO4	Analyze the functioning ofarduinoboards and various communications technologies to use with it.	An	20%
CO5	Perform in a team to build automation, agriculture and various real time applications using arduino.	Ap	Internal Assessment

UNIT I - INTRODUCTION TO INTERNET OF THINGS	**(9)**
Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.	
UNIT II - M2M AND IOT ARCHITECTURE	**(9)**
Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model.	
UNIT III - IOT PROTOCOLS	**(9)**
PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.	
UNIT IV - PROGRAMMING USING ARDUINO	**(9)**
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.	
UNIT V - APPLICATIONS OF IOT	**(9)**
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Internet of Things, RMD SundaramShriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019.
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.
3. Veneri,Giacomo and Antonio capasso "Hands on Industrial Internet of things:create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packet Publishing,Ltd,2018.

REFERENCES:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3			3										3	
4					3									3
5									1		1	1		
CO (W.A)	3		3		3				1		1	1	3	3

22AIP09 - DEEP LEARNING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To build strong practical applications using deep learning, such as image classification, natural language processing, and reinforcement learning tasks.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the MNIST dataset and its significance in the field of deep learning.	Ap
CO2	Make use of autoencoders for dimensionality reductions.	An
CO3	Demonstrate the concepts Boltzmann machines to solve real world problems.	An
CO4	Exemplify the concepts of CNN models and apply it for solving computer vision related problems.	An
CO5	Apply the concepts of RNN models for solving sequential modeling problems.	An

LIST OF EXPERIMENTS:

1. Create a multi-layer neural network and apply it to MNIST dataset.
2. Develop an application for outlier detection using Autoencoder.
3. Perform hyper parameter tuning and regularization to improve the performance of a classifier.
4. Implement a movie recommender system using RBM.
5. Solving XOR problem using Multilayer perceptron
6. Implement Speech Recognition using NLP
7. Implement Recurrent neural networks to generate new text.
8. Develop a hand written character recognition application using CNN.
9. Perform Sentiment Analysis in network graph using RNN
10. Implement Convolutional neural networks and use them to classify images

HARDWARE/SOFTWARE REQUIREMENTS

1. Understanding on Working of Colab and Transfer Learning Networks
2. High end GPU Systems (Huge Computation)

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3											3	
3		3	3											3
4	3			3									3	
5		3					3							
CO (W.A)	**3**	**3**	**3**	**3**			**3**						**3**	**3**

22AIP10-INTERNET OF THINGS AND ITS APPLICATIONSLABORATORY *(Common to 22CIP04, 22ITP09,22CSP11)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To equip students with comprehensive knowledge and hands on experience in designing and developing IoT systems and applications.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of controlling sensors using arduino.	Ap
CO2	Analyze the given Aduino program to build practical IoT solutions.	An
CO3	Apply arduino programming techniques to use various sesnors and actuators.	Ap
CO4	DesignIoT based system for given applicationand specifications.	An
CO5	Implement a mini-project to demonstrate the given problem using suitable sensors with Arduino development board.	C

LIST OF EXPERIMENTS :

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2			2	2										
3														2
4					3									2
5		2			3				1				3	
CO (W.A)	**3**	**2**	**2**	**2**	**3**				**1**				**3**	**2**

22MAN10R - COMMUNICATION AND QUANTITATIVE REASONING (Common to All Branches)				
	L	T	P	C
	1	0	2	0

PRE-REQUISITE : NIL

Course Objective:	• To enhance the proficiency of the students in both spoken and written communication • To acquire skills required to solve quantitative aptitude problems

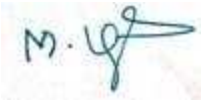
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - LANGUAGE BOOSTERS	**(5+10)**
JAM - General Topic Presentation - Group Discussion - Mock Interview - E Mail Writing - Essay writing	
UNIT II – APTITUDE	**(5+10)**
Mensuration - Area, Shapes, Perimeter - Races and Games - Data Interpretation on Multiple Charts.	
UNIT III - REASONING	**(5+10)**
Venn diagram - Syllogism - Data Sufficiency - Cubes & Embedded Images.	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication*. Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative Aptitude for Competitive Examinations.* S.Chand Publishing Company Ltd(s)., 2022.
3. Arun Sharma. *How to Prepare for Quantitative Aptitude for the CAT.* Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		1		1					1	1				



22AIC15- FULL STACK DEVELOPMENT (Common to 22ITC17, 22CIC15,22CSC15)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	To provide students with a solid foundation in the front-end and back-end web development fundamentals, integrate with databases and external services, and apply best practices in web development			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of MERN stack for Web application development.	Ap	20%
CO2	Analyze and develop web applications using bootstrap, node and Express JS focused on social and environmental issues	An	40%
CO3	Integrate front-end and back-end components effectively with databases and external services.	An	20%
CO4	Implement Full stack application through React framework.	An	20%
CO5	Demonstrate teamwork and problem-solving skills in project development.	C	Internal Assessment

UNIT I -BASICS OF MERN STACK	(9)
MERN Introduction-MERN Components - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js npm.	
UNIT II –BOOTSTRAP AND NODE JS BASICS	(9)
Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS. Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter.	
UNIT III -NODE JS EXPRESS	(9)
Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON- Express - Routing - Handler Function – Middleware-Rest API.	
UNIT IV -MONGODB	(9)
MongoDB - MongoDB Basics - Documents -Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB.	
UNIT V -REACT	(9)
React Introduction –State - Lifecycle methods - Hooks – useState, useEffect, useContext - Event handling - Forms – controlled components, submission, validation.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Bradshaw, S., Brazil, E., & Chodorow, K. (2019). MongoDB: the definitive guide: powerful and scalable data storage. O'Reilly Media.
3. Mardan, A. (2014). Express. js Guide: The Comprehensive Book on Express. js. Azat Mardan.
4. Kogent Learning Solutions Inc. "HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQUERY", Wiley India Pvt. Limited, 2011.
5. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.
6. Zammetti, F. (2020). Modern Full-Stack Development: Using TypeScript, React, Node. js, Webpack, and Docker. Apress.

REFERENCES:

1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, "Bootstrap 4–Responsive Web Design" Packt Publishing (6 July 2017)
2. Thomas Powell, "Web Design: The Complete Reference" ,Osborne / McGraw-Hill
3. https://www.w3schools.com/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				3								3	
2		3	3		3	3	3						3	
3			3		3									3
4				3	3								3	
5					3			3	3	3	3			3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**		**3**	**3**

22AIC16 - BIG DATA ANALYTICS *(Common to 22CSX13,22ITX13,22CSX25,22CIX12)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• Acquire a deep understanding of big data and NoSQL. • Develop expertise in map reduce analytics using Hadoop and related tools • Explore the Hadoop related tools for Big Data Analytics.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Real-world datasets can be analyzed using various big data analytics tools and approaches.	An	20%
CO2	Analyze the effectiveness of numerous NoSQL databases under different loads.	An	20%
CO3	Analyze Hadoop's architecture, notably HDFS, and use this information to develop a distributed computing environment	An	20%
CO4	To address certain data processing issues, use customized mappers and reducers.	Ap	20%
CO5	Analyze data processing jobs and determine a suitable tool (Pig or Hive) based on the task criteria.	An	20%

UNIT I – UNDERSTANDING BIG DATA	**9**
Introduction To Big Data – Sudden Hype Around Big Data Analytics - Classification Of Analytics – Top Challenges Facing Big Data –Importance of Big Data Analytics - Challenges Posed By Big Data - Terminologies Used In Big Data Environments – Basically Available Soft State Eventual Consistency(BASE) – Few Top Analytics Tools	
UNIT II – NOSQL DATA MANAGEMENT	**9**
Introduction To Nosql – Types Of Nosql Database – Use Of Nosql In Industry – Nosql Vendors – SQL Vs Nosql – Newsql – Comparison Of SQL,Nosql And Newsql - Introduction To Cassandra - Features Of Cassandra – CQL Data Types – CQLSH – CRUD – Collections – Time To Live(TTL) – Alter Commands – Import And Export – Querying System Tables	
UNIT III – BASICS OF HADOOP	**9**
Hadoop – Features Of Hadoop - Versions Of Hadoop – Hadoop Distributions – Hadoop Vs SQL –Cloud Based Hadoop Solution - Hadoop Introduction – RDBMS Vs Hadoop - Hadoop Overview – Use Case Of Hadoop – Hadoop Distributions – Processing Data With Hadoop – Interacting With Hadoop Ecosystem	
UNIT IV – MAP REDUCE APPLICATIONS	**9**
Introduction To Map Reduce –The Configuration API – Setting Up The Development Environment – Writing A Unit Test With MRUnit – Running On A Cluster- – Map Reduce Workflows–How Map Reduce Works Anatomy Of Map Reduce Job Run – Failures – Shuffle And Sort – Task Execution– Map Reduce Types And Formats - Input And Output Format – Map Reduce Features	

UNIT V – HADOOP RELATED TOOLS	9
Pig – Installing And Running Pig – Comparison With Databases – Pig Latin – User Defined Functions – Data Processing Operators – Hive – HiveQL – Tables – Querying Data – User-Defined Functions –Data Analytics – Multimedia - Streaming of data - Case Study: Analyzing Social Media Data	
TOTAL (L:45):45 PERIODS	

TEXT BOOKS

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019. (Unit 1-4).
2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Inc., Fourth Edition, 2015. (Unit 5).

REFERENCES

1. EMC Education Services,"Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley and Sons, 2015.
2. Alan Gates, Programming Pig Dataflow Scripting with Hadoop, O'Reilly Media, Inc, 2011.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3		3								3	
2	3	3			3									3
3			3	3									3	
4		3		3									3	
5				3	3									3
CO (W.A)	3	3	3		3								3	3

22AIP11 - BIG DATA ANALYTICS LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• Gain experience in processing and transforming big data using tools like Apache Spark, MapReduce, and Apache Hive processes.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply techniques to store, retrieve, and manage large volumes of data.	Ap
CO2	Apply MongoDB to perform CRUD operations on a NoSQL database, effectively managing documents within collections.	Ap
CO3	Analyze MapReduce programs to process and real-world datasets, gaining practical experience with large-scale data processing	An
CO4	Analyze the roles of the Mapper, Reducer and the way they interact to process data in a distributed manner.	An
CO5	Create and configure components of the Hadoop ecosystem, such as HDFS, MapReduce, and various tools like Hive, Pig, and HBase, to build a complete big data processing environment	C

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
4. Implement a MapReduce program that processes a dataset.
5. Write a MapReduce program to count the occurrences of similar words across files.
6. Word count in Hadoop and Spark
7. Installation of Hive along with practice examples.
8. Installing and Configuring Apache PIG and HIVE
9. Installation of HBase, Installing thrift along with Practice examples

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3		3										
3		3	3											3
4				3									3	
5				3					3				3	3
CO (W.A)	**3**	**3**	**3**						**3**				**3**	**3**

22GEA01 UNIVERSAL HUMAN VALUES (For Common To All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession.	E	Internal Assessment
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethicallife and profession.	Ap	

UNIT I: INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL- ENCOMPASSING RESOLUTION	(6)
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II: RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	(6)
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	
UNIT III: UNDERSTANDING HUMAN BEING	(6)
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	
UNIT IV: UNDERSTANDING NATURE AND EXISTENCE	(6)
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly	

awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V: UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION AND HOLISTIC WAY OF LIVING	(6)
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS

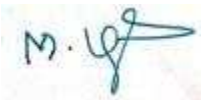
1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi

REFERENCES:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins,USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if peoplemattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers
8. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
9. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (includingHuman Values), Eastern Economy Edition, Prentice Hall of India Ltd.
10. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co.,Lucknow. Reprinted 2008.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
CO (W.A)						2	2	3	2	2		3		



22GED02 – INTERNSHIP / INDUSTRIAL TRAINING				
	L	**T**	**P**	**C**
	0	**0**	**0**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To obtain a broad understanding of the emerging technologies in Industry • To gain knowledge about I/O models.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Engage in Industrial activity which is a community service.	U
CO2	Prepare the project report, three minute video and the poster of the work.	Ap
CO3	Identify and specify an engineering product that can make their life comfortable.	An
CO4	Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms.	Ap
CO5	Identify the community that shall benefit from the product.	E

During semester breaks, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple products to make their life comfortable and convert new ideas into projects.

Every student is required to complete 12 to 16 weeks of internship (with about 40 hours per week), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports and Seminars during the VI and VIII semesters. The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs/Training Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute.
- Participation in Inter-Institute innovation related competitions like Hackathons.
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests
- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2								
2										3				
3		1												
4							2	3			2			
5						2								
CO (W.A)		**1**				**2**	**2**	**3**		**3**	**2**			

22AID01- PROJECT WORK					
		L	T	P	C
		0	0	20	10
PRE-REQUISITE : NIL					
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem.	Ap	20 % - First Review (Internal)		
CO2	Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment	Ap, E	20 % - Second Review (Internal)		
CO3	Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project, design, implement, analyze and interpret results of the implemented project	Ap, An, C	20 % - Third Review (Internal)		
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE format of the work and effective oral communication through presentation of the project work and demonstration of the project.	E	20 % - Final Review (External)		
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work (leading to start-up/ product/ research paper/ patent)	Ap, An	20 % - Final Review (External)		

DESCRIPTION
Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations
TOTAL (P: 300) = 300 PERIODS

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3										3	3	3
2						3	3				3		3	3
3	3	3	3	3	3								3	3
4								3		3			3	3
5									3		3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3	3	3	3	3	3	3

22AIX01 - KNOWLEDGE ENGINEERING

(Common to 22CSX02,22ITX02,22CCX21)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:

- To implement various techniques for knowledge acquisition and representation.

	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge representation with production rules.	Ap	20%
CO2	Implement SLD derivations with horn clauses.	An	20%
CO3	Apply reasoning with inheritance network and default logic.	Ap	20%
CO4	Apply subjective probability with actions and planning.	Ap	20%
CO5	Perform object oriented representation using frames	Ap	20%

UNIT I – INTRODUCTION (9)

Knowledge Representation and Reasoning – Syntax, Semantics, Pragmatics, Explicit and Implicit Belief - Expressing Knowledge – Resolution: Propositional Case-Handling Variables and Quantifiers-Dealing with Computational Intractability

UNIT II – HORN CLAUSES (9)

Horn Clauses-SLD Resolution-g SLD Derivations-Procedural Control of Reasoning - Rules in Production Systems: Production Rules- Conflict Resolution- Applications and Advantages

UNIT III – OBJECT-ORIENTED REPRESENTATION (9)

Objects and Frames-Frame Formalism-Frames to Plan a Trip-Beyond the Basics-Structured Descriptions-A Description Language-Meaning and Entailment-Computing Entailments-Taxonomies and Classification

UNIT IV – INHERITANCE AND DEFAULTS (9)

Inheritance Networks-Strategies for Defeasible Inheritance-A Formal Account of Inheritance Networks-Defaults: Introduction-Closed-World Reasoning-Circumscription-Default Logic-Autoepistemic Logic

UNIT V – VAGUENESS, UNCERTAINTY AND DEGREES OF BELIEF (9)

Noncategorical Reasoning-Objective Probability-Subjective Probability-Vagueness-Diagnosis-Explanation-Actions-Planning- Tradeoff between Expressiveness and Tractability.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, MorganKaufmann, 2004. 2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.
REFERENCES:
1. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000 2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3											3	
2		3	3											
3	3												3	
4	3												3	
5	3													
CO (W.A)	**3**	**3**	**3**										**3**	

22AIX02 - RECOMMENDER SYSTEMS *(Common to 22CSX03,22ITX03,22CIX14)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To learn the significance of machine learning algorithms for Recommender systems.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts and applications of recommender systems.	Ap	20%
CO2	Analyze various collaborative filtering models in content based recommendation.	An	20%
CO3	Conduct investigation about the issues in recommender system and experimental setup.	Ap	20%
CO4	Apply Recommendation system properties in IPVT.	Ap	20%
CO5	Implement the knowledge sources and recommendation types.	Ap	20%

UNIT I – INTRODUCTION	**(9)**
Introduction - Recommender Systems Function - Data and Knowledge Sources - Recommendation Techniques - Application and Evaluation - Applications of recommendation systems - Issues with recommender system.	
UNIT II – CONTENT-BASED RECOMMENDATION	**(9)**
High level architecture of content-based systems - Advantages and drawbacks of content based filtering- Item Representation - Learning User Profiles and Filtering - Trends and Future Research - Neighborhood-based Recommendation - Components of Neighborhood Methods.	
UNIT III – COLLABORATIVE FILTERING	**(9)**
Preliminaries: Baseline predictors - The Netflix data - Implicit feedback - Matrix factorization models - Neighborhood models - Enriching neighborhood models - Between neighborhood and factorization - Constraint-based Recommenders.	
UNIT IV – CONTEXT-AWARE RECOMMENDER SYSTEMS	**(9)**
Context in Recommender Systems - Paradigms for Incorporating Context in Recommender Systems - Combining Multiple Approaches – Case Studies - Additional Issues in Context-Aware Recommender Systems- Evaluating Recommender Systems: Experimental Settings - Recommendation System Properties.	

UNIT V – IPVT, MATCHING RECOMMENDATION TECHNOLOGIES	(9)
IPTV Architecture - Recommender System Architecture- Recommender Algorithms- Recommender Services – System Evaluation - Knowledge Sources – Domain - Knowledge Sources - Mapping Domains to Technologies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Francesco Ricci , Lior Rokach , Bracha Shapira , "Recommender Sytems Handbook", 1st ed, Springer (2011)
2. Charu C. Aggarwal, "Recommender Systems: The Textbook", First Ed., Springer, 2016.

REFERENCES:

1. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems for Learning", Springer, 1st Edition, 2013.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press (2011), 1st ed.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												
3	3			3										
4	3												3	
5	3	3												3
CO (W.A)	3	3		3									3	3

22AIX03 - SOFT COMPUTING *(Common to 22CSX04,22ITX04)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To learn and understand soft computing concepts and Fuzzy inference systems.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Make use of the soft computing concepts along with its architecture	Ap	20%
CO2	Apply the techniques of back propagation network along with its parameter tuning.	Ap	20%
CO3	Interpret the fuzzy logics to solve the neural network problems	Ap	20%
CO4	Utilize the genetic algorithm techniques to obtain the optimized solution	Ap	20%
CO5	Illustrate the working of hybrid soft computing and to solve real world problems	An	20%

UNIT I –INTRODUCTION	**9**
Introduction to Soft computing-Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies – applications.	
UNIT II –NEURAL AND BACKPROPAGATION NETWORK	**9**
Back propagation Neural Networks -single layer artificial neural network- Back propagation learning model for Multilayer perceptron-Back propagation learning- Neural Networks- Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network -Applications-Effect of tuning parameters of Backpropagation neural network- Unsupervised Learning Neural Networks.	
UNIT III-FUZZY LOGIC	**9**
Fuzzy set theory- Introduction to Fuzzy Logic- Fuzzy Sets - Classical Relations and Fuzzy Relations- Fuzzyversus Crisp-crisp set: operations on Crisp sets-Properties of Crisp sets- partition and covering-membership function-basic fuzzy set operations-properties of fuzzy sets-Crisp relations: Cartesian product-other crisp relations.	
UNIT IV – GENETIC ALGORITHMS	**9**
History –Basic concepts-Creation of offspring-Working principle- Encoding-Fitness Function- Population initialization and selection methods - Evaluation function - Operators - Cross Over - Inversion and Deletion - Mutation Operator- Generational cycle-Bit-wise Operators -Convergence of Genetic Algorithm.	

UNIT V – HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS	9
Hybrid systems-Neural networks ,fuzzy logic and genetic algorithms hybrids-GA Based Weight Determination – Fuzzy backpropagation networks-Simplified fuzzy ARTMAP-Fuzzy associative memories-Soft computing tools-Fuzzy constrains-Fuzzy logic controller.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. S. Rajasekharan& G. A. VijayalakshmiPai, "Neural Networks, Fuzzy Systems and Evolutionary algorithms: synthesis and applications", 2nd Edition, Prentice Hall of India, New Delhi, 2018.
2. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
3. 2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2019.

REFERENCES

1. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3		3								3	
2	3	3			3									3
3			3	3									3	
4		3		3									3	
5				3	3									3
CO (W.A)	3	3	3		3								3	3

22AIX04 - OPTIMIZATION TECHNIQUES *(Common to 22CIX15,22CCX22)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To apply transportation algorithms in engineering problems and to handle the problems of Project Management using CPM and PERT				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Able to apply and solve linear programming problems	Ap	20%
CO2	Evaluate transportation algorithms in engineering problems.	An	20%
CO3	Analyze game theory concepts in practical situations.	An	20%
CO4	Understand the problems of Project Management using CPM and PERT	U	20%
CO5	Analyze various types of Non-linear Programming problems	An	20%

UNIT I – LINEAR PROGRAMMING	**9**
Introduction – Formulation of Linear Programming Problem – Advantages of Linear Programming methods – Limitations of Linear Programming models – Standard form of LPP – Graphical Method – Simplex Method – Artificial variable techniques – Big M Method. Understanding convex sets, functions, and optimization problems- Non-Convex Optimization: Techniques for dealing with local minima, saddle points, and global optimization in non-convex landscapes.	
UNIT II – TRANSPORTATION PROBLEM	**9**
Mathematical Formulation of Transportation Problem – Initial basic feasible solution – North West Corner Method – Least Cost Method – Vogel's approximation method – Optimal solution – MODI Method – Degeneracy – Unbalanced transportation problem – Maximization transportation problem	
UNIT III – ASSIGNMENT PROBLEM AND THEORY OF GAMES	**9**
Assignment Problem: Mathematical model of Assignment problem – Hungarian Method – Unbalanced assignment problem. Theory of Games: Two-person zero-sum game – Pure strategies - Game with mixed strategies – Rules of Dominance – Solution methods: Algebraic method – Matrix method – Graphical method	
UNIT IV – PROJECT MANAGEMENT	**9**
Basic Concept of network Scheduling – Construction of network diagram – Critical path method – Programme evaluation and review technique – Project crashing – Time-cost trade-off procedure.	

UNIT V – NON-LINEAR PROGRAMMING	9
Formulation of non–linear programming problem – Constrained optimization with equality constraints – Kuhn-Tucker conditions – Constrained optimization with inequality constraints.	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Kanti Swarup, Gupta P.K. & Man Mohan, "Operation Research", 14th Edition, Sultan Chand & Sons, New Delhi, 2014.

REFERENCES

1. Sharma J.K., "Operations Research – Theory and Applications", 4th Edition, Macmillan Publishers India Ltd., New Delhi, 2009.
2. 2. Gupta P.K. & Hira D.S., "Operations Research: An Introduction", 6th Edition, S.Chand and Co. Ltd, New Delhi, 2008.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2								3	
2			3										3	
3					3								3	
4	3		3										3	
5	3		3										3	
CO (W.A)	3		3		3								3	

22AIX05 - COMPUTER VISION *(Common to 22CSX05,22ITX05,22CIX16,22CCX23)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge and understanding about the application of algorithms and techniques used to interpret and analyze visual data from the world.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement image processing techniques for feature extraction and enhancement in computer vision applications.	Ap	30%
CO2	Analyze object detection and recognition systems using various techniques.	An	20%
CO3	Make use of the optimization technique for image alignment and geometric transformations.	Ap	30%
CO4	Apply deep learning models to synthesize images for advanced photography techniques.	An	20%
CO5	Build an innovative solution for immersive rendering techniques in virtual reality.	C	Internal Assessment

UNIT I –INTRODUCTION	**9**
Introduction-Image Formation: Geometric primitives and transformations-Photometric image formation-The digital camera-Image processing: Point operators-Linear filtering -Fourier transforms -Geometric transformations.	
UNIT II – RECOGNITION &FEATURE DETECTION AND MATCHING	**9**
Instance Recognition-Image Classification-Object detection-Semantic segmentation-Points and patches-Edges and contours-Contour tracking-Lines and vanishing points-Segmentation.	
UNIT III – IMAGE ALIGNMENT AND STITCHING & STRUCTURE FROM MOTION	**9**
Pairwise alignment-Image stitching-Geometric Intrinsic calibration-pose estimation-Two-frame structure from motion-Multi-frame structure from motion-Simultaneous localization and mapping(SLAM):"Enhancing Autonomous Navigation: A Case Study on SLAM Implementation"	
UNIT IV – COMPUTATIONAL PHOTOGRAPHY & DEPTH ESTIMATION	**9**
Photometric calibration-High dynamic range imaging-Super-resolution:"Advancing Image Clarity: A Case Study on Super-Resolution Techniques"-denoising-blur removal-Image matting and compositing-Epipolar geometry-Sparse correspondence-Dense correspondence-Local methods-Global optimization-Multi-view stereo	

UNIT V – 3D RECONSTRUCTION & IMAGE-BASED RENDERING	9
Shape from X-3D Scanning-Surface representation-Point-based representation-Volumetric representation-GAN:Generative Adversarial Networks-Vision Transformation-Light fields and Lumigraphs:"Case study on Immersive Rendering in VR"-Video-based rendering:"Case study on Dynamic Scene Reconstruction Techniques".	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. E. R. Davies,"Computer Vision: Principles, Algorithms, Applications, Learning",Cambridge University Press,recent edition,2022.

REFERENCES

1. Simon J.D. Prince,"Computer Vision: Models, Learning, and Inference" ,2nd edition, Cambridge University Press.2012.
2. David A. Forsyth and Jean Ponce,"Computer Vision: A Modern Approach" , published by Prentice Hall,recent edition 2022.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2					3									
3			3											
4				3										
5							3	3	3		3			3
CO (W.A)		3	3	3	3		3	3	3		3			3

22AIX06 - ETHICS OF AI *(Common to 22CSX06,22ITX06,22CIX17)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To Learn about the Ethical initiatives in the field of artificial intelligence and reach AI standards and Regulations				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply about morality and ethics in AI	Ap	20%
CO2	Evaluate the knowledge of real time application ethics, issues and its challenges.	Ap	20%
CO3	Analysis the ethical harms and ethical initiatives in AI	An	20%
CO4	Apply AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	Ap	20%
CO5	Apply the societal issues in AI with National and International Strategies on AI	Ap	20%

UNIT I –INTRODUCTION	**9**
Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust.	
UNIT II –ETHICAL INITIATIVES IN AI	**9**
International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.	
UNIT III – AI STANDARDS AND REGULATION	**9**
Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems	
UNIT IV – ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS	**9**
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy.	

UNIT V – AI AND ETHICS- CHALLENGES AND OPPORTUNITIES	9
Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI. Chat gpt basics, prompt engineering.	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1								3						3
2	2						2	3						3
3							2	3						3
4	3					2		3						3
5								3						3
CO (W.A)	2.5					2	2	3						3

22AIX07 - BUSINESS INTELLIGENCE *(Common to 22CSX07,22ITX07,22CCX28)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To understand the effect of Business Intelligence (BI) on an organization			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Use of the knowledge of Business Intelligence in solving problems.	U	20%
CO2	Apply the concepts of Data visualization and Visual analytics.	Ap	20%
CO3	Able to apply data mining tools.	Ap	20%
CO4	Demonstrate the text analytics, text mining and sentiment analysis.	An	20%
CO5	Develop web mining.	C	20%

UNIT I –BUSINESS INTELLIGENCE – INTRODUCTION	**9**
A Frame work for Business Intelligence (BI)- The Architecture of BI - Benefits of business intelligence- Business intelligence VS competitive intelligence and knowledge management. Data Warehousing- Characteristics of Data Warehousing- Data Marts- Data warehousing process- Data warehousing Architectures – Data Integration and the Extraction, Transformation and Load (ETL) Process OLAP Versus OLTP- Data warehousing implementation issues – Real time data warehousing.	
UNIT II – BUSINESS REPORTING, VISUAL ANALYTICS AND BUSINESS PERFORMANCE MANAGEMENT	**9**
Data and Information Visualization – Different types of Charts and Graphs- Emergence of Data visualization and Visual analytics - Performance Dashboard - Balance Score Cards – Dashboards Versus Scorecards - Six Sigma as a performance measurement system.	
UNIT III – DATA MINING – SUPERVISED LEARNING, AND UNSUPERVISED LEARNING	**9**
Data mining concepts and applications – Data mining process – Data mining methods – Classification techniques – Decision trees, Case studies. Cluster Analysis – Partition and Hierarchical methods, Association rule mining –Data mining software Tools - Case studies.	
UNIT IV – TEXT ANALYTICS, TEXT MINING AND SENTIMENT ANALYSIS	**9**
Text analytics and Text mining concepts and definition – Text Mining Applications - Text mining process – Text mining tools – Sentiment analysis overview – Sentiment analysis applications – Sentiment analysis process, Sentiment Analysis and Speech Analytics.	

UNIT V – WEB MINING	9
Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis- Social Media Definitions and Concepts- Social Media Analytics.	
TOTAL = 45 PERIODS	

TEXT BOOKS

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics, Pearson 10th edition, 2018

REFERENCES

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson, 2017
2. David Loshin Morgan, Kaufman, —Business Intelligence: The Savvy Manager"s Guidell, Second Edition, 2012.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	2				3								3	
3			2		3								3	
4			3		2								3	
5			3		2								3	
CO (W.A)	3		3		3								3	

22AIX08 - ROBOTICS PROCESS AUTOMATION *(Common to 22CSX08,22ITX08,22CIX18,22CCX38)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To implement the fundamental concepts of AI in robotics and the major paradigms for achieving it.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret features of an Industrial robot with end effectors	AP	20%
CO2	Identify the characteristics of Autonomy robot and use Hierarchical Paradigm for organizing intelligence in Robots.	AP	20%
CO3	Apply reactive paradigm for AI Robots	AP	20%
CO4	The students able to know the various potential areas of automation and material handling	U	20%
CO5	Design sensor and vision system for robots	An	20%

UNIT I – FUNDAMENTALS OF ROBOTICS	**(9)**
Automation and Robotics, A brief history of Robotics, The robotics market and the future prospects, Robot anatomy, Robot drive systems, Precision of Movement, Robotic sensors, Robot programming and work cell control, Robot applications	
UNIT II – ROBOT TECHNOLOGY	**(9)**
Basic control systems concepts and models, Controllers, Control system analysis, Robot sensors and actuators, Velocity sensors, Actuators, Power transmissions systems, Modeling and control of a single joint robot, Robot motion analysis and control.	
UNIT III –ROBOT END EFFECTORS AND SENSORS	**(9)**
Types of end effectors, Mechanical grippers, other types of gripper, Tools as end effectors, The robot/end effectors interface, Considerations in gripper selection and design, Transducers and sensors, Sensors in robotics, Tactile sensors, Proximity and range sensors	
UNIT IV –MACHINE VISION AND ARTIFICIAL INTELLIGENCE	**(9)**
Introduction to machine vision, The sensing and digitizing functions in machine vision, Image processing analysis, Training the vision system, Robotic applications, Introduction to AI, Goals of AI research, AI techniques, AI and Robotics	

UNIT V- ROBOT APPLICATIONS IN MANUFACTURING	(9)
Material transfer and machine loading/unloading, Processing operations – spot welding, continuous arc welding, spray coating, other processing operations using robots, Assembly and Robotic assembly automation, Designing for robotic assembly, Inspection automation	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. M.P.Groover et al, McGrawhill "Industrial robotic technology-programming and application" 2008

REFERENCES:

1. Richared D.Klafter,Thomas Achmielewski and Mickael Negin," Robotic Engineering an Integrated approach"prentice hall India- newdelhi-2001
2. S.R. Deb, Dr Sankha Deb "Robotics technology and flexible automation" Tata McGraw-Hill Education ,2009
3. https://www.robots.com/applications

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1														
2		3												
3	3					3								3
4					3						3			
5			3						3				3	
CO (W.A)	3	3	3		3	3			3		3		3	3

22AIX11 - PATTERN RECOGNITION *(Common to 22CSX11,22ITX11,22CIX21,22CCX24)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To impart knowledge for solving real-world problems in fields such as computer vision, speech recognition, and bioinformatics. • To enrich the proficiency of the students in evaluating and selecting appropriate pattern recognition models based on performance metrics and domain-specific requirements.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply advanced probabilistic models and decision theory concepts to optimize inference.	Ap	30%
CO2	Apply supervised learning algorithms for solving problems.	An	20%
CO3	Interpret unsupervised learning techniques for clustering data.	Ap	30%
CO4	Apply graphical models and sequential data techniques to solve complex problems such as plant disease diagnosis.	Ap	20%
CO5	Evaluate proficiency in designing, training, and optimizing neural networks	E	Internal Assessment

UNIT I – INTRODUCTION	**9**
Probability Theory:Probability densities-Bayesian probabilities-The Gaussian distribution-Bayesian curve fitting-Model Selection-The Curse of Dimensionality-Decision Theory: Minimizing the misclassification rate-Minimizing the expected loss-The reject option-Inference and decision-Loss functions for regression-Information Theory.	
UNIT II –PROBABILITY DISTRIBUTION AND LINEAR MODELS FOR REGRESSION	**9**
Binary Variables-Multinomial Variables-The Gaussian Distribution-Linear Basis Function Models-Bayesian Linear Regression:Parameter distribution-Predictive distribution-Bayesian Model Comparison-The Evidence Approximation:Evaluation of the evidence function-Maximizing the evidence function-Effective number of parameters-Limitations of Fixed Basis Functions.	
UNIT III –LINEAR MODELS FOR CLASSIFICATION	**9**
Discriminant Functions-Probabilistic Generative Models-Probabilistic Discriminative Models:Logistic regression-Multiclass logistic regression-Probit regression-The Laplace Approximation-Bayesian Logistic Regression:Laplace approximation-Predictive distribution	

UNIT IV –NEURAL NETWORKS AND KERNEL METHODS	9
Feed-forward Network Functions-Network Training-Error Backpropagation-The Hessian Matrix-Regularization in Neural Networks-Mixture Density Networks-Bayesian Neural Networks-Constructing Kernels-Radial Basis Function Networks:Nadaraya-Watson model-Gaussian Processes	
UNIT V –GRAPHICAL MODELS AND SEQUENTIAL DATA	**9**
Bayesian Networks-Conditional Independence-Markov Random Fields-Inference in Graphical Models-Markov Models-Hidden Markov Models-Case study on Plant Disease Diagnosis in Random Forest - Conditional Mixture Models.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Christopher M. Bishop "Pattern Recognition and Machine Learning", Springer, Second edition 2021.
2. David G.Stork,PeterE.Hart,and Richard O.Duda"PatternClassification",published by Wiley in recent edition in 2022.

REFERENCES

1.Sergios Theodoridis and Konstantinos Koutroumbas"Machine Learning: A Bayesian and Optimization Perspective"AcademicPress,recent edition 2022.

2.David J.C. MacKay"Information Theory, Inference, and Learning Algorithms" Cambridge University Press, 2003.

3.David Barber "Bayesian Reasoning and Machine Learning",Cambridge University Press, 2012.

4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville"DeepLearning",MIT Press, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3									
2		3											3	
3				3									2	
4					3									2
5							2	3	3	2	2			3
CO (W.A)		3		3	3		2	3	3	2	2		2.5	2.5

22AIX12 - TEXT AND SPEECH ANALYTICS *(Common to 22CSX12,22ITX12,22CIX22)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To understand natural language processing basics. • To apply classification algorithms to text documents, question-answering and dialogue systems to develop a speech recognition system & speech synthesizer.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Examine the foundations of natural language processing and speech analysis	An	20%
CO2	Apply classification algorithms to text documents	Ap	20%
CO3	Analysis question-answering and dialogue systems	An	20%
CO4	Apply deep learning models for building speech recognition and text-to-speech systems	Ap	20%
CO5	Evaluate coreference and coherence for text processing	An	20%

UNIT I –INTRODUCTION	**(9)**
Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF mode	
UNIT II –TEXT CLASSIFICATION	**(9)**
Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Deep Learning models for text classification– Recurrent Neural Networks (RNN) – Transformers –Text summarization and Topic Models	
UNIT III – QUESTION ANSWERING AND DIALOGUE SYSTEMS	**(9)**
Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems –- evaluating dialogue systems	
UNIT IV – TEXT-TO-SPEECH SYNTHESIS	**(9)**
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy.	

UNIT V – AUTOMATIC SPEECH RECOGNITION	(9)
Named Entity Recognition (NER)-Coreference resolution-Text coherence and cohesion-Advanced sentiment analysis-Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3												3	
3		3												3
4	3				3								3	
5		3			3									3
CO (W.A)	3	3			3								3	3

22AIX13 - TIME SERIES ANALYSIS AND FORECASTING
(Common to 22CIX23)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• Understanding the fundamental concepts of time series analysis and forecasting • Developing forecasting models and evaluating their performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Ability to identify time series data patterns and trends	AP	20%
CO2	Make use of various smoothing methods for time series data analysis	AP	20%
CO3	Skill in applying appropriate time series models	AP	20%
CO4	Understand and apply frequency domain time series analysis	U	20%
CO5	Make use of variance transformation techniques for time series analysis and forecasting	AP	20%

UNIT I – EXPLORATORY ANALYSIS	**(9)**
Graphical displays–Numerical description of Time Series Data–Use of Data transformations and Adjustments–General Approach to Time Series Modeling and Forecasting – Evaluating and Monitoring Forecasting Model Performance-Statistical Inference in Linear regression-Model Adequacy Checking	
UNIT II – SMOOTHING METHODS:	**(9)**
First-Order Exponential Smoothing–Modeling Time Series data–Second-Order Exponential Smoothing–Higher-Order Exponential Smoothing–Forecasting–Exponential Smoothing for Seasonal Data–Exponential Smoothing of Bio surveillance data – Exponential Smoothers and ARIMA models	
UNIT III – ARIMA MODELS	**(9)**
Linear Models for Stationary Time Series–Finite Order Moving Average Processes–Finite Order Auto regressive Processes–Mixed Autoregressive-Moving Average Processes –Non stationary Processes – Time Series Model building – Forecasting ARIMA Processes – Seasonal Processes – ARIMA Modeling of Bio surveillance data	
UNIT IV – TRANSFER FUNCTIONS AND INTERVENTION MODELS	**(9)**
Transfer Function Models – Transfer Function – Noise Models – Cross – Correlation Function– Model Specification – Forecasting with Transfer Function-Noise Models–Intervention Analysis	

UNIT V- OTHER FORECASTING METHODS	(9)
Multivariate Time Series Models and Forecasting–State Space Models–Archand Garch models–Direct Forecasting of Percentiles–Combining Forecasts to improve Prediction Performance–Aggregation and Disaggregation of Forecasts–Neural Networks and Forecasting–Spectral Analysis–Bayesian Methods in Forecasting	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci, "Introduction to Time Series Analysis and Forecasting", 2nd Edition, Wiley, 2016.

REFERENCES:

1. George E.P.Box, Gwilym M.Jenkins, Gregory C. Reinsel, Greta M. Ljung, "Time Series Analysis: Forecasting and Control", 5thEdition, Wiley, 2016.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3	3											3
2					3									
3	3					3							3	
4													3	
5				3								3		
CO (W.A)	3	3	3	3	3	3						3	3	3

22AIX14 - HEALTH CARE ANALYTICS *(Common to 22CSX14,22ITX14,22CIX24,22CCX26)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To impart knowledge on health care analytics using machine learning concepts.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply machine learning and deep learning in health care analysis.	Ap	40%
CO2	Identify the appropriate selection of data using feature selection to train a model.	Ap	20%
CO3	Develop a database for clinical support and retrieving data using NoSQL database	An	20%
CO4	Visualize preprocessing data using smart sensors.	An	20%
CO5	Prepare a mini project to predict healthcare and data analysis.	C	Internal Assessment

UNIT I – INTRODUCTION TO HEALTHCARE ANALYSIS	**(9)**
Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, weighted sum approach.	
UNIT II – ANALYTICS ON MACHINE LEARNING	**(9)**
Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit – Learn : Preprocessing , Feature Selection.	
UNIT III – HEALTH CARE MANAGEMENT	**(9)**
IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.	
UNIT IV – HEALTHCARE AND DEEP LEARNING	**(9)**
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.	

UNIT V – CASE STUDIES	(9)
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.

REFERENCES:

1. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition,Wiley, 2016.
3. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3			3									3
3	3		3											
4		3	3		3								3	
5	3				3				3	3				
CO (W.A)	3	3	3		3					3			3	3

22AIX15 - PREDICTIVE ANALYTICS *(Common to 22CSX15,22ITX15,22CIX25)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Proficient in different predictive modeling approaches, such as regression analysis, classification, and clustering.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the performance of predictive analytics using appropriate metrics and understand the implications of these metrics.	An	20%
CO2	Apply data preparation and rules in predictive analytics to interpret the results in meaningful ways.	Ap	20%
CO3	Analyze and interpret the outputs of predictive models to generate actionable insights	An	20%
CO4	Analyze different predictive models to determine the most suitable model for a given problem based on performance metrics	An	20%
CO5	Apply techniques to collect text data from various sources of text mining	Ap	20%

UNIT I –INTRODUCTION TO PREDICTIVE ANALYTICS	**(9)**
Overview of Predictive Analytics-Setting Up the Problem-Data Understanding-Single Variable Summaries - Data Visualization in One Dimension, Two or Higher Dimensions-The Value of Statistical Significance-Pulling it all together into a Data Audit	
UNIT II –DATA PREPARATION AND ASSOCIATION RULES	**(9)**
Data Preparation-Variable Cleaning-Feature creation-Item sets and Association rules-Terminology-Parameter settings-How the data is organized-Measures of Interesting rules-Deploying Association rules-Problems with Association rules-Building Classification rules from Association rules	
UNIT III – MODELING	**(9)**
Descriptive Modeling-Data Preparation issues with Descriptive modeling-Model Selection-Principal Component analysis-Clustering algorithms-Interpreting Descriptive models-Standard cluster model interpretation	
UNIT IV – PREDICTIVE MODELLING	**(9)**
Decision Trees-Logistic Regression-Neural Network Model-K-Nearest Neighbors-Naive Bayes -Regression Models- Linear Regression-Building Neural Networks using XLMiner-Other Regression Algorithms	

UNIT V – TEXT MINING	(9)
Motivation for Text Mining-A Predictive modeling approach to Text Mining-Structured vs. Unstructured data-Why Text mining is hard-Data Preparation steps-Text mining features-Modeling with Text mining features-Regular Expressions - Web mining - Text Mining vs. Web Mining - Case studies:-Survey Analysis	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014.(Unit 1-5)
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012

REFERENCES

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014
3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Wiley, 2017.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2		3	3											3
3		3	3	3									3	
4		3	3	3									3	
5	3								3					
CO (W.A)	3	3	3		3					3			3	3

22AIX16 - IMAGE AND VIDEO ANALYTICS *(Common to 22CSX16,22ITX16,22CIX26,22CCX27)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide a broad view on processing and analyzing images and videos.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the image processing techniques for image and video analysis.	Ap	20%
CO2	Use image pre-processing techniques for object detection.	Ap	20%
CO3	Apply the various levels of segmentation and interpret the results for object detection.	Ap	20%
CO4	Apply recognition and machine learning techniques.	Ap	20%
CO5	Make use of video analysis for real time case studies.	An	20%

UNIT I - INTRODUCTION	(9)
Computer Vision – Image representation and image analysis tasks - Image representations – Digitization- Digital image properties- color images- Linear integral transforms- Images as stochastic processes- Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.	
UNIT II - IMAGE PRE-PROCESSING	(9)
Pixel brightness transformations – Geometric transformations-Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.	
UNIT III - OBJECT DETECTION USING MACHINE LEARNING	(9)
Object detection– Object detection methods – Deep Learning framework for Object detection– Bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-Fast R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Single Shot MultiBox Detector(SSD)-Transfer Learning-Python Implementation.	

UNIT IV - FACE RECOGNITION AND GESTURE RECOGNITION	(9)
Face Recognition- Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Face book- FaceNet for Face Recognition- Python Implementation using FaceNet-Python Solution for Gesture Recognition.	
UNIT V - VIDEO ANALYTICS	(9)
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture- ResNet and skip connections-Inception Network- GoogLENet architecture-Improvement in Inception v2-Video analytics-Python Solution using ResNet and Inception v3.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013. (UNIT-I and II)
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3				3								3	
3	3												3	
4	3													3
5		3	3		3									3
CO (W.A)	3	3	3		3								3	3

22AIX17 - NATURAL LANGUAGE PROCESSING *(Common to 22CSX17,22ITX17,22CIX27)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To learn and understand syntactic and semantic elements of NLP and knowledge representation and interface.			

Course Outcomes		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Summarize the concepts in speech and language processing and utilize regular expressions and other statistical methods to create Language Models.	Ap	20%
CO2	Apply Vector Embedding to words and build Neural Language models.	Ap	20%
CO3	Solve sequence labeling problems (Named Entity Tagging and POS tagging) using RNN and LSTM.	An	20%
CO4	Apply the Machine translation model to dialogue systems.	Ap	20%
CO5	Illustrate the working of Automatic speech recognition and information retrieval.	Ap	20%

UNIT I –FUNDAMENTALS OF NATURAL LANGUAGE PROCESSING	**(9)**
Regular Expressions, Text normalization, Edit Distance-.N-gram language models:N-grams-Evaluating language models: training and test sets-perplexity-Sampling sentences from a language model-Generalization and Zeros-Smoothing-Native bayes,text classification and sentiment-Logistic regression	
UNIT II –VECTOR SEMANTICS AND NEURAL NETWORK MODELS	**(9)**
Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors – pointwise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Visualizing embeddings-Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models.	
UNIT III – SEQUENCE LABELING AND DEEP LEARNING ARCHITECTURES	**(9)**
English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition-RNN and LSTMs-.Transformers and large language models-Fine tuning and masked language models.	
UNIT IV – MACHINE TRANSLATION (MT) AND DIALOGUE SYSTEMS	**(9)**
Language divergences and Typology – Machine translation using Encoder-Decoder model –Encoder-Decoder– Beam search-Translating in low resource situations- MT evaluation – Bias and ethical issues-properties of human conversations-Frame based dialogue systems-Dialogue acts and dialogue state.	

UNIT V –AUTOMATIC SPEECH RECOGNITION AND INFORMATION RETRIEVAL	(9)
The Automatic Speech Recognition Task -Feature Extraction for ASR: Log Mel Spectrum -Speech Recognition Architecture-CTC and TTS -Information Retrieval -Information Retrieval with Dense Vector-Evaluating Retrieval-based Question Answering-Context free grammars and constituency parsing-Dependency parsing-Information extractions-Semantic role labeling.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2020
2. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schuetze, MIT Press, 2018

REFERENCES

1. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019
2. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3			3									3
3	3		3											
4		3	3		3								3	3
5	3		3		3				3	3				
CO (W.A)	3	3	3		3					3			3	3

22AIX18 - AUGUMENTED REALITY AND VIRTUAL REALITY *(Common to 22CSX18,22ITX18,22CIX28)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of virtual reality and commercial VR technologies.	Ap	30%
CO2	Analyze the classic components of a VR system through hands-on experimentation and simulation.	An	20%
CO3	Make use of diverse modeling techniques with real-world sensor data.	Ap	30%
CO4	Evaluate the solution to enhance VR user experience and safety in diverse fields.	E	20%
CO5	Create VR applications by utilizing VR programming tools.	C	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
The three I's of virtual reality, commercial VR technology and the five classic components of a VR system, Augmented Reality and Tele presence.	
UNIT II -INPUT AND OUTPUT DEVICES	**(9)**
Input Devices : Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays& haptic feedback.	
UNIT III –MODELING	**(9)**
Geometric modelling, kinematics modelling, physical modelling, behaviour modelling, model management and Modelling real-life from sensors.	
UNIT IV - HUMAN FACTORS	**(9)**
Methodology and terminology, user performance studies, VR health and safety issues. Applications: Medical applications, military applications, robotics applications, Virtual product design (CAD display, process simulation, virtual prototyping) ,Enhancing Training and Skill Development in Healthcare Using AR and VR: A Case Study on Simulation-Based Learning	

UNIT V -VR PROGRAMMING	(9)
VR Programming-I: Introducing Unity 3D, Project panel, Scene hierarchy, Simple game object, Scene editor: A case study on Developing and Evaluation of a Simple Game Object and Scene Editor for Indie Game Developers VR Programming-II: Middle VR, device management, graphics card limitation, 3D user interactions, deployment, VR software: A case study on the Impact of Unreal Engine in Architectural Visualization: A Case Study of VR Integration in Real Estate Marketing.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. "Virtual Reality Technology", Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons, Inc., Second Edition,2006

REFERENCES:

1. "Virtual Reality Technology" Grigore C. Burdea and Philippe Coiffet,recentedition,January 2022.
2. "Virtual Reality Technology and Applications" Harry F. Shneider ,FirstEdition,2018.
3. "Virtual Reality: Concepts and Technologies" Philippe Fuchs, Pascal Guitton, and Guillaume Moreau, First Edition,2011.
4. "Human Factors in Augmented Reality Environments" Philippe Fuchs, Patrick Reignier, and Fabien Lotte, First Edition,2020.
5. "Unreal Engine Virtual Reality Quick Start Guide: Design and Develop immersive virtual reality experiences with Unreal Engine 4" Jessica Plowman, , First Edition,2019

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3											3	
3			3		3								3	
4			3										3	
5					3		3		3	2		3		3
CO (W.A)	3	3	3		3		3		3	2		3	3	3

22AIX21 - SOCIAL NETWORK SECURITY *(Common to* 22CSX25,22ITX25,22CIX34,22CCX02)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To focuses on understanding and addressing security issues related to social networking platforms, including protecting user privacy, preventing cyber threats, and managing data security.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply network analysis and explore its applications.	Ap	20%
CO2	Comprehend the role of ontologies in the Semantic Web, ontology-based knowledge representation.	An	20%
CO3	Develop skills to extract the evolution of web communities	C	20%
CO4	Predict human behavior in social communities through reality mining	An	20%
CO5	Visualizing social network on various technologies	An	20%

UNIT I - INTRODUCTION	**(9)**
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web – Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.	
UNIT II - MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	**(9)**
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.	
UNIT III - EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	**(9)**
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting community's social network infrastructures and communities - Decentralized online social networks - multi-relational characterization of dynamic social network communities.	

UNIT IV - PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	(9)
Understanding and predicting human behaviour for social communities - User data management – Inference and Distribution – Enabling new human experiences-Reality Mining-Context- Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.	
UNIT - V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	**(9)**
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover Networks-Community welfare - Collaboration networks - Co-Citation networks.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. PeterMika, —Social Networks and the Semantic Web‖, First Edition, Springer2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications‖, 1stEdition, Springer, 2010.

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking –Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3										3	3	3
2	3	3			3							3	3	3
3			3									3	3	
4	3					3						3	3	3
5	3		3									3	3	3
CO (W.A)	3	3	3		3	3						3	3	3

22AIX22 - BIOMETRIC SECURITY *(Common to 22CSX28,22ITX28,22CIX35,22CCX03)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide students with a comprehensive understanding of biometric security systems, covering their design, implementation, evaluation, and applications in various security contexts.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the biometric systems, their functionalities, and the underlying principles and their practical Applications in real-world scenarios.	An	20%
CO2	Apply the face recognition and face detection methods.	Ap	20%
CO3	Evaluate encoding and matching algorithms used to extract distinctive features from there is for Verification purposes.	E	20%
CO4	Illustrate the architecture and components involved in capturing data from multiple biometric sources.	An	20%
CO5	Research types of attacks that can occur at the user interface level.	An	20%

UNIT I - INTRODUCTION TO BIOMETRICS	**(9)**
Biometric functionalities – Biometric system errors – The design cycle of biometric systems – Applications of biometric systems – Security and privacy issues – Fingerprint recognition – Fingerprint acquisition – Feature extraction – Fingerprint indexing – Palmprint.	
UNIT II - FACE RECOGNITION	**(9)**
Introduction to face recognition – Image acquisition–Face detection–Feature extraction and matching.	
UNIT III – IRIS RECOGNITION	**(9)**
Introduction to iris recognition – Design of an iris recognition system – Iris segmentation – Iris normalization - Irisencodingandmatching–Irisquality–Biometrictraits–Handgeometry–Softbiometrics.	
UNIT IV - MULTI-BIOMETRICS	**(9)**
Multi-biometrics – Sources of multiple evidence – Acquisition and processing architecture – Fusion levels.	

UNIT V – SECURITY OF BIOMETRIC SYSTEMS	(9)
Adversary attack – Attacks at the user interface – Attacks on the biometric processing – Attacks on the template database.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Anil K Jain, Arun A Ross and Karthik Nandakumar, Introduction to Biometrics, Springer, First Edition,2011.
2. Rachid Guerraoui and Franck Petit, Stabilization, Safety, and Security of Distributed Systems, Springer, FirstEdition,2010.

REFERENCES:

1. Marcus Smith, Monique Mann and Gregor Urbas, Biometrics, Crime and Security, Taylor and Francis, FirstEdition,2018.
2. Ravindra Das, The Science of Biometrics SecurityTechnologyfor Identity Verification, Taylor and Francis, FirstEdition,2018.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3								3	
2	3			3	3								3	2
3	3			3	3									
4	3	3	3	3	3									
5	3	3		3	3	3							3	
CO (W.A)	3	3	3	3	3	3							3	2

22AIX23 – CLOUD SECURITY *(Common to 22CSX23,22ITX23,22CCX04)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce the fundamental concepts and architecture of cloud computing. • To understand and address security concerns, risks, and legal aspects. • To explore data security strategies and best practices for securing data in the cloud • To evaluate security criteria for building and managing private clouds and selecting external cloud service providers. • To assess and evaluate cloud security through comprehensive frameworks

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze various the concepts of cloud computing, policy and compliance in cloud environment.	An	20%
CO2	Develop and implement secure cloud architectures, security patterns, and strategies for secure cloud operations.	Ap	20%
CO3	Apply key strategies and best practices for managing cloud data security risks and monitoring security controls	Ap	20%
CO4	Apply the fundamental concepts in infrastructure security facilities in cloud computing.	Ap	20%
CO5	Implement security operations activities and architectures for efficient and secure cloud management	Ap	20%

UNIT I - INTRODUCTION	**(9)**
Introduction to Cloud computing and security: Understanding cloud computing – The IT foundation for Cloud. An historical view: Roots of Cloud computing – A brief primer on architecture. Security architecture: Cloud computing architecture – Cloud reference architecture – Control over security in the cloud model – Making sense of cloud deployment – Making sense of services models – Real- world cloud usage scenarios.	
UNIT II - SECURING THE CLOUD	**(9)**
Security concerns – Risk issues and legal aspects – Security concerns –Assessing risk tolerance in Cloud Computing–Legal and regulatory issues–Securing the Cloud: Architecture–Security patterns and architectural element – Cloud security architecture –Planning key strategies for secure operation.	
UNIT III - CLOUD DATA SECURITY	**(9)**

Securing the cloud: Data security – Overview of data security in Cloud Computing. Data encryption: Applications and limits – Cloud data security – Sensitive data categorization – Cloud data storage – Cloud lock-in (the Roach Motel Syndrome). Securing the cloud: Key strategies and Best practices–Overall strategy– Effectively managing risk –Overview of security controls –The limits of security controls – Best practices – Security monitoring.

UNIT IV - SECURITY CRITERIA **(9)**

Security criteria: Building an internal cloud – Private clouds – Motivation and overview – Security criteria for ensuring a private cloud – Security criteria – Selecting an external cloud provider – Selecting a CSP – Overview of assurance – Selecting a CSP – Overview of risks – Selecting a CSP

UNIT V – EVALUATING CLOUD SECURITY **(9)**

Security criteria – Evaluating cloud security – An information security framework – Evaluating cloud security – Checklists for evaluating cloud security – Metrics for the checklists – Operating a cloud – Architecture to efficient and secure operations – Security operations activities.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS

1. Raghuram Yeluri and EnriqueCastro-Leon, Building the Infrastructure for Cloud Security: A Solutions View, A press, First Edition,2014
2. Ronald L Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley, First Edition,2010

REFERENCES

1. Chris Dotson, Practical Cloud Security A Guide for Secure Design and Deployment, O'Reilly Media, First Edition,2019
2. Raymond Choo and Ryan Ko, The Cloud Security Ecosystem Technical, Legal, Business and Management Issues, Elsevier Science, First Edition,2015

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	3
2			3										3	3
3	3			3			3						3	3
4	3												3	3
5				3		3							3	3
CO (W.A)	3	3	3	3		3	3						3	3

22AIX24 - DATA PRIVACY AND PROTECTION *(Common to 22CSX26,22ITX26,22CCX06)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with a comprehensive understanding of how to safeguard personal and sensitive data from unauthorized access, breaches, and misuse.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge on fundamental principles of Data privacy.	Ap	20%
CO2	To design and development of data preservation by using datamining.	An	20%
CO3	Ability to assess privacy risks associated with Privacy regulations.	Ap	20%
CO4	Analyses various approaches in data security by using tools.	An	20%
CO5	Apply security on storage and database.	Ap	20%

UNIT I–INTRODUCTION TO DATA PRIVACY	**(9)**
Data Privacy and its Importance - Need for Sharing Data - Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Introduction to Anonymization Design Principles - Nature of Data in the Enterprise Static Data Anonymization on Multidimensional Data: Introduction - 36 Classification of Privacy Preserving Methods - Classification of Data in a Multidimensional Data Set - Group-Based Anonymization.	
UNIT II–PRIVACY PRESERVING DATA MINING	**(9)**
Introduction - Privacy Preserving Graph Data - Privacy Preserving Time Series Data - Privacy Preservation of Longitudinal Data - Privacy Preservation of Transaction Data - Static Data Anonymization: Threats to Anonymized Data-Threats to Data Structures-Threats by Anonymization Techniques.	
UNIT III–PRIVACY REGULATIONS	**(9)**
Introduction - UK Data Protection Act 1998. - Federal Act of Data Protection of Switzerland 1992 - Payment Card Industry Data Security Standard (PCI DSS)- The Health Insurance Portability and AccountabilityActof1996(HIPAA): Effects of Protection-Anonymization Considerations- Anonymization Design for HIPAA - Explicit Identifiers - Quasi-Identifiers - Sensitive Data. – Anonymization Design Checklist.	

UNIT IV–DATA SECURITY	(9)
Securing Unstructured Data: Structured Datavs. Unstructured Data – At Rest ,in Transit and in Use –ApproachestosecureUnstructuredData–NewerApproachestoSecureUnstructuredData. Information Rights Management: Overview–IRM Technology Details – Getting Started with IRM. Encryption: History of Encryption – Symmetric Key Cryptography – Public Key Cryptography.	
UNIT V–CONTEMPORARY ISSUES	**(9)**
Storage Security: Evolution – Modern Storage Security – Risk Remediation – Best Practices. Database Security: General Concepts – Database Security Layers – Database-Level Security – Database Backup and Recovery – Database Auditing and Monitoring.	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Venkataramanan, Nataraj, and Ashwin Shriram. Data Privacy: Principles and Practice. CRC Press, 2017

REFERENCES

1. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, And Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
2. David Salomon, Data Privacy and Security, Springer,2003
3. Andrew Vladimirov Michajlows ki, Konstantin, Andrew A. Vladimirov, and Konstantin V. Gavrilenko. Assessing Information Security: Strategies, Tactics, Logic and Framework. IT Governance Ltd, 2010.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3		3		3									3	2
4		3			3									
5	3		3										3	2
CO (W.A)	3	3	3	3	3								3	

22AIX25 - CYBER PHYSICAL SYSTEMS *(Common to 22CIX36,22CCX07)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To focuses on the integration of computer-based algorithms with physical processes, aiming to teach students about the design, analysis, and implementation of systems where physical and cyber components interact.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain a foundational understanding of CPS, including demarcating specific systems,	An	20%
CO2	Able to analysis information and its symbolic realities	Ap	20%
CO3	Design and development of various decision-making techniques applicable to cyber-physical Systems	E	20%
CO4	Develop skills in employing data networks and wireless communications within the framework of CPS, and grasp the practical applications of artificial intelligence and machine learning.	An	20%
CO5	Gain insight into upcoming technologies and their potential applications across different sectors along with ethics.	An	20%

UNIT I - INTRODUCTION TO CYBER PHYSICAL SYSTEMS	**(9)**
Introduction to Cyber-Physical Systems -Need for a General Theory-Systems Engineering-Demarcation of Specific Systems-Classification of Systems- Maxwell's Demon as a System-Games and Uncertainty-Uncertainty and Probability Theory-Random Variables: Dependence and Stochastic Processes	
UNIT II - INFORMATION AND NETWORK	**(9)**
. Data and Information- Information and Its Different Forms-Physical and Symbolic Realities-Network Types-Processes on Networks and Applications-Limitations	
UNIT III - DECISIONS AND ACTIONS	**(9)**
. Forms of Decision-Making-Optimization-Game Theory- Rule-Based Decisions-The Three Layers of Cyber-Physical Systems-Physical Layer, Measuring, and Sensing Processes-Data Layer and Informing Processes-Decision Layer and Acting Processes-Layer Based Protocols and Cyber-Physical Systems Design	
UNIT IV - DYNAMICS OF CYBER-PHYSICAL SYSTEMS	**(9)**
Introduction to Dynamics of Cyber-Physical Systems-Failures and Layer-Based Attacks-Enabling Information and Communication Technologies- Data Networks and Wireless Communications-Artificial Intelligence and Machine Learning-Decentralized Computing and Distributed Ledger Technology	

UNIT V – APPLICATIONS	(9)
Future Technologies: A Look at the Unknown Future-Cyber-Physical Industrial System-Cyber-Physical Energy System-Governance Models- Social Implications of the Cyber Reality-Case studies The Cyber Project	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:
1. Pedro H. J. Nardelli, Cyber-physical Systems, Released May 2022, Publisher(s): Wiley-IEEE Press, ISBN: 9781119785163.
REFERENCES:
1. Rajeev Alur, Principles of Cyber Physical Systems, 1st Edition, MIT Press 2015. 2. Raj Rajkumar, Dionisio de Niz, Mark Klein Cyber-Physical Systems, Released December 2016, Publisher(s): Addison-Wesley Professional. ISBN: 9780133416169

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3		3	3				3			3	3
2	3				3					3			3	3
3	3	3			3					3			3	3
4	3				3	3				3			3	3
5	3	3	3		3	3				3			3	3
CO (W.A)	3	3	3		3	3				3			3	3

22AIX26 - MOBILE DEVICE SECURITY *(Common to 22CIX37,22CCX11)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To equip students with the knowledge and skills necessary to protect mobile devices and the data they hold.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply theoretical knowledge to solve real-world security problems and scenarios related to mobile communication.	Ap	20%
CO2	Apply access control mechanisms and user authentication techniques to ensure that only authorized individuals can access device resources.	Ap	20%
CO3	Analyze security testing results and vulnerability reports to prioritize and address application-level security issues.	An	20%
CO4	List the various types of threats for MANET applications.	An	20%
CO5	Discuss security challenges and attacks over mobile commerce services.	An	20%

UNIT I - SECURITY ISSUES IN MOBILE COMMUNICATION	**(9)**
Mobile Communication History - Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application-level Security.	
UNIT II - SECURITY OF DEVICE, NETWORK, AND SERVER LEVELS	**(9)**
Mobile Devices Security Requirements - Mobile Wireless network level Security, Server Level Security; Application - Level Security in Wireless Networks - Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for GWi- Fi Applications, Recent Security Schemes for Wi-Fi Applications.	
UNIT III - APPLICATION-LEVEL SECURITY IN CELLULAR NETWORKS	**(9)**
Generations of Cellular Networks - Security Issues and attacks in cellular networks - GSM Security for applications - GPRS Security for applications - UMTS security for applications - 3G security for applications - Some of Security and authentication Solutions.	

UNIT IV- APPLICATION-LEVEL SECURITY IN MANETS	(9)
MANETs-Applications of MANETs, MANET Features, Security Challenges in MANETs; Security Attacks on MANETs - External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions; Ubiquitous Computing - Need for Novel Security Schemes for UC Security Challenges for UC, Security Attacks on UC networks, Some of the security solutions for UC.	
UNIT V - SECURITY FOR MOBILE COMMERCE APPLICATION	**(9)**
M-commerce Applications - M-commerce Initiatives - Security Challenges in Mobile E-commerce - Types of Attacks on Mobile E-commerce - A Secure M-commerce Model Based on Wireless Local Area Network – Some of M - Commerce Security Solutions.	
TOTAL= 45 PERIODS	

TEXTBOOKS:

1. Pallapa Venkata ram, Satish Babu, "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010.
2. Man Ho Au, Raymond Choo," Mobile Security and Privacy",1st Edition, Syngress Publisher,2016

REFERENCES:

1. Frank Adelstein, K.S.Gupta , "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.
2. Randall k. Nichols, Panos C. Lekkas, "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006.
3. Bruce Potter and Bob Fleck, "802.11 Security", 1st Edition, SPD O'REILLY 2005.
4. James Kempf, "Guide to Wireless Network Security, Springer. Wireless Internet Security - Architecture and Protocols", 1st Edition, Cambridge University Press, 2008.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3	3	3	3				3			3	3
2	3	3	3	3	3	3				3			3	3
3	3		3	3	3					3			3	3
4	3		3	3	3					3			3	3
5	3	3	3	3	3	3				3			3	3
CO (W.A)	3	3	3	3	3	3				3			3	3

22AIX27 - MALWARE ANALYSIS *(Common to 22CCX12)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with a comprehensive understanding of malware analysis, including techniques, tools, and methodologies used to dissect, analyze, and mitigate malicious software.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify various malwares the behavior of malwares in real world applications.	Ap	20%
CO2	Implement different malware analysis techniques.	C	20%
CO3	Analyze the malware behavior in windows and android.	An	20%
CO4	Create detection signatures and Indicators of Compromise (IOCs) to identify malware detection engineering.	C	20%
CO5	Conduct static analysis on Windows executables and DLLs to extract meaningful information without execution.	An	20%

UNIT I-MALWARE ANALYSIS	**(9)**
Malware Components and Distribution – Malware Packers – Persistence Mechanisms - Network Communication- Code Injection - Process Hollowing and API Hooking - Stealth and Rootkits	
UNIT II-MALWARE CLASSIFICATION	**(9)**
Static Analysis – Dynamic Analysis – Memory Forensics with Volatility -Malware Pay load Dissection and Classification	
UNIT III-MALWARE REVERSE ENGINEERING	**(9)**
Debuggers and Assembly Language – Debugging Tricks for Unpacking Malware- Debugging Code Injection- Armoring and Evasion: The Anti-Techniques-Fileless, Macros, and Other Malware Trends	
UNIT IV- DETECTION ENGINEERING	**(9)**
Antivirus Engines - IDS/IPS and Snort / Suricata Rule Writing – Malware Sand box Internals – Binary Instrumentation For Reversing Automation	

UNIT V - ANALYZING MALICIOUS WINDOWS PROGRAMS	(9)
Analyzing Malicious Windows Programs – The Windows API -Types and Hungarian Notation-File System Functions-Shared Files-Files Accessible via Namespaces - Alternate Data Streams - The Windows Registry.	
TOTAL = 45 PERIODS	

TEXTBOOKS:

1 Malware Analysis and Detection Engineering, A Comprehensive Approach to Detect and Analyze Modern Malware by Abhijit Mohanta, Anoop Saldanha, 2020,Publisher(s): Apress, ISBN: 9781484261934

2 Michael Sikorski and Andrew Honig,"PracticalMalwareAnalysis"byNoStarchPress,2012,ISBN: 9781593272906

REFERENCES:

1. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bacchanalian, Sebastien Josse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3											
2				3									3	
3	3												3	3
4	3				3									3
5		3											3	
CO (W.A)	3	3	3	3	3								3	3

22AIX28 - DIGITAL FORENSICS *(Common to 22CCX13)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To focuses on the methods and techniques used to investigate and analyze digital evidence.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explain the basics of digital forensics process.	AP	20%
CO2	Describe about digital crime and investigations procedures.	An	20%
CO3	Outline the Frameworks, Standards and Methodologies for digital forensics.	AP	20%
CO4	Identify the digital evidences and tools for iOS devices	AP	20%
CO5	Create clear and detailed forensic reports that summarize findings, methodologies, and conclusions, suitable for legal proceedings or organizational review.	C	20%

UNIT I - INTRODUCTION	**(9)**
Introduction - Computer Forensics Fundamentals, Types of Computer Forensics Technology, Types of Computer Forensics Systems; Vendor and Computer Forensics Services.	
UNIT II - COMPUTERFORENSICSEVIDENCEAND CAPTURE	**(9)**
Computer forensics evidence and capture - Data Recovery - Evidence Collection and Data Seizure - DuplicationandPreservationofDigitalEvidence-ComputerImageVerificationandAuthentication.	
UNIT III - COMPUTER FORENSIC ANALYSIS	**(9)**
Discover of Electronic Evidence - Identification of Data, Reconstructing Past Events - Fighting against Macro Threats; Tactics of the Military - Tactics of Terrorist and Rogues -Tactics of Private Companies.	
UNIT IV - INFORMATION OPERATIONS	**(9)**
Arsenal and Surveillance Tools - Hackers and Theft of Components, Contemporary Computer Crime, Identity Theft and Identity Fraud; Organized Crime &Terrorism - Applying the First Amendment to Computer Related Crime, The Fourth Amendment and other Legal Issues.	

UNIT V – DIGITAL FORENSIC CASES	(9)
Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence, Processing Evidence and Report Preparation, - Future Issues.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. JohnR.Vacca, "Computer Forensics: Computer Crime Scene Investigation", CengageLearning,2nd Edition, 2005.
2. MarjieTBritz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2ndEdition,2008.

REFERENCES:

1. Cyber security – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication 2019.
2. The basics of digital Forensics (Latest Edition)–The primer for getting started in digital forensics by John Sammons–ElsevierSyngressImprint2015.
3. Practical Digital Forensics – Richard Boddington [PACKT] Publication, Open-source community2010.
4. MajidYar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover,2nd Edition, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3		3	3											3
4				3									3	
5							3							
CO (W.A)	3	3	3	3			3						3	3

22AIX31 - INDUSTRIAL & MEDICAL IOT *(Common to 22CSX31,22ITX31,22CIX01,22CCX31)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with good depth of knowledge of Designing Industrial and Medical IoT Systems for various applications. • Students will learn the new evolution in hardware, software, and data				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply data management techniques to analyze and manipulate IIoT data, using tools for basic analytics and mining.	Ap	20%
CO2	Analyze various attack types targeting IoMT devices and systems, demonstrating the ability to identify specific vulnerabilities in real-world scenarios.	An	20%
CO3	Apply the IoMT system architecture by designing a basic framework that includes data collection, management, and server layers, ensuring proper integration of each component.	Ap	40%
CO4	Analyze the impact of smart medicinal packages on medication adherence, examining data on patient outcomes and adherence rates.	An	20%
CO5	Analyze case studies from various industrial IoT domains, focusing on operational efficiency, safety improvements, and sustainability impacts.	An	Internal Assessment

UNIT I- INTRODUCTION TO INDUSTIAL IOT (IIOT)	(9)
Introduction to IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT	
UNIT II - INTERNET OF MEDICAL THINGS SECURITY THREATS, SECURITY CHALLENGES AND POTENTIAL SOLUTIONS	(9)
IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.	
UNIT III - INTERNET OF MEDICAL THINGS INTRODUCTION AND SYSTEM ARCHITECTURE	**(9)**
Introduction, IoMT Devices-On-Body Devices, In-Home Devices, Community Devices, In-Clinic Devices, In- Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer.	

UNIT IV – HEALTH CARE TECHNOLOGIES & IoMT	(9)
Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases-What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare.	
UNIT V – APPLICATION DESIGN & CASE STUDY	**(9)**
Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process. Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.
2. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.
3. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.

REFERENCES:

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
2. Aboul Ella Hassanien, NilanjanDey and SureakaBoara, Medical Big Data and Internet of
3. Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3		3	3											3
4				3									3	
5							3							
CO (W.A)	3	3	3				3						3	3

22AIX32 - BLOCKCHAIN TECHNOLOGY *(Common to 22CSX32,22ITX32,22CIX02)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge of distributed ledgers in business • To acquire knowledge in emerging concepts using blockchain

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of blockchain technology to articulate their significance.	Ap	20%
CO2	Evaluate the effectiveness of different consensus algorithms in specific blockchain applications.	An	20%
CO3	Evaluate their impact on security and privacy in digital transactions.	An	20%
CO4	Implement a strategic plan for integrating specific distributed ledger technologies into a business environment, considering operational efficiency, security, and regulatory compliance.	Ap	20%
CO5	Apply appropriate techniques to manage trust-based business networks, considering societal, environmental, economic, and global perspectives.	Ap	20%

UNIT I –INTRODUCTION	(9)
The growth of blockchain technology – Distributed Systems – P2P – Distributed Ledger – Cryptographically Secure - Generic Element of Blockchain – Benefits and limitations of blockchain - Block chain Challenges - Tiers of BT – Types of Blockchain - Consensus.	
UNIT II –DECENTRALIZATION	(9)
Methods of Decentralization – Routes to Decentralization – Smart Contract – Decentralized Organization – Platforms for Decentralization – Consensus Algorithms.	
UNIT III –CRYPTOCURRENCIES	(9)
Cryptographic Hash Functions – Cryptography basic and Concepts – Introduction Bitcoin – Bitcoin Network and Payments – Bitcoin clients and APIs – Alternative Coins.	
UNIT IV -DISTRIBUTED LEDGERS FOR BUSINESS	(9)
Ethereum: Introduction – Ethereum Network – Components – Programming Languages; Hyperledger: Introduction – Reference Architecture – Fabric – Sawtooth Lake – Corda.	

UNIT V -BLOCKCHAIN DEVELOPMENT TOOLS AND FRAMEWORKS	(9)
Compilers: Solidity Complier – Ganache – Metamask – Truffle; Languages: Solidity – Go – Java – NodeJS; Blockchain Use case: Financials – Insurance - Supply Chain Management – HealthCare – IoT.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
2. Imran Bashir, "Mastering Blockchain" Packt 2nd Ediction, 2018.

REFERENCES:

1. Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.
2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3		3	3											3
4			3	3	3									
5											3	3	3	
CO (W.A)	3	3	3	3	3						3	3	3	3

22AIX33 - BEYOND 5G AND IOT TECHNOLOGIES *(Common to* 22CSX33,22ITX33,22CIX03,22CCX33)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Explore the evolution from 5G to 6G and the implications for data rates, latency, and connectivity. • Examine the role of edge computing in reducing latency and improving real-time data processing in IoT systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of key capabilities and requirements of 5G to evaluate their implications for specific industry applications, such as IoT, smart cities, and autonomous vehicles.	Ap	20%
CO2	Analyze the specific requirements for 5G waveform design, including spectral efficiency, flexibility, and resilience to interference.	An	20%
CO3	Apply knowledge of the 5G architecture framework to design a basic model of a 5G network, incorporating elements such as the Radio Access Network (RAN) and core network components.	Ap	40%
CO4	Analyze the theoretical foundations of multi-antenna systems, identifying key requirements and performance indicators essential for effective MIMO operation.	An	20%
CO5	Conduct a detailed case study on a specific implementation of V2X or terahertz communication technology, evaluating its design, performance outcomes, and lessons learned.	An	Internal Assessment

UNIT I- OVERVIEW OF 5G WIRELESS COMMUNICATIONS	**(9)**
Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.	
UNITII-WAVEFORM DESIGN FOR 5G & BEYOND	**(9)**
Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multicarriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods.	
UNITIII- 5G ARCHITECTURE AND 5G NEXTGEN CORE NETWORK	**(9)**
5G Architecture: Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements	

UNIT IV - MASSIVE MIMO SYSTEMS	(9)
Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming.	
UNITV -V2X COMMUNICATIONS AND NOVEL ASPECTS IN TERAHERTZ WIRELESS COMMUNICATIONS	**(9)**
Vehicle-to-Vehicle (V2V) Communications, Vehicle-to-Infrastructure (V2I) Communications, Vehicle-to-Pedestrian (V2P) Communication, Self-driving Vehicles & its challenges, Vehicle-to-Network (V2N) Communications.Overview, potential spectral windows at THz frequencies, Terahertz wave propagation characteristics, opportunities & challenges, application	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
2. Suvra Sekhar Das and Ramjee Prasad, "Evolution of Air Interface Towards 5G: Radio Access Technology andPerformance Analysis", Gistrup, Denmark: River Publishers series in Communication, 2018.
3. Wei Xiang, KanZheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer publications-2016.
4. William Stallings "5G Wireless: A Comprehensive Introduction", Pearson Education, 2021.
5. AfifOsseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology"Cambridge University Press-2016.

REFERENCES:

1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK,2017.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1													3	
2	3		3										3	
3		3												3
4				3									3	
5									2					
CO (W.A)	3	3	3	3					2				3	3

22AIX34 – PROGRAMMING FOR IoT BOARDS *(Common to 22CSX34,22ITX34,22CIX04,22CCX34)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce Internet of Things (IoT) environment and its technologies for designing smart systems • To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Investigate various challenges and explore open source hardware prototyping platforms for designing IoT devices	Ap	20%
CO2	Analyze basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world	An	20%
CO3	Apply knowledge on Tkinter GUI using python in different sensors	Ap	20%
CO4	Program SBC by exploring protocols, data conversion process, API and expansion boards for practical IoT devices using Python	Ap	20%
CO5	Apply embedded programming constructs and constraints in real time systems for real world socio-economic problems	Ap	20%

UNIT I- INTRODUCTION TO RASPBERRY PI	**(9)**
Raspberry Pi components-Installation of NOOBS and Raspbian on SD card- Terminal commands-Installation of Libraries on Raspberry pi- Getting the static IP address of Raspberry Pi-run a program-Installing the remote desktop server.	
UNIT II - INTERFACING WITH RASPBERRY PI	**(9)**
Interfacing of relay with raspberry Pi-LCD-DHT11 sensor-ultrasonic sensor- camera-play with digital sensor, analog sensor and actuator.	
UNIT III – PYTHON GUI WITH TKINTER	**(9)**
Tkinter for GUI design-LED Blink-brightness control-selection from multiple options-Reading a PIR sensor-Reading a analog sensor.	
UNIT IV – DATA ACQUISITION WITH PYTHON	**(9)**
Basics-CSV File- Storing Arduino data with CSV file- plotting random numbers using Matplotlib-Plotting real time from arduino- Integrating the plots in the TKinter window.	

UNIT V – CONNECTING TO THE CLOUD	(9)
Smart IoT systems- DHT11 data logger with thinkspeak server-ultrasonic sensor data logger-air quality monitoring system-landslide detection and disaster management system-smart motion detector and upload image to gmail.com.	

TEXT BOOKS :

1. Rajesh singh, AnithaGehlot, Lovi raj gupta, Bhupendrasingh and MahendranSwain "Internet of things with Raspberry Pi and Arduino" CRC Press 2020.

REFERENCES:

1. SaiYamanoor, SrihariYamanoor " Python programming with Raspberry Pi" Packet Publishing Ltd, 1st edition, 2017.
2. Wolfram Donat "Learn raspberry Pi programming in python" A Press 2014.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3				3										3
4			3										3	
5									3	3				
CO (W.A)	3	3	3	3					3	3			3	3

22AIX35 – PRIVACY AND SECURITY IN IOT *(Common to 22CIC12)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To impart knowledge on the state of the art methodologies and security in internet of things. • To implement the blockchain Technology and Privacy Preservation in Internet of Things (IoT).				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement the security mechanisms from the designing to the deployment of the IOT system using suitable protocols.	Ap	40%
CO2	Analyze IOT applications which are suitable for using Blockchain technology in development.	An	20%
CO3	Implement the privacy protection and preservation schemes for IOT applications	Ap	20%
CO4	Analyze the IOT application and select appropriate trust model for improving the security	An	20%
CO5	Review the literature related to Privacy and Security in IOT and presents a report with example application.	U	Internal Assessment

UNIT I - SECURITY IN IOT, NETWORK ROBUSTNESS AND MALWARE PROPAGATION CONTROL IN IOT	(9)
IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle. Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification - Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.	
UNIT II -BLOCKCHAIN TECHNOLOGY IN IOT, PRIVACY PRESERVATION IN IOT	(9)
Technical Aspects - Integrated Platforms for IoT Enablement - Intersections between IoT and Distributed Ledger - Testing at scale of IoTBlockchain Applications - Access Control Framework for Security and Privacy of IoT - Blockchain Applications in Healthcare. Privacy Preservation Data Dissemination: Network Model, Threat Model - Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building.	

UNIT III - PRIVACY PROTECTION IN IOT	(9)
Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing	
UNIT IV - TRUST MODELS FOR IOT	(9)
Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT.	
UNIT V - SECURITY PROTOCOLS FOR IOT ACCESS NETWORKS	(9)
Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers - Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

REFERENCES:

1. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK
2. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.
3. Whitehouse O Security of things: An Implementers' guide to cyber-security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2		3			3									3
3	3													
4		3											3	
5									3	3				
CO (W.A)	3	3	3		3					3			3	3

22AIX36 - WEARABLE COMPUTING *(Common to 22CSX36,22ITX36,22CIX05,22CCX36)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Explore various applications of wearable computing across industries, such as healthcare, sports, entertainment, and fitness. • Examine the technical challenges associated with wearable systems, including power management, data accuracy, and user comfort.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply theoretical knowledge to practical situations, fostering skills in design, evaluation, and innovative thinking within the field of wearable technology.	Ap	20%
CO2	Analyze different signal processing techniques can be integrated into wearable systems to improve data quality and user experience.	An	20%
CO3	Apply knowledge of different wireless communication techniques to evaluate their suitability for implementing BANs in healthcare settings.	Ap	40%
CO4	Apply theoretical knowledge to practical challenges in wireless health systems, fostering skills in design, problem-solving, and innovation within the context of healthcare technology.	An	20%
CO5	Analyze case studies focused on wearable technologies used for monitoring patients with chronic diseases, assessing their impact on patient care and management.	An	Internal Assessment

UNIT-I INTRODUCTION TO WEARABLE SYSTEMS	(9)
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems- Wearable ground reaction force sensor.	
UNIT-II SIGNAL PROCESSING	(9)
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation.	
UNIT-III WIRELESS HEALTH SYSTEM	**(9)**
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.	

UNIT-IV SMART TEXTILE	(9)
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study- smart fabric for monitoring biological parameters - ECG, respiration.	
UNIT-V APPLICATIONS OF WEARABLE COMPUTING	**(9)**
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Title: "Wearable Sensors: Fundamentals, Implementation and Applications" Author: Edward Sazonov, Sergey G. Togov Publisher: Elsevier Year: 2014

REFERENCES:

1. Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Subhas Chandra Mukhopadhyay.
2. "Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Robert Matthews and Alberto Piaggesi.
3. "Wearable Sensors and Systems" edited by Mehmet R. Yuce.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3		3										3	
3		3												3
4				3									3	
5							3							
CO (W.A)	3	3	3	3			3						3	3

22AIX37 – FOG AND EDGE COMPUTING *(Common to 22CSX37,22ITX37,22CIX06,22CCX37)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce IoT enabling technologies and its opportunities. • To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explore technologies behind the communication and management of fogs and edge resources.	Ap	20%
CO2	Analyze the techniques for storage and computation in fogs, edges and clouds.	An	20%
CO3	Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same	Ap	40%
CO4	Analyze the goals of middleware for fog and edge computing.	An	20%
CO5	Review the performance and issues of the applications developed using fog and edge architecture.	Ap	Internal Assessment

UNIT I- Internet of Things (IoT) and New Computing Paradigms	**(9)**
Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges	
UNIT II - Challenges in Federating Edge Resources	**(9)**
Introduction –the networking challenge - the management challenge- Miscellaneous challenges - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics.	
UNIT III – Optimization Problems in Fog and Edge Computing	**(9)**
Introduction- Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing – optimization Techniques.	
UNIT IV – Middleware for Fog and Edge Computing	**(9)**
Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Fog Data Management - Smart Building - Predictive Analysis with FogTorch .	

UNIT V – Applications of Fog and Edge Computing	**(9)**
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.	
TEXT BOOKS : 1. Buyya, Rajkumar, and SatishNarayanaSrirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.	
REFERENCES: 1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2ndedition, CreateSpace Independent Publishing Platform, USA 2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India	

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3				3										3
4			3										3	
5									3	3				
CO (W.A)	**3**	**3**	**3**	**3**					**3**	**3**			**3**	**3**

22AIX38 - MOBILE APPLICATION DEVELOPMENT FOR IOT *(Common to 22CIC16)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce mobile design principles and implementation of Application development with Android and IOS. • To develop competency in the students to independently design and develop their own professional apps.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyzes the fundamental mobile application architecture for IoT through outlining.	An	20%
CO2	Evaluates the design constraints for mobile applications, ensuring performance, usability, security, availability, and modifiability.	An	20%
CO3	Implements IoT applications using standardized hardware and software platforms.	Ap	20%
CO4	Apply low power communication technologies to create a prototype.	Ap	20%
CO5	Create an IoT solution development plan from a Product management perspective.	C	20%

UNIT I -INTRODUCTION TO IOT ECOSYSTEM	(9)
IoT ecosystem; Industry 4.0; Application development platforms for IoT; IoT Data sources - GPS and WIFI integration with social media applications.	
UNIT II - BASIC DESIGN	(9)
Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.	
UNIT III - SENSOR DATA PROCESSING	(9)
Sensor Data-Gathering and Data-Dissemination Mechanisms; Sensor Database system architecture; Sensor data-fusion mechanisms; Data-fusion Architectures and models.	

UNIT IV - PROGRAMMING FRAMEWORKS FOR INTERNET OF THINGS	(9)
IoT Programming Approaches: Node-Centric Programming - Database approach - Model-Driven Development - IoT Programming Frameworks: Android Things - ThingSpeak - IoTivity - Node-RED - DeviceHive - Contiki and Cooja – Zetta.	
UNIT V - COMMUNICATION TECHNOLOGIES FOR LOW POWER WIRELESS INTERACTIONS	(9)
Wireless communications in product development – Bluetooth LE - Near Field Communications (NFC) – WiFi; Prototyping Bluetooth LE with ArduinoNano; Power management strategies and practices - Case Study: E-Health - Telemedicine.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
2. Lea, Perry. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 1st edition, Packt Publishing Ltd, 2018.

REFERENCES:

1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press,2019
2. GiacomoVeneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packt Publishing,2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3		3										3	
3		3		3	3									3
4		3	3											
5											3	3	3	
CO (W.A)	3	3	3	3	3						3	3	3	3

22AIX41 - CLOUD COMPUTING *(Common to 22CSX41,22ITC15,22CIX44)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of virtualization and Experiment with virtualization of hardware resources and Docker.	Ap	40%
CO2	Analyze various cloud programming models and apply them to solve problems on the cloud.	An	20%
CO3	Develop and deploy services on the cloud and set up a cloud environment.	Ap	20%
CO4	Evaluate the security issues related to cloud computing and handle the security threats and construct different cloud delivery design models.	An	20%
CO5	Build cloud solutions for the societal problems.	C	Internal Assessment

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE	**(9)**
Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges	
UNIT II -VIRTUALIZATION BASICS	**(9)**
Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.	
UNIT III -VIRTUALIZATION INFRASTRUCTURE AND DOCKER	**(9)**
Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories	

UNIT IV -CLOUD DEPLOYMENT ENVIRONMENT	(9)
Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack	
UNIT V -CLOUD SECURITY	**(9)**
Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			3									3	
2	3	3											3	3
3			3											3
4				3									3	
5					3	3								3
CO (W.A)	3	3	3			3							3	3

22AIX42 - UI AND UX DESIGN *(Common to 22CSX42,22ITX42,22CIX45,22CCX41)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To understand fundamental concepts of UI/UX design and to develop real time applications.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply UI design concepts for building user Applications.	Ap	20%
CO2	Demonstrate UI Design of any product or application.	An	20%
CO3	Evaluate UX Skills in product development.	Ap	20%
CO4	Create Wireframe and Prototype and learns to design successful products through personas and ideation.	An	40%
CO5	Present their web design demonstrating teamwork and reflective learning.	Ap	Internal Assessment

UNIT I - FOUNDATIONS OF DESIGN	**(9)**
UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.	
UNIT II - FOUNDATIONS OF UI DESIGN	**(9)**
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.	
UNIT III - FOUNDATIONS OF UX DESIGN	**(9)**
Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals- FIGMA tool	
UNIT IV - WIREFRAMING, PROTOTYPING AND TESTING	**(9)**
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.	
UNIT V – RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE	**(9)**
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.	

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021.

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rdEdition , O'Reilly 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3		3	3		3									3
4				3						3			3	
5										3	3	3		3
CO (W.A)	3	3	3	3	3					3	3	3	3	3

22AIX43 – DEVOPS *(Common to 22CSX43,22ITX43,22CIX46,22CCX46)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To introduce DevOps terminology, definition & concepts, version control tools and configuration management.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyse different actions performed through Version control tools like Git	An	20%
CO2	Apply Jenkinsfor Continuous Integration and Continuous Testing and Continuous Deployment by building automating test cases using Maven & Gradle.	Ap	30%
CO3	Design configuration management application using Ansible	An	20%
CO4	Implement the configuration management using Ansible and leverage Cloud-based DevOps tools using Azure DevOps	An	30%
CO5	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems	An	Internal Assessment

UNIT I- INTRODUCTION TO DEVOPS	**(9)**
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.	
UNIT II - COMPILE AND BUILD USING MAVEN & GRADLE	**(9)**
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle	
UNIT III - CONTINUOUS INTEGRATION USING JENKINS	**(9)**
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.	
UNIT IV - CONFIGURATION MANAGEMENT USING ANSIBLE	**(9)**
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible	
UNIT V – BUILDING DEVOPS PIPELINES USING AZURE	**(9)**
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file	

TEXT BOOKS :

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. by Mitesh Soni
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
5. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
6. https://www.jenkins.io/user-handbook.pdf
7. https://maven.apache.org/guides/getting-started/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3				3								3	
3			3											3
4				3	3								3	
5						3				3				3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**				**3**			**3**	**3**

22AIX44 - PRINCIPLES OF PROGRAMMING LANGUAGES *(Common to 22CSX44,22ITX44,22CCX47)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	• To understand design concepts for programming languages.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply programming languages for problem solving.	Ap	20%
CO2	Analyze object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog.	Ap	40%
CO3	Design a solution for given problem using programming languages structures	An	20%
CO4	Demonstrate the different functionalities of programming languages.	An	20%
CO5	Make an Oral presentation related to course.	Ap	Internal Assessment

UNIT I -SYNTAX AND SEMANTICS	(9)
Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing	
UNIT II -DATA, DATA TYPES, AND BASIC STATEMENTS	(9)
Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements	
UNIT III - SUBPROGRAMS AND IMPLEMENTATIONS	(9)
Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions -implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping.	
UNIT IV - OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING	(9)
Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – statement level concurrency – Event handling	

UNIT V – FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	(9)
Introduction to lambda calculus – fundamentals of functional programming languages -Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Robert W. Segesta, Concepts of Programming Languages, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, Programming Language Pragmatics, Fourth Edition, Elsevier, 2018.
3. Jeffrey D. Ullman, Elements of programming, Second Edition, Pearson, 1997.
4. W. F. Clocksin and C. S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

REFERENCES:

1. Ghezzi, —Programming Languages‖, 3rd Edition, John Wiley, 2008

2. John C. Mitchell, —Concepts in Programming Language, Cambridge University Press, 2004

Lutz M, "Programming Python", SPD/O'reilly, (4th Edition),(2015).

3. Allen Tucker, Robert Noonan, "Programming Languages: Principles and Paradigms", Tata McGraw Hill, (2nd edition),(2007).

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3			3								3	
3			3		3								3	
4		3		3										3
5										3				2
CO (W.A)	**3**	**3**	**3**	**3**	**3**					**3**			**3**	**3**

22AIX45 - MEAN STACK DEVELOPMENT *(Common to 22CSX45,22ITX45,22CIX56,22CCX45)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To build complex web application with using minimum code.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Node JS and NOSQL concepts for front end and back-end design	Ap	40%
CO2	Analyse the various stacks available for web application development and finds the best for given application.	An	20%
CO3	Design responsive pages using scripting technologies and Mongo DB.	Ap	20%
CO4	Implement interactive web pages using Angular JS	An	20%
CO5	Involve in independent study and aware of technological advances related to the course	An	Internal Assessment

UNIT I- INTRODUCTION TO NOSQL DATABASE	**(9)**
Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	
UNIT II - Node JS	**(9)**
Introduction – Architecture – Features- Creating Web Servers with HTTP -Request - Response – Event Handling - GET and POST Methods –File Upload - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.	
UNIT III MONGO DB	**(9)**
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications	
UNIT IV–TYPESCRIPT AND ANGULAR	**(9)**
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces. Angular : Introduction - Needs - Evolution – Features – Architecture - Setup and Configuration – Components and Modules –Templates - Controllers – Scope – Directives – Data Binding.	
UNIT V - ANGULARJS FRAMEWORK	**(9)**
Pipes/Filters -DOM – Events - Routing - Services – HTTP – Ajax– Template Driven Forms - Reactive Forms – Form Validation – Basic Animations.	

TEXT BOOK:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

REFERENCE:

1. https://www.javatpoint.com

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3											3	
3			3		3									3
4				3	3								3	
5									2	3		3		3
CO (W.A)	**3**	**3**	**3**	**3**	**3**				**2**	**3**		**3**	**3**	**3**

22AIX46 - SOCIAL AND INFORMATION NETWORKS *(Common to 22CSX46,22ITX46,22CIX47,22CCX43)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• To determine the theories and methods for analyzing network data, understanding network formation, and applying network analysis to real-world problems.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply various techniques for analyzing and visualizing network data.	Ap	25%
CO2	Analyze the efficiency of different measurements and metrics of social network.	An	25%
CO3	Develop real-world applications of network analysis in various domains.	Ap	25%
CO4	Implement the solutions for problems in case studies related to social and information networks.	An	25%
CO5	Abide by the norms of professional ethics in information sharing in social networks.	Ap	Internal Assessment

UNIT I- INTRODUCTION TO SOCIAL AND INFORMATION NETWORKS	(9)
Overview of social and information networks - Basic terminology and concepts - Types of networks :Social networks, Information networks, Citation networks - Network Representations and Data Formats	
UNIT II – NETWORK STRUCTURE AND PROPERTIES AND MODELS	(9)
Degree distribution and Power loss – Clustering Co-efficients – Small World Phenomenon – Network Motifs and Patterns. Random Graphs – Scale Free Networks – Exponential Random Graphs – Preferential attachment Models	
UNIT III – INFORMATION DIFFUSION AND COMMUNITY DETECTION	(9)
Models of Information Diffusion – Influence Maximization – Contagion Models – Cascading behavior in networks – Community detection: Modularity and Community structure – Clustering algorithms : Louvain, Girvan-Newman – overlapping communities – Evaluation metrics for community detection	

UNIT IV – ALGORITHMIC ASPECTS OF NETWORK ANALYSIS	(9)
Network resilience and Robustness: Vulnerability of networks to nodes and edge removal – Resilience strategies – Robustness metrics – Cascading failures and network collapse. Algorithmic Aspects of Network Analysis: Centrality measures: Degree centrality and Betweenness centrality - Page Rank Algorithm - Network Embedding Techniques - Graph Neural Networks	
UNIT V – APPLICATIONS OF SOCIAL AND INFORMATION NETWORKS	(9)
Social media analysis – Recommender system – Epidemiology and disease spread modeling – Online advertising and viral marketing	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World" by David Easley and Jon Kleinberg, first edition,2010
2. "Network Science" by Albert-Laszlo Barabasi,first edition, 2016
3. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell, Second edition, O'Reilly Media , 2019

REFERENCES:

1. **"Social Network Analysis: Methods and Applications" by Stanley Wasserman and Katherine Faust**:
2. **"The Structure and Dynamics of Networks" by Mark Newman**,This book covers the fundamental principles of network theory, including network structure, dynamics, and applications in various fields.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3											3	
3			3										3	
4				3		3								3
5								3		3		3		3
CO (W.A)	3	3	3	3		3		3		3		3	3	3

22AIX47 - WEB MINING *(Common to 22CSX47,22ITX47,22CIX57,22CCX44)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To learn techniques for extracting knowledge from Web content as a basis for business decisions and applications.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key concepts of Web mining to discover useful information from the World-Wide Web and its usage patterns	Ap	25%
CO2	Analyse the data on web using crawlers and extract strutured data.	An	25%
CO3	Compare various methods of web data mining and its applications	Ap	25%
CO4	Demonstrate various pattern discovery and analysis techniques	An	25%
CO5	Ability to read and comprehend research articles related to the course.	An	Internal Assessment

UNIT I- INTRODUCTION -WEBSEARCH	**(9)**
Basic Concepts – Information Retrieval Models - Evaluation Measures – Text and Web Page Pre-processing – Inverted Index and its compression – Latent Sematic Indexing – Web Search – Meta-Searching and CombiningMultipleRankings–WebSpamming.	
UNIT II - WEBCRAWLING	**(9)**
BasicCrawlerAlgorithm–ImplementationIssues–UniversalCrawlers–FocusedCrawlers–TopicalCrawlers–Evaluation–CrawlerEthicsand Conflicts.	
UNIT III - STRUCTURED DATA EXTRACTION	**(9)**
Structured Data Extraction –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matchingand Tree Matching – Multiple Alignment – Building DOM Trees – Extraction Based on a Single List Page –IntroductiontoSchemaMatching–Pre-ProcessingforSchemaMatching-Schema–LevelMatch– DomainandInstance-Level Matching	
UNIT IV - WEBUSAGEMINING	**(9)**
WebUsageMining–ClickstreamAnalysis–LogFiles–DataCollectionandPre-Processing–DataModelingforWebUsageMining–TheBIRCHClusteringAlgorithm–AffinityAnalysisandtheAPrioriAlgorithm–DiscretizingtheNumericalVariable	

UNIT V – OPINION MINING	(9)
The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification –Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion SpamDetection.	

TEXT BOOKS :

1. Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)",Springer;2nd Edition2011forunitsI,II,III&V

2. ZdravkoMarkov,DanielT.Larose,"DataMiningtheWeb:UncoveringPatternsinWebContent,Structure,andUsage",JohnWiley& Sons, Inc.,2010for unit IV.

REFERENCES:

1 AnthonyScime,"WebMiningApplicationsandTechniques",IdeaGroupPub.,2005

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3											3
4				3	3								3	
5										3		3		
CO (W.A)	**3**	**3**	**3**	**3**	**3**					**3**		**3**	**3**	**3**

22AIX48 - MULTIMEDIA DATA COMPRESSION AND STORAGE *(Common to 22CSX48,22ITX48,22CIX48,22CCX48)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• Apply data compression algorithms • Explain Multimedia Information Sharing

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply compression algorithms related to multimedia components such as text,speech,audio,image and video.	Ap	20%
CO2	Analyze the various image compression techniques and apply efficient technique for multimedia content	An	20%
CO3	Design a video using advanced video compression techniques and ensure efficient disk placement.	An	40%
CO4	Implement scheduling methods for request streams	An	20%
CO5	Submit a Multimedia presentation on assigned topics related to course	An	Internal Assessment

UNIT I- BASICS OF DATA COMPRESSION	**(9)**
MULTIMEDIA: Introduction-Uses of multimedia, Text, Images, Sound, Animation, Video—Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications	
UNIT II - IMAGE COMPRESSION	**(9)**
Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding	
UNIT III - VIDEO COMPRESSION	**(9)**
Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.	
UNIT IV - DATA PLACEMENT ON DISKS	**(9)**
Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.	
UNIT V – DISK SCHEDULING METHODS	**(9)**
Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams	

TEXT BOOKS:

1. 1.KhalidSayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3	3	3									3
4				3									3	
5										3				3
CO (W.A)	3	3	3	3	3					3			3	3

22AIX51 - AGILE METHODOLOGIES
(Common to 22CSX51,22CIX43)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:
- Estimate in an incremental and iterative fashion using practical techniques
- Apply agile principles to a range of decision possibilities.

Course Outcomes Students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the ethical considerations and team dynamics	An	20%
CO2	Apply scrum practices in project management	Ap	30%
CO3	Interpret and utilize agile metrics for informed decision-making	An	30%
CO4	Conduct Effective Requirements Engineering in Agile	An	20%
CO5	Apply agile testing practices to ensure high product quality.	Ap	Internal Assessment

UNIT I – AGILE METHODOLOGY	**(9)**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II - AGILE PROCESSES	**(9)**

Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.

UNIT III - AGILITY AND KNOWLEDGE MANAGEMENT	**(9)**

Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM)

UNIT IV - AGILITY AND REQUIREMENTS ENGINEERING	(9)
Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.	
UNIT V - AGILE TESTING	**(9)**
The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools : Jira	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints or Business Results", Prentice Hall, 2003
2. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson, 2002.
3. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009

REFERENCES:

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions, Springer-Verlag Berlin Heidelberg, 2010
2. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										2			3
2			3		3			2	2		2			
3	3										2		3	3
4	3							2		2				
5			3		3						2			3
CO (W.A)	3		3		3			2	2	2	2		3	3

22AIX52 - SOFTWARE DEFINED NETWORKS *(Common to 22CSX52,22ITX52,22CCX52)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Gain knowledge in networking fundamentals and conceptual understanding of Software Defined Networks (SDN)				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the conventional network and SDN paradigm	An	20%
CO2	Analyze the flexibility and scalability of using SDN in terms of innovation and network management	An	20%
CO3	Apply troubleshooting on various components of SDN networks	Ap	20%
CO4	Evaluate the security challenges in SDN paradigm	An	20%
CO5	Evaluate the emerging SDN applications	Ap	20%

UNIT I – INTRODUCING SOFTWARE DEFINED NETWORKS	**(9)**
SDN Origins and Evolution – Introduction : SDN - Centralized and Distributed Control and Data Planes - The Genesis of SDN	
UNIT II - SOFTWARE DEFINED NETWORKS ABSTRACTIONS	**(9)**
How SDN Works - The Open flow Protocol - SDN Controllers: Introduction – General Concepts - VMware - Nicira - VMware/Nicira - Open Flow-Related - Mininet - NOX/POX- Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK	
UNIT III - PROGRAMMING SOFTWARE DEFINED NETWORKS	**(9)**
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing	
UNIT IV - SOFTWARE DEFINED NETWORKS APPLICATIONS AND USE CASES	**(9)**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System	
UNIT V - SOFTWARE DEFINED NETWORKS FUTURE AND PERSPECTIVES	**(9)**
SDN Open Source - SDN virtualization -SDN Futures - Final Thoughts and Conclusions	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. S. Azodolmolky, "Software Defined Networking with Open Flow", Packt Pub Ltd, Second Edition, October 2017
2. E. Banks, SDN Showdown: Examining the Differences between VMware's NSX and Cisco's ACI, Network World, January 6, 2014

REFERENCES:

1. Software Defined Networks "A Comprehensive Approach by Paul Goransson and Chuck Black", Morgan Kaufmann Publications, 2014
2. SDN "Software Defined Networks by Thomas D. Nadeau & Ken Gray", O'Reilly, 2013
3. Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2		3												
3	3											2		3
4		3			3									
5	3				3							2		3
CO (W.A)	**3**	**3**			**3**							**2**		**3**

22AIX53 - SOFTWARE PROJECT MANAGEMENT *(Common to 22CSX53,22CCX53,22CIX54,22ITX53)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide an insight into detailed project management activities including project evaluation, planning, estimation, monitoring and control activities especially for software projects.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply different techniques in monitoring and control of the project	Ap	30%
CO2	Apply project estimation and evaluation techniques to real world problems	Ap	20%
CO3	Plan, schedule and sequence the activities using various techniques	An	30%
CO4	Identify project risk, monitor and track project deadlines	An	20%
CO5	Managing people and organizing teams while developing a software project	Ap	Internal Assessment

UNIT I – SOFTWARE PROJECT MANAGEMENT	**(9)**
Project Definition – Importance – Activities – Overview of the project Planning – Software project economics – objectives – Project Life Cycle.	
UNIT II - PROJECT ESTIMATION AND EVALUATION	**(9)**
An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.	
UNIT III - ACTIVITY PLANNING AND SCHEDULING	**(9)**
Sequencing and scheduling activities – Objectives of planning – Forward pass and backward pass – Scheduling – PERT techniques – CRM.	
UNIT IV - RISK MANAGEMENT AND MONITORING	**(9)**
Creating Framework – Decision making – cost Monitoring – Types of Risk – Risk managing - Risk Planning and controlling.	

UNIT V - MANAGING TEAM PROJECT	(9)
Team structure – Project tracking - Managing the contract – change control – Team management – Communication – Software Configuration Management-Case Study: PMBOK , Agile Development	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management" – Sixth Edition, Tata McGraw Hill, New Delhi, 2017.
2. Pressman R S & Bruce R Maxhim, "Software Engineering - A Practitioner's Approach", Tata McGraw Hill- 9th Edition, 2023.

REFERENCES:

1. Robert K Wysocki "Effective Project Management, Traditional, Agile, Extreme, Hybrid", John Wiley & Sons Inc, 2019.
2. Hans-Bernd Kittlaus , Samuel A. Fricker, "Software Product Management: The ISPMA-Compliant Study Guide and Handbook",2018.
3. Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2			3										3	
3		3												
4				3										
5	3								3		3			
CO (W.A)	**3**	**3**	**3**	**3**					**3**		**3**		**3**	**3**

22AIX54 - SOFTWARE TESTING TOOLS AND TECHNIQUES
(Common to 22CSX54,22ITX54,22CIX52,22CCX54)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To equip students with the knowledge necessary to effectively utilize software testing tools and techniques in real-world software development environments.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of software testing fundamentals to a real-world problem	Ap	30%
CO2	Analyze various software testing levels	An	20%
CO3	Make use of structured and analytical testing approaches to ensure thorough testing	Ap	30%
CO4	Identify quality testing processes and tools in projects	An	20%
CO5	Use WinRunner tool to perform automated testing	Ap	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Introduction – The Testing process – Measurement of Testing - Basic Terminology Related to Software Testing - Testing Life Cycle – Principles of Testing – Limitations of Testing – Testing tools, techniques and metrics.	
UNIT II - LEVELS OF TESTING	**(9)**
Unit Testing – Integration Testing – System Testing – Acceptance Testing – Object Oriented Testing – Automated Testing.	
UNIT III - STRUCTURED AND ANALYTICAL TESTING	**(9)**
Structure-Based Testing: Introduction - Condition Coverage - Decision Condition Coverage - Modified Condition/Decision Coverage (MC/DC) - Multiple Condition Coverage - Path Testing - APT Testing; Analytical Techniques: Static Analysis - Dynamic Analysis.	
UNIT IV - QUALITY TESTING AND TOOLS	**(9)**
Quality Characteristics for technical testing: Security - Reliability - Efficiency – Maintainability - Portability - sample questionnaire; Test tools and Automation: Test automation project - Specific test tools: Fault Seeding and Fault Injection Tools – Performance Testing and Monitoring Tools – Tools for Web Testing.	

UNIT V - SOFTWARE TESTING TOOL	(9)
Need for Automated Testing Tool - Performance Testing Tools – WinRunner: Testing an application using WinRunner – Test Script Language (TSL) – GUI MAP File – Synchronization of Test Cases – Data-Driven Testing – Rapid Test Script Wizard – Mapping Custom Object to a Standard Classes – Checking GUI Objects. Silk Test: Architecture – Testing an Application Using Silk Test – The 4Test Scripting Language – Checkpoints – Data-Driven Test Cases.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Rajiv Chopra, Software Testing: A Self-Teaching Introduction, David Pallai, 2018.
2. Jamie L Mitchell, Rex Black, "Advanced Software Testing: Guide to the ISTQB Advanced Certification as an Advanced Technical Test Analyst", Second edition, Vol 3, 2015.

REFERENCES:

1. Dr.K.V.K.K Prasad, Software Testing Tools, Dream tech 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3												
3	3													3
4		3												3
5	3				3									3
CO (W.A)	3	3			3									3

22AIX55 - IT OPERATIONS *(Common to 22CSX57,22ITX57,22CIX55,22CCX55)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide knowledge on IT Operation Management and Service Management.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the fundamental components and processes involved in IT operations	**An**	30%
CO2	Analyze existing health and safety regulations applicable to IT operations environments	**An**	30%
CO3	Apply organizational theories to evaluate and improve the structure and efficiency of IT operations within an organization	**Ap**	20%
CO4	Analyze fundamental concepts and principles of information security in IT environments	**An**	20%
CO5	Develop strategies for leveraging Microsoft 365 to enhance productivity, collaboration, and efficiency within IT operations.	**Ap**	Internal Assessment

UNIT I – IT OPERATIONS	**(9)**
IT Operation Definition - Roles & Responsibilities of IT Operations - IT Monitoring - IT operations Management - Responsibilities of IT operations Management. IT Service Management: IT Service Management Best Practices - The Service Life Cycle(Service Strategy - Service Design - Service Transition - Service Operation - Continual Service Improvement) Functions of IT Service Management (Incident Management, Event Management, Request fulfillment, Problem Management, Change Management, Availability Management - The Service Desk) - Escalation & Governance Management.	
UNIT II - HEALTHY SAFE AND SECURE WORKING ENVIRONMENT & ETIQUETTE	**(9)**
Health and Safety Essentials - Control and Management Systems - Facilities Management and Ergonomics - Managing Equipment - Managing Material. Etiquette: Professionalism in Relationships - First Impressions - Conducting Yourself in a Working Environment - Make Your Work Place Healthy - Dinning Etiquette - Elevator Etiquette - Cafeteria Etiquette - Meeting Etiquette - Telephone Etiquette - Dealing with Difficult People and Conflicting Situations.	

UNIT III - ITIL	(9)
Introduction – Understanding ITIL Guiding Principles in an Organization–Optimize and Automate – Four Dimensions of Service Management – Key Activities of the Service Value Chain	
UNIT IV - IT INFRASTRUCTURE & INFORMATION SECURITY	**(9)**
Definition - Components of IT Infrastructure (Hardware, Software, Network) - Types of IT infrastructure (Traditional, Cloud, Hyperconverged)- Risk, Response and Recovery: Risk Management and Information Security - The Risk Management Process - Business Continuity Management - Backing Up Data and Applications - Incident Handling - Recovery From a Disaster.	
UNIT V - AMS & TOOLS	**(9)**
Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. John Sansbury, Ernest Brewster, Aidan Lawes, Richard Griffiths, "IT Service Management :Support for your ITSM Foundation Exam",March 2016.
2. Elearn ,"Managing Health, Safety and Working Environment ",Revised Edition(Management Extra), 1st Edition, 2017 .
3. Vivek Bindra ,"Everything About Corporate Etiquette" , Bloomsbury India,2015.
4. AXELOS, "ITIL: Foundation ITIL 4 Edition", 2019
5. David Kim, Michael G. Solomon,"Fundamentals of Information Systems Security", Jones & Bartlett Learning, 3rd Edition.
6. https://docs.microsoft.com/en-us/learn/m365

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3				3								3
3	3													3
4		3					3							3
5	3							3			3			3
CO (W.A)	**3**	**3**				**3**	**3**	**3**			**3**			**3**

22AIX56 - SOFTWARE QUALITY ASSURANCE *(Common to 22CSX55,22ITX55,22CIX53,22CCX56)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Acquire knowledge of software quality assurance principles, practices and standards				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the common challenges which affect software quality	An	20%
CO2	Apply the knowledge of SQA Components and Project Life Cycle	Ap	20%
CO3	Establish Software Quality Infrastructure through implementation of modern Engineering and IT tools	An	20%
CO4	Classify the various metrics used in quality management	An	20%
CO5	Apply SQA Standards, Certifications and Assessments	Ap	20%

UNIT I – INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	**(9)**
Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall"s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.	
UNIT II - SQA COMPONENTS AND PROJECT LIFE CYCLE	**(9)**
Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.	
UNIT III - SOFTWARE QUALITY INFRASTRUCTURE	**(9)**
Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.	
UNIT IV - SOFTWARE QUALITY MANAGEMENT & METRICS	**(9)**
Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.	

UNIT V - SQA STANDARDS, CERTIFICATIONS & ASSESSMENTS	(9)
Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

REFERENCES:

1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thomson Computer Press, 1997.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3		3									3	
3					3				3					3
4						3								
5							3	3						
CO (W.A)		**3**		**3**	**3**	**3**	**3**	**3**	**3**				**3**	**3**

22AIX57 - SERVICE ORIENTED ARCHITECTURE *(Common to 22CSX56,22ITX56,22CCX57)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To learn service-oriented analysis and design for developing SOA based application				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply XPath and XQuery to navigate and query XML documents efficiently	**Ap**	30%
CO2	Apply SOA principles and technologies to analyze real-world case studies across different industries.	**Ap**	30%
CO3	Analyze the impact of SOA on business process automation and agility	**An**	20%
CO4	Design service models and business process flows adhering to SOA principles and industry standards.	**Ap**	20%
CO5	Implement and demonstrate SOA-based applications using Microservices Architecture.	**An**	Internal Assessment

UNIT I – XML	**(9)**
XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery	
UNIT II - EXPLORING SOA	**(9)**
SOA Fundamentals: Evolution of SOA – SOA – Characteristics of SOA – Concept of a service in SOA – Basic SOA architecture -Web Services Introduction - Protocols: SOAP-REST – Web Security - Enterprise Software models - IBM on Demand operating environment.	
UNIT III - SOA PRINCIPLES AND DESIGN	**(9)**
Business centric SOA and its benefits – Principles of Service Orientation-SOA layers-SOA Patterns -Basic modeling building blocks –Service models for legacy application integration and enterprise integration – Enterprise solution assets (ESA).	
UNIT IV - BUILDING SOA BASED APPLICATIONS	**(9)**
Introduction to SAAS-Microservices Architecture-SOA Limitations - WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE.	

UNIT V - SERVICE ORIENTED ANALYSIS AND DESIGN	(9)
SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design – Case Study	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Thomas Erl; Service Oriented Architecture Concepts Technology & Design; Pearson Education Limited; 2015.

REFERENCES:

1. Mark Endrei, Jenny Ang, Ali Arsanjani, Sook Chua, Philippe Comte, Pål Krogdahl, Min Luo, Tony Newling – "Patterns: ServiceOriented Architecture and Web Services", 2004.
2. Mark D. Hansen "SOA Using Java™ Web Services", 2007.
3. Thomas Erl PHI "SOA Design Pattern", 2009.
4. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian "SOA with REST: principles, patterns & constraints for building enterprise solutions with REST", 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2	3	3												3
3		3												3
4	3													3
5	3		3							3				3
CO (W.A)	3	3	3							3				3

22AIX58 - PRODUCT LIFE CYCLE MANAGEMENT *(Common to 22CSX58,22ITX58,22CIX58,22CCX58)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To comprehend the foundations, implementation, business benefits, integration with product management strategy, and application in service-related industries				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Product Life Cycle Management **(**PLM) and integrate with lifecycle phases	Ap	30%
CO2	Analyze global impacts of PLM on product development	An	20%
CO3	Examine PLM deployment stages for decision-making	An	30%
CO4	Interpret and use PLM strategies for enhancing productization	An	20%
CO5	Develop a project using Scrum	Ap	Internal Assessment

UNIT I – INTRODUCTION TO PRODUCT LIFECYCLE MANAGEMENT	**(9)**
Introduction to PLM, Fundamentals of PLM- Objective of PLM - Activities of PLM - Joined-up and Holistic Approach - Generic Product Lifecycle Phases, PLM Grid, Components of PLM Grid, Why PLM, How PLM.	
UNIT II - COMPLEX AND CHANGING ENVIRONMENT	**(9)**
Changes and Interconnections, Macroeconomic and Geopolitical Changes, Environmental and Social Changes, Corporate Changes, Technological Changes, Product Changes, The Result and the Requirements.	
UNIT III - PLM DEPLOYMENT AND BUSINESS BENEFITS	**(9)**
Deployment Stages of PLM, PLM maturity model, Realization stage of the project, Accomplishing change, Business benefits of a PLM system - Factors leading to PLM, Benefits of the PLM system, Improving the productivity of labour, Costs of quality, PLM and data warehousing as a tool to support decision-making.	
UNIT IV - SERVICE INDUSTRY AND PLM	**(9)**
Introduction to service, Further productization, Making a service, PLM in service business - PLM challenges in service business, Services modularized, Making items out of product functions, IT specifically variable product.	

UNIT V - PRODUCT AND PRODUCT MANAGEMENT STRATEGY AS A PART OF BUSINESS STRATEGY	(9)
Product lifecycle management as a business strategy tool, From changes in the business environment to product strategy, Making a product strategy, Product management strategy, Time to market, Time to react, Time to volume, Time to service, Electronic business and PLM, Case Study: Scrum Framework	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", Springer Publisher, 2011 (2nd Edition).
2. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", Springer Publisher, 2008 (3rd Edition).

REFERENCES:

1. Uthayan Elagovan, "Product Lifecycle Management (PLM): A Digital Journey Using Industrial Internet of Things (IIoT)" , July 2020.
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, "Implementing and Integrating ProductData Management and Software Configuration Management", Art ech House Publishers, 2003

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3											3	
3		3												
4			3											
5					3				2	3				
CO (W.A)	**3**	**3**	**3**		**3**				**2**	**3**			**3**	**3**

22GEA02 - PRINCIPLES OF MANAGEMENT				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To provide with a foundational understanding of management concepts and practices. • To equip students with the knowledge and skills necessary to manage and lead organizations effectively, understanding both theoretical frameworks and practical applications in management. • To learn about various planning tools and decision-making processes crucial for organizational success. • To gain insights into human resource management functions. • To study effective communication strategies and the impact of information technology on communication and how effective control can lead to improved productivity and organizational performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key management theories and practices to real-world business scenarios, demonstrating the ability to implement management functions.	Ap	20%
CO2	Analyze human resource management practices, evaluating how recruitment, training, performance appraisal, and employee relations contribute to organizational success.	An	30%
CO3	Evaluate strategic decisions and their impacts on organizational performance,the effectiveness of communication strategies and the use of information technology in facilitating efficient and effective communication within organizations.	E	30%
CO4	Create comprehensive strategic plans and organizational policies and design control systems to ensure continuous improvement in productivity and organizational performance.	C	20%
CO5	Engage in independent study as a member of a team and develop higher-order thinking skills that are crucial for effective management and leadership in complex organizational settings with assignments or case studies.	Ap	Internal Assessment

UNIT I -INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**(9)**
Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers -managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization-Organization culture and Environment - Current trends and issues in Management.	
UNIT II -PLANNING	**(9)**
Nature and purpose of planning - planning process - types of planning - objectives - setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.	

UNIT III -ORGANISING	(9)
Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization -delegation of authority - centralization and decentralization -Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management	
UNIT IV - DIRECTING	**(9)**
Foundations of individual and group behaviour - motivation -motivation theories - motivational techniques - job satisfaction - job enrichment - leadership - types and theories of leadership -communication - process of communication - barrier in communication - effective communication -communication and IT.	
UNIT V - CONTROLLING	**(9)**
System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance -direct and preventive control -reporting.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrichand Mark V. Cannice"Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018.

REFERENCES:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Robert Kreitner&MamataMohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										3			
2		3									3			
3										3				
4			3							3				
5											3	3		
CO (W.A)	3	3	3							3	3	3		

22GEA03 - Total Quality Management				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To Recognize the importance of quality councils and strategic planning in TQM. • To Explore the elements and historical development of TQM. • To Foster employee involvement through motivation, empowerment, teamwork, and recognition. • To Implement continuous process improvement methods like Juran's Trilogy, PDSA Cycle, 5S, and Kaizen. • To Conduct quality audits and understand the introduction to other ISO standards like ISO 14000, IATF 16949, TL 9000, IEC 17025, ISO 18000, ISO 20000, ISO 22000, and ISO 21001.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	30%
CO2	Apply continuous process improvement methodologies such as Juran's Trilogy, PDSA Cycle, 5S, and Kaizen.	Ap	20%
CO3	Apply various quality tools and techniques in both manufacturing and service industry.	Ap	20%
CO4	Develop strong supplier partnerships and understand supplier selection,rating, and relationship development.	An	20%
CO5	choose appropriate quality standards and implement them in the respective industry App.	E	10%

UNIT – I QUALITY CONCEPTS AND PRINCIPLES	**(9)**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.	
UNIT – II TQM-PRINCIPLES AND STRATEGIES	**(9)**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.	
UNIT – III CONTROL CHARTS FOR PROCESS CONTROL	**(9)**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study- Introduction to Six Sigma.	

UNIT – IV TQM-MODERN TOOLS	(9)
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.	
UNIT – V QUALITY SYSTEMS	**(9)**
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, UrdhwareshеHemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1. SubburajRamasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3. David Goetsch& Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8thEdition,Pearson, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													
4		3												
5	3				2									
CO (W.A)	3	3			2									

22GEA04 - Professional Ethics				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To Familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To Foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To Encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	30%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	30%
CO3	Analyze the importance of ethics in professional practice.	An	20%
CO4	Develop the ability to make informed and ethical decisions in engineering practice.	An	10%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	10%

UNIT I: INTRODUCTION TO PROFESSIONAL ETHICS	**(9)**
Definition and Importance of Ethics,Ethical Theories and Principles,Ethics vs. Morals vs. Values, Role of Ethics in Engineering.	
UNIT II: PROFESSIONAL RESPONSIBILITY AND CODES OF CONDUCT	**(9)**
Professional Responsibility and Accountability, Codes of Conduct in Engineering (e.g., IEEE, NSPE),Conflicts of Interest and Whistleblowing, Case Studies.	
UNIT III: ETHICAL DECISION-MAKING AND PROBLEM-SOLVING	**(9)**
Ethical Decision-Making Models,Tools and Frameworks for Ethical Analysis,Resolving Ethical Dilemmas,Case Studies	
UNIT IV: LEGAL AND REGULATORY ASPECTS	**(9)**
Legal Frameworks Governing Engineering Practice, Intellectual Property Rights, Health, Safety, and Environmental Regulations, Case Studies.	

UNIT V: SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	(9)
Social Responsibility of Engineers, Sustainable Engineering Practices, Impact of Engineering on Society and Environment,Case Studies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins,"Engineering Ethics: Concepts and Cases" 6th edition, 2018.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering" 5thEdition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. SenthilKumar,"Professional Ethics and Human Values",Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3												
4		3												
5								3						
CO (W.A)	3	3						3						

22EYA01 - PROFESSIONAL COMMUNICATION - I *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To build essential English skills to address the challenges of communication in today's work environment.	**1.1**	The students will be able to apply knowledge of communication and language processes occur in various work environment.		
2.0	To comprehend the various dimensions of communication by employing LSRW skills.	**2.1**	The students will be able to involve in diverse discourse forms utilizing LSRW skills.		
3.0	To deploy students in contextual initiatives by assisting them in developing communication abilities.	**3.1**	The students will be able to participate actively in communication activities that enhance their creative skill.		
4.0	To facilitate students in comprehending the intent, target audience and environments of various forms of communication.	**4.1**	The students will be able to associate with the target audience and contexts using varied types of communication.		
5.0	To enhance coherence, cohesion, and proficiency in both verbal and nonverbal communication in the workplace environment.	**5.1**	The students will be able to convey the idea distinctly both in verbal and non verbal communication in work culture.		

UNIT I - INTRODUCTORY SKILLS	**(6+6)**
Grammar - Parts of Speech - Verb (Auxiliaries - Primary & Modal, Main Verb) - **Listening** - Listening to Short Conversations or Monologues - Listening to Experiences - Listening to Descriptions - **Speaking** - Introducing Oneself - Exchanging Personal information -Talking about food and culture - **Reading** - Reading for Interrogation - Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II - LANGUAGE ACUMEN	**(6+6)**
Grammar - Word Formation - Tenses (Present Tense) - Synonyms & Antonyms - **Listening** - Listening to Announcements - Listening to Interviews - Listening and Note-taking - **Speaking** - Talking about Holidays & Vacations - Narrating Unforgettable Anecdotes - **Reading** - Skimming - Scanning (Short Texts and Longer Passages) - Critical Reading - **Writing** - Instruction - Process Description	
UNIT III - COMMUNICATION ROOTERS	**(6+6)**
Grammar - Cause and Effect -Tenses (Past Tense) - Discourse Markers - **Listening** - Listening to Telephonic Conversations - Listening to Podcasts - **Speaking** - Talking about neoteric Technologies - Eliciting information to fill a form - **Reading** - Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - **Writing** - Checklist - Circular, Agenda & Minutes of the Meeting	
UNIT IV - DISCOURSE FORTE	**(6+6)**

Grammar - Tenses (Future Tense) - Yes/No & WH type questions - Negatives - **Listening** - Listening to TED/ Ink talks -**Speaking** - Participating in Short Conversations - **Reading** - Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing
UNIT V - LINGUISTIC COMPETENCIES **(6+6)**
Grammar - Articles - Homophones & Homonyms - Single line Definition - Phrasal Verb - **Listening** - Intensive listening to fill in the gapped text - **Speaking** - Expressing opinions through Situations & Role play **Reading** - Cloze Texts - **Writing** - Paragraph Writing
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills
TOTAL (L:30, P:30) = 60 PERIODS

TEXT BOOK:
1. Shoba K N., Deepa Mary Francis, "English for Engineers and Technologists", Volume 1, 3rd Edition, Orient Black Swan Pvt. Ltd, Telangana, 2022.
REFERENCES:
1. Koneru, Aruna, "English Language Skills", Tata McGraw Hill Education (India) Private Limited, Chennai, 2006. 2. Hewings M, "Advanced English Grammar", Cambridge University Press, Chennai, 2000. 3. Jack C Richards, Jonathan Hull and Susan Proctor, "Interchange", Cambridge University Press, New Delhi, 2015 (Reprint 2021).

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2	2	
2									3	3		2	2	
3									3	3		2	2	
4									3	3		2	2	
5									3	3		2	2	
CO (W.A)									**3**	**3**		**2**	**2**	

22MYB01-CALCULUS AND LINEAR ALGEBRA
(Common to All Branches)

	L	T	P	C
	3	1	0	4

PREREQUISITE : NIL

Course Objective:	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNIT I - MATRICES	**(9+3)**
Characteristic Equation - Eigen values and Eigen vectors of a matrix - Cayley Hamilton Theorem (excluding proof) and its applications - Quadratic form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane - Angle between two planes - Equation of straight lines - Coplanar lines - Equation of sphere - Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature - Curvature in Cartesian co-ordinates - Centre and Radius of curvature - Circle of curvature - Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives - Euler's theorem on homogeneous function - Jacobian - Maxima and Minima of functions of two variables - Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates - Change of order of integration - Area as double integral - Triple integration in Cartesian Co-ordinates - Volume as triple integrals.	
TOTAL (L:45+T:15) :60 PERIODS	

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test**)**:

1. Introduction to MATLAB
2. Matrix operations - Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig , "Advanced Engineering Mathematics", 9th Edition, John Wiley & sons, 2013
3. Veerarajan.T, "Engineering Mathematics of Semester I & II", 3rd Edition, Tata McGraw Hill., 2016

REFERENCES:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics - Sem - II", 6th Edition, Laxmi Publications, 2014.
2. Kandasamy.P, Thilagavathy.K, Gunavathy .K, "Engineering Mathematics for First Year", 9th Rev.Edition, S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2		2												
3		2												
4	3													
5	3				2				3			2		2
CO (W.A)	3	2			2				3			2		2

*Ratified by Eleventh Academic Council

22CYB02 - CHEMISTRY FOR ENGINEERS (Common to CIVIL and MECH Branches)				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To make the students conversant with water treatment, boiler feed water techniques, energy storage devices and corrosive nature of metals. • To impart knowledge on the basic principles, preparatory methods of nanomaterials and combustion nature of fuels.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO2	Investigate on renewable energy sources like nuclear, solar, wind energy and also on storage devices.	E	20%
CO3	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO4	Explore the type of corrosion and its control measures.	An	20%
CO5	Recommend suitable fuels for engineering processes and applications.	E	20%

UNIT I - ELECTROCHEMISTRY	**(9)**
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode - calomel electrode - electrochemical series - significance - Types of cell - electrolytic and electrochemical cells - reversible and irreversible cells - potentiometric titrations (redox) - conductometric titrations (acid-base).	
UNIT II - ENERGY SOURCES AND STORAGE DEVICES	**(9)**
Nuclear energy - nuclear fission - nuclear fusion - light water nuclear power plants - breeder reactor - solar energy conversion - solar cells - solar water heater - Recent developments in solar cell materials - wind energy - batteries - types of batteries - lead acid storage battery - lithium-ion battery, Electric vehicles - working principles.	
UNIT III - WATER TECHNOLOGY AND NANO MATERIALS	**(9)**
Municipal water treatment - disinfection methods (uv, ozonation, chlorination) - desalination of brackish water - reverse osmosis - boiler troubles (scale, sludge , priming, foaming and caustic embrittlement) - treatment of boiler feed water - internal treatment (carbonate, phosphate and calgon conditioning) - external treatment - demineralization process. Nanomaterials - synthesis (laser ablation, and chemical vapour deposition method) and applications of nanomaterials.	
UNIT IV - CORROSION AND ITS CONTROL	**(9)**
Corrosion - types - chemical corrosion - pilling bedworth rule - electrochemical corrosion - mechanism- galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors - protective coatings - paints - constituents and their functions	

UNIT V - FUELS AND COMBUSTION	(9)
Fuels: Introduction: Classification of fuels: Coal and coke: Analysis of coal (Proximate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process) - Knocking - octane number - diesel oil - cetane number: Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT method. CO2 emission and carbon foot print.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan, A,"Engineering Chemistry I & Engineering Chemistry II", Sri Krishna Hitech Publishing chem., Co. Pvt Ltd., 13th Edition, Chennai, 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand & Co.Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co, New Delhi, 15th Edition, 2018.
2. B.Sivasankar, "Engineering Chemistry", Tata McGraw- Hill Pub.Co.Ltd., New Delhi, 2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3								2					
2		2												
3														2
4			2				2							
5		2				2						2		
CO (W.A)	3	2	2			2	2		2			2		2

22MEC01 - ENGINEERING GRAPHICS

(Common to AGRI, CIVIL, CHEMICAL and EEE Branches)

L	T	P	C
2	0	2	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To Construct various plane curves	1.1	The students will be able to construct various plane curves.
2.0	To Construct the concept of projection of points, lines and plane	2.1	The students will be able to create the projection of points, lines and planes.
3.0	To Develop the projection of solids	3.1	The students will be able to develop projection of solids.
4.0	To Solve problems in sectioning of solids and developing the surfaces	4.1	The students will be able to solve problems in sections of solids and development of surfaces.
5.0	To Apply the concepts of orthographic and isometric	5.1	The students will be able to apply the concepts of isometric in engineering practice.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - use of drafting instruments - BIS conventions and specifications - size, layout and folding of drawing sheets - lettering and dimensioning - scales.

UNIT I - PLANE CURVES **(6+6)**

Basic geometrical constructions, curves used in engineering practices - conics - construction of ellipse, parabola and hyperbola by eccentricity method - construction of cycloid - construction of involutes of square and circle - drawing of tangents and normal to the above curves - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.

UNIT II - PROJECTION OF POINTS, LINES AND PLANES **(6+6)**

Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III - PROJECTION OF SOLIDS **(6+6)**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and parallel to another by rotating object method.

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **(6+6)**

Sectioning of solids (prism, cube, pyramid, cylinder and cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section - development of lateral surfaces of simple and sectioned solids - prisms, pyramids cylinder and cone.

UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS **(6+6)**

Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones – free hand sketching of orthographic views from isometric views of objects.

TOTAL (L:30+P:30) : 60 PERIODS

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna, "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. Luzzader, Warren.J, and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	-	1	-	-	-	2	-	3	2	1
2	3	2	1	-	-	1	-	-	-	2	-	3	2	2
3	3	2	1	-	-	1	-	-	-	2	-	3	3	1
4	3	2	1	-	-	1	-	-	-	2	-	3	2	1
5	3	3	1	-	-	1	-	-	-	2	-	3	3	2
CO (W.A)	**3**	**2.2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**3**	**2.2**	**1.6**

22EYA02 - PROFESSIONAL COMMUNICATION - II *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : 22EYA01					

Course Objectives		**Course Outcomes**	
1.0	To familiarize the students with the basic structures of English and to train them to use these elements correctly in speaking and writing	**1.1**	The students will be able to frame sentences both in written and spoken forms with accuracy and fluency.
2.0	To acquire proficiency in LSRW skills on par with the expectations of the industry.	**2.1**	The students will be able to attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.
3.0	To enable students to adopt strategies for enhancing vocabulary, language and fluency and to deliver professional presentations.	**3.1**	The students will be able to gain essential competency to express one's thoughts orally and in writing in a meaningful way.
4.0	To communicate effectively in an academic setting using the language skills as tools.	**4.1**	The students will be able to use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.
5.0	To acquire necessary language skills to follow and comprehend discourse such as lectures conversations, interviews, and discussions.	**5.1**	The students will be able to perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.

UNIT I - LANGUAGE RUDIMENTS	**(6+6)**
Grammar - Active and Passive Voice – Impersonal Passive Voice - Numerical Expressions - **Listening** - Listening for Specific Information and Match / Choose / Fill in the texts - **Speaking** - Describing a Person - Making Plans -**Reading** - Intensive Reading -**Writing** - Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	**(6+6)**
Grammar – Reported Speech – Infinitive and Gerund - **Listening** – Listening to Iconic Speeches and making notes - Listening news / documentaries - **Speaking** –Talking over Phone – Narrating Incidents - **Reading** – Extensive Reading (Motivational Books) - **Writing** – Recommendation	
UNIT III -TECHNICAL CORRESPONDENCE	**(6+6)**
Grammar – If Conditionals – Blended Words - **Listening** – Listening to business conversation on audio and video of Short Films, News, Biographies - **Speaking** – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- **Reading** - Finding key information in a given text - **Writing** –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	**(6+6)**
Grammar – Concord – Compound Words - **Listening** – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - **Speaking** – Introduction to Technical Presentation - Story Telling - **Reading** – Reading and Understanding Technical Articles - **Writing** – Report Writing (Accident, Survey and feasibility)	
UNIT V - LANGUAGE BOOSTERS	**(6+6)**
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - **Listening** – Listening to different kinds of Interviews - Listening to Group Discussion - **Speaking** – Group Discussion - **Reading** – Reading and Interpreting Visual Materials - **Writing** – Analytical Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Grammar
2. Listening Skills
3. Speaking Skills
4. Reading Skills
5. Writing Skills

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOK:

1. Sudharshana, N.P and Saveetha.C, "English for Technical Communication", Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf, "Effective Technical Communication", 2nd Edition, McGraw Hill Education India Pvt Ltd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds, "A Student's Introduction to English Grammar", 2nd Edition, Cambridge University Press, New Delhi, 2022

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2	2	
2									3	3		2	2	
3									3	3		2	2	
4									3	3		2	2	
5									3	3		2	2	
CO (W.A)									**3**	**3**		**2**	**2**	

22CEC01 - FUNDAMENTALS OF ENGINEERING MECHANICS

L	T	P	C
2	1	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To learn the scalar and vector representation of forces and moments.	1.1	The students will be able to compute the resultant force for various force systems using laws of mechanics.
2.0	To introduce the equilibrium of rigid bodies	2.1	The students will be able to calculate the moment produced by various force systems and conclude the static equilibrium equations for rigid body system
3.0	To study and understand the meaning of distributed forces	3.1	The students will be able to evaluate the sectional properties of surfaces and solids
4.0	To introduces the phenomenon of friction and its effects.	4.1	The students will be able to apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5.0	To Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar	5.1	The students will be able to apply the different principles to study the motion of a body and analyse their constitutive equations .

UNIT I - BASICS AND STATICS OF PARTICLES (6+3)

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Principle of Transmissibility - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces.

UNIT II - EQUILIBRIUM OF RIGID BODIES (6+3)

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions.

UNIT III - PROPERTIES OF SURFACES AND SOLIDS (6+3)

Determination of Areas and Volumes - Centre of Gravity - First moment of area, Second moment of area and Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Principal moments of inertia of plane areas - Principal axes of inertia.

UNIT IV - FRICTION (6+3)

Surface Friction - Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Rolling Resistance - Problems involving the equilibrium of rigid bodies with frictional forces.

UNIT V - DYNAMICS OF PARTICLES (6+3)

Kinematics - Relative motion - Curvilinear motion, Kinetics - Displacements, Velocity and acceleration, their relationship - Newton's laws of motion - Work Energy Equation.

TOTAL (L:30+T:15) = 45 PERIODS

TEXTBOOKS:

1. N. Koteeswaran, "Engineering Mechanics", Sri Balaji Publications, 2017.
2. R. K. Bansal, "A Textbook of Engineering Mechanics", Laxmi Publications (P) Ltd, New Delhi, 6th Edition, 2015

REFERENCES:

1. Beer Ferdinand P., Russel Johnston Jr., David F. Mazure, Philip J. Cornwell, Sanjeev Sanghi, "Vector Mechanics for Engineers: Statics and Dynamics", 12th Edition, McGraw Hill Education, Chennai, 2019.
2. Irving H. Shames, " Engineering Mechanics - Statics and Dynamics", 4th Edition, Pearson Education Asia Pvt. Ltd., 2005
3. M. S. Palanisamy and S. Nagan, "Engineering Mechanics - Statics & Dynamics", TMH Publishing Company, 2005

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2			3	2	2	3	2	2	1	3
2	3	3	2	2	3	2	3	2		1		2	2	2
3	3	3	2	2	2		2	2	2	3	3	3	2	3
4	3	3	2	2	2	2	3	2		3	2	3	1	2
5	3	2	2	1	2	2	2	2	1	2		2	2	2
CO (W.A)	**3.0**	**2.8**	**2**	**1.8**	**2.25**	**2**	**2.6**	**2**	**1.67**	**2.4**	**2.33**	**2.4**	**1.6**	**2.4**

22CYB08 - ENVIRONMENT AND SUSTAINABILITY

L	T	P	C
2	0	0	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To recognize the basic concepts of environment, ecosystems and biodiversity.	**1.1**	The students will be able to know the importance of environment and functions ecosystems and biodiversity
2.0	To impart knowledge on the causes, effects and control measures of environmental pollution.	**2.1**	The students will be able to identify the causes, effects of environmental pollution and contribute the preventive measures to the society.
3.0	To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.	**3.1**	The students will be able to identify and understand the renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4.0	To familiarize the concept of sustainable development goals, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.	**4.1**	The students will be able to recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
5.0	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyzes the role of sustainable urbanization.	**5.1**	The students will be able to demonstrate the sustainability practices and identify green materials, energy cycles.

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(6)**
Environment - scope and importance - Eco-system: Structure and function of an ecosystem - types of biodiversity - genetic - species and ecosystem diversity - values of biodiversity - hot-spots of biodiversity – conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(6)**
Pollution - Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act - Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(6)**
Energy management and conservation - New Energy Sources: Different types of new energy sources - Solar energy - wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV - SUSTAINABILITY AND MANAGEMENT	**(6)**
Development - Factors affecting development - advantages - disadvantages - GDP - Sustainability - needs - concept - concept of carbon credit - carbon footprint - Environmental management.	
UNIT V - SUSTAINABILITY PRACTICES	**(6)**
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable energy: Energy Cycles- carbon cycle and carbon emission - Green Engineering: Sustainable urbanization.	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15th Edition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEBLINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2			3	3	2	1			2		
2	2	2	2			3	3	2	1			2		
3	2	2	2			3	3	2	1			2		
4	2	2	2			3	3	2	1			2		
5	2	2	2			3	3	2	1			2		
CO (W.A)	**2**	**2**	**2**			**3**	**3**	**2**	**1**			**2**		

- Approved by Eleventh Academic Council

22MYB03 - STATISTICS AND NUMERICAL METHODS *(Common to AGRI, AI&DS,CSE,IT,IOT,CS(Cyber security)CIVIL,CHEMICAL,EEE,MECH Branches)*				
	L	**T**	**P**	**C**
	3	**I**	**0**	**4**
PREREQUISITE : NIL				
Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z, t - distribution, F - distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance - Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(9+3)**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method - Iterative methods of Gauss Jacobi and Gauss Seidel Methods- Eigen values of a matrix by Power method.	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules - Romberg's Methods.	

UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	(9+3)
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		2												
4	3													2
5	3				2				3			2		2
CO (W.A)	**3**	**2**			**2**				**3**			**2**		**2**

22CEC02 - MECHANICS OF MATERIALS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 22CEC01					
Course Objective:	To impart knowledge about stresses, strains, shear force, bending moment, slope and deflection in beams and concept of torsion in circular shaft.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Calculate simple stresses and strains in various structural members.	Ap	20%
CO2	Draw and interpret shear force and bending moment diagrams.	Ap	20%
CO3	Examine the effects of various loads on beams by analyzing their slope and deflection under standard loading configurations.	An	20%
CO4	Apply beam theory principles to predict structural behavior under various loading conditions.	An	20%
CO5	Examine the behavior of beams due to and cylinders subjected to bending stress.	An	20%

UNIT I - SIMPLE AND COMPOUND STRESSES	**(9)**
Stresses in simple and compound bars - Elastic constants - Thin cylindrical and spherical shells - Biaxial state of stress - Principal stresses and principal planes - Torsion on circular shafts.	
UNIT II - BENDING OF BEAMS	**(9)**
Types of beams and transverse loadings - Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending - Bending stress distribution - Shear stress distribution.	
UNIT III - DEFLECTION OF BEAMS	**(9)**
Double Integration method - Macaulay's method - Area moment method - Conjugate beam method - Strain energy method for determinate beams	
UNIT IV - INDETERMINATE BEAMS	**(9)**
Propped Cantilever and Fixed Beams - Fixed end moments reactions, slope and deflection for standard cases of loading - Continuous beams - support reactions and moments - Theorem of three moments - Shear Force and Bending Moment Diagrams.	
UNIT V - ADVANCED TOPICS	**(9)**
Bending stress in beams subjected to Unsymmetrical bending - Curved beams - Winkler Bach Theory - Rectangular, Circular, Trapezoidal sections - Thick cylinders - Compound cylinders.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2018.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures (SMTS) Vol - II", Laxmi Publishing Pvt Ltd, New Delhi 2017.
3. Vazirani.V.N, Ratwani. M.M, Duggal S.K, "Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1", Khanna Publishers, New Delhi 2014.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2017.
3. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021
4. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015
5. Beer. F.P. and Johnston E.R. "Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	2
3	2	3		2									2	2
4	2	2												
5		2												2
CO (W.A)	2.5	2.3		2									2	2

22CEC03 - HIGHWAY AND RAILWAY ENGINEERING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To identify key principles and terminology in highway and railway engineering, including design standards and materials used in infrastructure.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental principles of highway and railway engineering to develop new infrastructure projects including design standards.	Ap	40%
CO2	Implement construction practices for pavements ensuring compliance with IS standards.	Ap	20%
CO3	Apply design criteria to create geometric layouts for highway elements.	Ap	20%
CO4	Apply the construction techniques and maintenance of track laying and railway stations.	Ap	20%
CO5	Analyze and present a real-world highway / railway project to evaluate its design approaches, construction methods, and project outcomes.	An	Internal Assessment

UNIT I - HIGHWAY ENGINEERING	**(9)**
Classification of highways - Institutions for Highway planning, design and construction at different levels - factors influencing highway alignment - Typical cross sections of Urban and Rural roads - Engineering surveys for alignment - Conventional and Modern method	
UNIT II - DESIGN OF HIGHWAY ELEMENTS	**(9)**
Cross sectional elements - Horizontal curves, super elevation, transition curves, widening of curves - Sight distances - Vertical curves, gradients - pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).	
UNIT III - HIGHWAY CONSTRUCTION AND MAINTENANCE	**(9)**
Bitumen, material testing and properties - Construction practice of flexible and concrete pavement - Highway drainage - Evaluation and Maintenance of pavements.	
UNIT IV - RAILWAY PLANNING AND CONSTRUCTION	**(9)**
Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails - Route alignment surveys, conventional and modern methods - Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems) - Railway drainage.	
UNIT V - RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION	**(9)**
Points and Crossings - Design of Turnouts, Working Principle -Track Circuiting - Construction and Maintenance - Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development - Railways for Urban Transportation - LRT & MRTS Feasibility study, Planning and construction.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", SciTech Publications (India), Chennai, 2010
3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th Edition Delhi, 2015.
4. C. Venkatramaiah., "Transportation Engineering - Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES:

1. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia,2012
2. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, Ist Edition, USA,2011
3. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi,2010
4. IRC 37 - 2012,"The Indian roads Congress, Guidelines for the Design of Flexible Pavements", New Delhi
5. IRC 58 -2012, "The Indian Road Congress, Guidelines for the Design of Rigid Pavements for Highways", New Delhi
6. Saxena Subhash, C. and Satyapal Arora, "A Course in Railway Engineering", Dhanapat Rai and Sons, Delhi, 1998.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	3													
3	3		2										2	3
4	3													2
5								2	3			3		
CO (W.A)	2.8		2					2	3			3	2	2.3

22CEC04 - SURVEYING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To learn the use of various surveying instruments and apply surveying techniques to real-world problems.			

	Course Outcomes The students will be able to	Cognitive Level	Weightage of COs in End Semester Examination
CO1	Calculate various parameters of linear, direction, angular measurement of objects.	Ap	40%
CO2	Analyse and evaluate the measurements in leveling to obtain reduced levels and locate the contours.	An	20%
CO3	Apply hydrographic surveying techniques and analyse the data for mapping and charting water bodies.	Ap	20%
CO4	Apply the fundamental principles and advanced technologies in surveying.	Ap	20%
CO5	Create and Present their own maps based on surveyed data.	C	Internal Assessment

UNIT I - CHAIN AND COMPASS SURVEYING	**(9)**
Definition- Classifications - Plane and Geodetic Surveying - Basic principles - Equipment and accessories for ranging and chaining - Methods of ranging - well conditioned triangles - Compass - Types - Bearing - System and conversions - Sources of errors and Local attraction - Magnetic declination - Dip - Compass traversing and plotting - Closing error adjustment.	
UNIT II - LEVELING AND CONTOURING	**(9)**
Level line - Horizontal line - Datum - Bench marks - temporary and permanent adjustments - Methods of levelling - Fly levelling - Check levelling - Contouring - Methods - Characteristics and uses of contours. - Problems by using height of collimation and rise and fall method.	
UNIT III - THEODOLITE AND TACHEOMETRIC SURVEYING	**(9)**
Theodolite - Types - Horizontal and vertical angle measurements - Temporary and permanent adjustments -Tacheometric systems - Tangential and stadia methods - Stadia systems - Determination of stadia constants	
UNIT IV - HYDROGRAPHIC SURVEYING	**(9)**
Introduction to Hydrographic surveying - Tides - Mean Sea Level - Vertical depth measurements - Soundings - Methods of locating soundings	
UNIT V - DIGITAL SURVEYING	**(9)**
Introduction, aerial photogrammetry, types of EDM instruments. Total station - Principles of remote sensing and its applications.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, "Surveying Vol. I & II", Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. Duggal R.K, "Surveying Vol. I & II", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

REFERENCES:

1. R. Subramanian, "Surveying and Levelling", Oxford University Press, Second Edition, 2012.
2. Bannister and S. Raymond, "Surveying", Seventh Edition, Longman 2004.
3. S. K. Roy, "Fundamentals of Surveying", Second Edition, Prentice Hall of India 2010.
4. K. R. Arora, "Surveying Vol I & II", Standard Book house, Twelfth Edition 2013.
5 C. Venkatramaiah, "Textbook of Surveying", Universities Press, Second Edition, 2011.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2										2	3
2	3	2	2										3	3
3	3	2											3	3
4	2				3								3	3
5	3				2	2			3	3	2	3	3	3
CO (W.A)	**2.8**	**2**	**2**		**2.5**	**2**			**3**	**3**	**2**	**3**	**2.8**	**3**

22CEC05 - CONSTRUCTION MATERIALS AND PRACTICES

	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the materials used for construction and the construction techniques implemented in construction industry. • To evaluate sustainable practices, safety measures, and economic considerations in selecting and using materials.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify suitable building materials for a construction project.	Ap	40%
CO2	Select and apply appropriate binding agents and composite materials for a specific construction project.	Ap	20%
CO3	Interpret the various construction practices and techniques adopted in building construction.	An	20%
CO4	Select equipment that meets the requirements of a construction project.	Ap	20%
CO5	Design and develop a construction project that demonstrates the application of construction materials and practices, and document the process in a comprehensive report.	E	Laboratory Assessment

UNIT I - BUILDING MATERIALS	**(9)**
Introduction and types of building materials - Properties - Physical and mechanical properties. Stones and Rocks: Classification of Rocks - Qualities of good stones - Uses. Bricks: Constituents - Qualities of good brick - Classification - Uses. Cement: Ingredients - Qualities of good cement - Types and Uses of cement.	
UNIT II - MORTAR, CONCRETE AND STEEL	**(9)**
Mortar: Types of Mortars - Properties - Uses - Selection of mortar. Concrete: Ingredients - Types of Concrete - Properties - Uses - Reinforced concrete. Steel: Steel sections - steel as a reinforcing material - Types of reinforcing steels.	
UNIT III - OTHER MATERIALS	**(9)**
Timber: Characteristics of timber - Seasoning of timber - Properties and uses - Common forms of timber - Plywood - Veneer - False ceiling materials - Aluminum - Uses - Market forms - Glass - Ceramics - Refractories - Composite Materials - Types and applications - FRP - Fibre textiles - Geomembranes and Geotextiles for earth reinforcement.	
UNIT IV - CONSTRUCTION PRACTICES AND SERVICE REQUIREMENTS	**(9)**
Types of Foundations - Shallow and Deep Foundations - Stone Masonry - Brick Masonry - Plastering and Pointing - Cavity Walls - Diaphragm Walls - Formwork - Centering and Shuttering - Shoring - Scaffolding - Underpinning - Roofing - Flooring - Joints in concrete - Contraction/Construction/Expansion joints - Fire Protection - Thermal Insulation - Ventilation and Air conditioning - Acoustics and Sound Insulation - Damp Proofing.	

UNIT V - CONSTRUCTION EQUIPMENTS	(9)
Selection of equipment for earthwork excavation, concreting, material handling and erection of structures - Dewatering and pumping equipment.	

LIST OF EXPERIMENTS:

1. Determination of Tension on mild steel rod.
2. Determination of Compression strength on Bricks and Blocks.
3. Determination of Water Absorption Test on Bricks and Blocks.
4. Determination of Izod and Charpy impact test on metal specimens.
5. Finding out the Rockwell Hardness Number on metal Specimens.
6. Finding out the Brinell hardness test on metal Specimens.
7. Determination of Torsional strength of steel specimen.

TOTAL (L:45+P:30) = 75 PERIODS

TEXTBOOK:

1. Palanichamy M.S., "Basic Civil Engineering", 4th Edition, McGraw-Hill Education, New Delhi, 2020.

REFERENCES:

1. Navaneethakrishnan P., "Basic of Civil and Mechanical Engineering", 1st Edition, McGraw-Hill Education, New Delhi, 2016
2. Duggal S.K., "Building Materials", 5th Edition, New Age Publishers, 2021.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	3													3
3		3		2									2	2
4	2													2
5	3		2	2					3	2		3	3	3
CO (W.A)	2.8	3	2	2					3	2		3	2.7	2.6

22CEC06 - FLUID MECHANICS AND HYDRAULICS ENGINEERING

	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective:	• To apply fluid mechanics principles to analyze and solve engineering problems related to fluid flow, hydraulic systems, and fluid machinery. • To demonstrate proficiency in designing and evaluating hydraulic structures and systems for practical applications.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Calculate the properties and characteristics of fluids.	Ap	20%
CO2	Apply concept of fluid measurement and pipe flows in engineering problems.	Ap	40%
CO3	Classify different types of flow and apply the concepts to design efficient channel systems.	Ap	20%
CO4	Evaluate the dimensional and model parameters to solve complex fluid problems.	Ap	20%
CO5	Apply theoretical concepts to practical problems, analyze and evaluate the performance of various hydraulic systems and interpret the data.	E	Laboratory Assessment

UNIT I - FLUID PROPERTIES, STATICS AND KINEMATICS	**(9)**
Properties of fluids - Types of fluids- Hydrostatic law - Pascal's law- Types and measurement of pressure - Hydrostatic pressure -Total pressure - Centre of pressure - Buoyancy - Metacentre - Equilibrium conditions.	
UNIT II - FLUID DYNAMICS	**(9)**
Classification and types of flow - flow lines and Path lines - Continuity equation - Velocity potential function and Stream function - Flow net - Euler's equation of motion - Bernoulli's equation and its applications	
UNIT III - OPEN CHANNEL FLOW	**(9)**
Types of flow- Specific energy - Critical flow - Velocity measurements by Manning's and Chezy' formula - Most economical sections - Characteristics and types of flow profiles - Back water and draw down curves - Surface profile calculations	
UNIT IV - FLOW THROUGH PIPES AND BOUNDARY LAYER	**(9)**
Flow through Pipes in series and parallel - Darcy Weisbach's formula - Moody diagram - Hydraulic Jumps - Surges. Boundary layer concept, thickness and classification.	
UNIT V - DIMENSIONAL AND MODEL ANALYSIS	**(9)**
Dimensional analysis - Dimensional parameters - Rayleigh's method and Buckingham's Pi theorem - Model analysis - Hydraulic structures - Similitude - Scale effect - Distorted and undistorted models.	

22CEC07 - STRUCTURAL ANALYSIS					
		L	T	P	C
		3	1	0	4
PREREQUISITE : 22CEC02					
Course Objective:	• To provide knowledge on various methods for the analysis of determinate and indeterminate structures. • To impart knowledge on moving loads and influence line diagrams. • To understand the approximate methods for analyzing multi-storey frames				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Determine member forces including moments and shears in beams.	Ap	20%
CO2	Analyze the multistory frames using approximate methods.	An	20%
CO3	Apply flexibility matrix method to analyze the beams, frames and truss system.	Ap	20%
CO4	Analyze the beams, frames and truss system using stiffness matrix method.	An	20%
CO5	Analyze the response in structural elements for the moving loads using method of influence line diagram.	An	20%

UNIT I - SLOPE DEFLECTION METHOD	**(9+3)**
Introduction to displacement method of analysis - Sign conventions - Development of slope deflection equations - Analysis of continuous beams - Analysis of continuous beams with support settlement - Analysis of non-sway frames - Analysis of sway frames.	
UNIT II - MOMENT DISTRIBUTION METHOD	**(9+3)**
Introduction to moment distribution method - Stiffness factor - Carryover factor and distribution Factor - Analysis of continuous beams - Sinking of supports - Analysis of non-sway frames - Analysis of sway frames.	
UNIT III - FLEXIBILITY MATRIX METHOD	**(9+3)**
Introduction - Static and kinematic indeterminacy - Equilibrium and compatibility conditions - Primary structure - Element and global flexibility matrix - Applications - Analysis of indeterminate beams, frames and trusses (Redundancy restricted to two).	
UNIT IV - STIFFNESS MATRIX METHOD	**(9+3)**
Introduction to matrix methods of analysis - Displacement and force transformation matrices - Element and global stiffness matrix - Applications - Analysis of indeterminate beams - Analysis of portal frames - Analysis of trusses (Redundancy restricted to two).	
UNIT V - MOVING LOADS AND INFLUENCE LINES	**(9+3)**
Influence lines for reactions in statically determinate structures - Influence lines for member forces in pin-jointed frames - Influence lines for shear force and bending moment in beam sections - Muller Breslau's principle - Influence lines for continuous beams (2 - degree redundant structures)	
TOTAL (L:45+T:15) = 60 PERIODS	

TEXTBOOKS:

1. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi, 2018.
2. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis Volume I and II", Laxmi Publications Pvt. Ltd., Chennai, 4th Edition, 2016.
3. S.S.Bhavikatti, "Structural Analysis - Vol. I & II", Vikas Publishing Pvt Ltd., New Delhi, 4th ed., 2013.

REFERENCES:

1. Hibbeler, R.C, "Structural Analysis", 10th Edition, Pearson India, Bengaluru, 2018.
2. Punmia.B.C, Ashok K.Jain, Arun K.Jain, "Theory of Structures", 13th Edition, Laxmi Publications, New Delhi, 2017

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3	3											2	
3	3													
4	3	3		2										2
5	3	3		2									2	2
CO (W.A)	**3**	**3**		**2**									**2**	**2**

22CEC08 - WATER RESOURCES AND IRRIGATION ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To provide knowledge of water resources, irrigation engineering concepts, and national water policy. • To impart the required knowledge on reservoir management and Irrigation management practices.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the components of water storage structures along with its functions.	Ap	20%
CO2	Identify the suitable method of irrigation and estimate the water requirements of irrigation scheduling.	An	40%
CO3	Apply the principles of canal alignment in the design of irrigation canals.	Ap	20%
CO4	Assess water quality parameters and proposing strategies to maintain or improve water quality.	An	20%
CO5	Design and develop an irrigation project and document the process in a comprehensive report.	Ap	Internal Assessment

UNIT I - WATER RESOURCES	**(9)**
Need for water resources - Water resources of Tamil Nadu and India - Planning of water resources - Assessment of water requirement for drinking and irrigation purposes - Reservoirs - Single and multipurpose reservoir - Multi objective - Storage capacity of reservoirs - Reservoir operation strategies - Design flood level - levees and flood walls.	
UNIT II - WATER RESOURCE MANAGEMENT	**(9)**
Financial aspects of water resources planning - National Water Policy - Consumptive and non - consumptive water use - Water quality - Scope and aims of master plan - Idea of basin as a unit for development - Water budget - Conjunctive use of surface and ground water.	
UNIT III - IRRIGATION ENGINEERING	**(9)**
Need - Advantages and Disadvantages - Connection between Duty, Delta and Base period - Causes affecting duty - Problems - Irrigation efficiencies - problems - Seasonal crops of India - Crop water Requirement - Evaluation of Consumptive use of water.	
UNIT IV - CANAL IRRIGATION	**(9)**
Types of impounding structures: Gravity dam - Diversion Head works - Canal drop - Cross drainage works - Canal regulations - Canal outlets - Canal classifications - Alignment of canals - River Training works - Kennedy's and Lacey's Regime theory.	

UNIT V - IRRIGATION METHODS AND MANAGEMENT	(9)
Types of Irrigation - Lift irrigation - Tank irrigation - Well irrigation - Irrigation methods: Surface and Sub - Surface and Micro irrigation - Merits and demerits - Irrigation scheduling - Water distribution - Participatory irrigation management with a case study - On farm development works - Participatory irrigation management - Case study.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Garg S.K., "Water Resources Engineering Vol. II Irrigation Engineering and Hydraulic Structures", 34th Edition, Khanna Publishers,New Delhi, 2016.
2. Punmia B.C. and Pande B.B .Lal," Irrigation and Water Power Engineering", Laxmi Publishing, New Delhi, 2007
3. Asawa G.L., "Irrigation and Water Resources Engineering", 1st Edition, New Age International Publishers, New Delhi, 2005.

REFERENCES:

1. Suresh Ukarande, "Irrigation Engineering and Hydraulic Structures", 3rd Edition, Ane Books Pvt. Ltd., New Delhi, 2015.
2. Sharma R.K. "Irrigation Engineering", S.Chand and Co. 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2			2										
3	3													2
4		2		2										2
5	3								2	3		3		2
CO (W.A)	2.5	2		2					2	3		3		2

22CEC09 - SOIL MECHANICS				
	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective:	• To understand the role of water in soil behavior and how soil stresses, permeability and quantity of seepage under various loading conditions.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply weight-volume relations and index properties of soils to characterize soil behavior and properties for engineering applications.	Ap	20%
CO2	Estimate soil stresses and for various types of foundation loads.	An	40%
CO3	Apply the principles and techniques to achieve optimal density and stability in engineering constructions.	Ap	20%
CO4	Apply the concepts of shear strength in the analysis of stability of slopes, foundations, and earth structures.	An	20%
CO5	Conduct standard soil tests analyze the results to determine soil properties.	E	Laboratory Assessment

UNIT I - WEIGHT VOLUME RELATIONS AND INDEX PROPERTIES	**(9)**
Soil formation -Three phase diagram - Weight-volume relations - Index properties of soils - Atterberg's limits - Classification of soils - BIS System.	
UNIT II - SOIL WATER AND PERMEABILITY	**(9)**
Soil water - Effective and neutral stresses - Flow of water through soils - Permeability - Laboratory methods - Darcy's law - Seepage and flow-nets - Quick sand.	
UNIT III - STRESS DISTRIBUTION IN SOILS	**(9)**
Vertical pressure distribution - Boussinesq's equation for point load and uniformly distributed loads - New mark's influence chart - Westergaard's equation -Isobar diagram - Pressure bulb - Contact pressure distribution.	
UNIT IV - CONSOLIDATION AND COMPACTION	**(9)**
Compressibility - e-log p curve - Preconsolidation pressure - Primary consolidation - Terzaghi's consolidation theory - Compaction - factors affecting soil compaction - Laboratory compaction tests - dry density and moisture content relationship - field compaction.	
UNIT V - SHEAR STRENGTH OF SOIL	**(9)**
Shear strength of soils - Stress analysis by Mohr's circle - Mohr's strength theory - Mohr-Coloumb strength envelope - Measurement of shear strength - Direct shear test - Triaxial compression - Unconfined compression test - Vane shear test - Shear strength of saturated cohesive soils - Shear strength of cohesionless soils.	

LIST OF EXPERIMENTS:

1. Determination of specific gravity of soil.
2. Determination of moisture content of soil.
3. Determination of grain size distribution using sieve analysis.
4. Determination of plasticity index of soil.
5. Determination of field density by sand replacement method
6. Determination of field density by core cutter method
7. Determination of moisture - density relationship using Standard Proctor Method
8. Determination of shear strength of soil by direct shear test

TOTAL (L:45+P:30) = 75 PERIODS

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.
3. Arora K.R" Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 2005.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
3. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2				3					3	3
2		3												2
3		3		2										2
4	3							3						2
5	3							3				3	3	3
CO (W.A)	3	3		2				3				3	3	2.4

22CEC10 - DESIGN OF REINFORCED CONCRETE ELEMENTS

(IS 456 and SP 16 code books are permitted)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand and apply the fundamental principles of reinforced concrete design, including the behavior of concrete and steel under load, to ensure safety and durability in structures.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply limit state principles to the design and analysis of structural components.	Ap	20%
CO2	Apply relevant design codes and specifications in the design of structural elements, ensuring compliance with IS standards.	Ap	20%
CO3	Design slab and staircase using appropriate codes and standards, ensuring structural safety and serviceability.	An	20%
CO4	Categorize the column and apply the appropriate design procedure.	An	20%
CO5	Analyze and design foundations to safely transmit loads to the soil.	An	20%

UNIT I - DESIGN PHILOSOPHY	**(6)**
Concept of Elastic method, ultimate load method and limit state method - Advantages of Limit State Method over other methods - Design codes and specification - Limit State philosophy as detailed in IS code.	
UNIT II - DESIGN OF BEAM	**(12)**
Analysis and design of singly and doubly reinforced rectangular beam and Flanged beams (T- Beams only) - Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion.	
UNIT III - DESIGN OF SLAB AND STAIRCASE	**(9)**
Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams - Two way slab - Design of simply supported and continuous slabs using IS code coefficients - Types of Staircases - Design of dog-legged Staircase.	
UNIT IV - DESIGN OF COLUMN	**(9)**
Types of columns - Braced and unbraced columns - Design of short rectangular and circular columns for axial, uniaxial and biaxial bending.	
UNIT V - DESIGN OF FOOTING	**(9)**
Design of wall footing - Design of axially and eccentrically loaded rectangular pad and sloped footings - Design of combined footing.	
TOTAL (L: 45) = 45 PERIODS	

TEXTBOOKS:

1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
2. Krishnaraju.N, "Design of Reinforced Concrete Structures", CBS Publishers & Distributors

REFERENCES:

1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2016
4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013
5. IS 456 - Indian Standard Plain and Reinforced Concrete - Code of Practice. 2000
6. SP 16 :Design Aids for Reinforced Concrete to IS: 456- 1978

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3	3	3					3				3	3	3
3		3	3					3				3	3	3
4		3	3					3				3	3	3
5		3	3					3				3	3	3
CO (W.A)	**3**	**3**	**3**					**3**				**3**	**3**	**3**

22CEC11- CONCRETE TECHNOLOGY *(IS 456 and IS 10262-2019 code books are permitted)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : 22CEC05					
Course Objective:	• To imparts knowledge about the various ingredients and properties of materials used for concrete and mix design for concrete.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of concrete mix design to select appropriate constituents and proportions to achieve desired properties.	Ap	40%
CO2	Evaluate the concrete's properties and interpret with IS standards.	Ap	20%
CO3	Evaluate concrete's durability performance through standard tests and assessments.	An	20%
CO4	Identify and apply suitable special concretes in construction projects.	An	20%
CO5	Prepare comprehensive reports and presentations including experimental results, design rationale and recommendations.	C	Internal Assessment

UNIT I - CONSTITUENTS OF CONCRETE	**(9)**
Cement - Manufacturing Process - Types of cement - Properties - Heat of Hydration - Field and Laboratory Test on cement; Aggregates - Fine and Coarse aggregates - Properties - Classifications - Testing methods of Fine and Coarse aggregates; Admixtures - Mineral and Chemical admixtures; Water - Quality of water for use in concrete.	
UNIT II - MIX DESIGN OF CONCRETE	**(9)**
Concrete Mix Proportioning - Methods of IS concrete mix proportion - Guidelines for normal concrete - Concrete - Concepts variables in proportioning - Concepts of Self Compacting Concrete (SCC) mix design.	
UNIT III - FRESH AND HARDENED CONCRETE PROPERTIES	**(9)**
Workability - measurement of workability - Statistical and quality control of concrete; Properties of fresh concrete - Test on fresh concrete - Test on hardened concrete - modulus of elasticity of concrete- Elasticity - Creep, Shrinkage and temperature effects - Stress and Strain characteristics - Non Destructive Tests for concrete.	
UNIT IV - DURABILITY PROPERTIES OF CONCRETE	**(9)**
Durability of concrete - Tests for durability - Strength and durability relationship - Factors affecting durability of concrete - Permeability- Rapid Chloride Permeability Test (RCPT) - Sorptivity - Alkali Aggregate Reaction - Chemical attack - Corrosion tests - Cracks in Concrete- Performance based durability design	

UNIT V - SPECIAL CONCRETES	(9)
Introduction to Polymer concrete, High performance concrete, High strength concrete, Fibre reinforced concrete, Light weight concrete, Ready mix concrete and pumping of concrete, Slurry Infiltrated Fiber Concrete (SIFCON), Permeable concrete, Self compacting concrete, Geo-polymer Concrete, Ferrocement.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

REFERENCES:

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
2. Gambhir.M.L. "Concrete Technology", Fifth Edition, McGraw Hill Education, 2017.
3. Job Thomas., "Concrete Technology", Cencage learning India Private Ltd, New Delhi, 2015.
4. IS10262-2019," Recommended Guidelines for Concrete Mix Design", Bureau of Indian Standards, New Delhi.
5. IS : 12269-1987,"Specification for 53 grade OPC", BIS, New Delhi
6. IS : 383 - 2016, "Coarse and Fine Aggregate - Specification's, BIS, New Delhi
7. IS: 456-2000, "Plain and Reinforced Concrete - Code of Practice", BIS, New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3				3		3	3	3	3	3
2		3						3		3		3	3	3
3								3						3
4		3										3	2	3
5	3			3				3		3	3	3	3	3
CO (W.A)	3	3	3	3				3		3	3	3	2.8	3

22CEC12 - ENVIRONMENTAL ENGINEERING				
	L	T	P	C
	3	0	2	4
PREREQUISITE : NIL				

Course Objective:	• To impart knowledge on water and sewage occurrence, distribution, treatment and disposal techniques.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the water supply system, water sources and water quality characteristics and standards.	Ap	20%
CO2	Design various water treatment units.	Ap	20%
CO3	Design efficient wastewater treatment systems to minimize environmental impact.	An	40%
CO4	Identify suitable treatment units for disposal of sewage and sludge.	An	20%
CO5	Analyze and interpret the results of water quality tests to assess the condition of water samples and determine their suitability for various applications.	An	Laboratory Assessment

UNIT I - SOURCES AND CONVEYANCE OF WATER	**(9)**
Objectives of Public Water supply system - Intakes - Channels and pipes for conveying water - Planning, Design period, Population forecasting - water demand -Sources of water - Surface and Ground water - Characteristics of water	
UNIT II - WATER TREATMENT	**(11)**
Water treatment Objectives - Unit operations and processes in surface water treatment - Principles, functions and design of flash mixers, flocculators, sedimentation tanks and sand filters - Aeration - iron and manganese removal, defluoridation.	
UNIT III - PRIMARY SEWAGE TREATMENT	**(9)**
Characteristics of sewage, Primary treatment: Principles, functions and design of screen, grit chambers and primary sedimentation tanks - Layout of Sewage Treatment Plant.	
UNIT IV - SECONDARY SEWAGE TREATMENT	**(9)**
Activated Sludge Process and Trickling filter (no design); Other treatment methods - oxidation ditches, UASB -Waste Stabilization Ponds - Anaerobic Stabilization units - Septic tanks.	
UNIT V - DISPOSAL OF SEWAGE AND SLUDGE	**(7)**
Dilution - Self-purification of surface water bodies - Oxygen sag curve - Sewage farming - characteristics of Sludge -Thickening - Sludge digestion - Sludge disposal - Environmental Pollution Act.	

LIST OF EXPERIMENTS:

1. Determination of Turbidity by using Nephlometer
2. Measurement of pH and conductivity of water sample
3. Determination of Hardness by EDTA method
4. Determination of Alkalinity
5. Determination of Acidity in water
6. Determination of Chlorides
7. Determination of Optimum Coagulant by Jar test
8. Determination of Total, Dissolved and Suspended solids
9. Determination of Available chlorine in bleaching powder
10. Determination of COD for given sample

TOTAL (L:45+P:30) = 75 PERIODS

TEXTBOOKS:

1. Garg, S.K., "Environmental Engineering Vol. I and II", Khanna Publishers, New Delhi, 2010.
2. Modi, P.N. "Water Supply Engineering Vol. I", Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. Metcalf and Eddy, " Waste Water Engineering: Treatment and Reuse", 4th Edition, McGraw-Hill, New Delhi, 2017.
2. Duggal K.N., "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.
3. George Tchobanoglous, Franklin Louis Burton, H. David Stensel, Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw-Hill Edition, 4th Edition, New Delhi, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	3		2											2
3		3	3				3	3					2	2
4		2		2				2					2	2
5		3		3				3	3			3	3	3
CO (W.A)	2.5	2.7	2.5	2.5			3	2.7	3			3	2.3	2.3

17CEC12 - STRUCTURAL ANALYSIS – I				
L	T	P	C	
3	2	0	4	

PREREQUISITE : 17CEC07	QUESTION PATTERN : TYPE – 4

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To introduce the basic concepts of structural analysis and the classical methods for the analysis of buildings.	1.1	Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames	a,b,c
2.0	To analyse the structures for internal forces by theorem of three moments and slope deflection method.	2.1	Analyse the continuous beams and portal frames by slope defection method.	a,b,c
3.0	To analyse the structures for internal forces by Moment distribution method.	3.1	Understand the concept of moment distribution method.	a,b
4.0	To analyse the indeterminate structures and settlement of supports	4.1	Analyse the beams and support by kani's method.	a,b
5.0	To understand an influence lines for statically determinate and indeterminate beams.	5.1	Draw the influence lines for statically determinate and indeterminate structures	b,c

UNIT I - PIN JOINTED FRAME	**(9+6)**
Degree of static and kinematic indeterminacies of plane frames - analysis of indeterminate pin-jointed frames - rigid frames (Degree of statically indeterminacy upto two). Principles of virtual work for deflections - Deflections of pin jointed plane frames and rigid frames.	
UNIT II - SLOPE DEFLECTION METHOD	**(9+6)**
Slope deflection method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT III - MOMENT DISTRIBUTION METHOD	**(9+6)**
Moment distribution method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT IV - ENERGY METHOD	**(9+6)**
Kani's Method - Analysis of Indeterminate Structures - Settlement of Supports (with and without sway)	
UNIT V - INFLUENCE LINES	**(9+6)**
Influence line - influence lines for bending moment and shear force, Muller Breslau's - principle, determinate and indeterminate beams.	
TOTAL (L: 45+ T:30) = 75 PERIODS	

TEXT BOOKS:

1. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4th ed., 2016.
2. Subrata Chakarabarty, Sujit Kumar Roy., "Fundamentals of Structural Analysis", S.Chand & Company Ltd, New Delhi, 2012.

REFERENCES:

1. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain., "Theory of Structures", Laxmi Publications, New Delhi, 2015.
2. S.S.Bhavikatti, "Structural Analysis" – Vol.I& II, Vikas Publishing Pvt Ltd., New Delhi, 4th ed.,2013.
3. Wang, C.K., "Analysis of Indeterminate Structures", Tata McGraw-Hill, New Delhi, 2000.
4. Negi, L.S. and Jangid, R.S., "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2004.

17CEC14 - FOUNDATION ENGINEERING (IS 6403 code book is to be permitted)					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC08		**QUESTION PATTERN : TYPE- 4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart knowledge for plan and execute a detail site investigation programme	**1.1**	Understand the importance of soil investigation in various civil Engineering projects	**b,e**
2.0	To explain the concepts related to bearing capacity and settlement for various types of soils and loading conditions.	**2.1**	Estimate bearing capacity incorporating IS codal provisions.	**a,b,l**
3.0	To select geotechnical design parameters and type of foundations	**3.1**	Do proper foundation proportioning for any kind of shallow foundation system and get exposure in foundation analysis.	**a,d,j,l**
4.0	To discuss different types of pile foundation and its capacity	**4.1**	Estimate pile and pile group capacity, group efficiency for various types of soils	**a,b,c,e,g,l**
5.0	To study various earth pressure theories	**5.1**	Analysis earth retaining structures for various soil conditions	**a,g,l**

UNIT I - SOIL INVESTIGATION AND CHOICE OF FOUNDATION	**(7)**
Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation - Choice of foundation based on soil conditions.	
UNIT II - BEARING CAPACITY AND SETTLEMENT	**(9)**
Location and depth of foundations - Bearing capacity of shallow foundations on homogeneous deposit -Terzaghi's Theory - IS Code method - Problems - Field tests (SPT and SCPT) - Factors influencing Bearing Capacity - Settlement of foundations - Components of settlement - Allowable and maximum differential settlement.	
UNIT III - SHALLOW FOUNDATION	**(9)**
Types of footings - Contact pressure distribution: isolated footing - combined footings - proportioning - Mat foundation – Types and applications - Floating foundation.	
UNIT IV - PILE FOUNDATION	**(9)**
Need for deep foundations -Types of piles - classification of piles – Load carrying capacity of piles in granular and cohesive soils - Static and Dynamic formulae - Pile carrying capacity by field tests - Pile load test - Group Capacity - Settlement of Pile groups - Negative skin friction.	
UNIT V - STABILITY OF SLOPES AND EARTH PRESSURE	**(11)**
Slopes – Infinite and finite slopes - types of failure - causes of failure - Procedure for slip circle method - Earth pressure in soils: active and passive states - Lateral earth pressure - Rankine's theory - Cullman"s Graphical method - Stabilization of soil using various methods.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Dr. K. R. Arora., "Soil Mechanics and Foundation Engineering", Standard Publisher, New Delhi, 7th ed., 2017.
2. Venkataramaiah.C, "Geotechnical Engineering", New Age International Ltd., New Delhi, 2008.

17CEX07 – RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE-3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To give exposure to railway planning, geometric design, railway track construction, maintenance.	1.1	Understand the methods of route alignment and design elements in Railway Planning and Constructions	c,e,h,l
2.0	To understand the modern methods of railway construction.	2.1	Understand the Construction techniques and Maintenance of Track laying and Railway stations.	a,b,e,l
3.0	To prepare layout for airport and classification.	3.1	Gain an insight on the planning and site selection of Airport Planning and design.	a,b,f,g
4.0	To prepare geometric design for runway.	4.1	Analyze and design the elements for orientation of runways and passenger facility systems.	a,e,l
5.0	To provide knowledge on various components of harbour and ports.	5.1	Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.	b,c,e,l

UNIT I - RAILWAY PLANNING AND DESIGN	(10)
Significance of Road, Rail, Air and Water transports - Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings - Track Stress, coning of wheels, creep in rails, defects in rails - Route alignment surveys, conventional and modern methods- Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.	
UNIT II - RAILWAY CONSTRUCTION AND MAINTENANCE	**(9)**
Tunneling Methods, drainage and ventilation - Materials required for track laying - Construction and maintenance of tracks –Modern methods of construction and maintenance - Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	
UNIT III - AIRPORT PLANNING	**(8)**
Air transport characteristics-airport classification-airport planning: objectives, components, airport layouts - apron, terminal building, hangars, motor vehicle parking area and circulation pattern, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations.	
UNIT IV - AIRPORT DESIGN	**(8)**
Runway Design: Orientation, Wind Rose Diagram (Problems) - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration - Elements of Taxiway Design - Airport Zones - Passenger Facilities and Services - Runway and Taxiway Markings and lighting.	
UNIT V - HARBOUR ENGINEERING	**(10)**
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides - Planning and Design of Harbours: Requirements, Classification - Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage - mooring, types of mooring – Navigational aids- Inland Water Transport - Wave action on Coastal Structures. Coastal zone regulations and Coastal Protection Works.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", DhanpatRai and Sons, Delhi, 2010
2. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
3. Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013

REFERENCES:

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.
4. Oza.H.P. and Oza.G.H., “A Course in Docks and Harbour Engineering”, Charotar Publishing Co., 2013

17CEC16 - STRUCTURAL ANALYSIS – II				
	L	T	P	C
	3	2	0	4
PREREQUISITE : 17CEC12	**QUESTION PATTERN : TYPE -4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To analyze the three hinged, two hinged and fixed arches.	**1.1**	Analyze of three hinged, two hinged and fixed arches	**a,b**
2.0	To analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.	**2.1**	Analysis simple determinate and indeterminate beams, frames and trusses using flexibility matrix method	**a,b,d**
3.0	To formulate the element stiffness matrix and assemble the structure matrix for solving indeterminate problems	**3.1**	Analysis simple determinate and indeterminate beams, frames and trusses using stiffness matrix method.	**a,b,d**
4.0	To analyse the suspension bridges and space truss	**4.1**	Determine the member forces in suspension bridges and space truss	**a,d,f**
5.0	To understand the basics of finite element method and its application to structural analysis.	**5.1**	Explain the basic concepts in finite element method	**a.b**

UNIT I - ARCHES	**(9+6)**
Arches as structural forms - Types of arches - Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches - Settlement and temperature effects.	
UNIT II - FLEXIBILITY METHOD	**(9+6)**
Concept of flexibility matrix – determinate Vs indeterminate - Analysis of indeterminate pin-jointed plane frames, analysis of continuous beams, rigid jointed plane frames.	
UNIT III - STIFFNESS METHOD	**(9+6)**
Stiffness matrix for beam element - analysis of continuous beams - plane frames and pin jointed plane frames.	
UNIT IV - SPACE AND CABLE STRUCTURES	**(9+6)**
Analysis of Space trusses using method of tension coefficients - Beams curved in plan - Suspension cables - suspension bridges with two and three hinged stiffening girders.	
UNIT V - INTRODUCTION OF FINITE ELEMENT METHOD	**(9+6)**
Introduction - Discretization of a structure - Displacement functions - Truss element - Beam element - Plane stress and plane strain - Triangular elements.	
TOTAL (L: 45 + T:30) = 75 PERIODS	

TEXT BOOKS:

1. Vaidyanathan, R and Perumal, P. "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4th ed., 2016.
2. V.N.Vazirani and M.M.Ratwani, "Analysis of Structures" Volume I and II, Khanna Publishers, New Delhi, 2015.
3. S.S.Bhavikatti, "Structural Analysis" - Vol. I & II, Vikas Publishing Pvt Ltd., New Delhi, 4th ed., 2013.

REFERENCES:

1. R.L.Jindal, "Indeterminate Structures", Tata Mc Graw Hill Publishing House, 1996.
2. Negi.L.S, "Theory & Problems in Structural Analysis", Tata McGraw Hill Publishing House, 2004.
3. G.S.Pandit & Gupta S.P, Structural Analysis (A Matrix Approach), Tata McGraw Hill, Publishing Ltd, 2008.

17CEC17 - DESIGN OF STEEL STRUCTURES [IS 800-2007 and Steel Tables are to be permitted]			
L	T	P	C
3	2	0	4

PREREQUISITE : 17CEC03	QUESTION PATTERN : TYPE -4

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To study the design of bolted and welded connections.	1.1	Analyse the behaviour of bolted and welded connecting and design them,	a,b,l
2.0	To provide knowledge on design of tension members.	2.1	Know the concept of design of tension members	a,b,l
3.0	To get familiar with compression member design.	3.1	Design compression members using simple and built-up sections.	a,b,g,l
4.0	To study the behavior of flexural members and design the beams.	4.1	Design various types of flexural members.	a,b,g,l
5.0	To understand the design of industrial buildings.	5.1	Design Industrial structures and their components.	g,j,l

UNIT I - INTRODUCTION **(9+6)**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Connections using welding and bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints

UNIT II - TENSION MEMBERS **(9+6)**

Types of sections - Net area - Net effective sections for angles and Tee in tension - Design of connections in tension members - Use of lug angles - Design of tension splice - Concept of shear lag.

UNIT III - COMPRESSION MEMBERS **(9+6)**

Types of compression members - Theory of columns - Basics of current codal provision for compression member design - Slenderness ratio - Design of simple and built up members - Design of laced and battened type columns - Design of column bases - Gusseted base - Anchor Bolts.

UNIT IV - BEAM **(9+6)**

Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design of plate girders - Intermediate and bearing stiffeners - Flange and web splices.

UNIT V - ROOF TRUSS AND INDUSTRIAL BUILDING **(9+6)**

Roof trusses - Roof and side coverings - Introduction of Pre-Engineered Buildings - Design of purlins and elements of truss; end bearing - Design of gantry girder.

TOTAL (L: 45 + T:30) = 75 PERIODS

TEXT BOOKS:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013

3. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd ed., 2013.
4. Bhavikatti.S.S, “Design of Steel Structures”, IK International Publishing House Pvt. Ltd., New Delhi 2010

REFERENCES:

1. Dr. L. S. Jayagopal, Dr. D. Tensing, “Design of Steel Structures”, Vikas Publishing House Pvt. Ltd., 2015
2. Narayanan.R "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
3. Duggal. S.K, “Limit State Design of Steel Structures”, Tata McGraw Hill Publishing Company, 2009
4. Shah.V.L and Veena Gore, “Limit State Design of Steel Structures”, IS 800–2007 Structures Publications, 2012.
5. IS 800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007

17CEC18 - DESIGN OF REINFORCED CONCRETE STRUCTURES [IS 456, SP 16 and IS 3370 Code Books are to be permitted]			
L	T	P	C
3	0	0	3

PREREQUISITE : 17CEC13 | **QUESTION PATTERN : TYPE -4**

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes The students will be able to	Related Program outcomes
1.0	To understand the basic concepts in the behavior and design of earth retaining structures.	1.1	Design counterfort and cantilever retaining walls.	a,b,c,g,l
2.0	To provide knowledge on design of various components in the water tank.	2.1	Design underground and overhead R.C water tanks for the given capacity	a,c,l
3.0	To provide knowledge on design of flat slab and raft foundations.	3.1	Design flat slabs as per IS standards	a,b,c,g,l
4.0	To explain the basic concepts about the yield line theory for the analysis and design of slab.	4.1	Analyze and design various types of slabs using yield line theory.	a,b,c,g,l
5.0	To design the slender column and industrial structures	5.1	Design columns for axial, uniaxial and biaxial bending and industrial structures	a,b,c,d,g,l

UNIT I - RETAINING WALLS	**(9)**
Functions of a Retaining Wall - Design of Cantilever and Counterfort Retaining walls	
UNIT II - WATER TANKS	**(9)**
Design principles of elevated overhead water tank - Design of rectangular underground water tank - Design of circular overhead water tank	
UNIT III - FLAT SLABS	**(9)**
Design of flat slabs (Problems) - Principles of design of Raft foundation, box culvert and road bridges	
UNIT IV - YIELD LINE THEORY	**(9)**
Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment - Application of virtual work method - square, rectangular, circular and triangular slabs - Design problems	
UNIT V - SLENDER COLUMN AND INDUSTRIAL STRUCTURES	**(9)**
Design of Slender columns - Design for Uniaxial and Biaxial bending using Column Curves (Problems) - Bunkers – Basic Concepts - Silos - Design Principles	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Krishnaraju. N.,"Design of reinforced Concrete Structures", CBS Publishers and Distributors Pvt Ltd, 4th ed., 2015.
2. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
3. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.

REFERENCES:

1. Ram Chandra.N and Virendra Gehlot, "Limit State Design", Standard Book House, 2004.
2. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS 456:2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007
5. SP 16:1980, Design Aids for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
6. IS 3370 (Part I & II):2009, Concrete Structures for Storage of Liquids - Code of Practice, Bureau of Indian Standards, New Delhi.

17CEX03 – CONSTRUCTION PLANNING AND SCHEDULING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN : TYPE-3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To study the necessity of the planning in the diverse construction projects.	1.1	Understand basic concepts of construction planning.	b,i,l
2.0	To know the appropriate techniques used for scheduling the resources	2.1	Schedule the construction activities.	c,j,k
3.0	To have exposure on various cost control methods and accounting.	3.1	Forecast and control the cost in a construction.	b,i
4.0	To study the quality control and monitoring techniques	4.1	Understand about quality control and its safety during construction	a,h,j,k,l
5.0	To make awareness among the learners about management information system.	5.1	Organize information in Centralized database Management systems	c,f

UNIT I - CONSTRUCTION PLANNING	**(9)**
Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks – Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities coding systems..	
UNIT II - SCHEDULING PROCEDURES AND TECHNIQUES	**(9)**
Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity – on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software.	
UNIT III - COST CONTROL MONITORING AND ACCOUNTING	**(9)**
The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.	
UNIT IV - QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	**(9)**
Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.	
UNIT V - ORGANIZATION AND USE OF PROJECT INFORMATION	**(9)**
Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.	
	TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005
2. Srinath,L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001

REFERENCES:

1.Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.

2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming,VanNostrand Reinhold Co., 3rd ed., 1985.

3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.

17CEC20 – ESTIMATING, COSTING AND VALUATION				
	L	T	P	C
	3	0	2	4
PREREQUISITE : 17CEP07	**QUESTION PATTERN : TYPE-4**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To impart the knowledge on basic concepts related to estimate preparation	1.1	Prepare the estimate corresponding to the required specification	a,b,f,h,l
2.0	To analyse the rate of a work item according to the specification	2.1	Arrive rates of various work items of civil Engineering works and familiarized with tendering	b, c,e,g, i,k,l
3.0	To understand the concepts behind the preparation of estimate of the various civil engineering works.	3.1	Prepare bills of quantities in construction works	a,d,f,j,l
4.0	To study the rate analysis, valuation of properties and preparation of reports for estimation of various items.	4.1	Predict the value of properties considering various influencing factors.	b,e,f,l
5.0	To understand the terminologies and concepts behind the valuation of properties, depreciation and time value of money	5.1	Get familiarized with report process.	a,j,l

UNIT I - INTRODUCTION TO ESTIMATES AND SPECIFICATIONS (9)

General introduction to Quantity surveying - purpose of estimates - Types of estimates, various items to be included in estimates - Principles in selecting units of measurement for items, various units and modes of measurement for different trades - I.S. 1200, Specifications - purpose and basic principles of general and detailed specifications - detailed specifications for various items of work.

UNIT II - RATE ANALYSIS AND TENDERS (10)

Analysis of rates, factors affecting the cost of materials, labour. Taskwork, schedule as basis of labour costs. Plants and equipment - hour costs based on total costs and outputs. Overhead charges, rates for various items of construction of civil engineering works. Standard schedule of rate, price escalation.

UNIT III - ESTIMATION OF CIVIL ENGINEERING WORKS (9)

Reading and interpretation of architectural and structural drawings - Detailed estimate of masonry buildings, R.C.C works, Preparation of schedule for steel as reinforcement - Preparation of bills of quantities - Approximate estimates, purpose, various methods used for buildings and other civil engineering works such as culvert and road projects – Estimating of irrigation works – aqueduct, siphon.

UNIT IV – VALUATION (8)

Principles of valuation, definition of value, price and cost - Attributes of value, Different types of values- Valuer and his duties, purpose of valuation and its function. Factors affecting the valuation of properties - free hold and leasehold properties, different types of lease - Methods of valuation - Forms of rent, different types of rent - carpet area basis, unit basis, cubic content basis - Sinking fund, Depreciation

UNIT V - REPORT PREPARATION (9)

Principles for report preparation - Report on estimate of residential building - Culvert - Roads - Water supply and sanitary installations - Tube wells - Open wells.

LIST OF EXPERIMENTS:

1. Rate analysis for earth work, PCC, RCC, Brick work, plastering and steel fabrication
2. Calculation of quantities and prepare the estimate for load bearing structure (Residential)
3. Calculation of quantities and prepare the estimate for framed structure (Commercial)
4. Prepare the bar-bending schedule for footing, column, plinth / roof beam and slab

TOTAL (L: 45+ P:30)= 75 PERIODS

TEXT BOOKS:

1. Birdie .G.S, "Text Book on Estimating and Costing", Dhanpat Rai Publishing Company, New Delhi, 2014.
2. Dutta, B.N., "Estimating and Costing in Civil Engineering (Theory and Practice)", UBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016
3. Chakraborti .M," Estimating Costing, Specification and Valuation in Civil Engineering", Chakraborti Publishers., 2010.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2014
2. Jogleka .P.T, "Practical Information for Quantity Surveyors", Mrs. Mandakini Joglekar, Pune, 1992.
3. Rangwala .S.C.," Estimating,Costing and Valuation", Charotar Publishing House, Anand, 2017.

17CEC21 - CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICE

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE-3**

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes (The students will be able to)		Related Program outcomes
1.0	To aware of the various construction techniques and practices needed for different types of construction activities	1.1	Know the different construction techniques and structural systems	c,e,l
2.0	To get knowledge about the various construction procedures for sub to super structure	2.1	Apply the various construction practices in the field.	c,e,l
3.0	To get idea for selection of equipment's for earthwork	3.1	Predict the equipment for different types of work	b,e,l
4.0	To study the equipment needed for construction of various types of structures from foundation to super structure.	4.1	Plan the requirements for substructure construction.	c,g,l
5.0	To know the different construction of structures and erection works.	5.1	Know the methods and techniques involved in the construction of various types of super structures	b,e,l

UNIT I - CONSTRUCTION TECHNIQUES **(9)**

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism - floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials - responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Energy efficient buildings for various zones.

UNIT II - CONSTRUCTION PRACTICES **(9)**

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - Bond in masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick - weather and water proof - roof finishes - acoustic and fire protection.

UNIT III - CONSTRUCTION EQUIPMENT **(9)**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling.

UNIT IV - SUB STRUCTURE CONSTRUCTION **(9)**

Techniques of Box jacking - Pipe Jacking - under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation

UNIT V - SUPER STRUCTURE CONSTRUCTION **(9)**

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks - Prefabricated panels and structures – production, transportation and erection of structures.

TOTAL (L: 45)= 45 PERIODS

TEXT BOOKS:

1. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.
2. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
3. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi, 2013

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 2001.
2. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers,1999.
3. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.
4. Mahesh Varma, “Construction Equipment and its Planning and Application”, Metropolitan Book Company, New Delhi, 1983.

17CEX13 – REPAIR AND REHABILITATION OF STRUCTURES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE-3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.	1.1	Identify the maintenance and assessment method of distressed structures	c,d
2.0	To Recognize deterioration of concrete buildings.	2.1	Understand the strength and durability properties ,their effects due to climate and temperature.	b,c,e
3.0	To Know Deficiencies in various forms of steel constructions.	3.1	Know about recent development in concrete	c,e,l
4.0	To Aware of Strengthening techniques for prevailing structures.	4.1	Learn the techniques for repair rand protection methods	c,d,e,l
5.0	To Compare of verities of rehabilitation techniques according to requirement.	5.1	Study about repair,rehabilitation and retrofitting of structures and demolition methods.	b,c,g,l

UNIT I - MAINTENANCE AND REPAIR STRATEGIES	(9)
Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration	
UNIT II - SERVICEABILITY AND DURABILITY OF CONCRETE	**(11)**
Concrete properties - strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion – design and construction errors - Effects of cover thickness and cracking & IS Code Book for Cover thickness.	
UNIT III - MATERIALS FOR REPAIR	**(9)**
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.	
UNIT IV - TECHNIQUES FOR REPAIR AND DEMOLITION	**(8)**
Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidate structures - case studies.	
UNIT V - REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES	**(8)**
Repairs to overcome low member strength, Test on Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Guha, P.K, “Maintenance and Repairs of Buildings”, New Central Book Agency (P) Ltd, Calcutta, 2011
2. R.T.Allen and S.C.Edwards, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987.

REFERENCES:

1. M.S.Shetty, “Concrete Technology” Theory and Practice, S.Chand and Company, New Delhi, 2010.
2. Santhakumar, A.R., “Training Course notes on Damage Assessment and repair in Low Cost Housing” "RHDC-NBO" Anna University, 1992.
3. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Lakshmipathy, M. Lecture Notes of Workshop on "Repairs and Rehabilitation of Structures", 29th - 30th October 1999.

22STB01 - DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURAL SYSTEMS *(IS 456 -2000 code book is to be permitted)*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE REQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To make familiar to students in Design standards. which helps them,	**1.1**	The students will be able to calculate the deflection and crack width in the flexural members
2.0	To acquire knowledge about the design of special reinforced concrete elements.	**2.1**	The students will be able to formulate the procedure to design the slender column, corbels and spandrel beams
3.0	To know about the design of the flat slabs and grid floors	**3.1**	The students will be able to analysis and design the flat slabs and grid floors
4.0	To learn the knowledge about inelastic behavior of concrete structures.	**4.1**	The students will be able to evaluate the inelastic behavior of concrete structures
5.0	To impart knowledge on design of RC wall and concepts of ductility	**5.1**	The students will be able to design RC walls and observe the concepts of ductile detailing

UNIT I - DESIGN CONCEPTS AND LIMIT STATE OF SERVICEABILITY	**(12+3)**
Limit state method - Design of beams - Deflection - Calculation of short term deflection and long term deflection - Limits on deflection. Cracking - causes of cracking - Factors influencing crack width - Mechanism of flexural cracking - Calculation of crack width by IS 456.	
UNIT II - DESIGN OF SPECIAL R.C.ELEMENTS	**(9+3)**
Design of Slender Column - Design of corbels - Strut and tie method - Design of simply supported and continuous deep beams - Design of Spandrel beams	
UNIT III - DESIGN OF FLAT SLABS AND YIELD LINE THEORY	**(9+3)**
Design of flat slabs (IS method) - Check for shear - Yield line theory and Hiller borgs strip method of design of slabs - Analysis and design of grid floors as per IS 456	
UNIT IV - INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES	**(9+3)**
Inelastic analysis of RC beams - Moment- Rotation curves - moment redistribution - Concept of plastic hinges - Baker's method of plastic design	
UNIT V - DESIGN OF RC WALL AND DUCTILE DETAILING	**(6+3)**
Design of RC wall - Concepts and Detailing for ductility - Concrete cover - Fire resistance of structural members - Design of cast-in-situ joints in frames	
TOTAL (L:45, T: 15) : 60 PERIODS	

REFERENCES:

1. Unnikrishna Pillai and Devdas Menon, "Reinforced concrete Design", 4th Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2021.
2. Krishnaraju, N. "Advanced Reinforced Concrete Design",3rd Edition., CBS Publishers and Distributors, Delhi, 2016
3. Subramanian N., "Design of Reinforced Concrete Structures", 1st Edition, Oxford University Press, 2014.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2nd Edition, 2007.
5. IS 456 -2000, "Plain and Reinforced Concrete - Code of Practice" 4th revision, Bureau of Indian Standards, New Delhi.

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	2	2	3	2	3	2	3	3
2	3	2	3	2	3	3	2	3
3	3	2	3	3	3	3	2	3
4	2	2	2	2	3	2	2	3
5	3	2	3	3	3	3	3	3
CO (W.A)	**2.6**	**2**	**2.8**	**2.4**	**3**	**2.6**	**2.4**	**3**

22STB02 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING *(IS 1893:2002, IS 13920:2016 & IS 4326:1993 codes are to be permitted)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
sPRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To expose the students the principles and methods of dynamic analysis of structures.	**1.1**	The students will be able to do vibration analysis of system / structures with single degree of freedom and can explain the method of damping systems		
2.0	To study the analysis procedure for calculating the response of MDOF systems.	**2.1**	The students will be able to do the dynamic analysis of system /structures with Multi degrees of freedom under free and forced vibration		
3.0	To Educate the dynamic analysis of continuous systems using virtual work method	**3.1**	The students will be able to derive a mathematical model of continuous system and do a dynamic analysis under free and forced vibration		
4.0	To study the effects of earthquake, analysis and design of Earthquake resistant design of structures	**4.1**	The students will be able to explain the causes and effect of earthquake		
5.0	To obtain knowledge on design an earthquake resistant RC and masonry structure	**5.1**	The students will be able to design masonry and RC structures to the earthquake forces as per there commendations of IS codes of practice		

UNIT I - PRINCIPLES OF VIBRATION ANALYSIS	**(9)**
Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Evaluation of damping, Transmissibility, vibration control, Tuned mass damper	
UNIT II - DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS	**(9)**
Mathematical models of two degree of freedom systems and multi degree of freedom systems, free and forced vibrations of two degree and multi degree of freedom systems, normal modes of vibration, applications. Orthogonality of normal modes, free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Applications.	
UNIT III - DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS	**(9)**
Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh - Ritz method - Formulation using Conservation of Energy - Formulation using Virtual Work, Applications.	
UNIT IV - EARTHQUAKE GROUND MOTION AND ITS EFFECTS ON STRUCTURES	**(9)**
Engineering Seismology - Seismotectonics and Seismic zoning of India, Plate tectonics, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation. Effect of Earthquake on Different Types of Structures - Lessons Learnt	

From Past Earthquakes - Evaluation of Earthquake Forces as per codal provisions - Response Spectra, Design Spectra	
UNIT V - EARTHQUAKE RESISTANT DESIGN OF MASONRY AND RC STRUCTURES	**(9)**
Structural Systems - Types of Buildings - Causes of damage - Planning Considerations - effect of material of construction on performance of structures - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design of Masonry Buildings and R.C.C. Buildings. Design consideration - Rigid Frames - Shear walls - Capacity based Design and detailing	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Anil K.Chopra, Dynamics of Structures, 5th Edition, Pearson Education, 2017.
2. Paulay.T and Priestley M.J.N., "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 2013.
3. Mario Paz, "Structural Dynamics - Theory and Computation", Kluwer Academic Publishers, 5th Edition, 2006.
4. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009.
5. Duggal S K, "Earthquake Resistant Design of Structures", Oxford University Press, 2007.
6. IS 1893:2002 (Part -1), "Criteria for Earthquake Resistant Design of Structures", Bureau of Indian Standards, New Delhi
7. IS 13920- 2008, "Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice", Bureau of Indian Standards, New Delhi
8. IS 4326 : 1993, "Earthquake Resistant Design and Construction of Buildings - Code of Practice", Second Revision, Bureau of Indian Standards, New Delhi.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	3	3	2	3	2	3
2	3	2	3	3	2	3	3	3
3	2	1	2	2	2	3	2	3
4			2	2	3	2	2	2
5	3	2	3	3	3	3	3	3
CO (W.A)	**2.75**	**1.75**	**2.6**	**2.6**	**2.4**	**2.8**	**2.4**	**2.8**

22STB03 - ADVANCED CONCRETE TECHNOLOGY *(IS 456 & IS 10262: 2019 codes are to be permitted)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To study the properties of materials, tests, admixtures for concrete and concreting under special circumstances.	**1.1**	The students will be able to develop knowledge on various materials needed for concrete manufacture
2.0	To acquire knowledge about mix design of concrete by various methods	**2.1**	The students will be able to apply the rules to do mix designs for concrete by various methods
3.0	To identify different tests for identifying the properties of concrete	**3.1**	The students will be able to explain different tests for identifying the properties of concrete
4.0	To gain knowledge about the types of special concrete	**4.1**	The students will be able to apply the usage of special concretes
5.0	To learn about the durability and quality control on concrete	**5.1**	The students will be able to perform tests for permeability and durability properties.

UNIT I - CONCRETE MAKING MATERIALS	**(9)**
Aggregates - classification - IS Specifications - Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates - Cement, Grade of cement, Chemical composition, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures - Mineral admixtures.	
UNIT II - MIX DESIGN	**(9)**
Principles of Concrete Mix Design - Factors in the choice of mix proportions - Mix design methods - A.C. Method - I.S Method - DOE Method - Design of High strength concrete Design of Self Compacting Concrete by using EFNARC Specifications - Design of concrete mix using mineral admixtures - Design mix for pump ability and effect of super plasticizers in water reduction.	
UNIT III - TESTING ON CONCRETE	**(9)**
Workability - Compression - Tension - Flexure - Bond strength - Factors affecting the results - Accelerated strength results - Stress strain characteristics - Modulus of Elasticity - In situ strength determination - Variation in results - Distribution of strength - Standard deviation - Nondestructive tests - Microstructure analysis of Concrete	
UNIT IV - SPECIAL CONCRETES	**(9)**
Method of Manufacture, properties and applications - Lightweight concrete-Aerated concrete - No fines concrete - Heavy weight concrete - High Strength Concrete - High Performance Concrete - Polymer Concrete - Steel fiber Reinforced Concrete - Ferrocement Concrete - Vaccum Concrete - Shotcrete - Concrete using waste material - Ready Mixed Concrete – Self compacting concrete - Geopolymer concrete.	

UNIT V - DURABILITY OF CONCRETE	(9)
Permeability - chemical attack - sulphate attack - Quality of water - marine conditions - Methods to improve durability - Thermal properties of concrete - fire resistance - Mass Concrete - Formwork - Structural Concrete Block Masonry - Quality Control of Concrete Construction.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. A.M. Neville, "Properties of Concrete", Prentice Hall, London, 2012
2. Santhakumar A.R., "Concrete Technology", Oxford University Press, New Delhi, 2006.
3. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company Ltd. Delhi, 2018
4. Gambhir.M.L., "Concrete Technology", 5th Edition, McGraw Hill Education, New Delhi 2017.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1			3		2	2	2	3
2	3	3	2		3	3	2	3
3	2	2			2	2	3	3
4	2		3	2	2	2		3
5	2	2	2	3	3	3	2	3
CO (W.A)	**2.25**	**2.33**	**2.5**	**2.5**	**2.4**	**2.4**	**2.25**	**3**

22STB05 - ADVANCED DESIGN OF STEEL STRUCTURES *(IS 800: 2007, IS 801, IS 811, IS 875 Part 3, IS 804, IS 805 & SP-06 are to be permitted)*					
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**
PRE REQUISITE : NIL					

Course Objectives		**Course Outcomes** The students will be able to	
1.0	To study the analysis and design of industrial buildings and Gable column and Gable wind girder	**1.1**	Analyze and design industrial structures such as trusses and portal frames subjected to wind and seismic forces
2.0	To gain knowledge about the design of connections.	**2.1**	Design different types of steel connections such as welded and bolted flexible as well as moment resisting connections
3.0	To study of plastic analysis of structures.	**3.1**	Apply the knowledge of plastic analysis in steel design
4.0	To learn the analysis and design of steel towers	**4.1**	Design the special structures such as steel water tank and chimney, Silo and Towers
5.0	To acquire knowledge about the design of light gauge steel structures	**5.1**	Evaluate the behaviour and design of compression and flexural Cold-formed Steel members

UNIT I - ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS	**(9+3)**
Roof trusses - Roof and side coverings - Design of truss elements - Design of purlins -Design of end bearings - Gable column, gable rafter, gable wind girder and end bracings of industrial buildings - Introduction to the design of steel structures for fire loads - Aseismic design of steel buildings.	
UNIT II - DESIGN OF CONNECTIONS	**(9+3)**
Types of connections - Structural joints - Welded and Bolted – Throat and Root Stresses in Fillet Welds - Seated Connections - Unstiffened and Stiffened seated Connections - Moment Resistant Connections - Clip angle Connections - Split beam Connections - Framed Connections.	
UNIT III - PLASTIC ANALYSIS OF STRUCTURES	**(9+3)**
Introduction - Shape factors - Mechanisms - Plastic hinge - Analysis of beams and portal frames - Design of fixed and continuous beams and portal frame	
UNIT IV - SPECIAL STRUCTURES	**(9+3)**
Water tanks - Water pressure on tank walls - Seismic Analysis of water tank - Types of chimneys - Components of chimney - Design of self-supporting chimney - Design of Silos - Bunker design - Design of towers.	
UNIT V - DESIGN OF LIGHT GAUGE STEEL STRUCTURES	**(9+3)**
Types of cold formed cross sections - Local buckling - Design of compression and tension members - Design of beams - General concept of pre-engineered buildings - Simple portal frame design.	
TOTAL (L:45, T:15) : 60 PERIODS	

REFERENCES:

1. Subramanian N, "Design of Steel Structures", 2nd Edition, Oxford University Press, New Delhi, 2015.
2. Duggal. S K, "Limit State Design of Steel Structures", 3rd Edition, McGraw Hill Private Limited, New Delhi, 2017.
3. Wie Wen Yu, Design of Cold-Formed Steel Structures, McGraw Hill Book Company, 2019
4. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons, 1997

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	2	3	3	3	3	2	3
2	2		3	3	2	3	3	3
3			2	3		2		3
4	3	2	3	3	3	3	3	3
5	2			2	3	3		2
CO (W.A)	**2.5**	**2**	**2.75**	**2.8**	**2.75**	**2.8**	**2.67**	**2.8**

22STB06 - FINITE ELEMENTANALYSIS IN STRUCTURAL ENGINEERING					
		L	T	P	C
		3	1	0	4
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To impart fundamental knowledge on the finite element method and its applications	**1.1**	The student will be able to demonstrate the concept of finite element analysis and approximate solutions, techniques		
2.0	To gain knowledge on one dimensional structural engineering problems	**2.1**	The student will be able to execute finite element analysis concept in one dimensional element problems		
3.0	To Acquire knowledge about the finite element analysis of 2-D and 3-D problems	**3.1**	The student will be able to apply the finite element analysis concept in two and three dimensional element problems		
4.0	To understand the FEM analysis for framed structuresAnalyse the framed structures using FEM analysis	**4.1**	The student will be able to analyze the framed structures		
5.0	To study the applications of FEM	**5.1**	The student will be able to apply finite element analysis concept in nonlinear, vibration and thermal problems		

UNIT I - INTRODUCTION	**(9+3)**
Approximate solutions of boundary value problems-Methods of weighted residuals, approximate solution using variational method, Modified Galerkin method. Basic finite element concepts - Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method.	
UNIT II - ONE DIMENSIONAL PROBLEMS	**(9+3)**
One dimensional problems - Coordinate systems - global, local and natural coordinate systems, shape functions - Bar, beam and truss element - Generation of Stiffness Matrix and Load Vector.	
UNIT III - TWO AND THREE DIMENSIONAL PROBLEMS	**(9+3)**
Two Dimensional problems - Plane Stress, Plane Strain Problems -Triangular and Quadrilateral Elements - Isoparametric Formulation - Natural Coordinates, Shape function, stiffness matrix - Asymmetric Problems - Higher Order Elements -Numerical Integration - Three dimensional elasticity - Governing differential equations - Higher order Isoparametric solid elements	
UNIT IV - ANALYSIS OF FRAMED STRUCTURES	**(9+3)**
Stiffness of Truss Member - Analysis of Truss - Stiffness of Beam Member - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Numerical Evaluation of Element Stiffness - Formulation for 3 Dimensional Elements - Solution for simple frames	
UNIT V - APPLICATIONS	**(9+3)**
Finite Elements for Elastic Stability - Dynamic Analysis - Nonlinear, Vibration and Thermal Problems - Meshing and Solution Problems - Modeling and analysis using FEA software's.	
TOTAL (L:45 ,T:15) : 60 PERIODS	

REFERENCES:

1. S. S. Bhavikatti, "Finite Element Analysis", 4th Edition, New Age Publishers, 2005
2. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2006
3. Seshu, P, "Text Book of Finite Element Analysis", Prentice - Hall of India Pvt. Ltd., New Delhi, 2004
4. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", 4th Edition, Prentice Hall of India, 2015.
5. C. Krishnamoorthy, "Finite Element Analysis: Theory and Programming", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2		2	2			2	2
2			2	3		2		2
3	2		2	3	2	1	2	2
4		2		3	3	3	2	2
5	2		2		2		3	2
CO (W.A)	**2**	**2**	**2**	**2.75**	**2.33**	**2**	**2.25**	**2**

22STX02 - EXPERIMENTAL TECHNIQUES AND ANALYSIS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To study about the measurements and performance of strains.	1.1	The students will be able to evaluate the measurement system of strains in structural elements
2.0	To learn about the characteristics of structural vibrations measurements.	2.1	The students will be able to assess the different measurement method of vibrations
3.0	To gain knowledge about the non-destructive structures testing and wind flow measurements	3.1	The students will be able to demonstrate on various testing methods and technologies.
4.0	To understand the concepts of distress measurements and control	4.1	The students will be able to analyse the construction and damage assessment of RC Structures
5.0	To apply the non destructive testing on various structures and elements.	5.1	The students will be able to determine strength by using NDT testing

UNIT I - STRAIN MEASUREMENTS	(9)
Methods of measurements-Errors in measurements - Calibration of Testing Machines - Strain gauge, Principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges - Electronic load cells - Proving Rings.	
UNIT II - VIBRATION MEASUREMENTS	**(9)**
Characteristics of Structural Vibrations - Linear Variable Differential Transformer (LVDT) - Transducers for velocity and acceleration measurements. Vibration meter - Seismographs - Vibration Analyzer - Display and recording of signals - Cathode Ray Oscilloscope - XY Plotter - Chart Plotters - Digital data Acquisition systems.	
UNIT III - ACOUSTICS AND WIND FLOW MEASURES	**(9)**
Principles of pressure and flow measurements - pressure transducers - sound level meter - venturimeter - flow meters - wind tunnels and its uses in structural analysis - structural modeling - direct and indirect analysis.	
UNIT IV - DISTRESS MEASUREMENTS AND CONTROL	**(9)**
Diagnosis of distress in structures - crack observation and measurements - corrosion of reinforcement in concrete - Half cell, construction and use - damage assessment - controlled blasting for demolition - Techniques for residual stress measurements	
UNIT V NON DESTRUCTIVE TESTING METHODS	**(9)**
Load testing on structures, buildings, bridges and towers - Rebound Hammer - acoustic emission - ultrasonic testing principles and application - Holography - use of laser for structural testing - Brittle coating, Advanced NDT methods - Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR & GPR.	

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, 4th Edition, New Delhi, 2006.
2. Jindal U C ., "Experimental stress analysis", Pearson, New Delhi, 2013
3. Srinath.L.S, Raghavan.M.R, ingaiah.K, Gargesha.G, Pant.B and Ramachandra.K, "Experimental Stress Analysis", Tata McGraw Hill Company, New Delhi, 1984.
5. C. S. Rangan, "Instrumentation - Devices and Systems", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1983

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	2		2	2		2	2	3
2	2	1	3	2		2		2
3	2		2		2	2	3	2
4	3			3		2	2	
5			2			2		3
CO (W.A)	**1.8**	**1**	**2.25**	**2.33**	**2**	**2**	**2.33**	**2.5**

22STX09 - MAINTENANCE AND REHABILITATION OF STRUCTURES				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To emphasize the importance of maintenance and inspection of structures	1.1	The students will be able to explain the importance of maintenance assessment and repair strategies
2.0	To get the knowledge on strength and durability of concrete with effects due to environment, chemicals, fire and earthquakes.	2.1	The students will be able to identify the effects due to climate and temperature
3.0	To gain knowledge about the materials for repair.	3.1	The students will be able to realize the basic concepts, materials and techniques available for repair works.
4.0	To impart fundamental knowledge on various repairing strategies	4.1	The students will be able to explain the techniques for repair and protection methods
5.0	To impart a broad knowledge in the area of repair and rehabilitation of structures	5.1	The students will be able to identify the suitable methods for the repair, retrofitting and demolition of structures

UNIT I - MAINTENANCE AND REPAIR STRATEGIES	(9)
Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures - Service life behaviour - importance of Maintenance, causes and effects of deterioration. Non-destructive Testing Techniques	
UNIT II - STRENGTH AND DURABILITY OF CONCRETE	**(9)**
Quality assurance for concrete based on Strength, Durability and Microstructure of concrete - NDT techniques- Cracks- different types, causes - Effects due to Environment, Fire, Earthquake, Corrosion of steel in concrete, Mechanism, quantification of corrosion damage	
UNIT III - REPAIR MATERIALS AND SPECIAL CONCRETES	**(9)**
Repair materials - Various repair materials, Criteria for material selection, Methodology of selection, Special mortars and concretes - Polymer Concrete and Grouting materials - Bonding agents - Latex emulsions, Epoxy bonding agents, Protective coatings - Protective coatings for Concrete and Steel, FRP sheets.	
UNIT IV - PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING	**(9)**
Concrete protection methods - reinforcement protection methods - cathodic protection - Sacrificial anode - Corrosion protection techniques - Corrosion inhibitors, concrete coatings - Corrosion resistant steels, Coatings to reinforcement, Structural health monitoring	
UNIT V - REPAIR, RETROFITTING AND DEMOLITION OF STRUCTURES	**(9)**

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Repair to active cracks, Repair to dormant cracks - Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing Techniques, Strengthening Methods for Structural Elements. Engineered Demolition - Case studies
TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Ravishankar.K.,Krishnamoorthy. T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004
2. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical, UK, 1991.
3. Dayaratnam P. and Rao R., "Maintenance and Durability of Concrete Structures", 1st Edition, University Press, India, 1997
4. Santhakumar. A.R., "Training Course Notes on Damage Assessment and Repair in Low Cost Housing", "RHDC- NBO", Anna University, July, 1992.
5. Dodge Woodson, "Concrete Structures, Protection, Repair and Rehabilitation", Butterworth - Heinemann, Elsevier, New Delhi 2012

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2		3	3		2	2	
2				2		3		3
3			2	3	2	3	3	3
4	2		2			2	3	2
5	3		3	2		3	3	3
CO (W.A)	**2.5**		**2.5**	**2.5**	**2**	**2.6**	**2.75**	**2.75**

22STX17 - STRUCTURAL HEALTH MONITORING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To learn concepts involved SHM advantages and challenges	**1.1**	The students will be able to adopt a proper health monitoring technique		
2.0	To develop knowledge on sensor technique	**2.1**	The students will be able to suggest the materials and techniques used for repair of structures.		
3.0	To learn different static and dynamic measurement techniques	**3.1**	The students will be able to identify the suitable static and dynamic measurement technique		
4.0	To Gain Knowledge about Damage Detection techniques	**4.1**	The students will be able to compare the various damage detection techniques		
5.0	To impart knowledge on both elementary and advanced applications of SHM with case studies	**5.1**	The students will be able to apply the various data processing methods through case studies		

UNIT I - INTRODUCTION TO STRUCTURAL HEALTH MONITORING	**(9)**
Need for SHM, Structural Health Monitoring versus Non-Destructive Evaluation, Methods of SHM Local & Global Techniques for SHM, Short & Long -Term Monitoring, Active & Passive Monitoring, Remote Structural Health Monitoring- Advantages of SHM - Challenges in SHM	
UNIT II - SENSORS AND INSTRUMENTATION FOR SHM	**(9)**
Sensors for measurements: Electrical Resistance Strain Gages, Vibrating Wire Strain Gauges, Fiber Optic Sensors, Temperature Sensors, Accelerometers, Displacement Transducers, Load Cells, Humidity Sensors, Crack Propagation Measuring Sensors, Corrosion Monitoring Sensors, Pressure Sensors, Data Acquisition - Data Transmission - Data Processing - Storage of processed data - Knowledgeable information processing	
UNIT III - STATIC AND DYNAMIC MEASUREMENT TECHNIQUES FOR SHM	**(9)**
Static measurement - Load test, Concrete core trepanning, Flat jack techniques, Static response measurement, Dynamic measurement - Vibration based testing - Ambient Excitation methods, Measured forced Vibration-Impact excitation, step relaxation test, shaker excitation method.	
UNIT IV - DAMAGE DETECTION	**(9)**
Damage Diagnostic methods based on vibration response - Method based on modal frequency/shape/damping, Curvature and flexibility method, Modal strain energy method, Sensitivity method, Baseline-free method, Cross-correlation method, Damage Diagnostic methods based on wave propagation Methods-Bulk waves/Lamb waves, Reflection and transmission, Wave tuning/mode selectivity, Migration imaging, Phased array imaging, Focusing	

array/SAFT imaging
UNIT V - DATA PROCESSING AND CASE STUDIES **(9)**
Advanced signal processing methods -Wavelet, Hilbert-Huang transform, Neural networks, Support Vector Machine Principal component analysis, Outlier analysis. Applications of SHM on bridges and buildings, case studies of SHM in Civil / Structural engineering.
TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Daniel Balageas, Peter Fritzen, Alfredo Guemes, "Structural Health Monitoring", John Wiley & Sons, 2006.
2. Douglas E Adams, "Health Monitoring of Structural Materials and Components Methods with Applications", Wiley Publishers, 2007
3. Hua-Peng Chen, "Structural Health Monitoring of Large Civil Engineering Structures", Wiley Publishers, 2018
4. Ansari, F Karbhari, "Structural health monitoring of Civil Infrastructure Systems", V.M, Woodhead Publishing, 2009

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1			2	2		2		2
2			3	3	3	3	3	3
3			2		2		2	2
4	2			2			3	2
5	2			2		2	2	
CO (W.A)	**2**		**2.33**	**2.25**	**2.5**	**2.33**	**2.5**	**2.25**

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi
for
B.E – Computer Science and Engineering [R17]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

SEPTEMBER 2021

COMPUTER SCIENCE AND ENGINEERING DEPARTMENT PEOs, PSOs and POs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

The following Programme Educational Objectives are designed for B.E. Computer Science and Engineering programme in Computer Science and Engineering based on the Department Vision & Mission to provide higher engineering education and motivate research in the field of Computer Engineering.

- **PEO 1.** Graduates will be employed in IT industries to solve industrial technological issues.
- **PEO 2.** Graduates will take up masters and pursue career paths in teaching and research.
- **PEO 3.** Graduates will be an entrepreneur who develops, deploys and maintains Real-time software.
- **PEO 4.** Graduates will continuously learn and adopt new technologies to solve communal issues.
- **PEO 5.** Graduates will enhance leadership skills and contribute towards societal growth.

PROGRAM SPECIFIC OUTCOMES (PSOs):

- **PSO1.** Ability to understand the principles and working of hardware and software aspects in a computer system
- **PSO2.** Ability to demonstrate knowledge in mathematical models, algorithms and software development methodologies
- **PSO3.** Ability to develop practical competency in programming languages and open source platforms
- **PSO4.** Ability to provide a foundation for higher studies, research and entrepreneurship

PROGRAM OUTCOMES (POs)

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	**PO1**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	**PO2**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	**PO3**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d	Investigation of Complex Problems	**PO4**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	**PO5**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	**PO6**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	**PO7**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	**PO8**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work.	**PO9**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j	Communication	**PO10**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k	Project Management and Finance	**PO11**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l	Lifelong Learning	**PO12**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme educational objectives and the Program Outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	3	3	3	2	2	2	3	3	3	3
2	3	3	3	3	3	2	2	1	3	3	2	3
3	3	3	3	3	3	2	2	2	3	3	3	3
4	3	3	3	3	3	2	2	1	3	3	2	3
5	3	3	3	3	3	3	2	2	2	3	3	3

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Outcomes and the Programme Outcomes is given in the following table

PROGRAM SPECIFIC OUTCOMES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	2	2	2	1	1	1	1	1	1	2
2	3	3	3	3	2	2	1	3	1	2	3	3
3	3	3	3	3	3	3	1	2	1	1	2	3
4	3	3	2	3	3	2	2	3	1	2	2	3

*** Contribution** **1: Reasonable** **2: Significant** **3: Strong**

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2017 **CHOICE BASED CREDIT SYSTEM**

B.E. COMPUTER SCIENCE AND ENGINEERING

CURRICULA: I – VIII SEMESTERS **SYLLABI I - VIII SEMESTER**

SEMESTER: I									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA01	Professional English- I	HS	-	4	2	0	2	3
2.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4
3.	17PYB02	Physics for Computer Engineers	BS	-	5	3	0	2	4
4.	17CYB03	Environmental Science	BS	-	3	3	0	0	3
5.	17CSC02	Python Programming	ES	-	3	3	0	0	3
PRACTICAL									
6.	17MEP01	Engineering Graphics Laboratory	ES	-	4	0	0	4	2
7.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2
8.	17GEP01	Personal Values	HS	-	2	0	0	2	0
				TOTAL	**30**	**14**	**2**	**14**	**21**

SEMESTER: II									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17EYA02	Professional English- II	HS	17EYA01	4	2	0	2	3
2.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4
3.	17PYB04	Applied Physics	BS	17PYB02	3	3	0	0	3
4.	17CYB04	Chemistry for Computer Engineers	BS	-	5	3	0	2	4
5.	17CSC03	Structured Programming	ES	-	3	3	0	0	3
6.	17ECC04	Basics of Electronics Engineering	ES	-	4	3	0	0	3
PRACTICAL									
7.	17CSP03	Structured Programming Laboratory	ES	-	4	0	0	4	2
8.	17ECP02	Electronics Laboratory	ES	-	4	0	0	4	2
9.	17GEP02	Interpersonal Values	HS	17GEP01	2	0	0	2	0
				TOTAL	**34**	**17**	**2**	**14**	**24**

SEMESTER: III									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB04	Probability and Statistics	BS	-	4	2	2	0	3
2.	17CSC04	Data Structures using Python	PC	17CSC02	5	3	0	2	4
3.	17ITC01	OOPS using JAVA	PC	-	3	3	0	0	3
4.	17CSC05	Operating Systems	PC	-	3	3	0	0	3
5.	17ECC09	Digital Principles and System Design	ES	17ECC04	3	3	0	0	3
6.	17CSC06	Microprocessor and Computer Architecture	PC	-	3	3	0	0	3
PRACTICAL									
7.	17ITP01	OOPS using JAVA Laboratory	PC	-	4	0	0	4	2
8.	17CSP04	Operating Systems Laboratory	PC	-	2	0	0	2	1
9.	17GED01	Soft Skills – Listening & Speaking	EEC	-	2	0	0	2	0
				TOTAL	**29**	**17**	**2**	**10**	**22**

SEMESTER: IV									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17MYB08	Discrete Mathematics	BS	-	4	2	2	0	3
2.	17ITC04	Design and Analysis of Algorithms	PC	17CSC04	5	3	2	0	4
3.	17CSC07	Database Management System	PC	-	3	3	0	0	3
4.	17CSC08	Computer Networks	PC	-	3	3	0	0	3
5.	17CSC09	Artificial Intelligence	PC	-	3	3	0	0	3
6.	17GEA01	Engineering Economics and Financial Accounting	HS	-	3	3	0	0	3
PRACTICAL									
7.	17CSP05	Database Management System Laboratory	PC	-	4	0	0	4	2
8.	17CSP06	Computer Networks Laboratory	PC	-	2	0	0	2	1
9.	17GED02	Soft Skills – Reading and Writing	EEC	-	2	0	0	2	0
10.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0
				TOTAL	**30**	**17**	**4**	**9**	**22**

SEMESTER: V									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CSC10	Theory of Computation	PC	17MYB08	3	3	0	0	3
2.	17ITC09	Internet and Web Programming	PC	17ITC01	4	2	0	2	3
3.	17CSC11	Object Oriented Software Engineering	PC	17CSC07	3	3	0	0	3
4.	17CSC12	Graphics and Multimedia	PC	-	3	3	0	0	3
5.	E1	Elective (PSE)	PSE	-	3	3	0	0	3
6.	E2	Elective (PSE/OE)	PSE/OE	-	3	3	0	0	3
PRACTICAL									
7.	17CSP07	Case Tools Laboratory	PC	-	4	0	0	4	2
8.	17CSP08	Graphics and Multimedia Laboratory	PC	-	4	0	0	4	2
9.	17GED08	Essence of Indian Traditional Knowledge	MC	-	2	2	0	0	0
				TOTAL	**29**	**19**	**0**	**10**	**22**

SEMESTER:VI									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CSC14	Cloud Computing	PC	-	3	3	0	0	3
2.	17CSC15	Security in Computing	PC	17CSC07, 17CSC08	3	3	0	0	3
3.	17CSC16	Principles of Compiler Design	PC	17CSC10	3	3	0	0	3
4.	E3	Elective (PSE)	PSE	-	3	3	0	0	3
5.	E4	Elective (PSE)	PSE	-	3	3	0	0	3
6.	E5	Elective (PSE/OE)	PSE/OE	-	3	3	0	0	3
PRACTICAL									
7.	17CSP09	Internet of Things Laboratory	ES	-	4	0	0	4	2
8.	17GED06	Comprehension	PC	-	2	0	0	2	0
9.	17GED07	Constitution of India	MC	-	2	2	0	0	0
				TOTAL	**27**	**19**	**0**	**8**	**20**

SEMESTER: VII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	17CSC17	Mobile Computing	PC	17CSC08	3	3	0	0	3
2.	17ITC15	Machine Learning Techniques	PC	17MYB01	3	3	0	0	3
3.	17CSC18	Full Stack Development	PC	-	3	3	0	0	3
4.	E6	Elective (PSE/ OE)	PSE/OE	-	3	3	0	0	3
5.	E7	Elective (OE)	OE	-	3	3	0	0	3
PRACTICAL									
6.	17CSP10	Mobile Computing Laboratory	PC	-	2	0	0	2	1
7.	17CSD01	Project Work I	EEC	-	8	0	0	8	4
				TOTAL	**25**	**15**	**0**	**10**	**20**

SEMESTER: VIII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1.	E8	Elective (PSE)	PSE	-	3	3	0	0	3
2.	E9	Elective (OE)	OE	-	3	3	0	0	3
PRACTICAL									
3.	17CSD02	Project Work II	EEC	-	16	0	0	16	8
				TOTAL	**22**	**6**	**0**	**16**	**14**

LIST OF PROGRAMME SPECIFIC ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
1	17CSX04	TCP/IP Design and Implementation	PSE	17CSC08	3	3	0	0	3
2	17CSX05	Network Analysis and Management	PSE	17CSC08	3	3	0	0	3
3	17CSX06	Wireless Communication and Networks	PSE	17CSC08	3	3	0	0	3
4	17CSX07	Embedded systems	PSE	-	3	3	0	0	3
5	17CSX08	Graph Theory	PSE	17CSC04	3	3	0	0	3
6	17CSX10	Mobile Application Development	PSE	-	3	3	0	0	3
7	17CSX11	Human Computer Interaction	PSE	17CSC08	3	3	0	0	3
8	17CSX12	Green Computing	PSE	17CSC08	3	3	0	0	3
9	17CSX13	Nano Computing	PSE	17CSC08	3	3	0	0	3
10	17CSX15	Knowledge Management	PSE	-	3	3	0	0	3
11	17ITX05	PHP programming	PSE	17ITC09	3	3	0	0	3
12	17ITX06	Programming with Java2 Enterprise Edition	PSE	17ITC01	3	3	0	0	3
13	17ITX08	C# and .Net	PSE	17ITC01	3	3	0	0	3
14	17ITX09	Ruby programming	PSE	-	3	3	0	0	3
15	17CSX23	Text Mining	PSE	17CSX22	3	3	0	0	3
16	17CSX24	Distributed Systems	PSE	-	3	3	0	0	3
17	17CSX25	Game Programming	PSE	-	3	3	0	0	3
18	17CSX27	Quantum Computing	PSE	17MYB04	3	3	0	0	3
19	17CSX28	Container OrchestrationUsing Kubernetes	PSE	17CSC14	3	3	0	0	3
20	17CSX29	Internet of Things	PSE	17CSC08	3	3	0	0	3
21	17MYB12	Basic Statistics andNumerical Analysis	PSE	-	3	3	0	0	3
22	17CSX31	Problem Solving and Programming	PSE	-	3	3	0	0	3
23	17CSX32	Social network Analysis	PSE	-	3	3	0	0	3
24	17ITX26	Problem Solving and Algorithmic Skills	PSE	-	3	3	0	0	3
25	17ECX16	Internet of Things and its applications	PSE	-	3	3	0	0	3
26	17CSX33	Google Cloud Platform	PSE		3	3	0	0	3

27	17CSX34	Tableau	PSE	-	3	3	0	0	3
28	17CSX35	Node JS	PSE	17ITC09, 17ITX05	3	3	0	0	3
29	17CSX36	React JS	PSE	17ITC09, 17ITX05	3	3	0	0	3
30	17ITX29	IT operations	PSE	-	3	3	0	0	3
31	17ITX30	IT operations Advanced	PSE	17ITX29	3	3	0	0	3
32	17CSX37	Professional Readiness for Innovation, Employability and Entrepreneurship	PSE	-	3	3	0	0	3
33	17ITX32	Test Driven Programming	PSE	-	3	3	0	0	3
34	17ITX33	Java - Full Stack Implementation	PSE	-	3	3	0	0	3
35	17ITX17	Building Enterprise Applications	PSE	-	3	3	0	0	3
36	17ITX37	Problem Solving Using Java	PSE	-	3	3	0	0	3

HUMANITIES AND SOCIAL SCIENCES (HS)									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17EYA01	Professional English- I	HS	-	4	2	0	2	3
2.	17GEP01	Personal Values	HS	-	2	0	0	2	0
3.	17EYA02	Professional English- II	HS	17EYA01	4	2	0	2	3
4.	17GEP02	Interpersonal Values	HS	17GEP01	2	0	0	2	0
5.	17GEA01	Engineering Economics andFinancial Accounting	HS	-	3	3	0	0	3
BASIC SCIENCES (BS)									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4
2.	17PYB02	Physics for Computer Engineers	BS	-	5	3	0	2	4
3.	17CYB03	Environmental Science	BS	-	3	3	0	0	3
4.	17MYB02	Complex Analysis andLaplace Transforms	BS	17MYB01	5	3	2	0	4
5.	17PYB04	Applied Physics	BS	17PYB02	3	3	0	0	3
6.	17CYB04	Chemistry for Computer Engineers	BS	-	5	3	0	2	4
7.	17MYB04	Probability and Statistics	BS	-	4	2	2	0	3
8.	17MYB08	Discrete Mathematics	BS	-	4	2	2	0	3

ENGINEERING SCIENCES (ES)									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17CSC02	Python Programming	ES	-	3	3	0	0	3
2.	17MEP01	Engineering Graphics Laboratory	ES	-	4	0	0	4	2
3.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2
4.	17CSC03	Structured Programming	ES	-	3	3	0	0	3
5.	17ECC04	Basics of Electronics Engineering	ES	-	4	3	0	0	3
6.	17CSP03	Structured Programming Laboratory	ES	-	4	0	0	4	2
7.	17ECP02	Electronics Laboratory	ES	-	4	0	0	4	2
8.	17ECC09	Digital Principles and System Design	ES	17ECC04	3	3	0	0	3
9.	17CSC13	Internet of Things	ES	-	3	3	0	0	3
10.	17CSP09	Internet of Things Laboratory	ES	-	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17GED01	Soft Skills – Listening & Speaking	EEC	-	2	0	0	2	0
2.	17GED02	Soft Skills – Reading & Writing	EEC	-	2	0	0	2	0
3.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0
4.	17GED08	Essence of Indian Traditional Knowledge	MC	-	2	2	0	0	0
5.	17GED07	Constitution of India	MC	-	2	2	0	0	0
6.	17CSD01	Project Work I	EEC	-	8	0	0	8	4
7.	17CSD02	Project Work II	EEC	-	16	0	0	16	8
PROFESSIONAL CORE (PC)									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17CSC04	Data Structures using Python	PC	17CSC02	4	2	0	2	3
2.	17ITC01	OOPS using JAVA	PC	-	3	3	0	0	3
3.	17CSC05	Operating Systems	PC	-	3	3	0	0	3

4.	17CSC06	Microprocessor and Computer Architecture	PC	-	3	3	0	0	3
5.	17ITP01	OOPS using JAVA Laboratory	PC	-	4	0	0	4	2
6.	17CSP04	Operating Systems Laboratory	PC	-	2	0	0	2	1
7.	17CSC07	Database Management System	PC	-	3	3	0	0	3
8.	17CSC08	Computer Networks	PC	-	3	3	0	0	3
9.	17ITC04	Design and Analysis of Algorithms	PC	17CSC04	4	3	2	0	4
10.	17CSC09	Artificial Intelligence	PC	-	3	3	0	0	3
11.	17CSP05	Database Management System Laboratory	PC	-	4	0	0	4	2
12.	17CSP06	Computer Networks Laboratory	PC	-	2	0	0	2	1
13.	17CSC10	Theory of Computation	PC	17MYB08	3	3	0	0	3
14.	17CSC11	Object Oriented Software Engineering	PC	17CSC07	3	3	0	0	3
15.	17ITC09	Internet and Web Programming	PC	-	4	2	0	2	3
16.	17CSC12	Graphics and Multimedia	PC	-	3	3	0	0	3
17.	17CSP07	Case Tools Laboratory	PC	-	4	0	0	4	2
18.	17CSP08	Graphics and Multimedia Laboratory	PC	-	4	0	0	4	2
19.	17CSC14	Cloud Computing	PC	-	3	3	0	0	3
20.	17CSC15	Security in Computing	PC	17CSC07, 17CSC08	3	3	0	0	3
21.	17CSC16	Principles of Compiler Design	PC	17CSC10	3	3	0	0	3
22.	17GED06	Comprehension	PC	-	2	0	0	2	0
23.	17ITC15	Machine Learning Techniques	PC	17MYB01	3	3	0	0	3
24.	17CSC17	Mobile Computing	PC	17CSC08	3	3	0	0	3
25.	17CSP10	Mobile Computing Laboratory	PC	-	2	0	0	2	1
26.	17CSC18	Full Stack Development	PC	-	3	3	0	0	3

(b)Open Electives			AICTE Credit Distribution Norm:18							
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17AGZ01	Baking and Confectionery Technology	OE	-	3	3	0	0	3	VII
2.	17AGZ02	Food safety and quality control system	OE	-	3	3	0	0	3	VII
3.	17AGZ03	Farm Mechanization	OE	-	3	3	0	0	3	VIII
4.	17AGZ04	Processing of Fruits and Vegetables	OE	-	3	3	0	0	3	VIII
5.	17CHZ01	Waste Water Treatment	OE	-	3	3	0	0	3	VII
6.	17CHZ02	Piping Engineering	OE	-	3	3	0	0	3	VII
7.	17CHZ03	Process Automation	OE	-	3	3	0	0	3	VII
8.	17CHZ04	Process Instrumentation	OE	-	3	3	0	0	3	VII
9.	17CEZ01	Energy conservation in buildings	OE	-	3	3	0	0	3	VII
10.	17CEZ02	Air Pollution Management	OE	-	3	3	0	0	3	VIII
11.	17CEZ03	Building Services	OE	-	3	3	0	0	3	VIII
12.	17CEZ04	Road Safety Management	OE	-	3	3	0	0	3	VII
13	17CEZ05	Waste Management	OE	-	3	3	0	0	3	VII/VII I
14.	17CSZ01	Design Thinking	OE	-	3	3	0	0	3	VII
15.	17CSZ02	Digital Marketing	OE	-	3	3	0	0	3	VII
16.	17CSZ03	Software Engineering	OE	-	3	3	0	0	3	VIII
17.	17CSZ04	Unified Functional Testing	OE	-	3	3	0	0	3	VIII
18	17CSZ05	C Programming	OE	-	3	3	0	0	3	VI
19.	17CSZ06	Data Structures	OE	-	3	3	0	0	3	VI
20.	17CSZ07	Web Services Using Java	OE	-	3	3	0	0	3	VI
21.	17ECZ01	Modern wireless communication system	OE	-	3	3	0	0	3	VII
22.	17ECZ02	Consumer Electronics	OE	-	3	3	0	0	3	VII
23.	17ECZ03	Automotive Electronics	OE	-	3	3	0	0	3	VIII
24.	17ECZ04	Electronic Testing	OE	-	3	3	0	0	3	VIII
25.	17EEZ01	Renewable Energy Technology	OE	-	3	3	0	0	3	VII
26.	17EEZ02	Smart Grid	OE	-	3	3	0	0	3	VII

27.	17EEZ03	Energy Auditing, Conservation and Management	OE	-	3	3	0	0	3	VIII
28.	17EEZ04	Electrical Machines	OE	-	3	3	0	0	3	VIII
29	17EIZ01	Autotronix	OE	-	3	3	0	0	3	VII
30	17EIZ02	Industrial Automation	OE	-	3	3	0	0	3	VII
31.	17EIZ03	Fiber Optic Sensors	OE	-	3	3	0	0	3	VIII
32.	17EIZ04	Ultrasonic Instrumentation	OE	-	3	3	0	0	3	VIII
33.	17ITZ01	Software Testing Tool	OE	-	3	3	0	0	3	VII
34.	17ITZ02	User Experience	OE	-	3	3	0	0	3	VII
35.	17ITZ03	Developing Mobile Apps	OE	-	3	3	0	0	3	VIII
36.	17ITZ04	Software Project Management	OE	-	3	3	0	0	3	VIII
37.	17ITZ05	Java Programming	OE	-	3	3	0	0	3	VI
38.	17MEZ01	Engineering Ergonomics	OE	-	3	3	0	0	3	VII / VIII
39.	17MEZ02	Energy Audit and Resource Management	OE	-	3	3	0	0	3	VII / VIII
40.	17MEZ03	Electric Vehicle Technology	OE	-	3	3	0	0	3	VII / VIII
41.	17MEZ04	Value Engineering	OE	-	3	3	0	0	3	VII / VIII
42.	17MEZ05	Smart Mobility	OE	-	3	3	0	0	3	VII / VIII
43.	17MEZ06	Smart Sensor Systems	OE	-	3	3	0	0	3	VII / VIII
44.	17MYZ01	Mathematical Structures	OE	-	3	3	0	0	3	VII
45.	17MYZ02	Optimization Techniques	OE	-	3	3	0	0	3	VII
46.	17MYZ03	Statics for Engineers	OE	-	3	3	0	0	3	VII
47.	17MYZ04	Statistics for Engineers	OE	-	3	3	0	0	3	VII
48.	17PYZ01	Nanomaterials	OE	-	3	3	0	0	3	VII
49.	17PYZ02	Nuclear physics and Reactors	OE	-	3	3	0	0	3	VII
50.	17PYZ03	Space science and technology	OE	-	3	3	0	0	3	VII
51.	17CYZ01	Chemistry for Every DayLife	OE	-	3	3	0	0	3	VII

52.	17CYZ02	E - Waste Management	OE	-	3	3	0	0	3	VII
53.	17CYZ03	Industrial Chemistry	OE	-	3	3	0	0	3	VII
54.	17EYZ01	Communicative Hindi	OE	-	3	3	0	0	3	VII
55.	17EYZ02	Fundamentals of German	OE	-	3	3	0	0	3	VII
56.	17EYZ03	Basics of Japanese	OE	-	3	3	0	0	3	VII
57.	17EYZ04	Employability Enhancement and Analytical Skills	OE	-	3	3	0	0	3	VII
58.	17EYX01	Effective Communication	OE	-	3	3	0	0	3	VII
59.	17EYZ05	Workplace Communication	OE	-	3	3	0	0	3	VII
60.	17GYZ01	Biology for Engineers	OE	-	3	3	0	0	3	VII
61.	17BMZ01	Health care technology	OE	-	3	3	0	0	3	VII
62.	17BMZ02	Telemedicine	OE	-	3	3	0	0	3	VII
63.	17BMZ03	Epidemiology and Pandemic Management	OE	-	3	3	0	0	3	VII
64.	17BMZ04	Medical Ethics	OE	-	3	3	0	0	3	VII
65.	17AIZ01	Fundamentals of Artificial Intelligence and Machine Learning	OE	-	3	3	0	0	3	VII
66.	17AIZ02	Data Science Fundamentals	OE	-	3	3	0	0	3	VII
67.	17AIZ03	Introduction to Business Analytics	OE	-	3	3	0	0	3	VII
68.	17AIZ04	Augmented Reality/Virtual Reality Technologies	OE	-	3	3	0	0	3	VII
69	17ITZ06	Data Structures using C	OE	-	3	3	0	0	3	VII
70	17ITZ07	Product Lifecycle Management for Engineers	OE		3	3	0	0	3	VII

Honor Degree Courses								
Vertical I - Software Engineering								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17ITX07	Advanced Web Programming	17ITC09	3	3	0	0	3
2.	17CSX17	Software Design and Architecture	-	3	3	0	0	3
3.	17CSX18	Software Testing Methodologies	-	3	3	0	0	3
4.	17CSX19	Software Agents	-	3	3	0	0	3
5.	17CSX20	Software Quality Assurance	-	3	3	0	0	3
6.	17CSX21	Software Project Management	-	3	3	0	0	3
7.	17CSX30	Agile methodologies	-	3	3	0	0	3
8.	17CSX38	Devops	-i	3	3	0	0	3
Vertical II - Data Science								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**PRERQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17CSX01	Data Science	17MYB04, 17CSC07	3	3	0	0	3
2.	17CSX02	Data Warehousing and Data Mining	17CSC07	3	3	0	0	3
3.	17CSX03	Data Analytics	17CSC07	3	3	0	0	3
4.	17CSX09	Information Retrieval Techniques	17CSC07	3	3	0	0	3
5.	17CSX14	Deep Learning	17MYB02, 17MYB04	3	3	0	0	3
6.	17CSX16	Image Processing Techniques	-	3	3	0	0	3
7.	17CSX22	Natural Language Processing	-	3	3	0	0	3
8.	17CSX26	Block chain Technologies	17ITC09	3	3	0	0	3

Minor Degree Courses								
Full Stack Development								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**PRE-RQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	17CSM01	User Interface design	-	3	3	0	0	3
2.	17CSM02	Programming using Java	-	3	3	0	0	3
3.	17CSM03	Database System Concepts	-	3	3	0	0	3
4.	17CSM04	XML and Web Services	-	3	3	0	0	3
5.	17CSM05	Web Technologies	-	3	3	0	0	3
6.	17CSM06	Open source systems	-	3	3	0	0	3
7.	17CSM07	UI and UX Design	-	3	3	0	0	3
8.	17CSM08	C# and .Net frame work	17CSM02	3	3	0	0	3

CREDIT DISTRIBUTION

SEM	HS	BS	PC	ES	EEC	PSE	OE	TOTAL
I	3	11	-	7	-	-	-	**21**
II	3	11	-	10	-	-	-	**24**
III	-	3	16	3	-	-	-	**22**
IV	3	3	16	-	-	-	-	**22**
V	-	-	16	-	-	6	-	**22**
VI	-	-	9	2	0	9	-	**20**
VII	-	-	10	-	4	3	3	**20**
VIII	-	-	-	-	8	3	3	**14**
TOTAL	**9**	**28**	**64**	**22**	**12**	**24**	**6**	**165**
%	**5.5**	**17.0**	**38.8**	**13.3**	**7.3**	**14.5**	**3.6**	
AICTE %	**5-10**	**15-20**	**30-40**	**15-20**	**-**	**10-15**	**5-10**	

TOTAL CREDITS (21+24+22+22+22+20+20+14) = 165 CREDITS

17CSC10 THEORY OF COMPUTATION					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 17MYB08		**QUESTION PATTERN: TYPE - III**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the basic concepts in theoretical computer science.	**1.1**	The students will be able to explain the key properties of formal languages and finite automata	**a,c,j,k,l**
2.0	To comprehend complex concepts and formal proofs in theoretical computer science in order to improve reasoning and problem solving skills.	**2.1**	The students will be able to design and describe the strings recognized by regular languages.	**a,c,j,k,,**
3.0	To learn about context free grammar and how to develop context free grammar based on different normal forms.	**3.1**	The students will be able to construct the context-free grammars and explain the languages accepted by CFG	**a,b,c,j,k,l**
4.0	To study about the turing machine and push down automata.	**4.1**	The students will be able to design a turing machine and push down automata that accomplish a specific task.	**a,b,c,k,l**
5.0	To learn about the different classes of problem.	**5.1**	The students will be able to explain the undecidable and intractable classes of problems	**a,b,c,k,l**

UNIT I - AUTOMATA	**(9)**
Introduction to finite automata(FA) – Central concepts of automata theory – Deterministic finite automata – Non deterministic finite automata – Finite automata with epsilon transitions – Equivalence between epsilon NFA and DFA - Minimization of automata.	
UNIT II - REGULAR EXPRESSIONS	**(9)**
Regular expressions(RE) - Manipulation of regular expressions - Equivalence between RE and FA - Inter conversion - Pumping lemma - Closure properties of regular sets – Decision properties of Regular Languages.	
UNIT III - CONTEXT FREE GRAMMAR	**(9)**
Context free Grammars (CFG) - Derivation trees - Ambiguity in Context-Free Grammars - Applications of Context Free Grammars - Normal Forms - Chomsky Normal Form (CNF) - Greibach Normal Form (GNF).	
UNIT IV - PUSH DOWN AUTOMATA AND TURING MACHINE	**(9)**
Push Down Automata (PDA) – Languages of PDA – Equivalence of PDA's and CFG's - Turing Machine, Programming techniques of Turing Machine – Types of Turing Machine.	
UNIT V -CLASSES OF PROBLEMS	**(9)**
A language that is not Recursively Enumerable – Universal Turing Machine – Rice's Theorem and properties of the Recursively Enumerable Languages – Post's Correspondence Problem (PCP) – The Classes P and NP – An NP Complete Problem.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman," Introduction to Automata Theory, Languages, and Computation", 3rd ed., Pearson, 2013.
2. John C Martin, "Introduction to Languages and the Theory of Computation", 4th ed., Tata McGraw Hill Publishing Company, New Delhi, 2010

REFERENCES:

1. Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education 2009.
2. Lewis H.P. & Papadimitriou C.H.,” Elements of Theory of Computation”, Prentice Hall of India, 4th ed., 2007.
3. Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Prentice Hall of India, New Delhi, 3rd ed., 2004.
4. Harry R Lewis, Christos H Papadimitriou, “Elements of the Theory of Computation”, Prentice Hall of India/ Pearson Education, New Delhi, 2nd ed., 2003.

17ITC09 INTERNET AND WEB PROGRAMMING (Common to CSE and IT Branches)				
L	T	P	C	
2	0	2	3	
PRE REQUISITE : 17ITC01	**QUESTION PATTERN: TYPE - I**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To discuss the concepts of HTML 5 and CSS.	**1.1**	The students will be able to design a web page using HTML 5 and CSS	**a,c,d,e,f,g,i,k,l**
2.0	To infer the basics of JavaScript	**2.1**	The students will be able to make use of JavaScript client side coding	**a,b,c,d,e,f,g,i, k,l**
3.0	To know about basics Java Servlets	**3.1**	The students will be able to apply servlets for their web development	**a,b,c,d,e,f,g,i, k,l**
4.0	To know about basic concepts of JSP	**4.1**	The students will be able to make use of JSP	**a,b,c,d,e,f,g,i, k,l**
5.0	To know about XML and Web services	**5.1**	The students will be able to make use of XML and Web Services	**a,b,c,d,e,f,g,i, k,l**

UNIT I - HTML 5 and CSS	**(6+6)**
HTML Elements –HTML Forms – Introduction to HTML5 new elements – Semantic elements- CSS-Features–Syntax–Box Model- Selectors – Display Positioning – CSS Floats – CSS Colors – CSS text fonts	
UNIT II -JAVASCRIPT	**(6+6)**
JavaScript Introduction - Basic Elements - Variable - Data Types - Operators and Literals – Functions -Objects-Arrays–Built-in- Object – Event Handling – Validation	
UNIT III - SERVLETS	**(6+6)**
Java Servlets: Architecture–Overview – Servlet Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies	
UNIT IV - JSP	**(6+6)**
JSP: Overview –Basic JSP: Architecture- Lifecycle– Directives – Actions- Implicit Objects– Java Beans Classes and JSP – MVC Paradigm	
UNIT V - XML and WEB SERVICES	**(6+6)**
XML: Namespaces- XML Processing- -XML Documents- XSL – XSLT; Web Services: WSDL-XML Schema–Introduction to SOAP	

1. Programs with HTML and CSS.
2. Programs with Java script.
3. Programs on basic JSP tags
4. Programs for creating web applications using JSP.
5. Programs on HTTP Servlet.
6. Programs for creating web application using Servlets.
7. Creation of 3 tier Application.
8. Programs on XML

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE:

1. System with 1 GB RAM minimum.

SOFTWARE:

1. OS – Windows 7 or higher
2. Notepad++
3. Net beans

TOTAL (L: 30+P:30) = 60 PERIODS

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Deitel Deitel Nieto, “Internet &World Wide Web How To Program”, Prentice Hall, 5th ed., 2012.

REFERENCES:

1. Thomas A. Powell, “The Complete Reference HTML &CSS”, New Riders, 5th ed., 2010.
2. Steve Suehring, “JavaScript– Step by Step”, PHI, 2nd ed., 2010.
3. https://www.w3schools.com
4. https://www.tutorialspoint.com/jsp

17CSC11 OBJECT ORIENTED SOFTWARE ENGINEERING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 17CSC07	**QUESTION PATTERN: TYPE - I**				

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn about software engineering concepts and object modeling.	**1.1**	The student will be able to explain software development activites.	**a,c,d,g,j,k,l**
2.0	To perceive knowledge on requirement analysis	**2.1**	The student will be able to gather and analyze user's requirements for the given product.	**a,b,c,d,e,h,i,j, k,l**
3.0	To acquire knowledge on system design.	**3.1**	The students will be able to identify and apply appropriate system design.	**a,b,c,d,e,f,g,i,j ,k,l**
4.0	To study and learn how to reuse Design Patterns and specify interfaces.	**4.1**	The students will be able to apply Design Patterns and Interfaces.	**a,b,c,d,e,f,g,h, i,j,k,l**
5.0	To learn various levels of testing	**5.1**	The students will be able to formulate and employ different testing strategies.	**a,b,c,d,e,f,g,h, i,j,k,l**

UNIT I - INTRODUCTION	**(9)**
Introduction – Software Engineering Concepts – Development Activities – Managing Software Development – Modelling with UML.	
UNIT II - ANALYSIS	**(9)**
Requirements Elicitation – Concepts – Activities – Management – Analysis concepts – Analysis Activities – managing analysis.	
UNIT III - SYSTEM DESIGN	**(9)**
Decomposing the system – Overview of System Design – System Design Concepts – System Design Activities – Addressing Design Goals – Managing System Design.	
UNIT IV- OBJECT DESIGN	**(9)**
Reusing Pattern Solutions – Overview of object design – reuse concepts – reuse activities – managing Reuse – Specifying Interfaces – Overview – Interface Specification concepts – Interface Specification activities.	
UNIT V- MAPPING MODELS TO CODE AND TESTING	**(9)**
Overview of Mapping - Mapping concepts – mapping activities – Manage implementation – Overview of Testing – Testing concepts – Testing activities – Managing testing.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Bernd Bruegge & Allen H. Dutoit, "Object-Oriented Software Engineering", 3nd ed., Pearson Education, 2014.

REFERENCES:

1. Timothy C. Lethbridge, Robert Laganiere, Object Oriented Software Engineering, Tata McGraw-Hill, 6th ed., reprint, 2008.
2. Stephen Schach, "Object Oriented and Classical Software Engineering 6th ed., McGraw-Hill, 2005.

17CSC12 GRAPHICS AND MULTIMEDIA					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		**QUESTION PATTERN: TYPE - I**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To introduce the graphics model with the help of basic algorithms and methodologies.	**1.1**	The students will be able to explain the fundamentals of Graphics	**a,b,c,d,e,f,g,h,i,l**
2.0	To equip students with fundamental knowledge and basic technical competence in the field of computer graphics.	**2.1**	The students will be able to design two dimensional and three dimensional graphic transformations.	**a,b,c,d,e,f,g,h,i,l**
3.0	To provide an understanding of color models and surface detection methods.	**3.1**	The students will be able to detect the hidden surfaces and relate color models with graphics.	**a,b,c,d,e,f,g,h,i,l**
4.0	To enable students to acquire knowledge in Gimp Installation.	**4.1**	The students will be able to explain the techniques of image editing.	**a,b,c,d,e,f,g,h,i,l**
5.0	To learn the Color correction and Restoration.	**5.1**	The students will be able to manipulate an image.	**a,b,c,d,e,f,g,h,i,l**

UNIT I - FUNDAMENTALS	**(9)**
Introduction to Computer Graphics – Raster and vector graphics systems – Output primitives – Points and lines – Line drawing algorithms –Loading the frame buffer – Line function – Circle and ellipse generating algorithms – Pixel addressing and object geometry – Filled area primitives – Anti-aliasing	
UNIT II - 2D-3D REPRESENTATION AND MANIPULATION	**(9)**
2D Transformation: Translation, rotation, scaling, reflection and shearing – Matrix and homogeneous coordinates – Composite 2D transformations – 2D Viewing – Clipping: line, polygon and text clipping. 3D Transformation: Translation, rotation, scaling, reflection, shearing – Composite 3D transformation – 3D Viewing – Projection – 3D clipping	
UNIT III - VISIBLE SURFACE DETECTION AND COLOR MODELS	**(9)**
Back face detection – Depth buffer method – A-Buffer method -Scan line method – Depth sorting method – BSP – Tree method – Area Subdivision method – Octree method – Ray casting – Curved surfaces – Wireframe methods – Visibility Detection Functions – Color Models – RGB, CMY, HSV, HLS, CIE models.	
UNIT IV – INTRODUCTION TO GIMP	**(9)**
Downloading and Installing Gimp – Gimp Interface – Image Menu – Image Navigation Bar –Toolbox and Important tool Functions – Working with Layers – Digitizing Large Images – Scanning Slides and Negatives–Straightening and Cropping your Images–Correcting Tone And Exposure : Common Tonal Problems –The Brightness –Contrast Dialog–Tonal Corrections Using Levels, Curves, Layer Blend Modes.	
UNIT V – COLOR CORRECTION AND RESTORATION	**(9)**
Color essentials – Correcting Color Casts - Correcting And Restoring Color – Converting Color into Black and White – Digital Sepia Toning – Selective Colorizing – Colorizing Black and White Images Case Study : Image Editing	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Donald Hearn and Pauline Baker, “Computer Graphics”, Prentice Hall, New Delhi, 2nd ed., 2012.
2. Phillip Whitt, “Beginning Photo Retouching & Restoration Using GIMP”, Apress Publisher , 2014..

REFERENCES:

1. Ranjan Parekh, “Principles of Multimedia”, Tata McGraw-Hill, 2013.
2. Jan Smith, Roman Joost, “GIMP for Absolute Beginners”, Apress Publisher ,2012

17CSP07 CASE TOOLS LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To have a knowledge on problem analyzing.	**1.1**	The students will be able to outline the project scope and objectives.	**a,b,c,i,k,l**
2.0	To learn how to identify objects and their relationships.	**2.1**	The students will be able to write the software requirement analysis.	**a,b,e,i,k,l**
3.0	To get familiarized on object oriented design process.	**3.1**	The students will be able to create Data Modeling.	**a,b,c,d,k,l**
4.0	To know the project module development using tools.	**4.1**	The students will be able to develop and debug the projects.	**a,b,c,d,e,g,i,k,l**
5.0	To gain experience on writing test cases.	**5.1**	The students will be able to generate test cases using testing strategies.	**a,b,d,g,i,k,l**

Prepare the following documents for the project and develop the software using software engineering methodology.

1. Problem Analysis and Project Planning - study of the problem, Identify project scope, Objectives, and Infrastructure.
2. Software Requirement Analysis - Phases/ modules of the project, Identify deliverables.
3. Data Modeling - use work products, data dictionary and UML diagrams.
4. Software Development and Debugging.
5. Software Testing - Prepare test plan, perform validation testing, coverage analysis, develop test case hierarchy, Site check and site monitor.

LIST OF PROJECTS:

1. Passport automation system.
2. Book bank.
3. Exam Registration and result system.
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing.
7. Expert System for Medical Diagnosis System
8. Credit card processing.
9. Payroll System.
10. Student Information System.

SOFTWARE TOOLS:

1. Rational Suite 30 user License
2. Open Source Alternatives: ArgoUML, VisualParadigm
3. Eclipse IDE and JUnit, Selenium
4. PCs 30

TOTAL (P:60) = 60 PERIODS

17CSP08 GRAPHICS AND MULTIMEDIA LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To learn algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc.	**1.1**	The students will be able to draw basic shapes such as lines, circle and ellipse.	**a,b,c,d,e,f,g,h,i,l**
2.0	To understand the need of developing graphics applications.	**2.1**	The students will be able to execute processing of basic shapes by various algorithms and techniques.	**a,b,c,d,e,f,g,h,i,l**
3.0	To learn the representation and transformation of graphical images and pictures.	**3.1**	The students will be able to apply the transformations to the basic shapes and various clipping algorithms.	**a,b,c,d,e,f,g,h,i,l**
4.0	To illustrate the impact of animations.	**4.1**	The students will be able to design animation sequences using Open source animation Softwares.	**a,b,c,d,e,f,g,h,i,l**
5.0	To know the impact of videos.	**5.1**	The students will be able to create videos using video editing Softwares.	**a,b,c,d,e,f,g,h,i,l**

LIST OF EXPERIMENTS :

1. Implementation of Line Drawing Algorithms
    a) DDA
    b) Bresenham's
2. Implementation of Bresenham's Circle and Ellipse Generation Algorithm
3. Implementation of Two Dimensional Transformations
4. Implementation of Cohen-Sutherland Line Clipping Algorithm
5. Implementation of 3D Transformations
6. Basic Operations on the Image using image manipulation software.
    a) Selection Tool
    b) Color Tool
    c) Brush Tool
    d) Clone Tool
    e) Blur
    f) Scale Tool
7. Animation using 2D Animation Software.
    a) Tweening
8. Video Editing.

SOFTWARE REQUIRED:

1. Turbo C Software
2. Gimp,Paint .Net,etc.
3. Tupi 2d Animation, Synfig,etc.
4. Video editor – Movie maker, Virtual dub,etc.

TOTAL (P: 60) = 60 PERIODS

17CSC14 CLOUD COMPUTING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		QUESTION PATTERN: TYPE - I			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes		Related Program outcomes	
1.0	To learn the basic concepts of the cloud.	1.1	The students will be able to recall and describe cloud Platform and Technology.	a,j,l	
2.0	To be familiar with the architecture and virtualization of cloud.	2.1	The students will be able to describe and Implement Virtualization Technologies.	a,e,j,l	
3.0	To describe the key elements of Cloud Platform and Thread Programming.	3.1	The students will be able to develop and manage cloud applications using Aneka.	a,b,c,e,j,l	
4.0	To explore the concepts of Map Reduce Programming.	4.1	The students will be able to create a Hadoop Environment and Generate a Map- Reduce Programming.	a,b,c,e,j,l	
5.0	To design intelligent Cloud services and Applications.	5.1	The students will be able to design Web Based Applications for various Corporate.	a,b,c,d,e,i,j,k,l	

UNIT I - INTRODUCTION	**(9)**
Introduction: Cloud computing at a Glance – Historical Development – Building Cloud Computing Environments – Computing Platform and Technologies – Principles of Parallel and Distributed Computing: Elements of parallel Computing – Distributed Computing –Technologies of Distributed Computing.	
UNIT II - VIRTUALIZATION AND CLOUD COMPUTING ARCHITECTURE	**(9)**
Virtualization: Introduction – Characteristics of Virtualized Environments – Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Technology Examples – Cloud Computing Architecture: Cloud reference model – Types of the Clouds – Open Challenges.	
UNIT III - HADOOP AND MAP REDUCE	**(9)**
Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/O - Developing a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features– Hadoop Cluster Setup – Administering Hadoop.	
UNIT IV – SECURITY IN THE CLOUD	**(9)**
Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images.	
UNIT V - CLOUD PLATFORMS AND APPLICATIONS	**(9)**
Cloud Platforms in Industry: Amazon Web Services – Google AppEngine – Microsoft Azure – Cloud Application: Scientific Applications – Business and consumer Applications – Case Study – Cloud Deployment Tools: Eucalyptus, Open Nebula.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, “Mastering in Cloud Computing”, McGraw Hill Education (India) Private Limited, 2013.
2. Thomas Erl, ZaighamMahood, Ricardo Puttini, “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, 2013.

REFERENCES:

1. Anthony T Velte, “Cloud Computing: A Practical Approach”, Tata McGraw Hill, 2009.
2. Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, “Cloud Computing for Dummies”, Wiley India, 2009.
3. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing Principles Books and Paradigms”, Wiley, 2014.
4. Michael Miller , “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing ,2009
5. Dr. Kumar Saurabh, “Cloud Computing – Unleashing Next Gen Infrastructure to Application”, Willey, 2014.

17CSC15 SECURITY IN COMPUTING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 17CSC07, 17CSC08		**QUESTION PATTERN: TYPE - I**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To understand the basics of cryptography	**1.1**	The students will be able to summarize various cryptographic algorithms	**a,d,e,f,i,l**	
2.0	To learn to find the vulnerabilities in programs and how to overcome them	**2.1**	The students will be able to secure the programs from unauthorized access	**a,b,c,f,l**	
3.0	To know the different kinds of security threats in networks and solutions to solve them	**3.1**	The students will be able to employ security mechanism in networks	**a,f,i,j,l**	
4.0	To learn the different kinds of security issues in databases and recovery system also	**4.1**	The students will be able to apply security mechanisms to Secure databases	**a,c,f,i,j,l**	
5.0	To study about legal and ethical issues in computer security	**5.1**	The students will be able to differentiate various security models and standards	**f,g,h**	
UNIT I - ELEMENTARY CRYPTOGRAPHY					**(9)**
Terminology and Background – Substitution Ciphers – Transpositions – Making Good Encryption Algorithms- Data Encryption Standard- AES Encryption Algorithm – Public Key Encryption – Cryptographic Hash Functions – Key Exchange – Digital Signatures – Certificates.					
UNIT II - SECURITY IN PROGRAMS AND OPERATING SYSTEMS					**(9)**
Secure programs – Non-malicious Program Errors – Viruses – Targeted Malicious code – Controls Against Program Threat – Control of Access to General Objects – User Authentication – Designing Trusted Operating System – Security Policies – Models of Security – Trusted Operating System Design – Assurance in Trusted Operating System.					
UNIT III - SECURITY IN NETWORKS					**(9)**
Threats in networks – Encryption – Virtual Private Networks – PKI – SSH – SSL – IPSec – Content Integrity – Access Controls – Wireless Security – Honeypots – Traffic Flow Security – Firewalls – Intrusion Detection Systems – Secure e-mail.					
UNIT IV - SECURITY IN DATABASES					**(9)**
Security requirements of database systems – Reliability and Integrity in databases – Two Phase Update – Redundancy/Internal Consistency – Recovery – Concurrency/Consistency – Monitors – Sensitive Data – Types of disclosures – Inference.					
UNIT V - LEGAL AND ETHICAL ISSUES IN COMPUTER SECURITY					**(9)**
Protecting Programs and Data – Information and the Law – Rights of Employees and Employers – Redress for Software Failures – Computer Crime – Ethical Issues in Computer Security – Case study in Ethics.					
TOTAL (L:45) = 45 PERIODS					
TEXT BOOK: 1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th ed., Prentice Hall, 2015. 2. Matt Bishop, "Introduction to Computer Security", Addison-Wesley, 2004.					
REFERENCES: 1. William Stallings, "Cryptography and Network Security: Principles and Practices", 5th ed., Prentice Hall, 2010. 2. https://www.owasp.org/index.php/Top_10_2010.					

17CSC16 PRINCIPLES OF COMPILER DESIGN				
L	T	P	C	
3	0	0	3	

PRE REQUISITE : 17CSC10 | **QUESTION PATTERN: TYPE - III**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To learn the design principles of a Compiler	1.1	The students will be able to describe different phases of a Compiler and its applications	a,b,c,d,l
2.0	To understand, design and implement the different parsing techniques.	2.1	The students will be able to build parsers for syntax analysis using context free grammars.	a,b,c,d,l
3.0	To learn and design intermediate code generation schemes	3.1	The students will be able to create intermediate code for programming constructs.	a,b,c,d,l
4.0	To learn about the code generation techniques.	4.1	The students will be able to develop the code.	a,b,c,d,l
5.0	To learn how to optimize and effectively generate machine codes.	5.1	The students will be able to analyze and optimize the code to design a compiler.	a,b,c,d,l

UNIT I – INTRODUCTION AND LEXICAL ANALYSIS **(9)**

Introduction to Compiling- Compilers - Analysis of the source program - The phases - Cousins - The grouping of phases - Compiler construction tools. The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens - A language for specifying lexical analyzer.

UNIT II - SYNTAX ANALYSIS **(9)**

Syntax Analysis - The role of a parser - Context free grammar - Top down parsing– Recursive descent parsing, Predictive parsing - Bottom up parsing - Shift Reduce Parsing - Operator Precedence Parsing - LR parsers - SLR Parser, CLR Parser and LALR Parser.

UNIT III - INTERMEDIATE CODE GENERATION **(9)**

Intermediate languages - Declarations - Assignment statements - Boolean expressions - Case statements – Back patching - Procedure calls

UNIT IV - CODE GENERATION **(9)**

Issues in the design of a code generator- The target machine-Run-time storage management-Basic blocks and flow graphs- Next-use information-A simple code generator-Register allocation and assignment-The dag representation of basic blocks - Generating code from dags

UNIT V - CODE OPTIMIZATION **(9)**

Introduction-The principle sources of optimization-Peephole optimization- Optimization of basic blocks-Loops in flow graphs- Introduction to global data - flow analysis - Code improving transformations.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, “Compilers – Principles, Techniques, and Tools”, Pearson Education Asia, 2013.

REFERENCES:

1. Steven S. Muchnick, “Advanced Compiler Design & Implementation”, Morgan Kaufmann Publishers, 2003.
2. C. N. Fisher and R. J. LeBlanc “Crafting a Compiler with C”, Pearson Education, 2011.

17CSP09 INTERNET OF THINGS LABORATORY
(Common to CSE and IT Branches)

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the fundamentals of LED and light intensity control.	**1.1**	Studentswill be able to acquire knowledge about Arduino, LED and control intensity of light.	**a,k,l**
2.0	To understand about the components such as Buzzer and LCD.	**2.1**	Students will be able to implement buzzer and LCD in applications.	**a,k,l**
3.0	To understand how to work with sensors such as temperature and LDR.	**3.1**	Students will be able to implement LM35sensor, LDR in applications.	**a,b,c,e,k,l**
4.0	To understand about key input and servo motor.	**4.1**	Students will be able to implement the way to blink LED through key input and working with servo motor.	**a,b,c,k,l**
5.0	To understand the concept NODEMCU with app and sensor value to upload in Cloud.	**5.1**	Students will be able to implement applications with NODEMCU with Blynk app and upload sensor value in Cloud.	**a,b,c,d,e,g,j,k,l**

LIST OF EXPERIMENTS

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

HARDWARE OR SOFTWARE REQUIREMENT:

HARDWARE:

1. 36 nodes with WiFi connection or Standalone PCs
2. Temperature sensor, LDR, LCD, Servo motor, Buzzer, LEDs, Arduino Board, IoT Core board, ESP01 ESP8266.

SOFTWARE:

Arduino 1.8.5
Arduino Library

TOTAL (P: 60) = 60 PERIODS

17CSC17 MOBILE COMPUTING				
L	T	P	C
3	0	0	3

PRE REQUISITE : 17CSC08 | **QUESTION PATTERN: TYPE - I**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the basic concepts of mobile computing.	**1.1**	The students will be able to explain the basics of mobile telecommunication system	**a,b,i,j,k**
2.0	To be familiar with the network protocol stack	**2.1**	The students will be able to choose the required functionality at each layer for given application	**a,b,c,i,j,k**
3.0	To learn the basics standards of mobile telecommunication system.	**3.1**	The students will be able to identify different standards of mobile communication systems	**a,b,i,j,k**
4.0	To be expressed to Ad-Hoc networks.	**4.1**	The students will be able to use simulation tools and design Ad hoc networks	**a,b,d,i,j,k**
5.0	To gain knowledge about different mobile platforms and application development.	**5.1**	The students will be able to develop a mobile application.	**a,b,d,i,j,k**

UNIT I - MOBILE COMPUTING AND WIRELESS NETWORKING	**(9)**
Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications –Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols –Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	
UNIT II - MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER	**(9)**
Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – Route Optimization – Overview of TCP/IP– Architecture of TCP/IP – Adaptation of TCP Window – Improvement in TCP Performance.	
UNIT III - MOBILE TELECOMMUNICATION SYSTEM	**(9)**
Cellular Mobile Communication –Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	
UNIT IV - MOBILE AD–HOC NETWORKS	**(9)**
Ad- Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing–Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET)–MANET Vs VANET – Security .	
UNIT V - MOBILE PLATFORMS AND APPLICATIONS	**(9)**
Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – Mobile Commerce– Structure – Pros & Cons – Mobile Payment System – Security Issues.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

REFERENCES:

1. Jochen H. Schller, “Mobile Communications”, 2nd ed., Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt. Ltd., 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
4. William.C.Y.Lee, “Mobile Cellular Telecommunications– Analog and Digital Systems”, 2nd ed., Tata McGraw Hill Edition, 2006.
5. C.K.Toh, “Ad-Hoc Mobile Wireless Networks”, 1st ed., Pearson Education, 2002.
6. Android Developers : http://developer.android.com/index.html
7. Apple Developer : https://developer.apple.com/
8. Windows Phone Dev Center : http://developer.windowsphone.com

17ITC15 MACHINE LEARNING TECHNIQUES					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 17MYB01		**QUESTION PATTERN: TYPE - III**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To introduce the basic concepts and techniques of Machine Learning	**1.1**	The students will be able to explain the concepts of supervised, unsupervised and semi-supervised learning	**a,b**
2.0	To have a thorough understanding of the Supervised and Unsupervised learning techniques.	**2.1**	The students will be able to apply the appropriate machine learning strategy for any given problem	**b,c,e,i,j,k,l**
3.0	To study the various probability based learning techniques	**3.1**	The students will be able to suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem	**b,c,e,i,j,k,l**
4.0	To study the evolutionary models and genetic algorithm for machine learning	**4.1**	The students will be able to design systems that uses the appropriate graph models of machine learning	**b,c,d,f,i,j,k,l**
5.0	To understand graphical models of machine learning algorithms	**5.1**	The students will be able to modify existing machine learning algorithms to improve classification efficiency	**b,c,d,f,i,j,k,l**

UNIT I - INTRODUCTION	**(9)**
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.	
UNIT II - LINEAR MODELS	**(9)**
Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.	
UNIT III - TREE AND PROBABILISTIC MODELS	**(9)**
Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.	
UNIT IV - DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS	**(9)**
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.	
UNIT V - GRAPHICAL MODELS	**(9)**
Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Stephen Marsland, "Machine Learning – An algorithmic perspective", 2nd ed., Chapman and Hall/CRC Machine learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, "Machine Learning", 1st ed., McGraw Hill Education India Ltd, 2013.

REFERENCES:

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st ed., Cambridge University Press, 2012.
2. Jason Bell, "Machine learning –Hands on for Developers and Technical Professionals", 1st ed., Wiley, 2014.
3. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", 3rd ed., MIT Press, 2014.

17CSP10 MOBILE COMPUTING LABORATORY				
L	T	P	C	
0	0	2	1	

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To know the components and structure of mobile application development frameworks.	**1.1**	The students will be able to understand the fundamentals and various computational processing of mobile applications	**a,c,d,i,k**
2.0	To learn how to work with various mobile application development frameworks.	**2.1**	The students will be able to apply specifications and functionalities of various protocols/ standards of mobile applications.	**a,c,i,j,k**
3.0	To learn familiar with the capabilities and limitations of mobile devices.	**3.1**	The students will be able to implement the design using Android SDK and using Objective C and iOS.	**a,c,i,k**
4.0	To know how develop the Android and Windows OS based Mobiles.	**4.1**	The students will be able to design and Implement various mobile applications using emulators.	**a,c,d,i,k**
5.0	To learn how works android in different mobiles.	**5.1**	The students will be able to deploy applications to hand-held devices.	**a,c,i,j,k**

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement Multi-threading application.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Create a mobile alarm clock application.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development. Tools with appropriate emulators and debuggers - 30 Nos.

TOTAL (P:30) = 30 PERIODS

17CSD01 PROJECT WORK - I				
	L	T	P	C
	0	0	8	4

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To identify the problem in the specific domain or enhance the existing product to the next level.	**1.1**	The students will be able to demonstrate a sound technical knowledge of their selected project topic.	**a, b, l**
2.0	To learn how to formulate solution for the problem.	**2.1**	The students will be able to undertake problem formulation and solution legally for the sustainable development.	**c, d, e, g, h**
3.0	To be trained to function effectively as an individual and a member in diverse teams.	**3.1**	The students will be able to develop an attitude of team work and independent working on real time problems.	**h, i**
4.0	To interpret and justify the experimental results	**4.1**	The students will be able to design engineering solutions to complex problems based on engineering and management principles.	**c, d, e, k**
5.0	To develop an effective communication and be trained to write dissertation report	**5.1**	The students will be able to communicate with engineers and the community at large in written and oral forms.	**f, j**

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P:120) = 120 PERIODS

17CSD02 PROJECT WORK II					
			L	T	P	C
			0	0	16	8
PRE REQUISITE : 17CSD01					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To identify the problem in the specific domain or enhance the existing product to the next level.	**1.1**	The students will be able to demonstrate a sound technical knowledge of their selected project topic.	**a, b, l**	
2.0	To learn how to formulate solution for the problem	**2.1**	The students will be able to undertake problem formulation and solution legally for the sustainable development.	**c, d, e, g, h**	
3.0	To be trained to function effectively as an individual and a member in diverse teams.	**3.1**	The students will be able to develop an attitude of team work and independent working on real time problems.	**h, i**	
4.0	To interpret and justify the experimental results	**4.1**	The students will be able to design engineering solutions to complex problems based on engineering and management principles.	**c, d, e, k**	
5.0	To develop an effective communication and be trained to write dissertation report	**5.1**	The students will be able to communicate with engineers and the community at large in written and oral forms.	**f, j**	

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work (same title as in project work-I if the same project is continued in project work-II or the title will be selected based on different project) is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P:240) = 240 PERIODS

17CSX05 NETWORK ANALYSIS AND MANAGEMENT				
L	T	P	C
3	0	0	3

PRE REQUISITE : 17CSC08 | **QUESTION PATTERN: TYPE - I**

COURSE OBJECTIVES AND OUTCOMES:

	Course objectives		Course outcomes	Related program outcomes
1.0	To be familiar with basics of network design and requirement analysis.	1.1	The students will be able to explain basics of network design and requirement analysis.	a,b,c,e,g,h,i, j,l
2.0	To understand the network flow analysis.	2.1	The students will be able to apply a range of techniques for characterizing network structure.	a,b,c,i,j,k,l
3.0	To be aware of network logical design.	3.1	The students will be able to explain the methodologies for developing logical design of networks.	a,b,c,e,f,g,h, i,j,k,l
4.0	To understand network management and security concepts.	4.1	The students will be able to explore the network management and security concepts.	a,b,c,d, g,h,i,j,k,l
5.0	To understand network physical design and routing.	5.1	The students will be able to apply network physical design and routing for building networking applications.	a,b,c,d,e,f, h,j,k,l

UNIT I - A SYSTEM APPROACH TO NETWORK DESIGN AND REQUIREMENT ANALYSIS **(9)**

Introduction- Overview Of Analysis, Architecture And Design Process –System Methodology - System Description - Service Description - Service Characteristics-Performance Characteristics; User Requirements-Application Requirements-Device Requirements-Network Requirements –Requirement Analysis: Guidelines –Requirements Gathering And Listing-Developing Service Metrics To Measure Performance –Characterizing Behavior-Developing RMA Requirements.

UNIT II - FLOW ANALYSIS: CONCEPTS, GUIDELINES AND PRACTICE **(9)**

Background-flows-identifying and developing flows- data sources and sinks-flow model – flow prioritization – flow specification- examples of applying flow specs-case study.

UNIT III - NETWORK ARCHITECTURE **(9)**

Background- component architectures-reference architecture-architecture models- systems and network architectures; addressing and routing architecture-addressing mechanisms-routing mechanisms-address strategies-routing strategies- architectural considerations.

UNIT IV- MANAGEMENT ARCHITECTURE AND PERFORMANCE ARCHITECTURE **(9)**

Network Management Mechanisms- Architectural Considerations; Performance Architecture-Goals- Performance Mechanisms-Architectural Considerations

UNIT V - SECURITY, PRIVACY AND NETWORK DESIGN **(9)**

Developing a security and privacy plan- security and privacy administration- security and privacy mechanisms-architectural considerations; design concepts- design process- vendor, equipment and service-provider evaluations-network layout- design traceability- design metrics.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. James. D. Mccabe, “Practical Computer Network Analysis and Design”, 3rd ed., Morgan Kaufaman, 2014.

REFERENCES:

1. J. Radz,”Fundamentals of computer network analysis and engineering: basic approaches for solving problems in the networked computing environment”, universe, 2005.
2. Laura Chappell and Gerald Combs, “Wireshark 101: Essential Skills for Network Analysis”, Kindle Edition, 2013.

17CSX11 HUMAN COMPUTER INTERACTION			
L	T	P	C
3	0	0	3

PRE REQUISITE : 17CSC08	QUESTION PATTERN: TYPE - I

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To explain the fundamentals of human computer interaction.	**1.1**	The students will be able to explain the capabilities of both humans and computers from the viewpoint of human information processing	**a,c,d,e,h,i,j,l**
2.0	To create awareness on various models for interaction.	**2.1**	The students will be able to describe the typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms	**a,b,d,e,i,j,l**
3.0	To learn the design techniques and fundamentals of Human Computer Interaction (HCI).	**3.1**	The students will be able to apply an interactive design process, standards, guidelines and universal design principles to designing HCI systems.	**c,e,h,k,l**
4.0	To know the various types of existing interfaces and evaluation techniques.	**4.1**	The students will be able to analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.	**e,h,j,l**
5.0	To implement the applications of HCI in emerging trends.	**5.1**	The students will be able to analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.	**c,d,e,g,k,l**

UNIT I - THE HUMAN AND COMPUTER	**(9)**
The Human: Introduction – Input – output Channels – Human memory – Thinking: reasoning and problem – solving – Individual differences – Psychology and the design of interactive systems – The computer: Introduction – Text entry devices – Positioning – pointing and drawing – Paper: printing and scanning – Memory – Processing and networks.	
UNIT II - INTERACTION AND INTERFACES	**(9)**
The Interaction: Introduction – Models of interaction – Frameworks and HCI – Ergonomics – Interaction styles – Elements of the WIMP interface – Interactivity – The context of the interaction – Experience – Engagement and fun – Paradigms: Introduction – Paradigm for interaction – Expressive interfaces – models of emotions – interface types.	
UNIT III - DESIGNING RULES	**(9)**
Interaction design basics: Introduction – The process of design – User focus – Scenarios – Navigation design – Screen design and layout – Iteration and Prototyping – HCI in the software process: Introduction – The software life cycle – Usability engineering – Iterative design and prototyping – Design rationale – Design rules: Introduction – Principles to support usability – Standards – Guidelines – Golden rules and heuristics – HCI patterns.	
UNIT IV - MODELS AND EVALUATION FRAMEWORK	**(9)**
Cognitive models: Introduction – Goal and task hierarchies – Linguistics models – The challenge of display – based systems – Physical and device models – cognitive architecture – Communication and collaboration model: Introduction – Face-to-face communication – Conversation – Text-based communication – Group working – Models of the system: Introduction – Standard formalisms – Interactive models – Continuous behavior.	
UNIT V - INTERFACING APPLICATIONS	**(9)**
Groupware: Introduction – Groupware systems – Computer-mediated communication – Meeting and decision support systems – Shared applications and artifacts – Frameworks for groupware – Implementing synchronous groupware – Hypertext – multimedia and the World Wide Web: Introduction – Understanding hypertext – Finding things – Web technology and issues – Static web content – Dynamic web content.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Alan Dix, Janet Finlay, Gregory D.Abowd and Russell Beale. Human - Computer Interaction, Prentice Hall, 3rd ed., 2004.

REFERENCES:

1. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. "Human - Computer Interaction", Addison Wesley, 1994.
2. Andrew Sears, Julie A. Jacko, "The Human-Computer Interaction Handbook Fundamentals, Evolving Technologies, and Emerging Applications", 2nd ed., Taylor & Francis Group, 2008.
3. Claude Ghaoui, "Encyclopaedia of Human Computer Interaction", Wiley Publications, 2000.

17CSX29 INTERNET OF THINGS (Common to CSE and IT Branches)					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 17CSC08		**QUESTION PATTERN: TYPE - I**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the microcontroller architecture and the basic issues, policy and challenges in the Internet	**1.1**	The students will be able to explain the internal architecture of microcontroller and the concepts and the cause of technology.	**a,k,l**
2.0	To understand the components and the protocols in Internet	**2.1**	The students will be able to classify the sensors and controller as part of IoT.	**a,b,c,e,j,k,l**
3.0	To build a communication technologies with the internet	**3.1**	The students will be able to plan a communication framework with fog computing.	**a,b,c,k,l**
4.0	To apply the various data analytical and visualization tools.	**4.1**	The students will be able to plan the data analytical and data visualization platforms	**a,b,c,d,e,g,j,k,l**
5.0	To learn to manage the security concerns in IoT.	**5.1**	The students will be able to discover knowledge on security in IoT.	**a,b,c,d,e,f,g,h,l**

UNIT I - INTRODUCTION TO IOT AND MICROCONTROLLER	**(9)**
Basics of Embedded Systems - Definition of IoT - Evolution of IoT - IoT and related terms – Key Drivers of IoT Discipline – The Diversity of IoT data sources – Architecture of 8051 – 8051 Addressing modes – Interfacing of LCD, Sensors and Servo motor – Popular M2M applications – Emerging IoT Flavors.	
UNIT II - ELEMENTS AND IOT GATEWAYS	**(9)**
Introduction to Elements of IoT - Sensors & Actuators - Gateways - Layered architecture of IoT - IoT Communication Model – 6LoWPAN – Mobile Technologies for IoT.	
UNIT III - COMPUTING AND CONNECTING TECHNOLOGIES	**(9)**
Cloud Computing in IoT – Introduction of Fog/Edge Computing – Use Cases of Fog/Edge computing - IoT Communication protocol requirements - BLE,ZigBee , Z-Wave - LPWAN – Sigfox - LoRa – Cloud Connectivity	
UNIT IV - DATA ANALYTICS AND IOT PLATFORMS	**(9)**
Big Data Analytics - Real Time and Streaming Analytics – Key Drivers for IoT Data analytics – Emergence of Edge Clouds – Renowned Edge Analytics Use Cases - Data Visualization Platform – Modules of IoT Data Analytics Platform – Renowned Use Cases for IoT Data Analytics.	
UNIT V - SECURITY CONCERNS OF IOT PLATFORM	**(9)**
Security Requirements of an IoT Infrastructure – AAA Framework – Security concerns of Cloud Platforms – Security concerns in IoT components – Smart Use Cases of IoT.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Pethuru Raj and Anupama C.Raman, "The Internet of Things – Enabling Technologies, Platforms and Use Cases", CRC Press, 2017.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd ed., Pearson education, 2011.

REFERENCE:

1. Raj Kamal, "Internet of Things Architecture and Design Principles", Tata McGraw Hill Edition, Tata McGraw Hill Publication, 2017.
2. Fortino, Giancarlo, Liotta, Antonio, "Internet of Things", Springer.

17ITX32 TEST DRIVEN PROGRAMMING (Common to AI&DS,IT & CSE)					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : Nil					
COURSE OBJECTIVES AND OUTCOMES:					
Course objectives		**Course outcomes**		**Related program outcomes**	
1.0	To understand Object Oriented Programming concepts and basic characteristics of Java	1.1	The students will be able to implement fundamental concepts of Java.	**a,b,c,e,g,h,i, j,l**	
2.0	To gain exposure about Abstract classes and collection framework	2.1	The students will be able to develop applications using Abstract classes and collection framework	**a,b,c,i,j,k,l**	
3.0	To develop a java application with multiple threads and to access database through Java programs, using Java Data Base Connectivity (JDBC)	3.1	The students will be able to access database through Java programs, using Java Data Base Connectivity (JDBC)	**a,b,c,e,f,g,h, i,j,k,l**	
4.0	Design and develop Web applications	4.1	The students will be able to Design and develop Web applications	**a,b,c,d, g,h,i,j,k,l**	
5.0	To know about Servlet, XML and AJAX	5.1	The students will be able to apply servlets and AJAX for their web development	**a,b,c,d,e,f, h,j,k,l**	

UNIT I - JAVA FUNDAMENTALS	**(9)**
Java Architecture, Environment Setup, Variables, Data Types, Assignment, Operators.**Flow Control Statements**: If statement, If--Else Statement, Nested--If Statement, Switch Statement, While Statement, For Loop Statement, Enhanced For Loop Statement, Do while loop, Break and Continue Statement. **Arrays:** One dimensional and Two Dimensional Array. **OOPS / Inheritance:** Classes and Objects, Constructor, Return Statements. Encapsulation/Abstraction, Inheritance, Overriding/Polymorphism, Method Overloading, Garbage Collection, String, String Buffer.**Eclipse Overview:** Creating packages, classes, Adding Jar Files, Setting eclipse Preferences, Refactoring renaming classes or interfaces	
UNIT II - COLLECTION AND ABSTRACTION	**(9)**
Abstraction /Packages / Exception Handling: Abstract Classes, Final Keyword, Packages-import, Interfaces, Introduction to Exception Handling, Exception types, Try and Catch Block, Throws, Throw clause, Finally clause, Runtime exception.**Wrapper Classes:** Autoboxing, Unboxing and Cloneable Interface. **I/O Streams:** Introduction to I/O, I/O Operations, Object Serialization. **Collection Framework:** Introduction to Collection, List, ArrayLists, LinkedLists, Sorting Lists, Using Iterators, Generics, Set, Map, HashMap, SortedMaps, Using Custom Objects, Map	
UNIT III - TEST CASES AND DATABASE CONNECTIVITY	**(9)**
Junit: Introduction to Junit, Junit Features, Junit with Eclipse, Assert Methods, Annotations, Test Suite, Introduction to Mockito. **Multithreading I / II:** Introduction to Multithreading, Thread Creation-Thread class and Runnable Interface,Thread Control and Priorities, Thread Synchronization.**RDBMS / SQL / JDBC:** Introduction to RDBMS, Oracle 11g Introduction, Select Statement, Restricting and Sorting Data, DML, DDL, Introduction to JDBC, Establishing Connection, Executing Query and Processing Results, Meta data & Prepared Statement, Using Callable Statement and Transactions	

UNIT IV- ANT,HTML & JAVASCRIPT	(9)
ANT: Introduction to ANT, Building sample java projects. **HTML :** Introduction to HTML and its elemets, Basic Tags, Basic Elements, Formatting Tags, Layout tags and Semantic Tags, Tables, Forms and Frames, Style and div tags, Introduction to HTML5. **JavaScript / CSS:** Introduction to CSS, Styles and Style sheets, Formatting with CSS, Links and Lists, CSS Box Model, CSS3, Introduction to Javascripts, JS Functions, JS Strings, JS Events, JS Objects, JS Validations, JS Regular Expressions, Introduction to Bootstrap, Formatting and styling using Boostrap, Table, Bootstrap Grid System.	
UNIT V - SERVLET, XML AND AJAX	**(9)**
Servlets and JSP: Introduction to Servlets, Servlet-Get and Post Requests, Servlet Config and Servlet Context, Servlet-Cookies and Session Management, Introduction to JSP, JavaBeans in JSP.**XML-I and XML-II:** Introduction to XML, Document Type Definition, XML Namespaces, XML Schema, XSLT.**AJAX:** Introduction to AJAX, AJAX working principle, AJAX Application, AJAX Database Application.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Core Java Volume I- Fundamentals, Cay S. Horstmann, Gary Cornell, Pearson India Education Services Pvt. Ltd., 11th Edition,
2. Java: The Complete Reference, Eleventh Edition, 11th Edition by Herbert Schildt Released December 2018
3. HTML 5 Black Book, Kogent Learning Solutions Inc., ISBN:978-93-5004-095-9

REFERENCES

1. Head First EJB 3.0 by Kathy Sierra, Bert Bates, Publisher: O'Reilly Media
2. Head First Servlets and JSP by Bryan Basham, Kathy Sierra & Bert Bates, Publisher: O'Reilly Media

17ITX33 JAVA-FULL STACK IMPLEMENTATION Common to AI&DS,CSE&IT					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : Nil					
COURSE OBJECTIVES AND OUTCOMES:					
Course objectives		**Course outcomes**		**Related program outcomes**	
1.0	Designing Enterprise based applications by encapsulating an application's business logic.	**1.1**	The students will be able to map Java classes and object associations to relational database tables with Hibernate mapping files	**a,b,c,e,g,h,i, j,l**	
2.0	Learn Spring configuration using Java Configuration and Annotations	**2.1**	The students will be able to implement Spring configuration using Java Configuration and Annotations	**a,b,c,i,j,k,l**	
3.0	Simplifying application development with Spring Boot	**3.1**	The students will be able to simplify application development using Spring Boot.	**a,b,c,e,f,g,h, i,j,k,l**	
4.0	Consume REST services using observables	**4.1**	The students will be able to use REST web services	**a,b,c,d, g,h,i,j,k,l**	
5.0	Utilizing AngularJS formats adequately	**5.1**	The students will be able to use various Angular features including directives, components, and services.	**a,b,c,d,e,f, h,j,k,l**	

UNIT I - HIBERNATE	**(9)**
Hibernate Overview, Architecture, Configuration, Sessions, Annotations, Query Language, Native SQL, Batch Processing, Interceptors	
UNIT II -SPRING CORE	**(9)**
Spring Overview, Architecture, IoC Containers, Bean Definition and Scope, Bean Life cycle, Bean inheritance, Dependancy injection, Beans auto wiring, java based configuration, event handling, Custom events, AOP with spring framework, JDBC framework, transaction management.	
UNIT III - SPRING BOOT	**(9)**
Spring Boot-Introduction, Boostrapting, Tomcat deployment, Build systems, code structure, Spring beans and dependancy, Spring boot runners, Application properties, Logging, Building RESTful web services, Exception handling, Interceptor, Servlet filter, tomcat port number, File handling, Consuming RESTful web services, Internationalization, Spring boot scheduling	
UNIT IV - REST WEB SERVICE	**(9)**
RESTful-Introduction, Environment setup, Resources, Messages, Addressing, Methods, Statelessness, Caching, Security, JAX-RS.	
UNIT V - ANGULAR	**(9)**
Angular Introduction, Features, Apps Loading, Architecture, Directives, ngIf Directive, ngFor Directive, ngSwitch Directive, Data Binding, Property Binding, String Interpolation, Event Binding, Two way data binding, Forms.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Soni, R. K. (2017). Full stack angularJS for java developers: Build a full-featured web application from scratch using angularJS with spring RESTful. Apress.
2. Duldulao, D. B., & Villafranca, S. R. (2022). Spring Boot and Angular: Hands-on full stack web development with Java, Spring, and Angular. Packt Publishing Ltd.
3. Fisher, P. T., & Murphy, B. D. (2010). Spring persistence with Hibernate. Apress.

REFERENCES:

1. Just Hibernate, A Lightweight Introduction to the Hibernate Framework by Madhusudhan Konda, Publisher: O'Reilly Media

17ITX37 PROBLEM SOLVING USING JAVA					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcome**	
1.0	To understand the basics of Java Programming Language	**1.1**	The Students will be able to solve simple problems using Java.	**a,b,c,d,e, h,j,k,l**	
2.0	To understand fundamentals of programming such as conditional and iterative execution	**2.1**	The students will be able to write programs using branching and looping statements	**a,b,c,d,e, h,i,j,k,l**	
3.0	To understand the concepts of Java arrays and Strings.	**3.1**	The students will be able to Be able to develop confidently with Strings and implement arrays.	**a,b,c,d,e, h,i,j,k,l**	
4.0	To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods.	**4.1**	The students will be able to understand basic oops concepts and develop applications using inheritance and interfaces.	**a,b,c,d,e, h,i,j,k,l**	
5.0	To understand threads and collection concepts	**5.1**	The students will be able to build applications using threads and collection framework.	**a,b,c,d,e, h,i,j,k,l**	

UNIT I - INTRODUCTION TO JAVA	(9)
History of java-Features-Glimpse of java-Data types and Variables-Local variable-Instance variable-static variable-Keywords: this, super, final- Type conversion & casting- Importance of Scanner class-Getting started with Eclipse IDE and VSCode.	
UNIT II-OPERATORS AND DECISION MAKING STATEMENTS	(9)
Operators- Arithmetic Operator, Bitwise Operator, Conditional Operator, Unary Operator-Relational and Logical operators-Conditional statements: If else, If else if, Nested if -Looping Statements: For Loop, while Loop, do while loop-switch-break-continue- auto boxing and unboxing.	
UNIT III-ARRAYS AND STRINGS	(9)
Arrays: One Dimensional Array-Two Dimensional Array-Inbuilt functions in arrays. Strings-String array-Inbuilt functions in Strings-String Buffer class-String Builder class-String Tokenizer class	
UNIT IV-OBJECT-ORIENTED PROGRAMMING PARADIGM	(9)
Class-objects-Encapsulation-Inheritance and its types-Polymorphism: Static binding and dynamic binding-Methods –Constructors and its types-Abstract class-Interface.	
UNIT V- MULTITHREADING AND COLLECTIONS	(9)
Throwable classes-Exception types-Exception keywords-Collection classes: List, Set-Thread-Ways of thread creation-methods-thread priorities-Synchronization-multithreading-Lambda Expression.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Herbert Schildt, “Java:The Complete Reference”,McGraw Hill Education, Twelfth edition,2021.

REFERENCE:

1. Cay.S.Horstmann,GaryCornell, “Core Java-JAVA Fundamentals”, Prentice Hall,Eleventh edition, 2020.

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B.E – Computer Science and Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-23) onwards)

AUGUST 2022

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2022 CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
I	22MAN01	Induction Programme	MC	-	-	-	-	-	-
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra *	BSC	-	4	3	I	0	4
4	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
5	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
6	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
7	22GYA01	தமிழர் மரபு / Heritage of Tamils	HSMC	-	I	I	0	0	I
PRACTICAL									
8	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
9	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
10	22PYP01	Physics Laboratory *	BSC	-	2	0	0	2	I
Mandatory Non Credit Courses									
11	22MAN02	Soft / Analytical Skills - I	MC	-	3	I	0	2	0
12	22MAN03	Yoga – I *	MC	-	I	0	0	I	0
				TOTAL	**32**	**16**	**I**	**15**	**22**

*Ratified by Eleventh Academic Council

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication - II	HSMC	22EYA01	4	2	0	2	3
2	22MYB03	Statistics and Numerical Methods *	BSC	-	4	3	1	0	4
3	22CSC02	Data Structures using C *	ESC	22CSC01	3	3	0	0	3
4	22CSC03	Python Programming	ESC	-	3	3	0	0	3
5	22CSC04	Digital Principles and Computer Organization *	ESC	-	3	3	0	0	3
6	22GYA02	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22CSP02	Data Structures Laboratory *	ESC	22CSP01	4	0	0	4	2
8	22CSP03	Python Programming Laboratory	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN04	Soft/Analytical Skills - II	MC	22MAN02	3	1	0	2	0
11	22MAN05	Yoga – II *	MC	-	1	0	0	1	0
				TOTAL	**32**	**16**	**1**	**17**	**23**

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
2	22CSC05	Algorithms	PCC	22CSC02	3	3	0	0	3
3	22CSC06	Computer Networks	PCC	-	3	3	0	0	3
4	22CSC07	JAVA Programming	PCC	-	3	3	0	0	3
5	22CSC08	Operating Systems	PCC	-	3	3	0	0	3
PRACTICAL									
6	22CSP04	Algorithms Laboratory	PCC	-	4	0	0	4	2
7	22CSP05	Computer Networks Laboratory	PCC	-	4	0	0	4	2
8	22CSP06	JAVA Programming Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN07	Soft/Analytical Skills - III	MC	22MAN04	3	1	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**32**	**17**	**1**	**14**	**22**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CSC09	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
2	22CSC10	Theory of Computation	PCC	22MYB05	4	3	1	0	4
3	22CSC11	Database Management System	PCC	-	3	3	0	0	3
4	22CSC12	Advanced Java Programming	PCC	22CSC07	3	3	0	0	3
5	22CSC13	Foundations of Data Science	PCC	-	5	3	0	2	4
6	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3
PRACTICAL									
7	22CSP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
8	22CSP08	Advanced Java Programming Laboratory	PCC	22CSP06	4	0	0	4	2
9	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
Mandatory Non Credit Courses									
10	22MAN08	Soft/Analytical Skills - IV	MC	22MAN07	3	1	0	2	0
				TOTAL	**32**	**19**	**1**	**13**	**24**

22EYA01 - PROFESSIONAL COMMUNICATION - I *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To build essential English skills to address the challenges of communication in today's work environment	1.1	The students will be able to apply knowledge of communication and language processes occur in various work environment		
2.0	To comprehend the various dimensions of communication by employing LSRW skills	2.1	The students will be able to involve in diverse discourse forms utilizing LSRW skills		
3.0	To deploy students in contextual initiatives by assisting them in developing communication abilities	3.1	The students will be able to participate actively in communication activities that enhance their creative skill		
4.0	To facilitate students in comprehending the intent, target audience and environments of various forms of communication	4.1	The students will be able to associate with the target audience and contexts using varied types of communication		
5.0	To enhance coherence, cohesion, and proficiency in both verbal and nonverbal communication in the workplace environment	5.1	The students will be able to convey the idea distinctly both in verbal and non verbal communication in work culture		

UNIT I –INTRODUCTORY SKILLS	**(6+6)**
Grammar – Parts of Speech – Verb (Auxiliaries – Primary & Modal, Main Verb) -**Listening** – Listening to Short Conversations or Monologues - Listening to Experiences – Listening to Descriptions- **Speaking** – Introducing Oneself – Exchanging Personal information - Talking about food and culture - **Reading**– Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II – LANGUAGE ACUMEN	**(6+6)**
Grammar – Word Formation – Tenses (Present Tense) – Synonyms & Antonyms - **Listening** – Listening to Announcements – Listening to Interviews - Listening and Note-taking - **Speaking** – Talking about Holidays & Vacations – Narrating Unforgettable Anecdotes - **Reading** – Skimming – Scanning (Short Texts and Longer Passages) – Critical Reading - **Writing** – Instruction – Process Description	
UNIT III – COMMUNICATION ROOTERS	**(6+6)**
Grammar– Cause and Effect – Tenses (Past Tense) – Discourse Markers - **Listening** – Listening to Telephonic Conversations – Listening to Podcasts - **Speaking** – Talking about neoteric Technologies – Eliciting information to fill a form - **Reading** –Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - **Writing** – Checklist – Circular, Agenda & Minutes of the Meeting	

UNIT IV – DISCOURSE FORTE	(6+6)
Grammar – Tenses (Future Tense) –Yes/No & WH type questions – Negatives - **Listening** – Listening to TED/ Ink talks -**Speaking** – Participating in Short Conversations - **Reading** – Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing	
UNIT V – LINGUISTIC COMPETENCIES	**(6+6)**
Grammar – Articles – Homophones & Homonyms – Single line Definition – Phrasal Verb - **Listening** – Intensive listening to fill in the gapped text - **Speaking** –Expressing opinions through Situations & Role play **Reading** – Cloze Texts - **Writing** – Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOK:

1. Shoba K N., Deepa Mary Francis, "English for Engineers and Technologists", Volume 1, 3rd Edition, Orient BlackSwan Pvt.Ltd, Telangana, 2022.

REFERENCES:

1. Koneru, Aruna, "English Language Skills", Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings M, "Advanced English Grammar", Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor, "Interchange", Cambridge University Press, New Delhi, 2015 (Reprint 2021).

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	-	1
2	-	-	-	-	-	-	-	-	3	3	-	2	-	1
3	-	-	-	-	-	-	-	-	3	3	-	2	-	1
4	-	-	-	-	-	-	-	-	3	3	-	2	-	1
5	-	-	-	-	-	-	-	-	3	3	-	2	-	1
CO (W.A)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**1**

22MYB01-CALCULUS AND LINEAR ALGEBRA *(Common to All Branches)*					
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To develop the use of matrix algebra techniques needed by engineers for practical applications.	**1.1**	The students will be able to apply the concept of orthogonal reduction to diagonalise a given matrix.		
2.0	To use the techniques, skills and engineering tools necessary for engineering practice, with geometric concepts.	**2.1**	The students will be able to identify the geometric aspects of plane, straight line and sphere.		
3.0	To improve the ability of the students in solving geometrical applications of differential calculus problems.	**3.1**	The students will be able to evaluate the radius of curvature, circle of curvature and centre of curvature for a given curve.		
4.0	To learn the important role of mathematical concepts in engineering applications with the functions of several variables.	**4.1**	The students will be able to calculate the maxima and minima for a given function with several variables by finding the stationary points.		
5.0	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.	**5.1**	The students will be able to evaluate the area and volume by double and triple integrals.		

UNIT I - MATRICES	**(9+3)**
Characteristic Equation - Eigen values and Eigen vectors of a matrix - Cayley Hamilton Theorem (excluding proof) and its applications - Quadratic form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II – ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane – Angle between two planes – Equation of straight lines - Coplanar lines –Equation of sphere – Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL (L:45+T:15) :60 PERIODS	

*Ratified by Eleventh Academic Council

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test**)**:

1. Introduction to MATLAB
2. Matrix operations – Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Dr.B.S.Grewal, "Higher Engineering mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig , "Advanced Engineering mathematics" , 9th Edition , John Wiley & Sons ,2013
3. Veerarajan.T, "Engineering Mathematics of semester I & II", 3rd Edition, Tata McGraw Hill. ,2016

REFERENCES:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics -Sem-II", 6th Edition, Laxmi Publications, 2014.
2. Kandasamy.P, Thilagavathy.K, Gunavathy .K," Engineering Mathematics for first year", 9 th Rev.Edition, S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics" , 7th Edition, Wiley India, 2007

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	1	-	-	-	1	-	2	2	2	1
2	3	2	2	-	1	1	-	-	1	-	-	2	2	-
3	3	2	2	-	1	-	-	-	-	-	-	2	2	-
4	3	2	2	1	1	-	-	-	1	-	-	2	2	-
5	3	2	2	1	1	-	-	-	1	-	1	2	2	1
CO (W.A)	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**1**

*Ratified by Eleventh Academic Council

22PYB01 - SEMICONDUCTOR PHYSICS *(Common to AI&DS, CSE, CSE (CS), CSE (IoT) and IT Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To expose the concepts of conducting materials	**1.1**	Predict the importance of conducting materials in the communication field.
2.0	To gain fundamental knowledge about electrical properties of semiconductors.	**2.1**	Acquire knowledge about the electrical properties of semiconductors.
3.0	To Understand the basics of semiconductor laser.	**3.1**	Update the knowledge regarding semiconductor lasers
4.0	To expand familiarity in the field of photo detectors	**4.1**	Identify the importance of opto-electronic devices and their applications
5.0	To update the recent developments in the field advanced new engineering materials	**5.1**	Gain knowledge about recent developments in Advanced new engineering materials

UNIT I - INTRODUCTION TO CONDUCTING MATERIALS	**(9)**
Classical free electron theory – Expression for electrical conductivity – Thermal conductivity, expression – Wiedemann – Franz law- Success and failure – electrons in metals - Fermi- Dirac statistics – Density of energy states- - Particle in a three dimensional box- degenerate states -Energy bands in solids- - Electron effective mass- concept of hole.	
UNIT II - ELECTRICAL PROPERTIES OF SEMICONDUCTORS	**(9)**
Elemental and compound semiconductors - Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – variation of Fermi level with temperature and impurity concentration – Hall effect –determination of Hall coefficient – Applications	
UNIT III - SEMICONDUCTOR LASER	**(9)**
Population of energy levels – Einstein's A and B coefficients derivation -Resonant cavity – Types of Semiconductor lasers: homo junction and hetero junction- Determination of particle size using laser - Holography – construction – reconstruction – Engineering applications of lasers -Medical field (Surgery).	
UNIT IV - PHOTO DETECTORS	**(9)**
Classification of optical materials- Carrier generation and recombination processes- Absorption emission and scattering of light in metals , insulators and semiconductors (concept only)- Formation of P-N junction - Barrier potential and depletion layer – P-N junction diode-Solar cell–LED–organic LED- Laser diode – optical data storage technique.	

UNIT V - ADVANCED NEW ENGINEERING MATERIALS	(9)
Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): Characteristics, properties of NiTi alloy, application. Nano materials: Properties - Preparation – chemical vapour deposition of nano particles and applications. Carbon nano tubes: fabrication – arc method – pulsed laser deposition – structure – properties and application.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. R. A. Serway and J.W. Jewett, "Physics for Scientists and Engineers", 9th Edition. Cengage Learning, 2018.
2. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. V.Rajendran, "Engineering Physicsll", Tata McGraw-Hill, New Delhi,2019 .

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
3. B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	-	-	-	-	1	1	-	2	-	-
2	3	2	2	-	-	-	-	-	2	2	-	1	-	1
3	3	3	3	-	-	-	-	-	1	1	-	1	-	-
4	3	2	2	-	-	-	-	-	1	1	-	1	-	-
5	3	3	1	-	-	-	-	-	2	1	-	2	-	-
CO (W.A)	**3**	**2.4**	**1.8**	**-**	**-**	**-**	**-**	**-**	**1.4**	**1.2**	**-**	**1.0**	**-**	**1.0**

22ECC01 - BASICS OF ELECTRONICS ENGINEERING *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make students to learn and understand the basics of Electrical circuits.	**1.1**	The Students will be able to apply the Ohm's law and Kirchhoff's law and investigates the behavior of electric circuits by analytical techniques.
2.0	To enable the student to understand the analysis of DC and AC circuits using Network theorems.	**2.1**	The Students will be able to analyze and forecast the Network theorems in DC and AC circuits.
3.0	To enable the student to understand the working of semiconductor devices.	**3.1**	The Students will be able to understand the characteristics of semiconductor devices.
4.0	To make the students to understand the working of rectifiers, filters and amplifiers.	**4.1**	The students will be able to understand the concept of rectifiers, filters and amplifiers.
5.0	To make the students to understand the functions of transducer and measuring instruments.	**5.1**	The students will be able to design transducers, measuring instruments and logic circuits.

UNIT I - UNIT I - BASIC CIRCUITS ANALYSIS	**(9)**
Current, Voltage, Power – Nodes, Paths, Loops and Branches – Ohm's Law – Kirchhoff's laws – Single loop circuit – Series and parallel connected independent sources – Resistors in series and Parallel – Current and voltage division.	
UNIT II - NETWORK THEOREMS FOR DC CIRCUITS	**(9)**
Source transformation – Mesh Analysis-Node Analysis – Thevenins and Norton Theorem – Superposition Theorem – Maximum power transfer theorem.	
UNIT III - SEMICONDUCTOR DEVICES	**(9)**
PN junction diode, Characteristics – Diffusion and Drift Current – Zener diode, Characteristics – BJT: PNP and NPN, CE Configuration of BJT – JFET – MOSFET – UJT.	
UNIT IV - RECTIFIERS, FILTERS AND AMPLIFIERS	**(9)**
Transformers: Construction & Types – Rectifiers: Half Wave, Full Wave and Bridge – Filters: Induction, Capacitor, LC – Operational Amplifiers – Applications of Amplifier.	

UNIT V -TRANSDUCERS, MEASURING INSTRUMENTS AND DIGITAL CIRCUITS	(9)
LED – Piezo electric Transducers – LCD – Moving Coil and Moving Iron Instrument – CRO – Logic Gates: AND, OR, NOT and Universal Gates: NAND, NOR – Flip Flop: SR, JK.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", 8th Edition, Tata McGraw Hill publishers, New Delhi, 2013.
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGrawHill 4th Edition. 2017.

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
3. B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	-	-	-	-	-	-	-	-	3	2
2	2	2	3	3	-	-	-	-	-	-	-	-	3	2
3	3	-	2	-	3	-	-	-	-	-	-	-	3	3
4	2	-	2	-	2	3	2	-	-	-	-	-	3	3
5	2	-	2	-	-	2	3	-	-	-	-	-	3	3
CO (W.A)	**2.4**	**2**	**2.2**	**3**	**2.5**	**2.5**	**2.5**	**-**	**-**	**-**	**-**	**-**	**3**	**2.6**

22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to All Branches)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand problem solving, problem solving aspects, programming and to know about various program design tools.	**1.1**	The student will be able to identify the appropriate problem solving techniques to drive the solution for the given problem.		
2.0	To learn basic structure and Control Statements in C programming.	**2.1**	The student will be able to implement the appropriate looping and control statements in C for developing applications.		
3.0	To learn the manipulation of arrays and strings	**3.1**	The student will be able to develop programs on arrays of different dimensions of arrays and strings concepts.		
4.0	To understand the concept of modular programming using user defined functions.	**4.1**	The student will be able to implement programs using user defined functions.		
5.0	To acquaint with the use and benefits of Memory Allocation and file handling.	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO (W.A)	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**

22ECP01- BASICS OF ELECTRONICS ENGINEERING LABORATORY *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT Branches)*					
			L	**T**	**P**	**C**
			0	**0**	**4**	**2**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To make students to examine the basics of Semiconductor Diodes and its characteristics.	**1.1**	The Students will be able to examine Semiconductor Diodes and its characteristics.		
2.0	To enable the student to analyze the characteristics of BJT, FET and UJT.	**2.1**	The Students will be able to analyze characteristics of BJT, FET and UJT working principles and operations.		
3.0	To make the students to analyze the operation of Rectifier circuit.	**3.1**	The students will be able to analyze the operation of rectifier circuit and its applications		
4.0	To motivate the students to learn and practice with measurement of Electrical circuits using various theorems.	**4.1**	The Students will apply the Ohm's law ,Kirchhoff's law and various theorems (Thevenin's, Norton's etc) and investigates the behavior of electric circuits by analytical techniques.		
5.0	To motivate the students to design a digital circuits using various basic logic gates.	**5.1**	The Students will be able to Design simple digital circuits by exploring logic gates.		

List of Experiments

(Cycle- I)
1.Plot the V-I Characteristics of PN junction diode and also find the forward and reverse resistance
2.Plot the V-I Characteristics of Zener diode and also find the forward and reverse resistance
3.Plot the Input-Output characteristics of Common Emitter Configuration(CE) using BJT
4.Find the Characteristics of FET and also plot the drain and transfer characteristics
5. Plot the V-I Characteristics of UJT
6.Construct the Half wave Rectifier & Full wave Rectifier and plot the graph
(Cycle- II)
1.Verification Kirchoff's Voltage Law (KVL) ,Kirchoff's Current Law(KCL)
2.Verfication of Thevenin's Theorem
3. Verfication of Norton's Theorem
4.Verification logic gates
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2
2	3	2	2	1	-	-	-	-	-	-	-	1	3	1
3	3	-	2	2	-	-	-	-	-	-	-	1	3	1
4	3	-	2	-	-	1	-	-	-	-	-	-	3	2
5	3	-	2	-	-	1	-	-	-	-	-	2	3	1
CO (W.A)	**3**	**2**	**1.8**	**1.3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1.3**	**3**	**1.4**

22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to All Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language.	**1.1**	The student will be able to identify the appropriate programming construct to develop programs for all types of problems.		
2.0	To study, analyze and implement the concepts of arrays and strings in C programming.	**2.1**	The student will be able to implement programs on arrays of different dimensions and string concepts.		
3.0	To learn the importance user defined functions and pointers.	**3.1**	The student will be able to develop programs using user defined functions and pointers.		
4.0	To gain knowledge in user defined data types and file handling functions in C programming	**4.1**	The student will be able to design programs using user defined data types and various file handling functions.		
5.0	To acquire skill in dynamic memory allocation	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

C-Programming:

1. Draw the flowchart for the following using Raptor tool.
   a) Simple interest calculation
   b) Greatest among three numbers
   c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO (W.A)	**3**	**2**	**2.8**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**

22PYP01 - PHYSICS LABORATORY *(Common to All Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**
PREREQUISITE : NIL				

Course Objectives		**Course Outcomes**	
1.0	To provide the basic practical exposure to all the engineering and technological streams in the field of physics.	**1.1**	The students will be able to apply the concept of stress, strain and elastic limit for a given sample to find their properties.
2.0	To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.	**2.1**	The students will be able to gain the basic knowledge about handling the laser light and Identify the basic parameters of an optical fibre.
3.0	To enable the students to correlate the theoretical principles with application oriented studies.	**3.1**	The students will be able to analyze the properties of matter with sound waves.
4.0	To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics	**4.1**	The students will be able to recall the knowledge of properties of light through spectrometer grating and fiber optic cable.
5.0	To analyze the behavior and characteristics of solar cells and LED	**5.1**	The students will be able to acquire the knowledge in semiconducting devices such as solar cells and LED.

List of Experiments

1. Determination of Young's modulus by non-uniform bending method
2. Determination of (a) wavelength and (b) particle size using Laser.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of band gap of a semiconductor.
6. Determination of thickness of a thin wire – Air wedge method.
7. Determination of V-I characteristics of solar cell.

Total (30 P) = 30 periods

*Ratified by Eleventh Academic Council

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	-	-	-	-	-	-	1	-	2	1	-
2	3	3	2	-	-	-	-	-	-	-	-	1	1	-
3	3	3	2	-	-	-	-	-	1	-	-	1	-	-
4	3	2	3	-	-	-	-	-	-	-	-	2	-	-
5	3	2	2	-	-	-	-	-	-	1	-	1	-	-
CO (W.A)	**3.0**	**2.0**	**2.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**1.0**	**0.0**	**1.0**	**1.0**	**0.0**

22EYA02- PROFESSIONAL COMMUNICATION- II *(Common to All Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : 22EYA01					
Course Objectives		**Course Outcomes**			
1.0	To familiarize the students with the basic structures of English and to train them to use these elements correctly in speaking and writing	**1.1**	The students will be able to frame sentences both in written and spoken forms with accuracy and fluency.		
2.0	To acquire proficiency in LSRW skills on par with the expectations of the industry.	**2.1**	The students will be able to attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.		
3.0	To enable students to adopt strategies for enhancing vocabulary, language and fluency and to deliver professional presentations.	**3.1**	The students will be able to gain essential competency to express one's thoughts orally and in writing in a meaningful way.		
4.0	To communicate effectively in an academic setting using the language skills as tools.	**4.1**	The students will be able to use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.		
5.0	To acquire necessary language skills to follow and comprehend discourse such as lectures, conversations, interviews, and discussions.	**5.1**	The students will be able to perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.		

UNIT I - LANGUAGE RUDIMENTS	**(6+6)**
Grammar – Active and Passive Voice – Impersonal Passive Voice – Numerical Expressions - **Listening** – Listening for Specific Information and Match / Choose / Fill in the texts - **Speaking** – Describing a Person - Making Plans -**Reading** – Intensive Reading -**Writing** – Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	**(6+6)**
Grammar – Reported Speech – Infinitive and Gerund - **Listening** – Listening to Iconic Speeches and making notes - Listening news / documentaries - **Speaking** –Talking over Phone – Narrating Incidents - **Reading** – Extensive Reading (Motivational Books) - **Writing** – Recommendation	
UNIT III - TECHNICAL CORRESPONDENCE	**(6+6)**
Grammar – If Conditionals – Blended Words - **Listening** – Listening to business conversation on audio and video of Short Films, News, Biographies - **Speaking** – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- **Reading** - Finding key information in a given text - **Writing** –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	**(6+6)**
Grammar – Concord – Compound Words - **Listening** – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - **Speaking** – Introduction to Technical Presentation - Story Telling - **Reading** – Reading and Understanding Technical Articles - **Writing** – Report Writing (Accident, Survey and feasibility)	

UNIT V - LANGUAGE BOOSTERS	(6+6)
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - **Listening** – Listening to different kinds of Interviews - Listening to Group Discussion - **Speaking** – Group Discussion - **Reading** – Reading and Interpreting Visual Materials - **Writing** – Analytical Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOKS:

1. Sudharshana, N.P and Saveetha.C, "English for Technical Communication", Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf, "Effective Technical Communication", Second Edition, McGraw Hill Education India Pvt Ltd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds, "A Student's Introduction to English Grammar", Second Edition, Cambridge University Press, New Delhi, 2022.

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	-	1
2	-	-	-	-	-	-	-	-	3	3	-	2	-	1
3	-	-	-	-	-	-	-	-	3	3	-	2	-	1
4	-	-	-	-	-	-	-	-	3	3	-	2	-	1
5	-	-	-	-	-	-	-	-	3	3	-	2	-	1
CO (W.A)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**1**

22MYB03- STATISTICS AND NUMERICAL METHODS

(Common to CSE, IT, AI&DS, CSE(IoT) and CSE(CS) Branches)

L	T	P	C
3	1	0	4

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.	**1.1**	The students will be able to select a hypothesis testing method for the given numerical set of data to analyze the significance .
2.0	To understand the knowledge of design of experiments.	**2.1**	The students will be able to apply analysis of Variance for the data set of selected number factors for analyzing the significance.
3.0	To introduce the basic concepts of solving algebraic and transcendental equations.	**3.1**	The students will be able to solve an algebraic or transcendental equation using an appropriate numerical method.
4.0	To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.	**4.1**	The students will be able to appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
5.0	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.	**5.1**	The students will be able to solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t -distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(9+3)**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method – Iterative methods of Gauss Jacobi and Gauss Seidel Methods- Eigen values of a matrix by Power method .	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules -Romberg's Methods.	

UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	(9+3)
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

WEB REFERENCES:

1. https://youtu.be/zmyh7nCjmsg
2. https://youtu.be/NmgbFJ4UwPs
3. https://youtu.be/RgKy7URFx1c
4. https://archive.nptel.ac.in/courses/111/107/111107105/

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	1	-	-	-	1	1		2		
2	3	3	1	1	1	-	-	-	1	1		2		
3	3	2	1	1	1	-	-	-	1	1		2		
4	3	3	1	1	1	-	-	-	1	1		2		
5	3	2	1	1	1	-	-	-	1	1		2		
CO (W.A)	**3**	**2.6**	**1**	**1**	**1**	-	-	-	**1**	**1**		**2**		

*Ratified by Eleventh Academic Council

22CSC02 –DATA STRUCTURES USING C

(Common to 22AIC01, 22CCC01, 22CIC01 and 22ITC01)

L	T	P	C
3	0	0	3

PREREQUISITE : 22CSC01

	Course Objectives		Course Outcomes
1.0	To learn the concept of pointers and strings	**1.1**	The student will be able to able to perform array and string operations using pointers
2.0	To be able to implement the abstract data type list as a linked list using the node and reference pattern.	**2.1**	The student will be able to able to manipulate different operations using linked list
3.0	To understand the Stack and Queue ADT	**3.1**	The student will be able to able to deploy different operations on stack and queue.
4.0	To gain knowledge on tree data structure.	**4.1**	The student will be able to determine the structure and operations on trees
5.0	To understand the various operations on graph	**5.1**	The student will be able to implement the various operations on graph

UNIT I - POINTERS USING ARRAYS AND STRINGS	**(9)**
Pointers : Introduction – Pointers and arrays– passing an array to a function– returning an array from function – NULL pointers –Array of pointers – Pointer-to-pointer – Dangling Pointer. Function pointers: calling a function using function pointer- Using pointer as a function argument	
UNIT II - LIST	**(9)**
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT	
UNIT III - STACKS AND QUEUES	**(9)**
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressionsInfix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues	
UNIT IV - TREE	**(9)**
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.	
UNIT V - GRAPHS	**(9)**
Definitions – Representation of Graphs – Types of Graph – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph.	
	TOTAL (L:45) : 45 PERIODS

*Ratified by Eleventh Academic Council

TEXT BOOKS:

2. Sumitabha Das, "Computer Fundamentals &C Programming", McGraw Hill Education(India) Private Limited, 1st Edition, 2018.
3. Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.

REFERENCES:

3. Yashavant Kanetkar, "Pointers in C", BPP Publications, 4th Edition, 2017.
4. PradipDey, Manas Ghosh, "Programming in C", Oxford Higher Education, 2nd Edition, 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2	1	-	-	2	-	2	3	3	3
2	3	3	2	2	2	2	-	-	1	-	2	3	3	3
3	2	3	2	2	2	2	-	-	2	-	2	3	3	3
4	3	3	2	2	2	1	-	-	1	-	2	3	3	3
5	3	3	2	2	2	1	-	-	2	-	2	3	3	3
CO (W.A)	**2.8**	**3**	**2**	**2**	**2**	**1.4**	**-**	**-**	**1.6**	**-**	**2**	**3**	**3**	**3**

22CSC03 - PYTHON PROGRAMMING

(Common to 22AIC02, 22CCC02, 22CIC02 and 22ITC02)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To acquaint with data types, input output statements, decision making, looping in Python	**1.1**	The students will be able to develop understanding of basics of Python Programming constructs.
2.0	To acquire knowledge about manipulation of strings.	**2.1**	The students will be able to impart basic knowledge of all strings functions.
3.0	To be familiarized with programming concepts like list and tuples.	**3.1**	The students will be able to choose most appropriate programming constructs and features to solve the problems with list, tuples and dictionaries.
4.0	To understand the concepts of dictionaries, function and modules.	**4.1**	The students will be able to exhibit the programming skills for the use of the logical constructs of language using function and files.
5.0	To develop the skill of designing Graphical user Interfaces in Python	**5.1**	The students will be able to demonstrate significant experience with the Python program development environment.

UNIT I - INTRODUCTION TO PYTHON	**(9)**
Introduction to python: Features - Execution of python program – Flavors of Python – Comments - Data Types: Built-in data types– Sequences – Set - Literals– Operators – Input and Output Statements - Control Statements: if – if-else –if-else-if – while-For –Nested loops – the else suite - Break – Continue - pass - assert – return.	
UNIT II - STRINGS	**(9)**
Arrays: One Dimensional arrays - Multi Dimensional arrays - Strings and Characters: Creating - Length - Indexing - Slicing - Repeating - Concatenation - Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing - Splitting and Joining Strings - Changing Case - Checking Starting and Ending of a String – String Formatting - Working with Characters – Sorting and Searching Strings - Finding Number- Inserting sub string into a string.	
UNIT III - LISTS , TUPLES AND DICTIONARIES	**(9)**
Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a tuples. Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.	

UNIT IV - FUNCTIONS AND FILES	(9)
Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators. Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories.	
UNIT V - MODULES AND FRAMEWORKS	**(9)**
Modules: Importing module –Features – Built in functions. - Python Environment and Frameworks: NumPy: NumPy Arrays – Computation on NumPy Arrays – Aggregation – Sorting Arrays – Structured Arrays.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 2021 Edition.
2. Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1st Edition O'Reilly Publishers, 2016.

REFERENCES:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2018.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2013.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	3	3	3	-	-	-	-	3	3	3
2	3	2	3	3	3	3	3	-	-	-	-	3	3	3
3	3	2	3	3	3	3	3	3	-	-	3	3	3	3
4	3	2	3	3	3	3	3	3	-	-	3	3	3	3
5	3	2	3	3	3	3	3	3	-	-	3	3	3	3
CO (W.A)	**3**	**2**	**2.8**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**

22CSC04 - DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

(Common to 22AIC03, 22CCC03, 22CIC03 and 22ITC03)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make students to analyze and design combinational circuits	**1.1**	The students will be able to compile the combinational logic circuits.
2.0	To enable the student to analyze and design sequential circuits	**2.1**	The students will be able to design the sequential logic circuits.
3.0	To make the students to understand the basic structure and operation of a digital computer	**3.1**	The students will be able to acquire the computer fundamentals.
4.0	To make the students to study the design of data path unit, control unit for processor and to familiarize with the hazards.	**4.1**	The students will be able to get deep insight into the processor function.
5.0	To make the students to understand the concept of various memories and I/O devices.	**5.1**	The students will be able to catch on to about operation of various types of memories and input output devices.

UNIT I - COMBINATIONAL LOGIC	**(9)**
Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder –Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexer and Demultiplexers.	
UNIT II - SYNCHRONOUS SEQUENTIAL LOGIC	**(9)**
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis of clocked sequential circuits – Shift Registers – Counters – Mod Counter –Up/Down Counter.	
UNIT III - COMPUTER FUNDAMENTALS	**(9)**
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Design of Fast Address – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast multiplication.	
UNIT IV - PROCESSOR	**(9)**
Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.	
UNIT V - MEMORY AND I/O DEVICES	**(9)**
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping Techniques – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

REFERENCES:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", 6th Edition, Morgan Kaufmann/Elsevier, 2020
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2016.
3. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	1	-	-	1	2	3	2	3
2	3	3	3	3	2	1	-	-	-	1	2	3	1	2
3	3	3	3	3	2	2	1	1	-	-	2	3	2	3
4	3	3	3	3	1	-	-	-	1	1	1	2	1	3
5	3	3	3	3	1	2	1	-	-	-	-	2	1	2
CO (W.A)	**3**	**3**	**3**	**3**	**1.8**	**1.8**	**1**	**1**	**1**	**1**	**1.8**	**2.6**	**1.4**	**2.6**

22CSP02 – DATA STRUCTURES LABORATORY

(Common to 22AIP01, 22CCP01, 22CIP01 and 22ITP01)

	L	T	P	C
	0	0	4	2

PREREQUISITE : 22CSP01

Course Objectives		Course Outcomes	
1.0	To learn the concept of pointers	**1.1**	The students will be able to perform array operations using pointers
2.0	To learn the implementation of all types linked list with its different operations.	**2.1**	The students will be able to explore various operations on linked list.
3.0	To impart the basic stack and queue concepts and its applications.	**3.1**	The students will be able to work with stack and queue concepts.
4.0	To Explore the concepts of tree data structures	**4.1**	The students will be able to construct and manipulate various tree operations.
5.0	To understand the various operations on graph	**5.1**	The students will be able to deploy different operations on graphs.

LIST OF EXPERIMENTS:

1. Pointer using 1D, 2D array
2. Implementation of singly linked list and its operations
3. Implementation of doubly linked list and its operations
4. Implementation of circular linked list and its operations
5. Implementation of Infix to postfix conversion using stack ADT
6. Implement the application for evaluating postfix expressions using array of stack ADT
7. Implementation of reversing a queue using stack
8. Binary Search Tree
9. AVL Tree
10. Priority Queues (Heaps)
11. Implementation of Graph Traversals(BFS, DFS)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.

Software:

Compiler – C

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2	1	-	-	2	-	2	3	3	3
2	3	3	3	3	1	2	1	2	1	1	1	2	3	2
3	2	3	2	2	1	-	3	-	2	-	3	1	3	2
4	3	3	3	1	1	2	-	1	1	-	1	-	3	2
5	3	2	3	3	2	1	-	1	-	1	2	2	3	2
CO (W.A)	**2.8**	**2.8**	**2.6**	**2.2**	**1.4**	**1.5**	**2**	**1.3**	**1.5**	**1**	**1.8**	**2**	**3**	**2.2**

22CSP03 - PYTHON PROGRAMMING LABORATORY

(Common to 22AIP02, 22CCP02, 22CIP02, and 22ITP02)

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To impart the fundamental concepts of Python Programming	**1.1**	The students will be able to understand the basics of Python Programming constructs
2.0	To learn the operator concepts of Python Programming	**2.1**	The students will be able to understand the various operators of Python Programming.
3.0	To gain exposure about string manipulation, list, and tuples	**3.1**	The students will be able to realize the need of string manipulation, list, and tuples
4.0	To get knowledge about dictionaries, function and modules	**4.1**	The students will be able to design programs involving dictionaries, function and modules
5.0	To develop the skill of designing Graphical user Interfaces in Python	**5.1**	The students will be able to develop simple programs with GUI

List of Exercises:

1. Programs for demonstrating the use of different types of operators.
2. Programs for demonstrating control statements.
3. Programs to implement various string operations.
4. Programs for demonstrating the following
   i. Lists
   ii. Tuples
   iii. Dictionaries
5. Programs to demonstrate concepts using functions
6. Programs to implement applications using File handling
7. Programs to demonstrate modules.
8. Programs to implement applications using regular expression.
9. Program to demonstrate GUI.
10. Perform data manipulation using NumPy.

TOTAL (P:60) = 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,

Software:

OS – Windows / UNIX Clone

Open Source Software – Python

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	3	3	3	-	-	-	-	3	3	3
2	3	2	3	3	3	3	3	-	-	-	-	3	3	3
3	3	2	3	3	3	3	3	3	-	-	3	3	3	3
4	3	2	3	3	3	3	3	3	-	-	3	3	3	3
5	3	2	3	3	3	3	3	3	-	-	3	3	3	3
CO (W.A)	**3**	**2**	**2.8**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**

22MEP01 - ENGINEERING GRAPHICS LABORATORY

(Common to AI & DS, BME, CSE, CSE (IoT), CSE (CS), ECE and IT Branches)

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To Construct various plane curves drawing by Modeling software with dimensions	**1.1**	The students will be able to construct various plane curves drawing by Modeling software with dimensions
2.0	To Construct the concept of first angle projection of points, lines and plane drawing by Modeling software with dimensions	**2.1**	The students will be able to construct the projection of points, lines and planes drawing by Modeling software with dimensions
3.0	To Develop the projection of solids drawing by Modeling software with dimensions	**3.1**	The students will be able to develop projection of solids drawing by Modeling software with dimensions
4.0	To Solve problems in sectioning of solids and developing the surfaces drawing by Modeling software with dimensions	**4.1**	The students will be able to solve problems in sections of solids and development of surfaces drawing by Modeling software with dimensions
5.0	To Apply the concepts of orthographic and isometric drawing by Modeling software with dimensions	**5.1**	The students will be able to apply the concepts of isometric in engineering practice drawing by Modeling software with dimensions

LIST OF THE EXPERIMENTS:

1. Study of basic tools, commands and coordinate systems (absolute, relative, polar, etc.) used in 2D software.
2. Draw the conic curves and special curves by using drafting software.
3. Draw the front view, top view, side view of objects from the given isometric view.
4. Draw the projections of straight line inclined to both the principal planes.
5. Draw the projections of polygonal surface.
6. Draw the projections of prism, pyramid inclined to anyone of the principal plane.
7. Draw the sectional view and the true shape of the given cylinder and cone.
8. Draw the development of surfaces like prism and pyramid.
9. Draw the isometric projections of cylinder and cone.
10. Draw the isometric projections of Prism and Pyramid.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	3	1	-	-	-	2	-	3	-	2
2	3	2	1	-	3	1	-	-	-	2	-	3	-	2
3	3	2	1	-	3	1	-	-	-	2	-	3	-	2
4	3	2	1	-	3	1	-	-	-	2	-	3	-	2
5	3	3	2	-	3	1	-	-	-	2	-	3	-	2
CO (W.A)	**3**	**2.2**	**1.2**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**2**

22MYB05 - DISCRETE MATHEMATICS *(Common to CSE, AI&DS, CSE(IoT), CSE(CS) and IT Branches)*					
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the basic concepts of logic and their applications.	**1.1**	The students will be able to rephrase real world statements as logical propositions and demonstrate whether the proposition is satisfy, tautology or a contradiction.		
2.0	To gain knowledge about these discrete structures including logic, predicate calculus.	**2.1**	The students will be able to infer whether a logical argument is valid from the given set of premises by applying the inference rules of predicate calculus.		
3.0	To get exposed to concepts and properties of set theory and functions.	**3.1**	The students will be able to show mathematical reasoning and arrive at conclusions about sets and relations.		
4.0	To acquire ideas about the general counting methods involving permutations and combinations. These methods are very useful in constructing computer programs and in mastering many theoretical topics of computer science.	**4.1**	The students will be able to construct the number of arrangements and selections using the principles of counting.		
5.0	To understand the concepts of Lattices and its properties.	**5.1**	The students will be able to avail the concept of Lattices and its properties.		

UNIT I - PROPOSITIONAL CALCULUS	**(9+3)**
Propositions-Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables-Tautologies and Contradictions-Logical Equivalences and implications – De morgan's Laws-Normal forms-Rules of inference-Arguments-Validity of arguments.	
UNIT II - PREDICATE CALCULUS	**(9+3)**
Predicates-Statement Function-Variables-free and bound variables-Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements-Theory of inference-The rules of universal specification and generalization-Validity of arguments.	
UNIT III - SET THEORY AND FUNCTIONS	**(9+3)**
Set Operations-Properties-Power set-Relations-Graph and matrix of a relation-Partial Ordering-Equivalence relation-Functions-Types of functions-Composition of relation and functions-Inverse functions.	
UNIT IV - COMBINATORICS	**(9+3)**
Basics of counting - Counting arguments - Pigeonhole Principle - Permutations and Combinations- Recursion and recurrence relations - Generating Functions - Mathematical Induction – Inclusion and Exclusion.	

UNIT V - LATTICES	(9+3)
Posets-Lattices as posets-Properties of lattices-Lattices as Algebraic systems – Sub lattices - Direct product and Homomorphism.	
TOTAL (L:45+ L:15) : 60 PERIODS	

TEXT BOOKS:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science " , Tata McGraw-Hill, New Delhi, Reprint 2010.
2. Veerarajan.T, "Discrete Mathematics with Graph Theory and Combinatorics", 4th edition, Tata McGraw Hill, New Delhi, 2008.
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5th edition, Tata McGraw Hill Publications, New Delhi, 2007.

REFERENCES:

1. Venkatraman M.K., "Discrete Mathematics" , the National Publishing Company, Chennai, 2007.
2. S.Santha, "Discrete Mathematics with Combinatorics and Graph Theory" ,Cengage Learning India Pvt. Ltd. 2010 .
3. Swapan Kumar Sarkar, "A Text Book of Discrete Mathematics" , S. Chand & Company Ltd., New Delhi.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/106/108/106108227/
2. https://www.youtube.com/watch?v=dK8iaQYcbms

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	1	1	-	-	-	-	1	-	2	-	-
2	3	2	1	1	1	-	-	-	-	1	-	2	-	-
3	3	1	1	1	1	-	-	-	1	1	-	2	-	-
4	3	2	1	1	1	-	-	-	-	1	-	2	-	-
5	3	1	1	1	1	-	-	-	-	1	2	2	-	-
CO (W.A)	**3**	**2**	1	**1**	**1**	-	-	-	**1**	**1**	**2**	**2**	-	-

22CSC05 - ALGORITHMS *(Common to 22AIC06, 22CCC04,22CIC04 and 22ITC04)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : 22CSC02					
Course Objectives		**Course Outcomes**			
1.0	To know the fundamental concepts and techniques for problem solving and algorithm design.	1.1	The students will be able to analyze worst, best and average case running times of algorithms using asymptotic notations.		
2.0	To learn the different sorting algorithms and the strategy followed.	2.1	The students will be able to use different sorting techniques and strategies.		
3.0	To be familiar with dynamic and greedy algorithm design techniques	3.1	The students will be able to design dynamic-programming and greedy algorithms and apply them to test for optimality.		
4.0	To learn the different kinds of iterative improvement and limitations of algorithm power	4.1	The students will be able to analyze the notion of tractable and intractable problems.		
5.0	To understand backtracking, Branch bound techniques.	5.1	The students will be able to Use the state space tree method for solving problems.		

UNIT I - INTRODUCTION	**(9)**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.	
UNIT II - BRUTE FORCE AND DIVIDE-AND-CONQUER	**(9)**
Brute Force – Computing an – String Matching - Selection Sort and Bubble Sort – Sequential Search - Closest-Pair and Convex-Hull Problems - Exhaustive Search: Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort –Closest-Pair and Convex - Hull Problems.	
UNIT III - DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	**(9)**
Dynamic Programming : Computing a Binomial coefficient – Warshall's and Floyd's Algorithm – Optimal Binary Search trees - 0/1 Knapsack Problem. Greedy Technique: Prim's algorithm and Kruskal's Algorithm - Huffman Trees.	
UNIT IV - ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER	**(9)**
Iterative Improvement - The Simplex Method - The Maximum-Flow Problem- Maximum Matching in Bipartite Graphs. Limitations of Algorithm Power: Lower bound arguments – Decision trees – P, NP and NP complete Problems.	

UNIT V - STATE SPACE SEARCH ALGORITHMS	(9)
Backtracking: N Queen's problem – Hamiltonian Circuit problem – Subset problem - Graph colouring problem. Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem – Travelling Salesman Problem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 3rd ed., 2017.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
2. S. Sridhar, "Design and Analysis of Algorithms ", Oxford university press, 2014.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	-	-	-	1	-	-	-	-	-	3	2
2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
3	3	2	1	1	-	-	1	-	-	-	-	-	3	1
4	3	2	1	1	-	-		-	-	-	-	-	3	2
5	3	2	1	1	-	-	1	-	-	-	-	-	3	2
CO (W.A)	**3**	**2.4**	**1.4**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1.8**

22CSC06 - COMPUTER NETWORKS *(Common to 22AIC12, 22CCC05,22CIC09 and 22ITC07)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the concepts of data communications	**1.1**	The students will be able to gain knowledge on Data Communication Concepts		
2.0	To impart the fundamental concepts of Data Link Layer	**2.1**	The students will be able to use services of the Data Link Layer.		
3.0	To gain exposure about Addressing and Routing Protocols	**3.1**	The students will be able to work with network addressing and Routing Protocols.		
4.0	To get knowledge about services in Transport Layer	**4.1**	The students will be able to apply Transport Layer protocols.		
5.0	To learn about Application Layer functionalities	**5.1**	The students will be able to work with Application layer protocols		

UNIT I - INTERNET AND DATA COMMUNICATIONS	**(9)**
Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.	
UNIT II - DATA LINK LAYER	**(9)**
Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – Media Access Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.	
UNIT III - NETWORK LAYER	**(9)**
IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-State Routing, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.	
UNIT IV - TRANSPORT LAYER	**(9)**
Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.	
UNIT V - APPLICATION LAYER	**(9)**
Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022.

REFERENCES:

1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	-	-	3	-	3	3	3	-	3	3	3
2	3	3	3	-	3	-	-	-	3	-	-	3	3	3
3	3	3	3	3	3	-	-	-	3	3	-	3	3	3
4	3	3	3	2	3	-	-	-	3	3	-	3	3	3
5	3	3	3	2	3	-	-	-	3	3	-	3	3	3
CO (W.A)	**3**	**3**	**3**	**2.3**	**3**	**3**		**3**	**3**	**3**		**3**	**3**	**3**

22CSC07 - JAVA PROGRAMMING *(Common to 22AIC04, 22CCC06,22CIC06 and 22ITC06)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand Object oriented programming concepts and characteristics of Java	**1.1**	The students will be able to develop Java programs using OOP principles		
2.0	To know the principles of Inheritance, abstraction and interfaces	**2.1**	The students will be able to develop Java programs with the concepts of inheritance		
3.0	To define exceptions and use I/O streams	**3.1**	The students will be able to construct applications with exception handling.		
4.0	To understand threads concepts	**4.1**	The students will be able to develop Java applications using threads		
5.0	To design and build simple GUI programs using AWT and Swings.	**5.1**	The students will be able to develop interactive Java applications using GUI components.		

UNIT I - INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	**(9)**
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Strings, Packages - JavaDoc comments.	
UNIT II - INHERITANCE AND INTERFACES	**(9)**
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods-Keywords: Static-final-this- final methods and classes – Method overloading-Method overriding-Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces	
UNIT – III EXCEPTION HANDLING AND I/O	**(9)**
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing File	
UNIT – IV –THREADS	**(9)**
Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads — Thread Priorities – Synchronization – Inter thread Communication – Suspending, Resuming, and Stopping Threads – Using Multithreading.	

UNIT – V EVENT DRIVEN PROGRAMMING	(9)
Graphics programming - Frame – Components Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019 for Units I, II, III, IV.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015 for Unit V.

REFERENCE:

1. Cay. S. Horstmann, Gary Cornell, "Core Java-JAVA Fundamentals", Prentice Hall, 10th ed., 2016.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.3. SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	1	-	-	-	1	-	-	1	3	3
2	3	1	1	-	1	-	-	-	1	-	-	1	3	3
3	3	1	1	-	1	-	-	-	2	-	-	1	3	3
4	3	2	1	-	1	-	-	-	2	-	-	2	3	3
5	3	2	2	2	1	-	-	-	3	1	3	-	3	3
CO (W.A)	**3**	**1.6**	**1.2**	**2**	**1**	**-**	**-**	**-**	**1.8**	**1**	**3**	**1.25**	**3**	**3**

22CSC08 - OPERATING SYSTEMS *(Common to 22AIC08, 22CIC07, and 22ITC05)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To learn about the basics of operating system and system calls.	**1.1**	The students will be able to perceive knowledge on the systematic approach of the Operating system.		
2.0	To impart the knowledge about how the process scheduling work together to perform computing tasks.	**2.1**	The students will be able to apply the concepts of CPU scheduling.		
3.0	To Learn about the process synchronization and Deadlock concepts.	**3.1**	The students will be able to use various synchronization and deadlock handling methods.		
4.0	To learn the importance of memory management in the operating system.	**4.1**	The students will be able to apply page replacement policies to address demand paging		
5.0	To explore the disk and files management of operating systems	**5.1**	The students will be able to work with file and disk organizations for a real time applications.		

UNIT I - FUNDAMENTALS	**(9)**
Introduction - System Architecture - Operating System Structure - Operations - Process Management - Memory Management - Storage Management - System Structure - User Operating System Interface - System Calls - Types - System Programs - Operating System Design and Implementation - Virtual machines.	
UNIT II - PROCESS MANAGEMENT	**(9)**
Process Concept - Process Scheduling - Operations on Processes- Inter Process Communication - Shared Memory and Message Passing Systems - CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Threads Overview - Thread Scheduling.	
UNIT III - PROCESS SYNCHRONIZATION	**(9)**
Synchronization: The Critical-Section Problem - Peterson's solution - Hardware support for Synchronization - Mutex – Semaphores - Deadlocks: Deadlock Characterization - Methods for handling deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.	
UNIT IV - MEMORY MANAGEMENT	**(9)**
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Segmentation - Virtual Memory - Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing,	

UNIT V - SECONDARY STORAGE MANAGEMENT	(9)
Secondary Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap Space Management - File System - File Concepts: Access Methods - Directory Structure - File System Mounting - File System Implementation - Structure – Implementation - Directory Implementation - Allocation Methods -Free Space Management - I/O Systems - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

REFERENCES:

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall of India Pvt., 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2	2	-	-	-	-	3	2	-	1	3	1
2	2	2	3	1	1	-	-	-	2	1	-	2	3	1
3	1	3	2	2	1	-	-	-	2	2	-	1	3	1
4	1	3	2	2	1	-	-	-	2	2	-	1	3	1
5	1	3	3	3	-	-	-	-	1	2	-	2	3	1
CO (W.A)	**1.6**	**2.4**	**2.4**	**2**	**1**	**-**	**-**	**-**	**2**	**1.8**	**-**	**1.4**	**3**	**1**

22CSP04 - ALGORITHMS LABORATORY *(Common to 22AIP05, 22CCP03, 22CIP03, and 22ITP03)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make the use of programs using Brute force technique.	**1.1**	The students will be able to implement programs using Brute force technique.
2.0	To gain exposure about the concept of divide and conquer design techniques.	**2.1**	The students will be able to Make use of algorithm design techniques like divide and conquer.
3.0	To understand the dynamic programming technique.	**3.1**	The students will be able to apply dynamic programming to solve problems
4.0	To explore knowledge about greedy techniques.	**4.1**	The students will be able to apply greedy techniques to solve problems
5.0	To understand the knowledge on Backtracking techniques.	**5.1**	The students will be able to apply Backtracking techniques to solve problems

LIST OF EXPERIMENTS:

1. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
2. Sort a given set of elements using the Insertion sort, Selection sort and Bubble sort
3. Implementation of Linear Search.
4. Implementation of Recursive Binary Search
5. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
6. Develop a program to sort the numbers using Merge and Quick sort .
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
10. Implement N Queens problem using Backtracking.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,.

Software:

C/C++/JAVA/ Python

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	-	-	-	-	-	-	-	-	-	3	2
2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
3	3	2	1	1	-	-	1	-	-	-	-	-	3	1
4	3	2	1	1	-	-	1	-	-	-	-	-	3	1
5	3	2	1	1	-	-	1	-	-	-	-	-	3	2
CO (W.A)	**3**	**2.4**	**1.4**	**1**	**-**	**-**	**1**	**-**		**-**	**-**	**-**	**3**	**1.6**

22CSP05 - COMPUTER NETWORKS LABORATORY *(Common to 22CCP04, 22CIP06 and 22ITP05)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					

Course Objectives		**Course Outcomes**	
1.0	To know the connectivity of systems with different types of cables	**1.1**	The students will be able to connect a system with various topologies
2.0	To work with addressing protocols	**2.1**	The students will be able to apply addressing protocols
3.0	To gain knowledge about the working of routing algorithms	**3.1**	The students will be able to implement various routing algorithms
4.0	To learn socket programming	**4.1**	The students will be able to program using Sockets
5.0	To use analyzing tools to analyze the performance of protocols in different layers in computer networks	**5.1**	The students will be able to use Analyzer tools

LIST OF EXPERIMENTS:

1. Study of Color coding Jack RJ45 and do the following Cabling works in a network
   a. Cable Crimping
   b. Standard Cabling
   c. Cross Cabling and
   d. Establish a LAN connection using three systems using any topology.
2. Configure IP Address in a system in LAN (TCP/IP Configuration) and Implement the client server communication using socket connection
3. Write a program for transferring a file between nodes in a network.
4. Perform CRC computation
5. By varying the number of frames, design the Sliding Window Protocol
6. Simulation of ARP/RARP
7. Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.
8. Write a program for downloading a file from HTTP server
9. Develop a client that contacts a given DNS server to resolve a given host name.
10. Configure a Network topology using Packet tracer software
11. Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.

TOTAL (P:60) : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 60 STUDENTS SOFTWARE :

HARDWARE:

Standalone desktops 60 Nos., Jack RJ45 connectors

SOFTWARE:

C / C++ / Java / Equivalent Compiler

Network simulator like Ethereal / NS2 / NS3 / Glomosim /OPNET/ 60 Equivalent.

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	-	-	-	-	-	3	-	3	3	3
4	3	3	3	2	-	-	-	-	-	3	-	3	3	3
5	3	3	3	2	3	-	-	-	-	3	-	3	3	3
CO (W.A)	**3**	**3**	**3**	**2.6**	**3**	-	**-**	-	-	**3**	**-**	**3**	**3**	**3**

22CSP06 - JAVA PROGRAMMING LABORATORY *(Common to 22AIP03, 22CCP05,22CIP05 and 22ITP04)*			
L	**T**	**P**	**C**
0	**0**	**4**	**2**

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To impart fundamental concepts of OOP using java.	**1.1**	The students will be able to create simple Java programs using basic programming elements in Java.
2.0	To gain exposure about inheritance, packages and Interfaces.	**2.1**	The students will be able to develop applications using inheritance, packages and interfaces.
3.0	To explore about the exception handling mechanism.	**3.1**	The students will be able to construct applications with exception handling.
4.0	To understand threads concepts.	**4.1**	The students will be able to build applications using threads and collection framework.
5.0	To know about Event handling using swing components.	**5.1**	The students will be able to create GUIs and event driven programming applications for real world problems.

LIST OF EXPERIMENTS:

1. Write simple Java programs using operators, arrays and control statement
2. Programs using Static, final and this keywords.
3. Demonstrate the concepts of inheritance
4. Programs illustrating overloading and overriding methods in Java
5. Programs to use packages and Interfaces in Java.
6. Implement exception handling and creation of user defined exception.
7. Implement program to demonstrate multithreading and inter thread communication.
8. Write a program to perform file operations.
9. Develop applications using swing layouts

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 No's, Printers – 3 Nos.

Software:

- Java / Equivalent Compiler

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	-	2	-	3	2	2	2	3	3	1	3
2	2	2	3	3	3	1	3	3	2	2	3	3	1	3
3	2	2	3	3	3	1	3	3	2	2	3	3	1	3
4	2	2	3	3	3	1	3	3	2	2	3	3	1	3
5	2	2	3	3	3	2	3	3	2	2	3	3	1	3
CO (W.A)	**2.2**	**2.2**	**3**	**3**	**2.8**	**1.25**	**3**	**2.8**	**2**	**2**	**3**	**3**	**1**	**3**

22CSC09 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING *(Common to 22CCC08, 22CIC08 and 22ITC14)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To study about uninformed and Heuristic search techniques.	**1.1**	The students will be able to use appropriate search algorithms for problem solving.		
2.0	To learn techniques for reasoning under uncertainty.	**2.1**	The students will be able to apply reasoning under uncertainty.		
3.0	To introduce machine Learning and supervised learning algorithms.	**3.1**	The students will be able to build supervised learning models.		
4.0	To study about ensembling and unsupervised learning algorithms.	**4.1**	The students will be able to build ensembling and unsupervised models.		
5.0	To learn the basics of deep learning using neural networks	**5.1**	The students will be able to develop neural network models.		

UNIT I -PROBLEM SOLVING	**(9)**
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP).	
UNIT II - PROBABILISTIC REASONING	**(9)**
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	
UNIT III - SUPERVISED LEARNING	**(9)**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests.	
UNIT IV - ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	**(9)**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.	
UNIT V - NEURAL NETWORKS	**(9)**
Artificial Neural Networks – Structures, perceptron, Multilayer perceptron, activation functions, network training, Learning in multilayer networks , Learning neural network structures, Case study: Handwritten digit recognition, Word senses and house prices.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar, "Foundations of Machine Learning", MIT Press, 2012.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	3	-	-	-	-	1	3	3	3	1	2
2	1	1	1	3	1	-	-	-	1	2	1	3	2	3
3	2	1	2	1	1	-	-	-	2	1	1	3	1	1
4	3	1	3	1	-	-	-	-	2	1	2	1	2	2
5	3	1	1	2	2	-	-	-	2	2	2	3	2	2
CO (W.A)	**2.4**	**1.2**	**2**	**2**	**1.3**	**-**	**-**	**-**	**1.6**	**1.8**	**1.8**	**2.6**	**1.6**	**2**

22CSC10 - THEORY OF COMPUTATION *(Common to 22ITC09)*					
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**
PREREQUISITE : 22MYB05					
Course Objectives		**Course Outcomes**			
1.0	To learn the basic concepts in theoretical computer science.	**1.1**	The students will be able to explain the key properties of formal languages and finite automata		
2.0	To comprehend complex concepts and formal proofs in theoretical computer science in order to improve reasoning and problem solving skills.	**2.1**	The students will be able to design and describe the strings recognized by regular languages.		
3.0	To learn about context free grammar and how to develop context free grammar based on different normal forms.	**3.1**	The students will be able to construct the context-free grammars and explain the languages accepted by CFG		
4.0	To study about the turing machine and push down automata.	**4.1**	The students will be able to design a turing machine and push down automata that accomplish a specific task.		
5.0	To learn about the different classes of problem.	**5.1**	The students will be able to explain the undecidable and intractable classes of problems		

UNIT I - AUTOMATA	**(9+3)**
. Introduction to finite automata(FA) – Central concepts of automata theory – Deterministic finite automata – Non deterministic finite automata – Finite automata with epsilon transitions – Equivalence between epsilon NFA and DFA - Minimization of automata.	
UNIT II - REGULAR EXPRESSIONS	**(9+3)**
Regular expressions(RE) - Manipulation of regular expressions - Equivalence between RE and FA - Inter conversion - Pumping lemma - Closure properties of regular sets – Decision properties of Regular Languages.	
UNIT III - CONTEXT FREE GRAMMAR	**(9+3)**
Context free Grammars (CFG) - Derivation trees - Ambiguity in Context-Free Grammars - Applications of Context Free Grammars - Normal Forms - Chomsky Normal Form (CNF) - Greibach Normal Form (GNF).	
UNIT IV - PUSH DOWN AUTOMATA AND TURING MACHINE	**(9+3)**
Push Down Automata (PDA) – Languages of PDA – Equivalence of PDA's and CFG's - Turing Machine, Programming techniques of Turing Machine – Types of Turing Machine.	

UNIT V - CLASSES OF PROBLEMS	(9+3)
A language that is not Recursively Enumerable – Universal Turing Machine – Rice's Theorem and properties of the Recursively Enumerable Languages – Post's Correspondence Problem (PCP) – The Classes P and NP – An NP Complete Problem.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman," Introduction to Automata Theory, Languages, and Computation", 3rd ed., Pearson, 2013.
2. John C Martin, "Introduction to Languages and the Theory of Computation", 4th ed., Tata McGraw Hill Publishing Company, New Delhi, 2011

REFERENCES:

1. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009.
2. Lewis H.P. & Papadimitriou C.H.," Elements of Theory of Computation", Prentice Hall of India, 4th ed., 2007.
3. Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Prentice Hall of India, New Delhi, 3rd ed., 2006.
4. Harry R Lewis, Christos H Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India/ Pearson Education, New Delhi, 2nd ed., 2015.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	3	3	-	-	-	-	-	-	3	3	1
2	3	2	1	3	3	-	-	-	-	-	-	3	3	1
3	3	2	1	3	-	-	-	-	-	-	-	3	3	1
4	3	2	1	3	-	-	-	-	-	-	-	3	3	1
5	3	2	1	3	3	-	-	-	-	-	-	3	3	1
CO (W.A)	**3**	**2**	**1**	**3**	**3**	-	-	-	-	-	-	**3**	**3**	**1**

22CSC11 - DATABASE MANAGEMENT SYSTEM *(Common to 22CIC10 and 22ITC11)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To know the fundamentals of data models.	**1.1**	The students will be able to identify suitable data models for real time application and conceptualize a database system using ER Diagram		
2.0	To learn about Relational database architecture and querying through SQL.	**2.1**	The students will be able to write queries in relational algebra and SQL.		
3.0	To know about normalization	**3.1**	The students will be able to normalize the database design.		
4.0	To understand the storage structures and the queries processing/optimization.	**4.1**	The students will be able to apply storage structure and process/optimize Queries.		
5.0	To gain knowledge about transaction processing, concurrency control and recovery.	**5.1**	The students will be able to apply concepts of query processing, transaction processing, and concurrency control.		

UNIT I - DATABASE SYSTEM CONCEPT	**(9)**
Purpose of Database systems – Views of data – Database Languages - Database design – Database system architecture – Data models – Data Dictionary – Database Administration – Entity-Relationship model – EER Model.	
UNIT II - RELATIONAL DATABASE	**(9)**
Structure of Relational Database – Integrity Constraints – Relational Algebra – Relational Calculus – SQL – Views – Joins – Functions and Procedures – Triggers.	
UNIT III - DATABASE DESIGN	**(9)**
Functional Dependencies – Decomposition: Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	
UNIT IV - PHYSICAL DATABASE DESIGN AND QUERY PROCESSING	**(9)**
Storage and file structure: RAID – File Organization – Organization of Records in Files – Data dictionary Storage - Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices — Query Processing	
UNIT V - TRANSACTION PROCESSING	**(9)**
Transactions: Desirable properties of Transactions – Serializability – Concurrency Control: Lock-Based Protocols – Timestamp-Based Protocols – Validation-Based Protocols – Recovery systems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, McGraw Hill, 2020.

REFERENCES:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2017
2. Date C.J., Kannan A. and Swamynathan S., "An Introduction to Database Systems", 8th Edition, Pearson Education, New Delhi, 2013.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	3	3	-	3	3	-	3	3	3	3
2	3	3	3	3	2	-	-	-	-	-	3	3	3	3
3	3	3	3	3	2	-	-	2	3	-	3	3	3	3
4	3	3	3	3	3	-	-	2	2	-	3	3	3	3
5	3	3	3	3	3	3	-	3	3	-	3	3	3	3
CO (W.A)	**3**	**3**	**3**	**2.8**	**2.6**	**3**	**-**	**2.5**	**2.75**	**-**	**3**	**3**	**3**	**3**

22CSC12–ADVANCED JAVA PROGRAMMING *(Common to 22CCC14, 22CIC14 and 22ITC13)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : 22CSC07

Course Objectives		**Course Outcomes**	
1.0	To Explore advanced topic of Java network programming for solving problems	**1.0**	The Students will be able to understand the networking concepts related to Java Technology
2.0	To know the principles of SQL and JDBC connectivity	**2.0**	The students will be able to develop database connected java programs using SQL and JDBC connectivity
3.0	To Provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business	**3.0**	The students will be able to develop advanced skills for programming in Java
4.0	To understand servlet life cycle and architecture and created servlet communication programs	**4.0**	The students will be able to Create dynamic web pages, using Servlets and JSP
5.0	To put into use the advanced features of the Java language to build and compile robust enterprise grade applications	**5.0**	The students will be able to explore the use of Java Server Programming and make a reusable software component using Java Bean

UNIT I - NETWORK PROGRAMMING IN JAVA	**(9)**
Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URL classes – Reading Data from the server – writing data – configuring the connection– Reading the header – telnet application – Java Messaging services	
UNIT II - DATABASE CONNECTIVITY	**(9)**
The Design of JDBC: JDBC Driver Types and Typical Uses of JDBC; the Structured Query Language; JDBC Configuration; Working with JDBC Statements; Query Execution; Scrollable and Updatable Result Sets; Row Sets	
UNIT III - APPLICATIONS IN DISTRIBUTED ENVIRONMENT	**(9)**
Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models - JAR file creation	
UNIT IV - SERVLETS AND JSP	**(9)**
Background; The Life Cycle of a Servlet; A Simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameters; The javax.servlet.http Package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking; Introduction to JSP; Using JSP; Comparing JSP with Servlet; Java Web Frameworks	

UNIT V - ENTERPRISE APPLICATIONS	(9)
Server Side Component Architecture – Introduction to J2EE – the Java Beans API; Writing JavaBeans Session Beans – Entity Beans–Persistent Entity Beans	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Core java Volume I— Fundamentals, Tenth Edition, Cary S. Horstmann, Prentice Hall
2. Core java Volume II— Advanced Features, Tenth Edition, Cary S. Horstmann, Prentice Hall
3. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill

REFERENCES:

1. Advanced Java Programming, Uttam K. Roy, Oxford University Press
2. Java: Advanced Features and Programming Techniques, Nathan Clark

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	1	-	-	-	1	-	-	1	3	3
2	3	1	1	-	1	-	-	-	1	-	-	1	3	3
3	3	1	1	-	1	-	-	-	2	-	-	1	3	3
4	3	2	1	-	1	-	-	-	2	-	-	2	3	3
5	3	2	2	2	1	-	-	-	3	1	3	2	3	3
CO (W.A)	**3**	**1.6**	**1.2**	**2**	**1**	**-**	**-**	**-**	**1.8**	**1**	**3**	**1.4**	**3**	**3**

22CSC13 - FOUNDATIONS OF DATA SCIENCE					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the data science fundamentals and process.	**1.1**	The students will be able to Define the data science process		
2.0	To learn to describe the data for the data science process	**2.1**	The students will be able to Understand different types of data description for data science process		
3.0	To learn to describe the relationship between data.	**3.1**	The students will be able to Gain knowledge on relationships between data		
4.0	To utilize the Python libraries for Data Wrangling.	**4.1**	The students will be able to Use the Python Libraries for Data Wrangling		
5.0	To present and interpret data using visualization libraries in Python	**5.1**	The students will be able to Apply visualization Libraries in Python to interpret and explore data		

UNIT I - INTRODUCTION	**(9+6)**
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data	
UNIT II - DESCRIBING DATA	**(9+6)**
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores	
UNIT III - DESCRIBING RELATIONSHIPS	**(9+6)**
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.	
UNIT IV - PYTHON LIBRARIES FOR DATA WRANGLING	**(9+6)**
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.	

UNIT V - DATA VISUALIZATION	(9+6)

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

List of Experiments:

1. Working with Numpy arrays
2. Working with Pandas data frames.
3. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
4. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:

   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.

   b. Bivariate analysis: Linear and logistic regression modeling

   c. Multiple Regression analysis

   d. Also compare the results of the above analysis for the two data sets.
5. Apply and explore various plotting functions on UCI data sets.

   a. Normal curves

   b. Density and contour plots

   c. Correlation and scatter plots

   d. Histograms

   e. Three dimensional plotting

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE:

1. Standalone PC's.

SOFTWARE:

1. OS – Windows 7 or higher
2. Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
3. Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

TOTAL (L:45+P:30) : 75 PERIODS

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III) 69
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)

REFERENCE:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	2	-	-	-	1	1	1	2	2	2
2	2	1	-	1	1	-	-	-	2	1	1	2	3	1
3	2	2	1	2	2	1	1	-	1	2	1	3	2	3
4	3	2	2	1	2	-	-	-	1	1	2	2	3	2
5	2	2	1	2	2	-	-	-	1	1	1	2	2	2
CO (W.A)	**2**	**1.8**	**1.25**	**1.6**	**1.8**	**1**	**1**	**-**	**1.2**	**1.2**	**1.2**	**2.2**	**2.4**	**2**

22CYB07 - ENVIRONMENTAL SCIENCE AND ENGINEERING *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To recognize the basic concepts of environment, ecosystems and biodiversity.	**1.1**	The students will be able to know the importance of environment and functions ecosystems and biodiversity
2.0	To impart knowledge on the causes, effects and control measures of environmental pollution.	**2.1**	The students will be able to identify the causes, effects of environmental pollution and contribute the preventive measures to the society.
3.0	To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.	**3.1**	The students will be able to identify and understand the renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4.0	To familiarize the e–waste, recognize and analyze the challenges of environmental management.	**4.1**	The students will be able to recognize the different methods of management of e-waste and apply them for suitable technological advancement and societal development.
5.0	To impart knowledge on the e-waste and its recycling methods of cell phone, battery, laptop and PCB.	**5.1**	The students will be able to demonstrate the recycling of battery, cell phone , laptop and PCB

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(9)**
Environment - scope and importance - Eco-system- Structure and function of an ecosystem-types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(9)**
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(9)**
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	

UNIT IV - E- WASTE AND ITS MANAGEMENT	(9)
E-waste – sources of e-waste – hazardous substance in e-waste – chlorinated compounds – heavy metals - need for e-waste management – management of e-waste – Inventory management – production process – modification- Disposal treatment of e –waste – Incineration –acid baths – landfills.	
UNIT V - BATTERIES AND RECYCLING OF E-WASTE	**(9)**
Battery – types – Lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – process of recycling battery – lead acid battery – lithium ion battery – benefits of recycling battery – recycling of computing devices - mobile phones - PCB and servers.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK :

1. http://www.jnkvv.org/PDF/080420202015128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	-	-	3	3	2	1	-	-	2	-	-
2	2	2	2	-	-	3	3	2	1	-	-	2	-	-
3	2	2	2	-	-	3	3	2	1	-	-	2	-	-
4	2	2	2	-	-	3	3	2	1	-	-	2	-	-
5	2	2	2	-	-	3	3	2	1	-	-	2	-	-
CO (W.A)	**2**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**1**	**-**	**-**	**2**	**-**	**-**

22CSP07 - DATABASE MANAGEMENT SYSTEM LABORATORY *(Common to 22CIP07 and 22ITP06)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To design a database system.	**1.1**	The students will be able to define database with various integrity constraints.		
2.0	To study the usage of DDL and DML commands.	**2.1**	The students will be able to work with various DDL, DML queries.		
3.0	To learn about joins, views, various built in functions and procedures and functions	**3.1**	The students will be able to create various views and make use of various types of joins and procedures and functions		
4.0	To know about normalization	**4.1**	The students will be able to design and normalize the design.		
5.0	To work with database connectivity.	**5.1**	The students will be able to work with real time data base connectivity		

LIST OF EXPERIMENTS

1. Structured Query Language : Creating Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes
2. Table and Record Handling
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements
3. Retrieving Data from a Database
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause
   - Using Aggregate Functions Combining Tables
   - Using JOINS Sub queries
4. Database Management
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users Using GRANT and REVOKE
5. High level language extension with Triggers
6. Database design using E-R model and Normalization
7. Design and implementation of Payroll processing system

8. Design and implementation of Banking system
9. Design and implementation of Library Information System
10. Design and implementation of Student Evaluation System

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE:

1. 33 nodes with LAN connection or Standalone PCs

SOFTWARE:

1. MYSQL 8.0
2. Visual Basic 6.0

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	3	3	-	-	-	-	-	-	2	-	3	3	3
2	-	3	3	3	2	-	2	-	-	-	-	3	3	3
3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	-	-	-	-	-	-	-	3	3	3	3
5	3	-	3	-	-	-	-	-	-	2	3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**	2	-	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

22CSP08 – ADVANCED JAVA PROGRAMMING LABORATORY
(Common to 22CCP09,22CIP09 and 22ITP07)

	L	T	P	C
	0	0	4	2

PREREQUISITE : 22CSP06

	Course Objectives		Course Outcomes
1.0	To understand creating GUI using AWT and SWING	**1.1**	The Students will be able to design window based applications
2.0	To develop Database applications	**2.1**	The Students will be able to access database through java programs
3.0	To design applications using pre built frameworks.	**3.1**	The Students will be able to invoke the remote methods in an application using Remote Method Invocation (RMI)
4.0	To develop web application using Java Servlet and Java Server Pages technology.	**4.1**	The Students will be able to develop the dynamic web pages using JSP
5.0	To learn how to work with JavaBeans.	**5.1**	The Students will be able to design reusable software components using java beans

LIST OF EXPERIMENTS

1. The laboratory work includes writing Java programs
2. To create GUI applications using swing, event handling, and layout management
3. Use JDBC connectivity and create Table, insert and update data.
4. Write a program in Java to implement a Client/Server application using RMI.
5. Write a program in Java to create a Cookie and set the expiry time of the same.
6. Write a program in Java to create Servlet to count the number of visitors to a web page.
7. Write a program in Java to create a form and validate a password using Servlet.
8. Develop a Java Bean to demonstrate the use of the same.
9. Develop Chat Server using Java

TOTAL (P:60) : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS SOFTWARE :

HARDWARE:
Standalone desktops 30 Nos.

SOFTWARE:
Java SDK or JRE 1.6 or higher
Java Servlet Container (Free Servlet Container available)
Supported Database and library that supports the database connection with Java.

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	-	-	3	1	2	2	3	3
2	3	3	3	3	3	1	-	-	3	1	2	2	3	3
3	3	3	3	3	3	1	-	-	3	1	2	2	3	3
4	3	3	3	3	3	1	-	-	3	1	2	2	3	3
5	3	3	3	3	3	1	-	-	3	1	2	2	3	3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**1**			**3**	**1**	**2**	**2**	**3**	**3**

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2022 **CHOICE BASED CREDIT SYSTEM**

M.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CPA01	Theoretical Foundations of Computer Science	FC	-	3	3	0	0	3
2	22CPB01	Networking Technologies	PCC	-	3	3	0	0	3
3	22CPB02	Advanced Data Structures and Algorithms	PCC	-	3	3	0	0	3
4	22CPB03	Advanced Database Technology	PCC	-	3	3	0	0	3
5	22CPB04	Multi core Architecture and Programming	PCC	-	3	3	0	0	3
6	22CPB05	Machine Learning Techniques	PCC	-	3	3	0	0	3
PRACTICAL									
7	22CPP01	Advanced Data Structures Laboratory	PCC	-	4	0	0	4	2
Audit Non Credit Courses									
8	A1	Audit Course	EEC	Ref. AC	2	2	0	0	0
				TOTAL	**24**	**20**	**0**	**4**	**20**

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CPB06	Big Data Analytics	PCC	-	3	3	0	0	3
2	22CPB07	Security Principles and Practices	PCC	-	3	3	0	0	3
3	22CPB08	Internet of Things	PCC	-	3	3	0	0	3
4	E1	Elective (PEC/OEC)	PEC/OEC	Ref. PE	3	3	0	0	3
5	E2	Elective (PEC)	PEC	Ref. PE	3	3	0	0	3
6	E3	Elective (PEC)	PEC	Ref. PE	3	3	0	0	3
PRACTICAL									
7	22CPP02	Big Data Analytics Laboratory	PCC	-	4	0	0	4	2
8	22CPE01	Technical Term Paper	EEC	-	4	0	0	4	2
				TOTAL	**26**	18	0	8	22

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	E4	Elective (PEC)	PEC	Ref. PE	3	3	0	0	3
2	E5	Elective (PEC)	PEC	Ref. PE	3	3	0	0	3
3	E6	Elective (PEC)	PEC	Ref. PE	3	3	0	0	3
PRACTICAL									
4	22CPE02	Project Phase I	EEC	-	12	0	0	12	6
				TOTAL	**21**	**9**	**0**	**12**	**15**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22CPE03	Project Phase II	EEC	22CPE02	24	0	0	24	12
				TOTAL	**24**	**0**	**0**	**24**	**12**

(A) FC,PCC, PEC, OEC, EEC and AC Courses

(a) FOUNDATION COURSES(FC)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CPA01	Theoretical Foundations of Computer Science	FC	NIL	3	3	0	0	3

(b) PROFESSIONAL CORE COURSES (PCC)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CPB01	Networking Technologies	PCC	NIL	3	3	0	0	3
2	22CPB02	Advanced Data Structures and Algorithms	PCC	NIL	3	3	0	0	3
3	22CPB03	Advanced Database Technology	PCC	NIL	3	3	0	0	3
4	22CPB04	Multi core Architecture and Programming	PCC	NIL	3	3	0	0	3
5	22CPB05	Machine Learning Techniques	PCC	NIL	3	3	0	0	3
6	22CPP01	Advanced Data Structures Laboratory	PCC	NIL	4	0	0	4	2
7	22CPB06	Big Data Analytics	PCC	NIL	3	3	0	0	3
8	22CPB07	Security Principles and Practices	PCC	NIL	3	3	0	0	3
9	22CPB08	Internet of Things	PCC	NIL	3	3	0	0	3
10	22CPP02	Big Data Analytics Laboratory	PCC	NIL	4	0	0	4	2

(c) PROFESSIONAL ELECTIVE COURSES (PEC)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CPX01	Cloud Computing	PEC	NIL	3	3	0	0	3
2	22CPX02	Data Warehousing and Data Mining	PEC	NIL	3	3	0	0	3
3	22CPX03	Software Requirement Engineering	PEC	NIL	3	3	0	0	3
4	22CPX04	Agile Software Development Methodologies	PEC	NIL	3	3	0	0	3
5	22CPX05	Advanced Operating Systems	PEC	NIL	3	3	0	0	3
6	22CPX06	Semantic Web	PEC	NIL	3	3	0	0	3
7	22CPX07	Deep Learning	PEC	NIL	3	3	0	0	3
8	22CPX08	Digital Image Processing and Applications	PEC	NIL	3	3	0	0	3
9	22CPX09	Information Retrieval Techniques	PEC	NIL	3	3	0	0	3
10	22CPX10	Web Services	PEC	NIL	3	3	0	0	3
11	22CPX11	Mobile Application Development	PEC	22CPB01	3	3	0	0	3
12	22CPX12	Wireless Sensor Networks	PEC	22CPB01	3	3	0	0	3
13	22CPX13	Natural Language Processing	PEC	NIL	3	3	0	0	3
14	22CPX14	GPU Computing	PEC	NIL	3	3	0	0	3
15	22CPX15	Compiler Construction and Optimization	PEC	NIL	3	3	0	0	3
16	22CPX16	Blockchain Technologies	PEC	NIL	3	3	0	0	3
17	22CPX17	Pattern Recognition	PEC	NIL	3	3	0	0	3
18	22CPX18	Virtualization Techniques	PEC	NIL	3	3	0	0	3
19	22CPX19	Quantum Computing	PEC	NIL	3	3	0	0	3

(d) OPEN ELECTIVE COURSES (OEC)									
S. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22BAZ01	Research Methodology and IPR	OEC	NIL	3	3	0	0	3
2	22CPZ01	Machine Vision	OEC	NIL	3	3	0	0	3

(e) EMPLOYABILITY ENHANCEMENT COURSES (ECC)									
S. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	Ref. AC	Audit Course	EEC	NIL	2	2	0	0	0
2	22CPE01	Technical Term Paper	EEC	NIL	4	0	0	4	2
3	22CPE02	Project Phase I	EEC	NIL	12	0	0	12	6
4	22CPE03	Project Phase II	EEC	22CPE02	24	0	0	24	12

(f) AUDIT COURSES (AC)									
S. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22PGA01	English for Research Paper Writing	EEC	NIL	2	2	0	0	0
2.	22PGA02	Disaster Management	EEC	NIL	2	2	0	0	0
3.	22PGA03	Constitution of India	EEC	NIL	2	2	0	0	0

SUMMARY						
S.No.	SUBJECT AREA	CREDITS AS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	FC	3	0	0	0	3
2	PCC	17	11	0	0	28
3	PEC	0	9	9	0	18
4	EEC	0	2	6	12	20
TOTAL CREDITS		20	22	15	12	69

TOTAL CREDITS (20+22+15+12) = 69 CREDITS

22CPA01 - THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objectives		Course Outcomes	
1.0	To learn about cardinality, finite and countable infinite sets and to determine their characteristics	**1.1**	The Students will be able to arrive at conclusions about sets and relations, construct the number of arrangements and selections using principles of counting.
2.0	To impart the knowledge of propositional and predicate logics.	**2.1**	The Students will be able to solve propositional logic, including modeling English description with propositions and connectives along with truth analysis and will be conversant in predicate logic.
3.0	To explain about various types of graphs including Regular graphs and Random graphs.	**3.1**	The Students will be able to identify spanning trees, cut sets, isomorphism and different representation of a graph.
4.0	To inculcate more complex queuing systems.	**4.1**	The Students will be able to analyze the basic characteristic features of a queuing system and models.
5.0	To gain knowledge on advanced courses in automation theory, formal languages, algorithms & logic.	**5.1**	The Students will be able to solve problems using formal languages and automata.

UNIT I - FOUNDATIONS	**(9)**
Sets-Relations-Equivalence relations-Partial orders-Functions-Recursive functions-Sequences-Induction principle- Structural induction-Recursive algorithms-Counting - Pigeonhole principle-Permutations and Combinations (Self study)-Recurrence relations.	
UNIT II - LOGIC	**(9)**
Propositional logic-Logical connectives-Truth tables-Normal forms (conjunctive and disjunctive)-Predicate logic- Universal and existential quantifiers-Proof techniques-Direct and Indirect-Proof by contradiction-Mathematical Induction (Self study).	
UNIT III - GRAPH STRUCTURES	**(9)**
Tree Structures- Graph Structures- Graph Representations-Regular graph structures-Random graphs-Connectivity- Cycles-Graph coloring-Cliques, Vertex Covers, Independent sets-Spanning Trees-Network flows(Self study)- Matching.	
UNIT IV - QUEUE MODELS	**(9)**
Characteristics of Queuing Models- Kendal's Notation-Single and Multi-Server Markovian queuing models – M/M/1, M/M/C(Self study) (finite and infinite capacity) and (M/G/1) :(∞/GD).	

UNIT V - MODELING COMPUTATION AND LANGUAGES	(9)
Finite state machines – Deterministic and Non- deterministic finite state machines – Turing Machines – Formal Languages – Classes of Grammars – Type 0 – Context Sensitive – Context Free – Regular Grammars(Self study) – Ambiguity.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, TMH, 2011.
2. M.K. Venkataraman, N. Sridharan and N.Chandrasekaran," Discrete Maths.", The National Publishing Company, 2003.
3. Kishore S Trivedi, "Probability and statistics with reliability, Queuing and computer science applications", PHI, 2006.
4. H. A.Taha, ," Operations Research" - An Introduction,9th Edition, Prentice Hall of India Ltd New Delhi, 2014.
5. Ralph P Girmaldi and B.V. Ramana ,"Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education ,Asia, Delhi, 5th Edition, 2006.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2	-	1	-	-	2	2	-
2	3	-	1	2	-	2	2	-
3	3	-	1	-	-	2	-	2
4	2	-	-	1	1	2	-	-
5	3	-	1	2	-	2	2	2
CO (W.A)	3	-	1	2	1	2	2	2

22CPB01 - NETWORKING TECHNOLOGIES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To learn about integrated and differentiated services architectures.	**1.1**	The student will able to identify the different features of integrated and differentiated services.		
2.0	To know about TCP performance & congestion avoidance techniques.	**2.1**	The students will be able to outline an insight of TCP performance, congestion avoidance and control.		
3.0	To study the developments in cellular networks and understand the working of wireless network protocols.	**3.1**	The student will able to design and demonstrate protocols for cellular & wireless networks.		
4.0	To get familiarized with next generation networks.	**4.1**	The student will able to analyze the use of next generation networks.		
5.0	To know the concepts behind software defined networks.	**5.1**	The student will be able to provide solutions using SDN.		

UNIT I - NETWORK ARCHITECTURE AND QoS	**(9)**
Overview of TCP/IP Network Architecture – Integrated Services Architecture – Approach – Components – Services – Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services.	
UNIT II - TCP PERFORMANCE MODELING	**(9)**
TCP Segment format - TCP Sliding Windows - Congestion Control and Queuing – TCP Congestion Control - Analysis of TCP: Buffer Sizing - Throughput - Fairness - Random Early Detection Gateways for Congestion Avoidance. - Congestion Control for High Bandwidth - Delay Product Networks - Variations of TCP.	
UNIT III - CELLULAR AND WIRELESS NETWORKS	**(9)**
GSM – GPRS – UMTS – UTRAN - UMTS Security - IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – WLAN: Configuration and Security– IEEE 802.11e and WMM – Comparison of WLAN and UMTS – Bluetooth.	
UNIT IV - 4G NETWORKS	**(9)**
LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks –Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) – 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G& XG networks.	

UNIT V - SOFTWARE DEFINED NETWORKS	(9)
Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. William Stallings, "High Speed Networks and Internets: Performance and Quality of Service", Prentice Hall, 2nd Edition, 2002.
2. James F Kurose, Keith W Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Pearson Education, India, 2012.
3. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.
4. Martin Sauter,"3G, 4G And Beyond–Bringing Networks, Devices And The Web Together" A John Wiley & Sons, Ltd., Publication, 2nd Edition, 2013.
5. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.
6. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2014.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	1	3	2	2	-	3	3	2
2	3	2	2	3	1	2	1	2
3	3	3	-	3	2	1	2	1
4	3	2	1	2	2	2	3	3
5	-	3	3	2	3	3	3	3
CO (W.A)	2.5	2.6	2	2.4	2	2.2	2.4	2.2

22CPB02 - ADVANCED DATA STRUCTURES AND ALGORITHMS					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To extend the students' knowledge on basic techniques of algorithm analysis.	**1.1**	The student will be able to use recursive design.		
2.0	To get familiarized with various types of tree structures.	**2.1**	The student will be able to choose appropriate tree data structure as applicable to specified problem definition.		
3.0	To learn the usage of graphs and its applications	**3.1**	The student will be able to design algorithms using graph structure to solve real-life problems		
4.0	To impart knowledge on different algorithm design techniques.	**4.1**	The student will be able to use different algorithm Design Techniques.		
5.0	To learn about advanced algorithms.	**5.1**	The student will be able to apply suitable design strategy for problem solving		

UNIT I - ALGORITHM ANALYSIS	**(9)**
Asymptotic Notations – Properties of Big-oh Notation – Conditional Asymptotic Notation –Algorithm Analysis: Analysis of iterative and recursive Algorithms –Introduction to Linear and Non Linear data structures.	
UNIT II - HIERARCHICAL DATA STRUCTURES	**(9)**
Binary Search Trees – AVL Trees – Red-Black –Properties of Red-Black Trees –Insertion and Deletion-Min/Max heaps– Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps.	
UNIT III - GRAPHS	**(9)**
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components – Minimum Spanning Trees- Single –Source Shortest Paths –All Pairs Shortest Paths – Maximum Flow.	
UNIT IV - ADVANCED ALGORITHMS	**(9)**
Huffman Coding – Convex Hull – Closest pair of points – Tree Vertex Splitting – Activity Networks – Flow Shop Scheduling – Introduction to Randomized algorithms.	
UNIT V - NP COMPLETE AND NP HARD	**(9)**
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility - NP Complete Problems - Approximation Algorithms: Travelling Salesman Problem - Sum of Subset Problem - Vertex Cover Problem.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein," Introduction to Algorithms", 4th Edition, Prentice Hall of India, New Delhi, 2022.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson Education, 2014.
3. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2008.
4. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms/C++", 2nd Edition, University Press, 2007.
5. Alfred .V. Aho, John .E. Hopcroft, and Jeffrey .D. Ullman, "Data Structures and Algorithms", Addison-Wesley Publications, 2008.
6. Anany Levitin, "Introduction to the Design and Analysis of algorithms", 3rd Edition, Pearson, USA, 2012.

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	1	1
2	2		2	3	3	3	2	2
3	3	-	3	3	3	3	3	3
4	3	-	3	2	1	3	3	3
5	3	3	3	3	3	3	3	3
CO (W.A)	2.8	3	2.8	2.8	2.6	3	2.4	2.4

22CPB03 - ADVANCED DATABASE TECHNOLOGY					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To acquire knowledge on parallel and distributed databases and its applications.	**1.1**	The students will be able to select the appropriate high performance database like parallel and distributed database.		
2.0	To study the usage and applications of Object Oriented database.	**2.1**	The students will be able to model and represent the real world data using object oriented database.		
3.0	To understand the usage of advanced data models.	**3.1**	The students will be able to design a semantic based database to meaningful data access.		
4.0	To gain knowledge about intelligent databases.	**4.1**	The students will be able to embed the rule set in the database to implement intelligent databases.		
5.0	To acquire inquisitive attitude towards research topics in database like NoSQL.	**5.1**	The students will be able to demonstrate competency in designing and selecting a particular NoSQL database for specific use cases.		

UNIT I - PARALLEL DATABASES	**(9)**
Database System Architectures: Centralized and Client-Server Architectures - Server System Architectures - Parallel Systems- Parallel Databases: I/0 Parallelism - Inter and Intra Query Parallelism - Inter and Intra operation Parallelism- Design of Parallel Systems.	
UNIT II - DISTRIBUTED DATABASES	**(9)**
Distributed Database Concepts - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control - Distributed Query Processing.	
UNIT III - OBJECT BASED DATABASES	**(9)**
Concepts for Object Databases: Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance - Complex Objects - Object Database Standards, Languages and Design: ODMGModel - ODL - OQL .	
UNIT IV - INTELLIGENT DATABASES	**(9)**
Active Databases: Syntax and Semantics -Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- Deductive Databases: Logic of Query Languages - Data log Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures Spatial Access Methods- Mobile Databases.	

UNIT V - NOSQL DATABASES	(9)
Introduction to Big Data-Storage- NoSQL Introduction - Differences from relational databases- Column family store- Document stores - key-value databases - Graph databases - Choosing a NoSQL database.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 7 t h Edition, Pearson Education/Addison Wesley, 2017.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 6th Edition, Pearson Education, 2015.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 7th Edition, McGraw Hill, 2019.
4. C. J. Date, A.Kannan and S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	-	2	3	-	3	2
2	3	2	1	2	3	-	3	2
3	-	-	1	-	-	1	3	3
4	3	3	2	2	3	2	3	3
5	3	3	-	2	3	-	3	3
CO (W.A)	3	2.5	1.33	2	3	1.5	3	2.6

22CPB04 – MULTICORE ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the basic structure and operation of Multicore architecture and parallel processing.	**1.1**	The student will be able to analyze the working principle of ILP.
2.0	To understand parallel programming concepts and threading APIs.	**2.1**	The student will be able to know the concepts of threading and parallel programming constructs.
3.0	To understand Memory Hierarchy Design and virtual machines.	**3.1**	The student will be able to understand the concept of Memory Hierarchy Design and virtual machines.
4.0	To understand MPI programming and multicore debugging techniques.	**4.1**	The student will be able to understand the issues related to processors, memories, I/O devices.
5.0	To provide knowledge of memory technologies, interfacing techniques and subsystem devices.	**5.1**	The student will be able to use memory technologies, interfacing techniques and subsystem devices efficiently.

UNIT I - INTRODUCTION	**(9)**
Classes of Computers-Trends in Technology-Trends in Power and Energy in Integrated Circuits- Instruction Level Parallelism-Basic Compiler Techniques for Exposing ILP-Software and hardware multithreading – SMT and CMP architectures –Design issues – Case studies – Intel Multi-core architecture	
UNIT II – PARALLEL PROGRAMMING	**(9)**
Fundamental concepts – Designing for threads – Scheduling - Threading and parallel Programming constructs – Synchronization – Critical sections – Deadlock - Threading APIs	
UNIT III – MEMORY HIERARCHY DESIGN	**(9)**
Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies .	
UNIT IV – MPI PROGRAMMING	**(9)**
MPI Model – Collective communication – Data decomposition – Communicators and topologies – Interconnection networks – Buses, crossbar-Multi-stage switches – Point-to-point communication – MPI Library	
UNIT V – MULTI THREAD AND STORAGE APPLICATION	**(9)**
Algorithms, program development and performance tuning-Advanced topics in disk storage-Video control–I/O Performance–SMART technology and fault detection–Processor to network interfaces	
	TOTAL (L:45) : 45 PERIODS

REFERENCES :

1. John L. Hennessey and David A. Patterson, "Computer architecture – A quantitative approach", Morgan Kaufmann/Elsevier Publishers, 6th Edition, 2019.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2010.
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2004.
4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/ Software Approach", Morgan Kaufmann/Elsevier Publishers, 1999.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	-	-	-	3	-	2	3	3
2	2	-	-	-	3	2	3	3
3	-	-	1	3	3	2	2	2
4	-	-	2	2	2	2	1	1
5	-	-	1	2	2	2	1	-
CO (W.A)	2	-	1.33	2.5	2.5	2	2	2.75

22CPB05 - MACHINE LEARNING TECHNIQUES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the concepts of Machine Learning.	1.1	The students will be able to learn the types of machine learning models.
2.0	To appreciate supervised learning and their applications.	2.1	The students will be able to use the supervised learning algorithms for any given problem.
3.0	To appreciate the concepts and algorithms of unsupervised learning.	3.1	The students will be able to use the unsupervised learning algorithms for any given problem.
4.0	To understand the theoretical and practical aspects of Probabilistic Graphical Models.	4.1	The students will be able to apply the graphical models of machine learning
5.0	To appreciate the concepts and algorithms of advanced learning.	5.1	The students will be able to identify applications suitable for different types of Machine Learning with suitable justification.

UNIT I - INTRODUCTION	(9)
Machine Learning–Types of Machine Learning –Machine Learning process- preliminaries, testing Machine Learning algorithms, turning data into Probabilities, and Statistics for Machine Learning- Probability theory – Probability Distributions – Decision Theory.	
UNIT II - SUPERVISED LEARNING	**(9)**
Linear Models for Regression – Linear Models for Classification- Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes – Ensemble Methods, Bagging, Boosting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back propagation - Support Vector Machines.	
UNIT III - UNSUPERVISED LEARNING	**(9)**
Clustering- K-means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis	
UNIT IV - PROBABILISTIC GRAPHICAL MODELS	**(9)**
Graphical Models – Undirected Graphical Models – Directed Graphical Models –Bayesian Networks – Conditional Independence properties – Markov Random Fields- Hidden Markov Models – Conditional Random Fields(CRFs).	
UNIT V - ADVANCED LEARNING	**(9)**
Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Computational Learning Theory – Mistake Bound Analysis – Reinforcement learning – Markov Decision processes, Deterministic and Non-deterministic Rewards and Actions, Temporal Difference Learning Exploration.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, 2nd Edition, 2014.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 3rd Edition, 2014.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 3rd Edition,2013.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	1	-	2	3	3	2
2	3	1	2	1	2	3	2	2
3	3	2	3	2	3	3	2	3
4	3	1	2	3	2	3	3	2
5	3	3	3	3	3	3	3	3
CO (W.A)	3	1.6	2.2	2.3	2.4	3	2.6	2.4

22CPP01 - ADVANCED DATA STRUCTURES LABORATORY				
	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To gain knowledge on various basic and advanced data structures.	**1.1**	Student will be able to formulate new solutions for programming problems
2.0	To know various techniques for representation of the data in the real world.	**2.1**	The students will be able to identify the appropriate data structure for given problem.
3.0	To have practical knowledge on data structure applications.	**3.1**	The students will be able to develop the application of data structures.
4.0	To learn about implementation of various tree data structures.	**4.1**	Student will be able to handle operations like searching, insertion, deletion mechanism on tree data structures.
5.0	To have practical knowledge on advanced data structure concepts.	**5.1**	Student will be able to determine and demonstrate advanced data structures.

LIST OF EXPERIMENTS:

1. Implementation of the following Heap data structures
   - i) Min/Max Heap(Insertion, Delete Min, Delete Max)
   - ii) Skew Heap and Fibonacci Heap
2. Implementation of the following Search Structures
   - i) AVL Trees (Insertion, Deletion and Search)
   - ii) Splay Trees (Insertion, Deletion and Search)
   - iii) B-Trees (Insertion, Deletion and Search)
   - iv) Red-Black Trees.
3. Implementation of Topological sort.
4. Implementation of Convex Hull.
5. Solve NP Problems- sum of Subset problem.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	-	3	3	1	3	3	3
2	3	-	3	3	-	2	3	3
3	3	-	3	3	-	2	3	3
4	3	-	3	3	-	2	3	3
5	3	-	3	3	-	2	3	3
CO (W.A)	3	-	3	3	1	2	3	3

22CPB06 - BIG DATA ANALYTICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide an overview of an exciting growing field of big data analytics.	**1.1**	The student will able to understand the fundamentals of various big data analytics techniques.		
2.0	To introduce the tools required to manage and analyze big data like Hadoop, NoSql.	**2.1**	The student will able to acquire fundamental enabling techniques and scalable algorithms like Hadoop, NO SQL in big data analytics		
3.0	To teach the fundamental techniques and programming in achieving big data analytics with scalability and streaming capability.	**3.1**	The student will able to Categorize and summarize the fundamental techniques and programming in Big Data and its importance.		
4.0	To introduce programming tools PIG & HIVE in Hadoop echo system	**4.1**	The student will able to explore on Big Data applications Using Pig and Hive.		
5.0	To enable students to learn to use various techniques for mining data stream.	**5.1**	The student will be able to build a complete business data analytics solution		

UNIT I - INTRODUCTION TO BIG DATA AND ANALYTICS	**(9)**
Introduction to Big Data - Classification of Digital Data, Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data Analytics importance - Data Science- Terminologies used in Big Data Environments - Analytics Tools.	
UNIT II - INTRODUCTION TO TECHNOLOGY LANDSCAPE	**(9)**
NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop – Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System – Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem.	
UNIT III - INTRODUCTION TO MONGODB ,CASSANDRA AND MAPREDUCE PROGRAMMING	**(9)**
MongoDB: Terms used in Mongo DB - Data Types - MongoDB Query Language- Cassandra: Features - CQL Data Types –CRUD Operations – Collections alter Commands - Import and Export - Querying System Tables. MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.	
UNIT IV - INTRODUCTION TO HIVE AND PIG	**(9)**
Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having - RCFile Implementation - Hive User Defined Function - Serialization and Deserialization. Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig – Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig – HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo	

UNIT V - INTRODUCTION TO DATA ANALYTICS WITH R	(9)
Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Machine Learning Algorithms: Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, Decision Tree, Big Data Analytics with BigR.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, 2nd Edition,2019
2. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc.,2013.
3. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, 4th Edition,2015
4. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications,2014
5. Robert D.Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc.,2012
6. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2012
7. Chuck Lam, "Hadoop In Action", Dreamtech Publications, 2010

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	1	-	2	3	2	2
2	3	2	2	1	2	3	2	2
3	3	2	3	2	3	3	2	3
4	3	2	2	3	2	3	2	2
5	3	3	3	3	3	3	3	3
CO (W.A)	3	2	2.2	1.8	2.4	3	2.2	2.4

22CPB07 - SECURITY PRINCIPLES AND PRACTICES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To learn the core fundamentals of system security concepts.	**1.1**	The students will be able to comprehend the core fundamentals of system security.		
2.0	To have thorough knowledge in the security concepts related to networks.	**2.1**	The students will be able to apply the security concepts related to networks in wired and wireless scenario.		
3.0	To deploy the security essentials in IT Sector.	**3.1**	The students will be able to implement and manage the security essentials in IT Sector.		
4.0	To be exposed to the concepts of Cyber Security and encryption Concepts.	**4.1**	The students will be able to elucidate the notion of cyber security and encryption concepts.		
5.0	To perform a detailed study of Privacy and Storage security and related Issues.	**5.1**	The students will be able to procure intelligence in the area of privacy and storage security and related issues.		

UNIT I - SYSTEM SECURITY	**(9)**
Building a secure organization- A Cryptography primer- detecting system Intrusion, Preventing system Intrusion - Guarding Against Network Intrusions: Preventive Measures - Intrusion Monitoring and Detection - Reactive Measures.	
UNIT II - NETWORK SECURITY	**(9)**
Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network Security - Cellular Network Security – RFID Security.	
UNIT III - SECURITY MANEGEMENT	**(9)**
Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Identity Management - Intrusion and Detection and Prevention System.	
UNIT IV - CYBER SECURITY AND CRYPTOGRAPHY	**(9)**
Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption –Public key Infrastructure.	
UNIT V - PRIVACY AND STORAGE SECURITY	**(9)**
Privacy in the Digital Society - Privacy Enhancing Technologies - Personal privacy Policies –VoIP Security - Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. John R.Vacca, "Computer and Information Security Handbook", 3rd Edition, Elsevier 2017.
2. Herbert J. Mattord and Michael E. Whitman, "Principal of Information Security", 6th Edition, Cengage Learning,2017
3. Richard E.Smith, "Elementary Information Security", 3rd Edition, Jones and Bartlett Learning, 2019.

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	-	3	3	2	2	3	3
2	3	-	3	3	3	3	3	3
3	3	-	3	3	2	3	3	3
4	3	-	3	3	2	3	3	3
5	3	-	3	3	3	3	3	3
CO (W.A)	3	-	3	3	2.4	2.8	3	3

22CPB08 - INTERNET OF THINGS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : Basic programming skills, Basic electronics skills

Course Objectives		Course Outcomes	
1.0	To learn the basic issues, policy and challenges in the Internet	**1.1**	The students will be able to identify the components of IOT
2.0	To understand the components and the protocols in Internet	**2.1**	The students will be able to design a portable IOT using appropriate boards
3.0	To build a small low cost embedded system with the internet	**3.1**	The students will be able to program the sensors and controller as part of IOT
4.0	To understand the various modes of communications with internet	**4.1**	The students will be able to develop schemes for the applications of IOT in real time scenarios
5.0	To learn to manage the resources in the Internet	**5.1**	The students will be able to establish the communication to the cloud through Wi-Fi / Bluetooth

UNIT I - INTRODUCTION	**(9)**

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – RF links – Mobile Internet – Wired Communication.

UNIT II – PROGRAMMING THE MICROCONTROLLER FOR IOT	**(9)**

Basics of Sensors and actuators – Examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors - Communication-Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using WiFi / Ethernet

UNIT III - RESOURCE MANAGEMENT IN THE INTERNET OF THINGS	**(9)**

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object - Data Synchronization-Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behavior of Objects.

UNIT IV - BUSINESS MODELS FOR THE INTERNET OF THINGS	(9)
The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things – Semantic Interoperability as a Requirement for DiY Creation - Ontology- Value Creation in the Internet of Things- Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology – The Internet of Things in Context of EURIDICE - Business Impact.	
UNIT V - FROM THE INTERNET OF THINGS TO THE WEB OF THINGS	**(9)**
Resource-oriented Architecture and Best Practices- Designing RESTful Smart Things - Web-enabling Constrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case study –CAM:cloud Assisted Privacy– Other recent projects.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2012.
2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011
3. Luigi Atzor et.al, "The Internet of Things: A survey", Journal on Networks, Elsevier Publications, October, 2010
4. Huang Lin, Gainesville, Jun Shao, Chi Zhang, Yuguang Fang, "CAM: Cloud-Assisted Privacy Preserving Mobile Health Monitoring", IEEE Transactions on Information Forensics and Security, 2013
5. Pengwei Hu; Fangxia Hu, "An optimized strategy for cloud computing architecture", 3rd IEEE Transactions on Computer Science and Information Technology (ICCSIT), 2010.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	2	2	3	-	3	2
2	3	2	-	2	3	-	3	2
3	-	-	1	-	-	1	3	3
4	3	3	3	2	3	2	3	3
5	3	3	-	2	3	-	3	3
CO (W.A)	3	2.5	2.33	2	3	1.5	3	2.6

22CPP02 - BIG DATA ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the installation and configuration procedure for Hadoop and HDFC	**1.1**	The student will able to improve the Knowledge of Hadoop and HDFC file system tools
2.0	To understand and implement Map Reduce programs and R for processing big data.	**2.1**	The student will able to identify problems, analyze, and evaluate using various R, MapReduce Programs.
3.0	To understand and how to run the Hive tools.	**3.1**	The student will able to know various tools in Hive.
4.0	To learn about various queries in Pig.	**4.1**	The student will able to exhibit new ideas and innovations in Hive and Pig.
5.0	To gain knowledge on analyzing big data using linear models, machine learning techniques such as SVM / Decision tree classification and clustering.	**5.1**	The student will able to build and apply linear and logistic regression models and perform data analysis with machine learning method.

LIST OF EXPERIMENTS:

HADOOP,HIVE AND PIG

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce,Hive.
3. Implement an MR program that processes a weather dataset
4. Design and Implement the following Mapreduce programs
   a) Writing mapper programs b) Writing reducer programs
5. Develop and execute the Partitions and Buckets partitioning program in Hive.
6. Design and Implement the following Hive Tables
   a) Importing Data. b)Querying Data
7. Pig Queries [Hands-on]

R

8.Implement Linear and logistic Regression

9.Implement SVM / Decision tree classification techniques

10.Implement clustering techniques

11.Visualize data using any plotting framework

12. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3		3	3	1	3	3	3
2	3	1	3	3	1	2	3	3
3	3	1	3	3	1	2	3	3
4	3	1	3	3	1	2	3	3
5	3	1	3	3	1	2	3	3
CO (W.A)	3	1	3	3	1	2.2	3	3

22CPE01 - TECHNICAL TERM PAPER				
	L	T	P	C
	0	0	4	2
PRE REQUISITE : NIL				

Course Objectives		Course Outcomes	
1.0	To provide exposure to the students to refer, read and review the research articles in referred journals and conference proceedings.	1.1	At the end of the course the student will be able to read and review the research articles and publish a technical paper.

METHODOLOGY

- Each student is allotted to a faculty of the department by the Dean/ HOD.
- By mutual discussions, the faculty guide will assign a topic in the general / subject area to the student.
- The students have to refer the Journals and Conference proceedings and collect the published literature.
- The student is expected to collect at least 20 such Research Papers published in the last 5 years.
- Using OHP/PowerPoint, the student has to make presentation for 15-20 minutes followed by 10 minutes discussion.
- The student has to make two presentations, one at the middle and the other near the end of the semester.
- The student has to write a Technical Report for about 30-50 pages (Title page, one page Abstract, Review of Research paper under various sub headings, Concluding Remarks and List of References).The technical report has to be submitted to the Dean/ HOD one week before the final presentation, after the approval of the faculty guide.

EXECUTION

Week	Activity
I	Allotment of Faculty Guide by the Dean/ HoD
II	Finalizing the topic with the approval of Faculty Guide
III-IV	Collection of Technical papers
V-VI	Mid semester presentation
VII-VIII	Report writing
IX	Report submission
X-XI	Final presentation

EVALUATION

100%by Continuous Assessment - 3 Hrs/week and 1 credit	
Component	Weight age
Mid semester presentation	25%
Final presentation(Internal)	25%
End Semester Examination Report	30%
Presentation	20%
Total	100%

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3

22CPE02 - PROJECT PHASE I				
	L	T	P	C
	0	0	12	6

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature, the methodology to solve the identified problem and preparing project reports and to face reviews and viva-voce examination.	1.1	At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the phase II project work in a systematic way.

SYLLABUS:

- Student individually works on a specific topic approved by the head of the department under the guidance of a faculty member who is familiar in this area.
- The student can select any topic which is relevant to the area of Computer Science and Engineering. The topic may be theoretical or case studies.
- At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.
- The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL (P:180) : 180 PERIODS

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3

22CPE03 - PROJECT PHASE II				
	L	T	P	C
	0	0	24	12
PRE REQUISITE : 22CPE02				

Course Objectives		Course Outcomes	
1.0	To solve the identified problem based on the formulated methodology.	1.1	On completion of the project work students will be in a position to take up any challenging practical problem in the field of engineering design and find better solutions to it.

SYLLABUS:

- Student should continue the phase - I work on the selected topic as per the formulated methodology. At the end of the semester,
- After completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.
- The students will be evaluated based on the report submitted and the viva -voce examination by a panel of examiners including one external examiner.

TOTAL (P:360) : 360 PERIODS

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3

22CPX02 - DATA WAREHOUSING AND DATA MINING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					

Course Objectives		Course Outcomes	
1.0	To understand the basic principles, concepts and applications of data mining	**1.1**	The students will be able to describe the concepts of data mining and perform statistical analysis of data.
2.0	To enlighten the Data warehousing concepts and preprocessing techniques.	**2.1**	The students will be able to develop and apply preprocessing techniques and design data warehouse.
3.0	To understand and create association rules	**3.1**	The students will be able to apply association rule mining methods to solve the given problem.
4.0	To learn the importance of supervised learning and relevant algorithms,	**4.1**	The students will be able to apply classification techniques to solve real world problems.
5.0	To learn the importance of unsupervised learning algorithms and recent trends.	**5.1**	The students will be able to utilize different clustering methods for various applications.

UNIT I - INTRODUCTION TO DATA MINING	**(9)**
Data Mining – Steps in Knowledge Discovery Process – Kinds of Data and Patterns –Technologies used – Targeted applications – Major issues in Data Mining – Data objects and Attribute types – Statistical descriptions of data – Measuring data similarity and dissimilarity.	
UNIT II – DATA PREPROCESSING AND DATA WAREHOUSING	**(9)**
Data Preprocessing: Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization – Data Warehouse Architecture –Data Warehouse: Concepts – Modeling – Design – Implementation – Need of Data Warehousing	
UNIT III - FREQUENT PATTERN MINING	**(9)**
Basic concepts – Frequent item set mining methods: Apriori Algorithm – A pattern growth approach for Mining frequent item sets – Pattern Evaluation methods – Multilevel – Multi dimensional frequent pattern mining.	
UNIT IV - CLASSIFICATION AND PREDICTION	**(9)**
Basic Concepts – Decision Tree Induction – Bayesian Classification – Classification by Back Propagation – Support Vector Machines – Model Evaluation and Selection – Techniques to Improve Classification Accuracy – Advanced methods.	
UNIT V - CLUSTER ANALYSIS AND TRENDS IN DATA MINING	**(9)**
Basic Concepts – Partitioning Methods – Hierarchical Methods – Density based Methods – Grid based Methods – Data Mining Applications – Data mining Trends: Mining complex Data types.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Han Jiawei, and Kamber Micheline, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2012.
2. Alex Berson and Stephen J.Smith,"Data Warehousing , Data Mining and OLAP" , Tata McGraw-Hill Edition,13th Reprint 2008.
3. Deepali Kamthania, "Data Warehousing and Data Mining" 1st Edition, IK International Publishing House Pvt Ltd., 2022.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	-	-	2	3	1	2
2	3	2	2	2	3	3	3	3
3	3	2	2	2	3	3	3	3
4	3	3	-	1	3	3	2	2
5	3	3	3	3	3	3	3	3
CO (W.A)	3	2.2	1.4	1.6	2.8	3	2.4	2.6

22CPX03 - SOFTWARE REQUIREMENT ENGINEERING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the basic concepts of software requirements engineering.	**1.1**	The students will be able to define a process for requirement engineering.
2.0	To be able to recognize requirements of each type, a prerequisite for effective documentation writing.	**2.1**	The students will be able to understand the professional and ethical responsibilities of a software engineer.
3.0	To gain knowledge on the quality assurance and evolution	**3.1**	The students will be able to check the quality assurance for the project
4.0	Develop the skills for building system models	**4.1**	The students will be able to draw UML diagrams and system models for a respective project.
5.0	To understand the stakeholders involved in requirements engineering.	**5.1**	The students will be able to design a software within realistic constraints.

UNIT I - INTRODUCTION	**(9)**
Introduction – Requirements engineering – categories of requirements –requirements in software life cycle-agile development process and requirement engineering- identifying stake holders-arte-fact driven elicitation techniques- stake holder driven elicitation technique-risk analysis-requirement prioritization.	
UNIT II – REQUIREMENT SPECIFICATION AND DOCUMENTATION	**(9)**
Diagrammatic notations: system scope-conceptual structures-activities and data-instruction flow-interaction scenarios-system behavior-stimuli and behavior-formal specification.	
UNIT III - QUALITY ASSURANCE AND EVOLUTION	**(9)**
Requirements inspection and review-validation by specification animation-verification through formal checks-evolution: time space dimension-change anticipation-traceability management- control management-runtime monitoring.	
UNIT IV - BUILDING SYSTEM MODELS	**(9)**
Modeling system objectives with goal diagrams-building goal models-risk analysis on goal models-modeling conceptual objects with class diagrams.	
UNIT V - REASONING ABOUT SYSTEM MODELS	**(9)**
Semiformal reasoning-formal specification of system models-formal reasoning for specification construction and analysis.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Axel van Lamsweerde, "Requirements Engineering", Wiley, 2009.
2. Dean Leffingwell and Don Widrig, "Managing Software Requirements: A Use Case Approach", 2nd Edition, Addison- Wesley, 2003.
3. Gerald Kotonya, Ian Sommerville, "Requirements Engineering: Processes and Techniques", John Wiley and Sons, 1998.
4. SEI Report, "Quality Attributes Workshop", http://www.sei.cmu.edu/library/abstracts/reports/03tr016.cfm, 2003.

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	1	-	-	2	3	1	2
2	3	2	2	2	3	3	3	3
3	3	2	2	2	3	3	3	3
4	3	3	-	1	3	3	2	2
5	3	3	3	3	3	3	3	3
CO (W.A)	3	2.2	1.4	1.6	2.8	3	2.4	2.6

22CPX06 – SEMANTIC WEB					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To learn fundamental concepts of semantic web.	**1.1**	The students will be able to understand the fundamental concepts of the semantic web.		
2.0	To know about different framework used in semantic web.	**2.1**	The students will be able to outline for semantic syntax and schema.		
3.0	To learn the methodologies of ontology.	**3.1**	The students will be able to design ontology using Web Ontology Language (OWL).		
4.0	To know about ontology management and tools used for Ontology annotation.	**4.1**	The students will be able to differentiate monotonic and non-monotonic rules.		
5.0	To comprehend the role of semantics in web services.	**5.1**	The students will be able to apply Semantic web technology to real world application		

UNIT I - INTRODUCTION	**(9)**
History – Semantic web layers – Semantic web technologies – Semantics in semantic web – XML – Structuring –Namespaces – Addressing – Querying – Processing XML.	
UNIT II – RDF AND QUERYING THE SEMANTIC WEB	**(9)**
RDF data model – syntax – Adding semantics – RDF schema – RDF and RDF schema in RDF schema – An axiomatic semantics for RDF and RDF schema – Querying in SPARQL.	
UNIT III – ONTOLOGY	**(9)**
Introduction – Ontology movement – OWL – OWL specification – OWL elements – OWL constructs – Simple and complex – Ontology engineering – Introduction – Constructing ontologies – Reusing ontologies – On-To-Knowledge semantic web architecture.	
UNIT IV – LOGIC AND INFERENCE	**(9)**
Logic – Description logics – Rules – Monotonic rules – syntax – semantics and examples – Non-monotonic rules –Motivation – syntax – Examples – Rule markup in XML– Monotonic rules – Non-Monotonic rules.	
UNIT V – APPLICATIONS OF SEMANTIC WEB TECHNOLOGIES	**(9)**
Case Study – Horizontal information products at Elsevier – Openacademia – Bibster – Data Integration at Audi – Skill finding at Swiss Life – Think tank portal at Enersearch – e-learning – web services – other scenarios.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Grigorous Antoniou and Van Hermelen, "A Semantic Web Primer", PHI Learning Private Limited, 2nd Edition, 2010.
2. James Hendler, Henry Lieberman and Wolfgang Wahlster, "Spinning the Semantic Web: Bringing the world wide web to its full potential", The MIT Press, 2005.
3. Shelley Powers, "Practical RDF", O'reilly publishers, 2009.
4. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	1	-	2	1	-	-	2	-
2	1	-	2	1	-	-	2	-
3	3	-	3	3	2	-	3	1
4	3	-	2	2	-	-	3	2
5	3	-	3	3	3	-	3	2
CO (W.A)	2.2	-	2.4	2	2.5	-	2.6	1.67

22CPX07 – DEEP LEARNING					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the concepts of Deep Learning.	**1.1**	The students will be able to Understand the basics concepts of deep learning		
2.0	To know about the deep neural networks	**2.1**	The students will adapt to the appropriate deep network architecture		
3.0	To appreciate the types of deep learning networks	**3.1**	The students will model different types of deep network with its functional components		
4.0	To understand the theoretical and practical aspects of CNN and RNN	**4.1**	The students will make use of CNN and RNN for modeling applications.		
5.0	To create the applications using deep learning concepts	**5.1**	The students will be able to know the various challenges involved in designing deep learning algorithms for varied applications.		

UNIT I - FOUNDATIONS OF DEEP LEARNING	**(9)**
Introduction – Math behind machine learning – Linear Algebra – Statistics –Machine Learning works – Logistic regression – Evaluating Models – Neural Networks – Training Neural Networks – Activation functions – Loss functions – Hyper parameters	
UNIT II – ARCHITECTURAL DESIGN	**(9)**
Defining Deep Learning – Common Architectural Principles of Deep Networks: Parameters – Layers - Activation functions - Loss functions - Optimization Algorithms – Hyper parameters. Building blocks of Deep Networks: RBMS - Auto encoders – Variational Auto encoders.	
UNIT III – TYPES OF DEEP NETWORKS	**(9)**
Unsupervised pre trained Networks – Convolutional Neural Networks (CNNs) – Recurrent Neural Networks – Recursive Neural Networks – Applications-About Deep Reinforcement Learning. Q-Learning-Implementation of linear regression technique-Program to create a multi-layer neural network	
UNIT IV – CONVOLUTIONAL AND RECURRENTNEURAL NETWORKS	**(9)**
Convolutional Neural Networks: Applying Pooling layers – Optimizing with Batch Normalization – Understanding padding and strides – Experimenting with Different types of initialization – Implementing a convolutional auto encoder – Applying a 1D CNN to text. **Recurrent Neural Networks**: Implementing a simple RNN – Adding LSTM – Using GRUs – Implementing Bidirectional RNNs- Character-level text generation.	

UNIT V – DEEP GENERATIVE MODELS	(9)
Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling- gradient computations in RBMs - Deep Belief Networks- Deep Boltzmann Machines- Applications: Large-Scale Deep Learning - Computer - Speech Recognition - Natural Language Processing .	
TOTAL (L:45) : 45 PERIODS	

REFERENCES :

1. Josh Patterson and Adam Gibson,"DeepLearning – A Practitioner'sApproach",1st Edition, O'Reilly Series, August2017
2. Indra den Bakker, "Python Deep Learning Cookbook", 1st Edition, Packt Publishing, October 2017.
3. Ian Good fellow, Yoshua Bengio and Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016.
4. Nikhil Buduma, Nicholas Locascio " Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms" ,O' Reilly Media, Inc., May-2017

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	1	-	2	3	3	2
2	3	1	2	1	2	3	2	2
3	3	2	3	2	3	3	2	3
4	3	1	2	3	2	3	3	2
5	3	3	3	3	3	3	3	3
CO (W.A)	3	1.6	2.2	2.3	2.4	3	2.6	2.4

22CPX10 – WEB SERVICES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To employ basic XML specifications, technologies and applications.	**1.1**	The student will be able to analyze a web page and identify its elements and attributes.		
2.0	To understand about the XML schema and query.	**2.1**	The student will be able to Relate to XML Presentation Oriented Publishing (POP) applications and XML Message Oriented Middleware (MOM) applications		
3.0	To learn about SOAP and WSDL implementations.	**3.1**	The student will be able to develop web services using SOAP and WSDL technologies.		
4.0	To describe web service, supporting specifications and technologies including SOAP and UDDI,JAX-RPC.	**4.1**	The student will be able to build and consume web services using SOAP and UDDI, JAX-RPC.		
5.0	To learn to develop applications using JAX and RPC.	**5.1**	The student will be able to implement client server applications using JAX and RPC.		

UNIT I - XML	**(9)**
XML Basis – XML Namespace – Working with DTD: Validating your XML document – Defining DTD Entities – Working with Attributes – Adding Style – XSL Transformations.	
UNIT II – XML SCHEMA AND QUERY	**(9)**
Using Schema: Schema Elements, Types and Groups – Defining Schema Attributes – XML Query – XLink – XPointer.	
UNIT III – WEB SERVICES: SOAP & WSDL	**(9)**
Web Services SOAP: – Structure of SOAP – SOAP Namespaces – SOAP Headers – SOAP Body – SOAP Messaging Modes – SOAP Faults – SOAP over HTTP. WSDL: Structure of WSDL – WSDL Declarations – WSDL Abstract Interface – Messaging Exchange patterns – WSDL Implementation.	
UNIT IV – WEB SERVICES: UDDI	**(9)**
UDDI: Introduction – Data structures – Business Entity Structure - Business Service and Binding Template Structures – tModel Structure – UDDI Inquiry API – Operations – UDDI Publishing API.	
UNIT V – WEB SERVICES: JAX – RPC	**(9)**
JAX- RPC: Overview – JAX-RPC Service Endpoints – JAX-RPC EJB Endpoints - JAX-RPC Clients APIs. SAAJ: Creating a SOAP Message – Working with SOAP Documents – Working with SOAP Faults – Sending SOAP messages with SAAJ.	
	TOTAL (L:45) : 45 PERIODS

REFERENCES :

1. Richard Monson-Haefel, "J2EE Web Services", 8th Edition, Person Education, 2012.
2. D.A. Chappell & T. Jewell "Java Web Services", O'Reilly,SPD
3. G. Alonso, F. Casati and others,"Web Services" ,Springer, 2005
4. Heather Williamson, "The Complete Reference XML", TMH, 2001.

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	3	2	-	2	3	-	3	3
2	3	2	1	2	3	-	3	3
3	-	-	1	-	-	1	3	3
4	3	3	2	2	3	2	3	3
5	3	3	-	2	3	-	3	3
CO (W.A)	3	2.5	1.33	2	3	1.5	3	3

22CCC05 - COMPUTER NETWORKS

(Common to 22AIC12, 22CSC05,22CIC09 and 22ITC07)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective: Develop expertise in networking fundamentals, protocols, security mechanisms, and network management for effective operational efficiency.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End SemesterExamination
CO1	Apply the fundamental concepts of communication in networking technologies.	Ap	30%
CO2	Analyze network performance metricsand optimize network configurations.	An	20%
CO3	Develop solutions for network routing algorithms and traffic management strategies.	Ap	30%
CO4	Manage network security protocols and evaluate their effectiveness in protecting network resources.	An	20%
CO5	Collaborate to design and deploy network infrastructures and services	C	Internal Assessment

UNIT I - INTERNET AND DATA COMMUNICATIONS (9)

Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.

UNIT II - DATA LINK LAYER (9)

Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – MediaAccess Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.

UNIT III - NETWORK LAYER (9)

IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-StateRouting, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.

UNIT IV - TRANSPORT LAYER (9)

Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.

UNIT V - APPLICATION LAYER (9)

Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.

TOTAL (L:45) : 45 PERIODS
TEXT BOOK:
1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022.
REFERENCES:
1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017. 2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3										3	
4		3	3							3				3
5					3			3				3		3
CO (W.A)	**3**	**3**	**3**		3			**3**		**3**		**3**		**3**

22CCC07 – OPERATING SYSTEMS AND SECURITY				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To provide understanding about the fundamental concepts, design principles,and functionalities of operating systems and security is implemented in various operating systems.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COsin End Semester Examination**
CO1	Apply the different concepts and functionalities of operating system	Ap	20%
CO2	Analyze the efficient scheduling algorithms in process management	An	20%
CO3	Develop solutions using the paging and virtual memory management strategies	Ap	20%
CO4	Manage concurrent access to shared resources in operating systems	An	20%
CO5	Collaborate and compare the various file systemsecurity exposure in various operating systems.	An	20%

UNIT I – OPERATING SYSTEM OVERVIEW	**(9)**
Computer-System Organization – Architecture–Operating-System Operations–Resource Management – Security and Protection – Distributed Systems – Kernel Data Structures –Operating-System Services– System Calls– System Services–Why Applications Are Operating-System Specific – Operating System Design and Implementation - Operating-System Structure –Building and Booting an Operating System.	
UNIT II - PROCESS MANAGEMENT	**(9)**
Process Concepts – Process Scheduling – Operation on Processes, Inter- process Communication – Threads – Overview Multi threading models – Threading issues; CPU Scheduling criteria, Scheduling algorithms; Process Synchronization – Critical section problem, Synchronization hardware, Mutex locks, Semaphores, Critical regions,Monitors; deadlock. System model, Deadlock characterization, Method for handling deadlock, Dead lock prevention, Deadlock avoidance, Detection, Recovery.	
UNITIII – MEMORY MANAGEMENT AND FILE SYSTEMS	**(9)**
Memory—Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation—Virtual Memory — Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory. Mass Storage system - HDDScheduling - File concept, Access methods, Directory Structure, Sharing and Protection; File System Structure, Directory implementation, Allocation Methods, Free Space Management.	
UNITIV – SECURESY STEMS AND VERIFIABLE SECURITY GOALS	**(9)**
Security Goals – Trust and Threat Model – Access Control Fundamentals – Protection System – ReferenceMonitor – Secure Operating System Definition – Assessment Criteria – Information Flow – Information Flow	

Secrecy Models — Denning's Lattice Model — Bell LaPadula Model —Information Flow Integrity Models — Biba Integrity Model – Low-Water Mark Integrity – Clark-Wilson Integrity

UNITV - SECURITY IN OPERATING SYSTEMS	**(9)**

UNIX Security – UNIX Protection System – UNIX Authorization – UNIX Security Analysis – UNIX Vulnerabilities – Windows Security – Windows Protection System – Windows Authorization –Windows Security Analysis– Windows Vulnerabilities—Address Space Layout Randomizations—Retrofitting Security into a Commercial Operating System–Introduction to Security Kernels

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvinand Greg Gagne, "Operating System Concepts", John Wiley& Sons, Inc., 10th Edition, 2021.
2. Trent Jaeger, Operating System Security, Morgan& Claypool Publishers series, 2008.

REFERENCES:

1. MorrieGasser, "Building A Secure Computer System", Van Nostrand Reinhold, NewYork, 1988.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition,Prentice Hall, New Delhi, 2015.
3. William Stallings, "Operating Systems–Internals and Design Principles", 9th Edition, Pearson, 2017.
4. Michael Palmer, "Guide to Operating Systems Security", Course Technology – Cengage Learning, NewDelhi, 2008.
5. Mohammad Tehrani poor, Cliff Wang, "Introduction to Hardware, Security and Trust, book", Springer,2012. Gerardus Blokdyk, Security Focused Operating System A Complete Guide-2020 Edition,5STAR Cooks, ISBN: 9781867373353, 2020.

LIST OF EXPERIMENTS:

Basics of UNIX commands, Understand and practice Linux permissions, special permissions and authentication(various options of chmod, setuid, setgid)

1. Write programs using the following system calls of UNIX operating system fork, exec, getp id, exit, wait,close, stat, open dir., read dir.
2. Write C programs to implement the various CPU Scheduling Algorithms
3. Implementation of Semaphores
4. Implementation of Shared memory
5. Bankers Algorithm for Deadlock Detection &Avoidance
6. Implementation of the following Memory Allocation Methods for fixed partition
   a) First Fit b) Worst Fit c) Best Fit
7. Implementation of the following Page Replacement Algorithms
   a) FIFO b) LRU c) LFU
8. Program to demonstrate the working of Bell LaPadula Model and Biba Integrity Model
9. Setting up access control lists of files and directories and testing the lists in Linux
10. Learn to enable and disable address space layout randomization.

TOTAL = 30 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			2										2	
4				3	2									3
5								2	2					
CO (W.A)	**3**	**3**	**2**	**3**	**2**			**2**	**2**				**2**	**3**

22CCC09 – SECURE SOFTWARE ENGINEERING					
		L	T	P	C
		3	1	0	4
PREREQUISITE: NIL					
Course Objective:	To improve the performance and profitability of any system by identifying and eliminating the "constraints" that limits its output, throughput, and goal achievement.				
Course Outcomes: The students will be able to		**Cognitive Level**	**Weightage of COs in EndSemester Examination**		
CO1	Apply fundamental concepts of softwareEngineering process models problems.	AP	30%		
CO2	Analyze efficiency and effectiveness of parsing algorithms in language processing.	An	30%		
CO3	Develop solutions for language recognition and generation using formal language constructs.	Ap	30%		
CO4	Evaluate and manage complexity in designing Turing machines for computational tasks.	An	20%		
CO5	Utilize tools to explore and identify thequality of the product.	Ap	Internal Assessment		

UNIT I - Introduction to Software Engineering	**(9)**
The evolving role of software - changing nature of software -software myths - A Generic view of process: Software engineering- a layered technology - a process framework -the capability maturity model integration (CMMI) - process patterns - process assessment -personal and team process models -Process models: The waterfall model- incremental process models - evolutionary process models - the unified process.	
UNIT II - Software Requirements	**(9)**
Functional and non-functional requirements - user requirements - system requirements - interface specification - the software requirements document. Requirements engineering process: Feasibility studies - requirements elicitation and analysis - requirements validation - requirements management. System models: Context models -behavioral models - data models - object models - structured methods.	
UNIT III - Design Engineering	**(9)**
Design Engineering: Design process and design quality - design concepts, the design model. Creating anarchitectural design: software architecture - data design -architectural styles and patterns - architectural design - conceptual model of UML - basic structural modeling - class diagrams -sequence diagrams - collaborationdiagrams - use case diagrams -component diagrams.	

UNIT IV - Testing Strategies	(9)
Testing Strategies: A strategic approach to software testing -test strategies for conventional software - black- box and white-box testing - validation testing - system testing - the art of debugging. Product metrics: Softwarequality - metrics for analysis model - metrics for design model - metrics for source code - metrics for testing - metrics for maintenance.	
UNIT V - Risk management and Quality Management	**(9)**
Metrics for Process and Products: Software measurement - metrics for software quality. Risk management:Reactive Vs proactive risk strategies - software risks - risk identification - risk projection - risk refinement –RMMM - RMMM plan. Quality Management: Quality concepts - software quality assurance - software reviews - formal technical reviews - statistical software quality assurance - software reliability - the ISO 9000 quality standards.	
TOTAL(L:45):45PERIODS	

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, PearsonEducation.

REFERENCES:

1. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2								3	
2		3			2								3	
3	3				2								3	
4		3			2								3	
5	3				2								3	
CO (W.A)	3	3			2								3	

22CCC10 - DATABASE SECURITY				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• This course covers data models and ER diagrams, database normalization, transaction processing with ACID properties, and security measures including encryption and access control.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in EndSemester Examination**
CO1	Apply concept modeling and design database schemas based on the conceptual model.	Ap	20%
CO2	Gain knowledge about how to organize data efficiently and reduce data anomalies in relational database designs.	An	20%
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database	Ap	20%
CO4	Implement run transactions and estimate the procedures for controlling the consequences of concurrent data access.	An	20%
CO5	Examine and handle security issues in database and gain knowledge about access control techniques.	An	20%

UNIT I - RELATIONAL DATABASES	(9)
Data Models – Relational Data Models – Relational Algebra – Structured Query Language Entity RelationshipModel– MappingERModelstoRelations–DistributedDatabases–DataFragmentation –Replication.	
UNITII - DATABASE DESIGN	(9)
ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies –First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation –Boyce/Codd Normal Form– Multi-Valued Dependencies and Fourth Normal Form–Join Dependencies and Fifth Normal Form.	
UNITIII - TRANSACTION MANAGEMENT	(9)
TransactionConcepts–ACIDProperties–Serializability–TransactionIsolationLevels–Concurrency Control– Need for Concurrency –Lock-Based Protocols – Deadlock Handling –Recovery System – Failure Classification–Recovery Algorithm.	
UNITIV - DATABASE SECURITY	**(9)**
Need for database security – SQL Injection Attacks– The Injection Technique – SQLi Attack Avenues and Type	
UNIT V - ACCESS CONTROL AND ENCRYPTION	**(9)**
Database Access Control – SQL based access definition – Cascading Authorizations – Role based access control– Inference– Database encryption.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Henry F.Korth, S.Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B.Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016.
3. William Stallings, Lawrie Brown "Computer Security: Principles and Practice", Fourth Edition,Pearson 2019.

REFERENCES:

1. C.J.Date, A.KannanandS.Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. Narain Gehani and Melliyal Annamalai, "The Database Book: Principles and Practice Using the OracleDatabase System", Universities Press, 2012.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3												
4			3											
5			3		3									3
CO (W.A)	3	3	3		3									3

22CCC12 – CRYPTOGRAPHY AND NETWORK SECURITY *(Common to 22CIX37)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE: NIL					
Course Objective:	• To equip students with a thorough understanding of the principles and practices of securing digital information.				
Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs inEnd Semester Examination**		
CO1	Apply number theory concepts in the implementation of cryptographic algorithms	Ap	20%		
CO2	Analyze block cipher algorithms in terms of security and efficiency.	An	20%		
CO3	Apply Public Key Cryptography in Real-World Scenarios use public key cryptography to securedata and communications in various real-world applications.	Ap	20%		
CO4	Analyze common hash algorithms such as MD5, SHA-1, and SHA-2.	An	20%		
CO5	Analyze the functioning and security protocolssuch as SSL/TLS, HTTPS, and IPsec.	An	20%		

UNITI-INTRODUCTIONANDNUMBERTHEORY	**(10)**
Computer security concepts - OSI security architecture – Security attacks – Security services – Security mechanism – Model for network security– Classical encryption techniques: substitution techniques, transposition techniques, Rotor machine, steganography— Finite Fields and Number Theory: Divisibilityand Division algorithm–Euclid's algorithm-Modular arithmetic- Groups,Rings,Fields-Finitefields—PolynomialArithmetic— Primenumbers-Fermat'sandEuler'stheorem-Testingforprimarily-TheChineseremainder theorem-Discrete logarithms.	
UNITII-BLOCKCIPHERSANDENCRYPTIONSTANDARDS	**(9)**
BlockcipherandDataEncryptionStandard—AdvancedEncryptionStandards: Finite field arithmetic—AES structure— AESTransformationfunctions–AESkeyexpansion–AESimplementation-Blockcipher operation : Multiple Encryption andtriple DES - Electronic Codebook - Cipher Block Chaining Mode - Cipher Feedback Mode- Output Feedback Mode- Counter Mode— Pseudo random Number Generation- Stream cipher—RC4.	
UNITIII- PUBLICKEYCRYPTOGRAPHY	**(8)**
Public key cryptography: Principles of public key cryptosystems-The RSA algorithm - Diffie Hellman Key exchange- El Gamal cryptosystem - Elliptic curve arithmetic - Elliptic curve cryptography – Pseudorandom Number Generation Based on an Asymmetric Cipher.	

UNITIV - MESSAGE AUTHENTICATION AND DIGITAL SIGNATURES	(9)
Cryptographic Hash Function s- Message Authentication Code – Digital signature – Key management and distribution – user authentication.	
UNITV–NETWORKANDINTERNETSECURITY	**(9)**
Transport level security-Wireless network security-Electronic Mail security: PGP,S/MIME– IP security – Intruders – Malicious software—Firewalls.	
TOTAL :45 PERIODS	

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.

REFERENCE:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3										3	
4	3		3	3	3									
5			3	3	3									3
CO (W.A)	3	3	3	3	3								3	3

22MYB05 – DISCRETE MATHEMATICS *(Common to CSE,IT,AI&DS,IOT,CS(Cyber security))*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE-REQUISITE : NIL

Course Objective:	• To understand the basic concepts of logic, properties of set theory and their applications in Algorithms. • To understand the ideas about Lattices and general counting methods involving permutations and combinations.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of logic to solve the problems in Artificial Intelligence.	Ap	20%
CO2	Calculate the applications of predicate logic used in data science.	An	20%
CO3	Solve different properties of injection, surjection, bijection, composition and inverse functions in software engineering.	Ap	20%
CO4	Determine the concepts of lattices, Permutations, Combinations and Mathematical induction in the experience of network theory and analysis of algorithms.	An	40%
CO5	Demonstrate the importance of lattice theory using the modern tools and solve the real time problems in various contexts.	Ap	Internal Assessment

UNIT-I PROPOSITIONAL CALCULUS	**(9+3)**
Propositions-Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables-Tautologies and Contradictions-LogicalEquivalences and implications – DeMorgan's Laws-Normal forms-Rules of inference-Arguments-Validity of arguments.	
UNIT-II PREDICATE CALCULUS	**(9+3)**
Predicates-Statement Function-Variables-free and bound variables-Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements-Theory of inference-The rules of universal specification and generalization-Validity of arguments.	
UNIT-III SET THEORY AND FUNCTIONS	**(9+3)**
Set Operations-Properties-Power set-Relations-Graph and matrix of a relation-Partial Ordering-Equivalence relation-Functions-Types of functions-Composition of relation and functions-Inverse functions.	

UNIT-IV COMBINATORICS	(9+3)
Basics of counting - Counting arguments - Pigeonhole Principle - Permutations and Combinations- Recursion and recurrence relations - Generating Functions - Mathematical Induction – Inclusion and Exclusion.	
UNIT-V LATTICES	**(9+3)**
Posets-Lattices as posets-Properties of lattices-Lattices as Algebraic systems – Sub lattices - Direct product and Homomorphism.	
TOTAL (L:45+ L:15) : 60 PERIODS	

TEXT BOOKS:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science " , Tata McGraw-Hill, New Delhi, Reprint 2010.
2. Veerarajan.T, "Discrete Mathematics with Graph Theory and Combinatorics", 4thedition, Tata McGraw Hill, New Delhi, 2008.
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5th edition, Tata McGraw Hill Publications, New Delhi, 2007.

REFERENCES:

1. Venkatraman M.K., "Discrete Mathematics" , the National Publishing Company, Chennai, 2007.
2. S.Santha, "Discrete Mathematics with Combinatorics and Graph Theory" ,Cengage Learning India Pvt. Ltd. 2010 .
3. Swapan Kumar Sarkar, "A Text Book of Discrete Mathematics" , S. Chand & Company Ltd., New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2												
3	3													
4		2												
5	3				2				3			2		
CO (W.A)	**3**	**2**			**2**				**3**			**2**		

22CIC04 - ALGORITHMS *(Common to 22AIC06, 22CCC04,22CSC05 and 22ITC04)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• To develop problem-solving skills through algorithms and prepare students to apply the skills in various domains such as software development, research, and engineering.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the time and space complexities of algorithms using asymptotic notations	An	20%
CO2	Apply algorithmic concepts and techniques to design and develop efficient solutions for real-world problems	Ap	40%
CO3	Apply the knowledge of complexity classes P, NP and NP-Completeness problem	An	20%
CO4	Design efficient algorithms to solve graph problems	Ap	20%
CO5	Optimized the existing algorithms by reducing the lines of code	An	Internal mode

UNIT-I INTRODUCTION	**(9)**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.	

UNIT-II BRUTE FORCE AND DIVIDE-AND-CONQUER	**(9)**
Brute Force – Computing an – String Matching - Selection Sort and Bubble Sort – Sequential Search - Closest- Pair and Convex-Hull Problems - Exhaustive Search: Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort –Closest- Pair and Convex - Hull Problems.	

UNIT-III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	**(9)**
Dynamic Programming : Computing a Binomial coefficient – Warshall's and Floyd's Algorithm – Optimal Binary Search trees - 0/1 Knapsack Problem. Greedy Technique: Prim's algorithm and Kruskal's Algorithm - Huffman Trees.	

UNIT-IV ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER	(9)
Iterative Improvement - The Simplex Method - The Maximum-Flow Problem- Maximum Matching in Bipartite Graphs. Limitations of Algorithm Power: Lower bound arguments – Decision trees – P, NP and NP complete Problems.	
UNIT-V STATE SPACE SEARCH ALGORITHMS	**(9)**
Backtracking: N Queen's problem – Hamiltonian Circuit problem – Subset problem - Graph colouring problem. Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem – Travelling Salesman Problem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. M. Morris Mano & Michael D.Ciletti, "Digital Design with an Introduction to the Verilog HDL, 5th Edition, Prentice Hall of India Pvt.Ltd. 2015.
2. Dr. Sanjay Sharma, "Digital Electronics and Logic Design" 4th Edition., S.K.Kataria & Sons, 2017

REFERENCES:

1. Stephan D.Brown & Zvonko G.Vranesic, "Fundamentals of Digital Logic with VHDL Design, 2'nd Edition, Tata Mc Graw – Hill, 2003.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis,"2'nd Edition., Prentice Hall, 2009.
3. Thomas L. Floyd & R P Jain, "Digital Fundamentals," 10th Edition., PHI, 2011.
4. Ronald J Tocci & Neal S. Widmer, "Digital Systems, Principles and Applications," 10th Edition., Pearson education, 2011.
5. Frank Vahid, "Digital Design with RTL Design, Verilog and VHDL," 10'th Edition, John Wiley and Sons, 2010

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	3
2	3												3	
3		3											3	
4	3												3	
5			3	3					3				3	3
CO (W.A)	**3**	**3**	**3**	**3**					**3**				**3**	**3**

22CIC05 – INTERNET OF THINGS AND ITS APPLICATIONS *(Common to 22AIC14,22CSC17 and 22ITC16)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide an understanding of the technologies and the standards relating to the Internet of Things. • To review about IoT protocols and arduino processor with underlying technologies, limitations, and challenges.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify various characteristics and deployment levels of IoT.	Ap	40%
CO2	Analyze the concepts of M2M and IoT architecture.	An	20%
CO3	Implement Various IoT communication protocols like MQTT, CoAP, and HTTP in developing IoT applications.	Ap	20%
CO4	Analyze the functioning of arduino boards and various communications technologies to use with it.	An	20%
CO5	Perform in a team to build automation, agriculture and various real time applications using arduino.	Ap	Internal Assessment

UNIT-I INTRODUCTION TO INTERNET OF THINGS	**(9)**
Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.	
UNIT-II M2M AND IOT ARCHITECTURE	**(9)**
Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model.	
UNIT-III IOT PROTOCOLS	**(9)**
PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.	

UNIT-IV PROGRAMMING USING ARDUINO	(9)
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.	
UNIT-V APPLICATIONS OF IOT	**(9)**
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.
3. Veneri,Giacomo and Antonio capasso "Hands on Industrial Internet of things:create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packet Publishing,Ltd,2018.

REFERENCE:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													
3			3										3	
4					3									3
5									1		1	1		
CO (W.A)	**3**		**3**		**3**				**1**		**1**	**1**	**3**	**3**

22C1C06 - JAVA PROGRAMMING *(Common to 22AIC04, 22CCC06,22CSC07 and 22ITC06)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To understand object-oriented programming concepts, and apply them in solving problems. • To introduce the design of Graphical User Interface using applets and swing controls.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of classes and objects to solve simple problems using Java	Ap	20%
CO2	Analyse how oops concepts like inheritance, polymorphism improves code organization and enhances flexibility.	An	20%
CO3	Build interactive applications using applets and swing	An	20%
CO4	Conduct practical experiments for demonstrating exception handling, multithreaded applications with synchronization.	An	40%
CO5	Build the Java Project for engineering applications and make an individual study being member of team.	An	Internal Assessment

UNIT-I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	**(9)**
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Strings, Packages - JavaDoc comments.	
UNIT-II INHERITANCE AND INTERFACES	**(9)**
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods-Keywords: Static-final-this- final methods and classes – Method overloading-Method overriding-Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces	
UNIT-III EXCEPTION HANDLING AND I/O	**(9)**
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing File	

UNIT – IV THREADS	(9)
Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads — Thread Priorities – Synchronization – Inter thread Communication – Suspending, Resuming, and Stopping Threads – Using Multithreading.	
UNIT – V EVENT DRIVEN PROGRAMMING	**(9)**
Graphics programming - Frame – Components Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019 for Units I, II, III, IV.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015 for Unit V.

REFERENCES:

1. Cay. S. Horstmann, Gary Cornell, "Core Java-JAVA Fundamentals", Prentice Hall, 10th ed., 2016.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.3. SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2		3												3
3			3		3								3	
4				3										
5					3				3		2	3		3
CO (W.A)	**3**	**3**	**3**		**3**				**3**		**2**	**3**	**3**	**3**

22CIC07 - OPERATING SYSTEMS *(Common to 22AIC08, 22CSC08, and 22ITC05)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To provide understanding about the fundamental concepts, design principles, and functionalities of operating systems.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the different concepts and functionalities of operating system	Ap	20%
CO2	Analyze the efficient scheduling algorithms in process management	An	30%
CO3	Develop solutions using the paging and virtual memory management strategies	Ap	40%
CO4	Manage concurrent access to shared resources in operating systems	An	10%
CO5	Collaborate and compare the various file system structures	An	Internal Assessment

UNIT-I FUNDAMENTALS	**(9)**
Introduction - System Architecture - Operating System Structure - Operations - Process Management - Memory Management - Storage Management - System Structure - User Operating System Interface - System Calls - Types - System Programs - Operating System Design and Implementation - Virtual machines.	
UNIT-II PROCESS MANAGEMENT	**(9)**
Process Concept - Process Scheduling - Operations on Processes- Inter Process Communication - Shared Memory and Message Passing Systems - CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Threads Overview - Thread Scheduling.	
UNIT-III PROCESS SYNCHRONIZATION	**(9)**
Synchronization: The Critical-Section Problem - Peterson's solution - Hardware support for Synchronization - Mutex – Semaphores - Deadlocks: Deadlock Characterization - Methods for handling deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.	
UNIT-IV MEMORY MANAGEMENT	**(9)**
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Segmentation - Virtual Memory - Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing,	

UNIT-V SECONDARY STORAGE MANAGEMENT	(9)
Secondary Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap Space Management - File System - File Concepts: Access Methods - Directory Structure - File System Mounting - File System Implementation - Structure – Implementation - Directory Implementation - Allocation Methods -Free Space Management - I/O Systems - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

REFERENCES:

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall of India Pvt., 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			2										2	
4				3	2									3
5								2	2					
CO (W.A)	**3**	**3**	**2**	**3**	**2**			**2**	**2**				**2**	**3**

22CIP03 - ALGORITHMS LABORATORY *(Common to 22AIP05, 22CCP03, 22CSP04, and 22ITP03)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE: NIL

Course Objective:	• To learn and apply important algorithmic design paradigms and methods of analysis.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Implement basic algorithms such as brute force, string matching, sorting, and sequential search.	Ap
CO2	Apply algorithmic thinking to break down problems into manageable steps.	Ap
CO3	Apply dynamic programming techniques to solve complex computational problems.	Ap
CO4	Apply the greedy approach used in algorithm for finding minimum spanning trees in weighted undirected graphs.	Ap
CO5	Implement backtracking algorithms to solve a variety of combinatorial problems efficiently.	Ap

LIST OF EXPERIMENTS:

1. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
2. Sort a given set of elements using the Insertion sort, Selection sort and Bubble sort
3. Implementation of Linear Search.
4. Implementation of Recursive Binary Search
5. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
6. Develop a program to sort the numbers using Merge and Quick sort .
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
10. Implement N Queens problem using Backtracking.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:
LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,.
Software:
C/C++/JAVA/ Python

TEXT BOOK:
1. William H. Hayt, Jr and John A. Buck, "Engineering Electromagnetics", 9th Edition, Tata McGraw Hill Publishing Company, Noida, 2020
REFERENCE:
1. Matthew N.O. Sadiku, S.V.Kulkarani, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015. 2. Edward .C.Jordan. and Keith.G.Balmain "Electromagnetic Waves and Radiating Systems", 2nd Edition, Pearson Education, 2015.
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2	3		3											
3	3		3				3							
4	3		3			3	3							
5	3		3											
CO (W. A)	**3**		**3**			**3**	**3**						**3**	

22CIP04 - INTERNET OF THINGS AND ITS APPLICATIONS LABORATORY *(Common to 22AIP10,22CSP11 and 22ITP0)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To equip students with comprehensive knowledge and hands on experience in designing and developing IoT systems and applications.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of controlling sensors using arduino.	Ap
CO2	Analyze the given Aduino program to build practical IoT solutions.	An
CO3	Apply arduino programming techniques to use various sesnors and actuators.	Ap
CO4	Design IoT based system for given application and specifications.	An
CO5	Implement a mini-project to demonstrate the given problem using suitable sensors with Arduino development board.	C

LIST OF EXPERIMENTS :

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

TOTAL (P:60) = 60 PERIODS

Hardware:

WiFi UNIT or ESP 8266 UNIT 33, Connecting cable or USB cable 33, Ultrasonic sensor 33, Jumper wires 33, Vibration sensor 33, Touch Sensor 33, Temperature and humidity sensor 33, HDMI 33, Micro USB power input 33, Breadboard 33, Resistor (47K/1W) 33, LED 33, Arduino Uno 33, 16 x 2 LCD display 33, ACS712 Voltage sensor 33, 9/12V Battery 33, Center tapped transformer (230/6-0-6V) 33 , Diode (IN4007) 33, Opto-coupler 33

Software:

OS – Windows / UNIX Clone 33

Computer with Arduino IDE software 33

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2			2	2										
3														2
4					3									2
5		2			3				1				3	
CO (W.A)	**3**	**2**	**2**	**2**	**3**				**1**				**3**	**2**

22CIP05 - JAVA PROGRAMMING LABORATORY *(Common to 22AIP03, 22CCP05,22CSP06 and 22ITP04)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	To learn Java Programming concepts and develop applications based on Java.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Apply the concepts of Java to solve problems	Ap
CO2	Analyze the efficiency of using appropriate programming constructs.	An
CO3	Demonstrate the usage of different programming structures through example programs	Ap
CO4	Develop simple applications using swing.	C
CO5	Engage in independent study and learn to use Java for real time applications.	An

LIST OF EXPERIMENTS:

1. Write simple Java programs using operators, arrays and control statement
2. Programs using Static, final and this keywords.
3. Demonstrate the concepts of inheritance
4. Programs illustrating overloading and overriding methods in Java
5. Programs to use packages and Interfaces in Java.
6. Implement exception handling and creation of user defined exception.
7. Implement program to demonstrate multithreading and inter thread communication.
8. Write a program to perform file operations.
9. Develop applications using swing layouts

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 No's, Printers – 3 Nos.

Software:

- Java / Equivalent Compiler

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3		3			2									3
4			3		3								3	
5									3			3		
CO (W.A)	**3**	**3**	**3**		**3**				**3**			**3**	**3**	**3**

22MAN07-SOFT / ANALYTICAL SKILLS – III (Common to All Branches and Applicable for (2022-2026) Batch only)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**
PRE-REQUISITE : 22MAN04				
Course Objective:	• Improving overall language proficiency for personal or professional reasons • To develop problem solving skills across all levels			

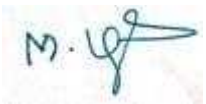
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Write grammatically correct and coherent sentences.	U	40%
CO2	Develop problem solving skills across all levels.	Ap	30%
CO3	Solve reasoning problems with ease.	An	30%

UNIT-I Verbal Competency	**(5+10)**
Sentence Selection-Paragraph Formation- Sentence Correction- Spellings.	
UNIT-II Aptitude	**(5+10)**
Clocks, Calendar, Age Problems-Problem on Trains- Problems on Numbers - Partnerships.	
UNIT-III Logical & Reasoning	**(5+10)**
Coding and Decoding - Logical Equivalent- Venn Diagram Problem.	
TOTAL (L:15, P:30) : 45 PERIODS	

REFERENCES:

1. Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand and Company Limited, New Delhi, 2014.
2. Ashish Aggarwal, "Quick Arithmetic", S Chand and Company Limited, New Delhi, 2014.
3. Raymond Murphy, "English grammar in use", Fourth Edition, Cambridge University, 2012.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				



22MAN07R - SOFT/ANALYTICAL SKILLS – III *(Common to All Branches and Applicable for (2023-2027) Batch only)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To improve language proficiency for personal or professional reasons • To enhance students' mathematical problem-solving and critical thinking skills

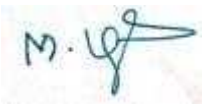
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Demonstrate effective communication skills by listening actively, speaking clearly, reading critically, and writing coherently in contexts.	U	40%
CO2	Develop proficiency in applying mathematical concepts of time, speed, distance, and financial calculations involving simple and compound interest.	Ap	30%
CO3	Analyse logical reasoning skills through various forms of statements.	An	30%

UNIT-I VERBAL ABILITY	**(5+10)**
Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.	
UNIT-II APTITUDE	**(5+10)**
Simple and Compound Interest - Time, Speed and Distance - Problems on Trains - Boats and Streams - Chain Rule - Time and Work - Pipe and Cisterns.	
UNIT-III REASONING	**(5+10)**
Seating Arrangements - Syllogism - Statement and Conclusion - Statement and Assumption - Statement and Course of Action.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. Effective Technical Communication. Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. Quantitative Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. How to Prepare for Quantitative Aptitude for the CAT. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. Quantitative Aptitude and Reasoning. PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN09 - INDIAN CONSTITUTION (*Common to All Branches*)				
	L	**T**	**P**	**C**
	1	**0**	**0**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To educate students to learn about the Constitutional Law of India. • To motivate students to understand the role of Union Government. • To make students to understand about State Government. • To understand about District Administration, Municipal Corporation and Zila Panchayat. • To encourage students to Understand about the election commission.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain Knowledge about the Constitutional Law of India.	U	Internal Assessment
CO2	Know the Union Government and role of President and Prime Minister.	R	
CO3	Gain knowledge about State Government and role of Governor, Chief Minister.	U	
CO4	Understand the District Administration, Municipal Corporation and Zila Panchayat.	U	
CO5	Understand the role and function of election commission.	U	

UNIT- I THE CONSTITUTION INTRODUCTION	**(3)**
The History of the Making of the Indian Constitution - Preamble and the Basic Structure, and its interpretation - Fundamental Rights and Duties and their interpretation - State Policy Principles.	
UNIT-II UNION GOVERNMENT	**(3)**
Structure of the Indian Union - President - Role and Power - Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha	
UNIT-III STATE GOVERNMENT	**(3)**
Governor - Role and Power - Chief Minister and Council of Ministers - State Secretariat	
UNIT-IV LOCAL ADMINISTRATION	**(3)**
District Administration - Municipal Corporation - Zila Panchayat	
UNIT-V ELECTION COMMISSION	**(3)**
Role and Functioning - Chief Election Commissioner - State Election Commission	
TOTAL (L:15) : 15 PERIODS	

TEXT BOOKS:
1. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008. 2. B.L. Fadia, "The Constitution of India", Sahitya Bhawan; New edition (2017). 3. DD Basu, "Introduction to the Constitution of India", Lexis Nexis; Twenty-Third 2018 edition.
REFERENCES:
1. Steve Blank and Bob Dorf, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K & S Ranch ISBN – 978-0984999392 2. Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" , Penguin UK ISBN - 978-0670921607 3. Adrian J. Slywotzky with Karl Weber, "Demand: Creating What People Love Before They Know They Want It", Headline Book Publishing ISBN - 978-0755388974 4. Clayton M. Christensen, "The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business", Harvard business ISBN: 978-142219602.
REFERENCES: Web link
1. https://www.fundable.com/learn/resources/guides/startup 2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/ 3. https://www.finder.com/small-business-finance-tips 4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						3		3		2		3		
2						3		3		2		3		
3						3		3		2		3		
4						3		3		2		3		
5						3		3		2		3		
CO (W.A)						**3**		**3**		**2**		**3**		

22CIC08 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING *(Common to 22CCC08, 22CSC09 and 22ITC14)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• Learn to design, implement, and evaluate AI/ ML models				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of AI and implement basic heuristic techniques.	Ap	30%
CO2	Develop solution for search algorithms, constraint satisfaction and planning problem	Ap	30%
CO3	Analyze the basic concepts of machine learning and preprocess the dataset	An	20%
CO4	Implement supervised learning techniques for complex problems	An	20%
CO5	Collaborate and design neural networks to predict real world problems	E	Internal Assessment

UNIT-I PROBLEM SOLVING	**(9)**
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP).	
UNIT-II PROBABILISTIC REASONING	**(9)**
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	
UNIT-III SUPERVISED LEARNING	**(9)**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests.	
UNIT-IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	**(9)**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.	

UNIT-V NEURAL NETWORKS	(9)
Artificial Neural Networks – Structures, perceptron, Multilayer perceptron, activation functions, network training, Learning in multilayer networks, Learning neural network structures, Case study: Handwritten digit recognition, Word senses and house prices.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2			3											
3		3			2								3	
4				3										
5						3			2	2				3
CO (W.A)	**3**	**3**	**3**	**3**	**2**	**3**			**2**	**2**			**3**	**3**

22CIC09 - COMPUTER NETWORKS *(Common to 22AIC12, 22CCC05,22CSC06 and 22ITC07)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To Develop expertise in networking fundamentals, protocols, security mechanisms, and network management for effective operational efficiency.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamental concepts of communication in networking technologies.	Ap	30%
CO2	Analyze network performance metrics and optimize network configurations.	An	20%
CO3	Develop solutions for network routing algorithms and traffic management strategies.	Ap	30%
CO4	Manage network security protocols and evaluate their effectiveness in protecting network resources.	An	20%
CO5	Collaborate to design and deploy network infrastructures and services	C	Internal Assessment

UNIT-I INTERNET AND DATA COMMUNICATIONS	**(9)**
Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.	
UNIT-II DATA LINK LAYER	**(9)**
Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – Media Access Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.	
UNIT-III NETWORK LAYER	**(9)**
IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-State Routing, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.	
UNIT-IV TRANSPORT LAYER	**(9)**
Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.	
UNIT-V APPLICATION LAYER	**(9)**
Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOK:
1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022.
REFERENCES:
1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017. 2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3										3	
4		3	3							3				3
5					3			3				3		3
CO (W.A)	**3**	**3**	**3**		**3**			**3**		**3**		**3**	**3**	**3**

22CIC10 - DATABASE MANAGEMENT SYSTEM *(Common to 22CSC11 and 22ITC11)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To gain knowledge on introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design ER-models to represent simple database application scenarios	Ap	10%
CO2	Apply the concepts of database management system for various applications.	Ap	30%
CO3	Analyse database concepts for a given problem.	An	20%
CO4	Design conceptual data model for database applications	Ap	20%
CO5	Demonstrate SQL commands to create, manipulate and query data in a database	Ap	20%

UNIT-I DATABASE SYSTEM CONCEPT	**(9)**
Purpose of Database systems – Views of data – Database Languages - Database design – Database system architecture – Data models – Data Dictionary – Database Administration – Entity-Relationship model – EER Model.	
UNIT-I RELATIONAL DATABASE	**(9)**
Structure of Relational Database – Integrity Constraints – Relational Algebra – Relational Calculus – SQL – Views – Joins – Functions and Procedures – Triggers.	
UNIT-III DATABASE DESIGN	**(9)**
Functional Dependencies – Decomposition: Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	
UNIT-IV PHYSICAL DATABASE DESIGN AND QUERY PROCESSING	**(9)**
Storage and file structure: RAID – File Organization – Organization of Records in Files – Data dictionary Storage - Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices — Query Processing	
UNIT-V TRANSACTION PROCESSING	**(9)**
Transactions: Desirable properties of Transactions – Serializability – Concurrency Control: Lock-Based Protocols – Timestamp-Based Protocols – Validation-Based Protocols – Recovery systems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, McGraw Hill, 2020.

REFERENCES:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2017
2. Date C.J., Kannan A. and Swamynathan S., "An Introduction to Database Systems", 8th Edition, Pearson Education, New Delhi, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3											3	
4			3											
5			3		3								3	3
CO (W.A)	**3**	**3**	**3**		**3**								**3**	**3**

22CIC11 - SENSORS AND ACTUATOR DEVICES				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To create a conceptual understanding of the basic principles of sensors, actuators, and their operations. • To promote awareness regarding recent developments in the fields of sensors and actuators.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics.	Ap	20%
CO2	Analyze the working principles of thermal, optical & electric sensors and actuators to interpret their mathematical model	An	20%
CO3	Analyze the performance of different sensors and actuators to select suitable components for specific applications.	An	20%
CO4	Design a system that effectively utilize sensors and actuators to achieve desired functionalities.	An	20%
CO5	Apply the knowledge to address real world challenges involving sensors and actuators.	Ap	20%

UNIT-I OVERVIEW OF SENSORS AND ACTUATORS & TEMPERATURE SENSORS AND THERMAL ACTUATORS	**(9)**
The five senses: vision, hearing, smell, taste, and touch – Definitions: Sensors & Actuators – Overview of Sensor and Actuator classifications – Performance characteristics of Sensors & Actuators: Transfer Function, Range, Span, Input and Output Full Scale, Resolution, and Dynamic Range - Calibration & Reliability. Thermo resistive sensors: Thermistors, Resistance temperature, and silicon resistive sensors – Thermoelectric sensors – Other Temperature sensors: Optical and Acoustical – Thermo mechanical Sensors and Actuators – Case study: Breath analyzer using temperature	

UNIT-II OPTICAL SENSORS , ELECTRIC AND MAGNETIC SENSORS AND ACTUATORS	**(9)**
Principles of Optics: Optical units – Quantum effects – Quantum-based Optical sensors – Photoelectric sensors – Charge coupled device (CCD) based – Thermal-based Optical sensors – Active infrared (AFIR) sensors – Optical Actuators – Case study: Liquid Level Indicator using Optical Sensors. Principles of Electric and Magnetic fields: Basic units – The Electric field: Capacitive Sensors & Actuators – Magnetic sensors and actuators – Magnetoresistance – Magnetostrictive Sensors and Actuators – Magnetometers – Magnetic actuators: Voice Coil Actuators, Motors as Actuators & Magnetic Solenoid Actuators and Magnetic Valves – Case Study: Speed sensing and odometer in a car using smart sensors.	

UNIT-III MECHANICAL SENSORS AND ACTUATORS	(9)
Definitions and units – Force Sensors: Strain Gauges, Semiconductor Strain Gauges & Tactile Sensors – Accelerometers: Capacitive Accelerometers, Strain Gauge Accelerometers & Magnetic Accelerometers – Pressure Sensors: Mechanical, Piezoresistive, Capacitive & Magnetic – Velocity sensing – Inertial sensors and actuators: Mechanical or Rotor & Optical Gyroscopes – Case study: Tire-pressure monitoring system using smart sensors.	
UNIT-IV ACOUSTIC SENSORS , CHEMICAL SENSORS AND ACTUATORS	**(9)**
Definitions and units – Elastic waves and their properties – Microphones: Carbon, Magnetic, Ribbon and Capacitive Microphones – Piezoelectric effect – Piezoelectric Sensors – Acoustic Actuators: Loudspeakers, Headphones and Buzzers - Magnetic and Piezoelectric – Ultrasonic sensors and actuators – Case Study: Ultrasonic parking system. Chemical units and Definitions – Electrochemical sensors: Metal Oxide Sensors and Solid Electrolyte Sensors – Potentiometric smart sensors: Glass Membranes, Soluble Inorganic Salt Membrane and Polymer - Immobilized Ionophore Membranes sensors – Thermochemical, Optical, Mass humidity gas sensors – Chemical Actuators: The Catalytic Converter - The Airbag System using smart sensors – Case study: Water quality monitoring system.	
UNIT-V RADIATION SENSORS, MEMS AND SMART SENSORS AND ACTUATORS	**(9)**
Radiation sensors: Ionization sensors- Scintillation sensors- Semiconductor radiation detectors. Microwave radiation: Microwave sensors. Antennas as sensors and actuators: General relations- Antennas as sensing elements- Antennas as actuators. MEMS sensors and actuators: MEMS sensors- MEMS actuators- Nanosensors and actuators- Smart sensors and actuators.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Nathan Ida, "Sensors, Actuators and their Interfaces - A Multidisciplinary Introduction", 2020, 2nd Edition, IET, United Kingdom.

REFERENCES:

1. Jacob Fraden, "Handbook of Modern Sensors Physics, Designs, and Applications", 2016, 5th Edition, Springer, Switzerland.
2. Subhas Chandra Mukhopadhyay, Octavian Adrian Postolache, Krishanthi P. Jayasundera, Akshya K. Swain, "Sensors for Everyday Life Environmental and Food Engineering", 2017, Volume 23, Springer, Switzerland.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												
3				3									3	
4					3									
5		3							1	1				2
CO (W.A)	3	3		3	3				1	1			3	2

22CIC12 – PRIVACY AND SECURITY IN IoT (Common to 22AIX35)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : 22CIC05					
Course Objective:	• To impart knowledge on the state of the art methodologies and security in internet of things. • To implement the blockchain Technology and Privacy Preservation in Internet of Things (IoT).				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement the security mechanisms from the designing to the deployment of the IOT system using suitable protocols.	Ap	40%
CO2	Analyze IOT applications which are suitable for using Blockchain technology in development.	An	20%
CO3	Implement the privacy protection and preservation schemes for IOT applications	Ap	20%
CO4	Analyze the IOT application and select appropriate trust model for improving the security	An	20%
CO5	Review the literature related to Privacy and Security in IOT and presents a report with example application.	Ap	Internal Assessment

UNIT-I SECURITY IN IOT, NETWORK ROBUSTNESS AND MALWARE PROPAGATION CONTROL IN IOT	**(9)**
IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle. Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification - Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.	
UNIT-II BLOCKCHAIN TECHNOLOGY IN IOT, PRIVACY PRESERVATION IN IOT	**(9)**
Technical Aspects - Integrated Platforms for IoT Enablement - Intersections between IoT and Distributed Ledger - Testing at scale of IoT Blockchain Applications - Access Control Framework for Security and Privacy of IoT - Blockchain Applications in Healthcare. Privacy Preservation Data Dissemination: Network Model, Threat Model - Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination - Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building.	

UNIT-III PRIVACY PROTECTION IN IOT	(9)
Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing	
UNIT-IV TRUST MODELS FOR IOT	**(9)**
Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT.	
UNIT-V SECURITY PROTOCOLS FOR IOT ACCESS NETWORKS	**(9)**
Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers - Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

REFERENCES:

1. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK
2. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.
3. Whitehouse O Security of things: An Implementers' guide to cyber-security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2		3			3									3
3	3													
4		3											3	
5									3	3				
CO (W.A)	3	3	3		3					3			3	3

22CYB07 ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to AIDS, CSE, CSE-CS, CSE-IOT and IT)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Produce the renewable and non-renewable resources and preserve them for future generations.	Ap	20%
CO4	Inspect the different methods of management of e-waste and apply them for suitable technological advancement and societal development.	An	20%
CO5	Evaluate the recycling of battery, cell phone , laptop and PCB	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(9)**
Environment - scope and importance - Eco-system- Structure and function of an ecosystem-types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(9)**
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(9)**
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	

UNIT IV – E- WASTE AND ITS MANAGEMENT	(9)
E-waste – sources of e-waste – hazardous substance in e-waste – chlorinated compounds – heavy metals - need for e-waste management – management of e-waste –Inventory management – production process – modification- Disposal treatment of e –waste – Incineration –acid baths – landfills.	
UNIT V – BATTERIES AND RECYCLING OF E-WASTE	**(9)**
Battery – types – Lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – process of recycling battery – lead acid battery – lithium ion battery – benefits of recycling battery – recycling of computing devices - mobile phones - PCB and servers.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3							
5						3			2			2		
CO (W.A)	**2**	**2**	**2**			**3**	**3**	**2**	**2**			**2**		

22CIP06 - COMPUTER NETWORKS LABORATORY *(Common to 22CCP04, 22CCP05 and 22ITP05)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PRE-REQUISITE: NIL					
Course Objective:	• Acquire expertise in network infrastructure through tasks such as cable crimping, LAN setup, TCP/IP configuration, socket communication, protocol simulations, and network topology design.				

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Identify and implement RJ45 cable crimping for straight-through, standard, and crossover cables.	Ap
CO2	Develop and execute a program to transfer files between nodes using socket connections.	C
CO3	Implement the sliding window protocol with varying frame sizes to observe efficiency and throughput.	Ap
CO4	Apply the routing protocol for displaying the routing table.	Ap
CO5	Develop a client application that interacts with a DNS server to resolve domain names into IP addresses.	C

IST OF EXPERIMENTS:

1. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
2. Sort a given set of elements using the Insertion sort, Selection sort and Bubble sort
3. Implementation of Linear Search.
4. Implementation of Recursive Binary Search
5. Develop a program to find out the maximum and minimum numbers in each list of n numbers using the divide and conquer technique.
6. Develop a program to sort the numbers using Merge and Quick sort.
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Wars hall's algorithm.
9. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
10. Implement N Queens problem using Backtracking.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 30 nodes (OR) Standalone PCs – 30 Nos.

Software:

C/C++/JAVA/ Python

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2	3		3											
3	3		3				3							
4	3		3			3	3							
5	3		3											
CO (W.A)	**3**		**3**			**3**	**3**						**3**	

22CIP07 - DATABASE MANAGEMENT SYSTEM LABORATORY *(Common to 22CSP07,22CCP06 and 22ITP06)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PRE-REQUISITE : NIL				
Course Objective:	To provide practical experience in designing, implementing, and managing databases using database management system concepts.			

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Analyse database concepts for a given problem.	An
CO2	Demonstrate SQL commands to create, manipulate and query data in a database.	Ap
CO3	Design SQL queries and conceptual data models for database applications.	Ap
CO4	Construct front end tools to design forms, reports and menus	C
CO5	Develop the solutions using database concepts for real time requirements	C

LIST OF EXPERIMENTS

1. Structured Query Language : Creating Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes
2. Table and Record Handling
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements
3. Retrieving Data from a Database
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause
   - Using Aggregate Functions Combining Tables
   - Using JOINS Sub queries
4. Database Management
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users Using GRANT and REVOKE
5. High level language extension with Triggers
6. Database design using E-R model and Normalization
7. Design and implementation of Payroll processing system

8. Design and implementation of Banking system 9. Design and implementation of Library Information System 10. Design and implementation of Student Evaluation System
TOTAL (P:60) : 60 PERIODS
HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
HARDWARE: 1. 33 nodes with LAN connection or Standalone PCs **SOFTWARE:** 1. MYSQL 8.0 2. Visual Basic 6.0

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											2	
2	3												3	2
3			3										3	
4					3								3	
5			3				3		3		3	3	3	
CO (W.A)	**3**	**3**	**3**		**3**		**3**		**3**		**3**	**3**	**3**	**2**

22CIP08 - SENSORS AND ACTUATOR DEVICES LABORATORY					
		L	T	P	C
		0	0	4	2
PRE-REQUISITE : NIL					
Course Objective:	• To provide practical experience in utilizing various sensors and actuators for engineering applications.				

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Demonstrate a clear understanding of characteristics and application of various sensors and actuators.	Ap
CO2	Analyze data from different sensors ensuring accurate and reliable measurements.	An
CO3	Develop skills in interfacing sensors and actuators with microcontrollers.	Ap
CO4	Design an integrated system to achieve functional requirements in fields such as automation and robotics.	An
CO5	Create solutions using sensors and actuators for real world applications	C

LIST OF EXPERIMENTS :

1. Exploring the Arduino Programming Environment (IDE) and the different Sensors and Actuators available with the Arduino Kit
2. Design a data logger with different types of sensors and learn various sensor calibration techniques
3. Design and implementation of Breath analyzer using temperature sensors
4. Design and implementation of Liquid Level Indicator using optical Sensors
5. Design and implementation of odometer prototype to sense speed of an automobile
6. Design and implementation of a prototype to monitor real-time tire-pressure
7. Develop and validate a prototype for sensing PH and humidity parameters using polymer-based sensors
8. Design and demonstrate a water quality monitoring system
9. Demonstrate a simple parking system using ultrasonic sensors

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2			2	2										
3														2
4					3									2
5		2			3				1	1			3	
CO (W.A)	**3**	**2**	**2**	**2**	**3**				**1**	**1**			**3**	**2**

22MAN08- SOFT / ANALYTICAL SKILLS – IV *(Common to All Branches and Applicable for (2022-2026) Batch only)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE: NIL

Course Objective:	• To recollect the functional understanding of basic grammar and its structure • To enrich their knowledge and to develop their logical reasoning ability

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment test**
CO1	Construct the sentences with basic grammar.	U	40%
CO2	Analyze quantitative aptitude problems and find solutions.	Ap	30%
CO3	Develop the ability to solve problems through logical reasoning.	An	30%

UNIT I - VERBAL	**(5+10)**
Articles - Fill in the blanks - Grammatical Error - Sentence improvement	
UNIT II - APTITUDE	**(5+10)**
Speed and Distance-Time and Work- Mixture and Allegations- Permutation and Combinations	
UNIT III - LOGICAL AND REASONING	**(5+10)**
Seating Arrangement- Directions and Distance - Nonverbal Reasoning	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				

22MAN08R - SOFT/ANALYTICAL SKILLS – IV *(Common to All Branches and Applicable for (2023-2027 Batch only)*				
L	**T**	**P**	**C**
1	**0**	**2**	**0**

PRE-REQUISITE : NIL

Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts. • To develop quantitative aptitude and analytical reasoning skills.

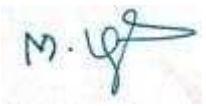
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I – VERBAL ABILITY	**(10+5)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II – APTITUDE	**(10+5)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(10+5)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

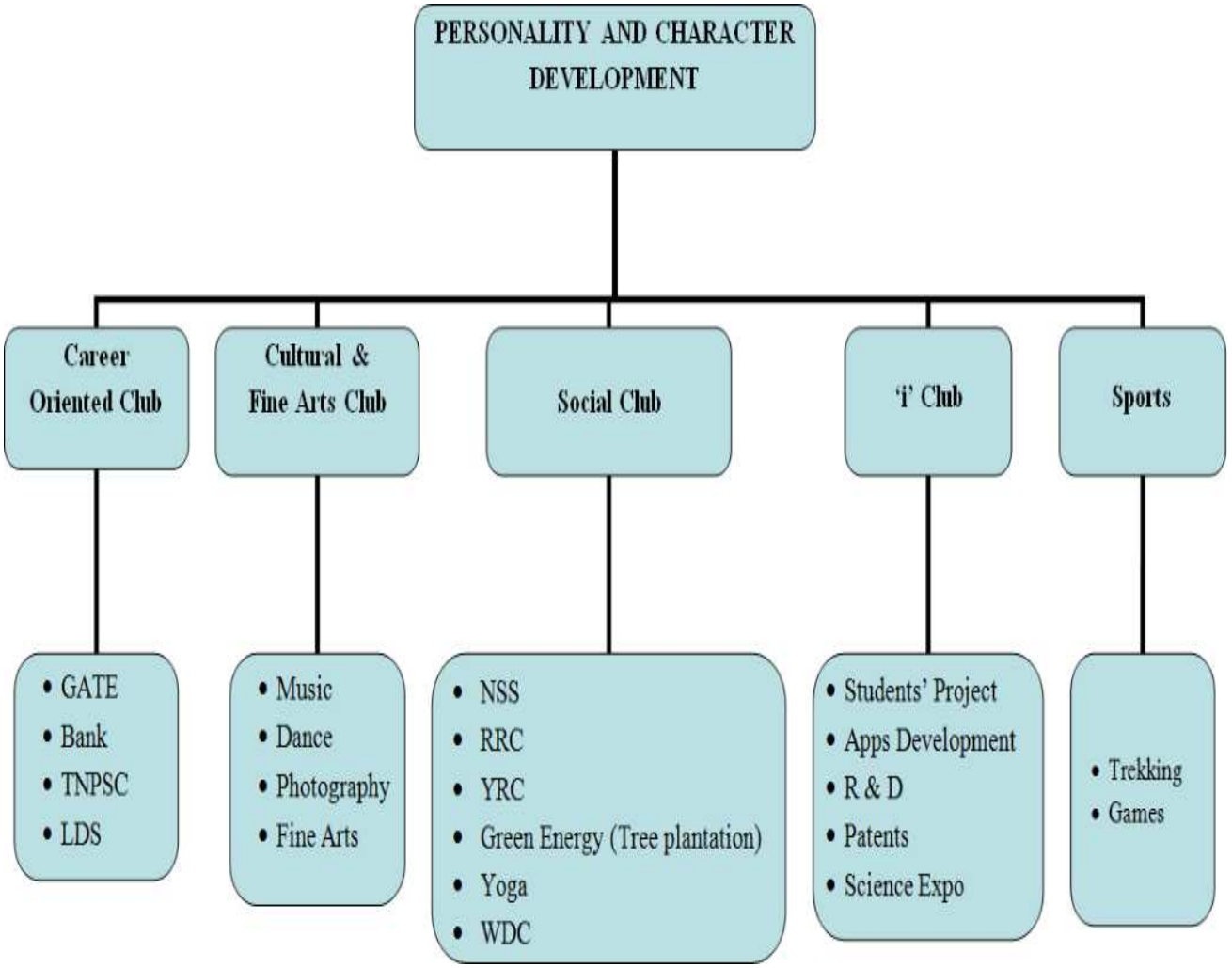
REFERENCES:

1. Rizvi, M.Ashraf. "Effective Technical Communication", Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. "Quantitative Aptitude for Competitive Examinations", S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. "How to Prepare for Quantitative Aptitude for the CAT", Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22GED01 – PERSONALITY AND CHARACTER DEVELOPMENT				
	L	T	P	C
	0	0	1	0
PRE-REQUISITE : NIL				



*LDS - Leadership Development Skills

OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
• To provide support for identifying specific career field of interests and career path • To provide support for preparing for competitive exams	• To bring out the hidden talent of students in music, dance and other fine arts. • To promote photography skill among the students • To develop and enhance the performance of students by participating in various events. • To inculcate managerial capabilities such as event management and stage organization.	•To create social awareness and develop a sense of social and civic responsibility •To inculcate socially and environmentally sound practices and be aware of the benefits •To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	•To inculcate the basic concepts of innovation •To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities. •To enrich the academic experience, build competencies and relationships beyond the classroom	•To provide opportunities to excel at sports •To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. •To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. •To develop leadership skills and nurture the team building qualities. **<u>Trekking:</u>** •To provide opportunities to explore nature and educating about the purityof nature •To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events. • Develop team spirit, leadership and managerial qualities.	• Develop socially responsive qualities by applying acquired knowledge. • Build character, social consciousness, commitment and discipline.	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs. • Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team.	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS

(Cumulatively for Two Semesters)

22CIC13 - EMBEDDED SYSTEMS				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To introduce students to various components of typical embedded systems viz., sensors and actuators, data converters, UART etc., and their interfacing. • To expose students to characteristics and various challenge of real time operating systems in terms of resources and deadline.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the challenges in designing an embedded system using various microcontrollers	An	40%
CO2	Make use of the working principle to interface embedded system components.	Ap	20%
CO3	Analyze the benefits and drawbacks of real –time scheduling and to recommend acceptable solution for specific challenges.	An	20%
CO4	Analyze the ideas behind serial communication technologies and their applications.	An	20%
CO5	Implement the embedded system in real world application.	Ap	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Overview of Embedded System - Design Challenge: Optimizing Design Merits - Embedded Processor Technology: Software and Hardware - Application of Specific Processors - Micro-controller architecture: 8051, PIC, and ARM.	
UNIT II - I/O INTERFACING TECHNIQUES	**(9)**
Introduction to memory - Memory interfacing: SRAM, DRAM and Flash Memory - A/D - D/A - Timer and counter - Watchdog timers: ATM Timeout using a Watchdog Timer - Encoder & Decoder – UART - Sensors and actuators interfacing.	
UNIT III - REAL TIME OPERATION SYSTEM	**(9)**
Classification and characteristics of Real – Time Tasks - features of real time operating system - issues and challenges in RTS - Real time task Scheduling : EDF- RMA and Hybrid schedulers - POSIX : RT and IEEE POSIX Standards.	

UNIT IV - EMBEDDED NETWORKING PROTOCOLS	(9)
Serial Protocols : Inter Integrated Circuits (I^2C) and Controllers Area Network - Embedded Ethernet Controller - RS232 – Bluetooth - ZigBee - Wi-Fi.	
UNIT V - APPLICATION OF EMBEDDED SYSTEM AND CASE STUDIES	**(9)**
Introduction to embedded system application using case studies : Role in Agriculture sector, Automotive electronics, Consumer Electronics, Industrial controls, Embedded system for Adaptive Cruise Control (ACC), Study of Embedded system for Smart Card.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Vahid, Frank, and Tony D. Givargis. Embedded system design: a unified hardware/software introduction. John Wiley & Sons, 2001.
2. RajKamal. Embedded Systems-SoC, IoT, AI and Real-Time Systems. McGraw-Hill Education, 2020.

REFERENCES:

1. Marilyn Wolf, Computer as Components – Principles of Embedded Computing System Design, Fourth Edition, Morgan Kaufman Publishers, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2				3									3	
3			3		3									3
4	3				3									
5									3	3				3
CO (W.A)	**3**		**3**	**3**	**3**				**3**	**3**			**3**	**3**

22CIC14 – AUTOMATA THEORY AND COMPILER DESIGN (Common to 22CCC13)				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE-REQUISITE: NIL

Course Objective:	To understand the various phases of compiler design and design context free grammar of any language, various parsing techniques, the intermediate code generation and implement the code generator.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design minimized automata for regular expression.	Ap	20%
CO2	Construct parsing table using different parsers. SLR, CLR, LALR and Shift reduce parsing.	Ap	20%
CO3	Generate intermediate code for the expression.	E	20%
CO4	Apply the code optimization techniques to generate machine code.	Ap	20%
CO5	Demonstrate the construction of automata using JFLAP and present the compiler construction process with a sample code	Ap	20%

UNIT I - INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS	**(9)**
Introduction – Translators - Compilation and Interpretation - Language processors - The Phases of Compiler – Compiler Construction Tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA.	
UNIT II – CONTEXT FREE GRAMMAR AND PUSHDOWN AUTOMATA	**(9)**
Types of Grammar - Chomsky's hierarchy of languages – Context Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and CNF and GNF – Push Down Automata (PDA) : Definition – Moves – Instantaneous descriptions – Languages of push down automata – Equivalence of pushdown automata and CFG - CFG to PDA - PDA to CFG – Deterministic Pushdown Automata.	
UNIT III – SYNTAX ANALYSIS	**(9)**
Role of Parser – Types of Parsing - Top down parser and Bottom up parser - Recursive Descent Parser - LL(1) - LR(0) Item Construction of SLR Parsing Table – CLR(1) - LALR Parser - Error Handling and Recovery in Syntax Analyzer.	

UNIT IV - IMPLEMENTATION OF THREE ADDRESS CODE	(9)
Intermediate Representation: Translation to Syntax Trees and DAGs.- Syntax-Directed Translation Schemes for Code Generation - Assignment and Boolean Operators & Control flow – Backpatching - Procedural calls.	
UNIT V – CODE OPTIMIZATION & CODE GENERATION	**(9)**
Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks - Issues in the Design of a Code Generator - Basic Blocks and Flow Graphs; Representation of Flow Graphs, Loops- A Simple Code Generator.	
TOTAL (L:45, T:15) : 60 PERIODS	

TEXTBOOKS:

1. J.E .Hopcroft, R.Motwani and J.D Ullman, Introduction to Automata Theory, Languages and computations, Second Edition, Pearson Education, 2003.
2. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, Elements of the theory of computation, Second Edition,PHI, 2003.
2. J.Martin, Introduction to Languages and the theory of computation, Third Edition, TMH, 2003.
3. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence Based Approach, Morgan Kaufmann Publishers, 2002.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			3										3	3
2	3												3	3
3			3										3	3
4	3	3											3	3
5					3					3		3	3	3
CO (W.A)	3	3	3		3					3		3	3	3

22CIC15 - FULL STACK DEVELOPMENT *(COMMON TO 22CSC15,22AIC15 AND 22ITC17)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	To provide students with a solid foundation in the front-end and back-end web development fundamentals, integrate with databases and external services, and apply best practices in web development

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of MERN stack for Web application development.	Ap	20%
CO2	Analyze and develop web applications using bootstrap, node and Express JS focused on social and environmental issues	An	40%
CO3	Integrate front-end and back-end components effectively with databases and external services.	An	20%
CO4	Implement Full stack application through React framework.	An	20%
CO5	Demonstrate teamwork and problem-solving skills in project development.	C	Internal Assessment

UNIT I - BASICS OF MERN STACK	(9)
MERN Introduction-MERN Components - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js npm.	
UNIT II – BOOTSTRAP AND NODE JS BASICS	(9)
Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS.Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter.	
UNIT III - NODE JS EXPRESS	(9)
Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON- Express - Routing - Handler Function – Middleware-Rest API.	

UNIT IV - MONGODB	(9)
MongoDB - MongoDB Basics - Documents -Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB.	
UNIT V - REACT	(9)
React Introduction – State - Lifecycle methods - Hooks – useState, useEffect, useContext - Event handling - Forms – controlled components, submission, validation.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Bradshaw, S., Brazil, E., & Chodorow, K. (2019). MongoDB: the definitive guide: powerful and scalable data storage. O'Reilly Media.
3. Mardan, A. (2014). Express. js Guide: The Comprehensive Book on Express. js. Azat Mardan.
4. Kogent Learning Solutions Inc. "HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQUERY", Wiley India Pvt. Limited, 2011.
5. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.
6. Zammetti, F. (2020). Modern Full-Stack Development: Using TypeScript, React, Node. js, Webpack, and Docker. Apress.

REFERENCES:

1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, "Bootstrap 4–Responsive Web Design" Packt Publishing (6 July 2017)
2. Thomas Powell, "Web Design: The Complete Reference" ,Osborne / McGraw-Hill
3. https://www.w3schools.com/

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				3								3	
2		3	3		3	3	3						3	
3			3		3									3
4				3	3								3	
5					3			3	3	3	3			3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**		**3**	**3**

22CIP09 - EMBEDDED SYSTEM LABORATORY				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• Provide a comprehensive understanding of embedded systems and their application in IoT • Equip students with the knowledge and skills to effectively implement and manage a range of IoT communication protocols.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Utilise the knowledge of embedded systems and their range of uses in the Internet of Things environment.	Ap
CO2	Interfacing the various kind of embedded system components with Internet of Things.	An
CO3	Apply embedded programming techniques to solve real-world problems	Ap
CO4	Develop an integrated hardware and software solutions for embedded systems to ensuring functionality and efficiency.	Ap
CO5	Design a various IoT communication protocols to enable seamless device connectivity and data exchange within IoT networks.	Ap

LIST OF EXPERIMENTS :

1. Monitoring a machinery vibration using vibration sensors
2. Interfacing an MQ-2 Gas Sensor with an LED
3. Interfacing an ADXL345 Accelerometer with ARM
4. Interfacing soil moisture sensor with ARM
5. Implementing a program to heartbeat sensor and ARM
6. Interfacing UART for LED Control between IoT and PC
7. Application to transmit & receive a character through RS232 and Bluetooth low energy Communication
8. Interfacing GSM Module with IoT and Sending Sensor Data to Cloud
9. Interfacing ESP8266(WIFI Module) with IoT for HTTP Communication
10. Implement Zigbee interface for Data Transmission with IoT

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3												
3					3									2
4				3										
5										3				
CO (W.A)	**3**	**3**		**3**	**3**					**3**			**3**	**2**

22CIP10 - FULL STACK DEVELOPMENT LABORATORY (Common to 22CSP09 AND 22ITP10)				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	To develop full stack applications with clear understanding of user interface, business logic and data storage.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Install and develop programs using React JS.	Ap
CO2	Make use of multiple node js modules to implement the application.	An
CO3	Develop responsive and dynamic web pages	C
CO4	Develop responsive and mobile supported applications	C
CO5	Perform database operations using MongoDB and aware of recent technologies in Full Stack through self-learning.	An

LIST OF EXPERIMENTS :

1. Build a Basic React APP that display custom message from users
2. Create a Login form using React JS
3. Write a program to upload Single/Multiple images to cloudinary using Node JS
4. Write a program to create router using Node.js with Express
5. Design a program to create Single Responsive Page using Bootstrap
6. Implement Create and Read Operations in MongoDB.
7. Implement Update and Delete Operations in MongoDB.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3			3								3	
3		3	3											3
4				3	3								3	
5					3				2			3		
CO (W.A)	**3**	**3**	**3**	**3**	**3**				**2**			**3**	**3**	**3**

22MAN10R - COMMUNICATION AND QUANTITATIVE REASONING				
	L	T	P	C
	1	0	2	0

PRE-REQUISITE : NIL

Course Objective:	• To enhance the proficiency of the students in both spoken and written communication • To acquire skills required to solve quantitative aptitude problems

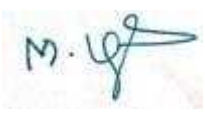
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - LANGUAGE BOOSTERS	**(5+10)**
JAM - General Topic Presentation - Group Discussion - Mock Interview - E Mail Writing - Essay writing	
UNIT II – APTITUDE	**(5+10)**
Mensuration - Area, Shapes, Perimeter - Races and Games - Data Interpretation on Multiple Charts.	
UNIT III - REASONING	**(5+10)**
Venn diagram - Syllogism - Data Sufficiency - Cubes & Embedded Images.	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication*. Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative Aptitude for Competitive Examinations.* S.Chand Publishing Company Ltd(s)., 2022.
3. Arun Sharma. *How to Prepare for Quantitative Aptitude for the CAT.* Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		1		1					1	1				



22CIC16-MOBILE APPLICATION DEVELOPMENT FOR IoT (Common to 22AIX38)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce mobile design principles and implementation of Application development with Android and IOS. • To develop competency in the students to independently design and develop their own professional apps.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyzes the fundamental mobile application architecture for IoT through outlining.	An	20%
CO2	Evaluates the design constraints for mobile applications, ensuring performance, usability, security, availability, and modifiability.	An	20%
CO3	Implements IoT applications using standardized hardware and software platforms.	Ap	20%
CO4	Apply low power communication technologies to create a prototype.	Ap	20%
CO5	Create an IoT solution development plan from a Product management perspective.	C	20%

UNIT I - INTRODUCTION TO IOT ECOSYSTEM	**(9)**
IoT ecosystem; Industry 4.0; Application development platforms for IoT; IoT Data sources - GPS and WIFI integration with social media applications.	
UNIT II - BASIC DESIGN	**(9)**
Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.	
UNIT III - SENSOR DATA PROCESSING	**(9)**
Sensor Data-Gathering and Data-Dissemination Mechanisms; Sensor Database system architecture; Sensor data-fusion mechanisms; Data-fusion Architectures and models.	

UNIT IV - PROGRAMMING FRAMEWORKS FOR INTERNET OF THINGS	(9)
IoT Programming Approaches: Node-Centric Programming - Database approach - Model-Driven Development - IoT Programming Frameworks: Android Things - ThingSpeak - IoTivity - Node-RED - DeviceHive - Contiki and Cooja – Zetta.	
UNIT V - COMMUNICATION TECHNOLOGIES FOR LOW POWER WIRELESS INTERACTIONS	**(9)**
Wireless communications in product development – Bluetooth LE - Near Field Communications (NFC) – WiFi; Prototyping Bluetooth LE with Arduino Nano; Power management strategies and practices - Case Study: E-Health - Telemedicine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
2. Lea, Perry. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 1st edition, Packt Publishing Ltd, 2018.

REFERENCES:

1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press,2019
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packt Publishing,2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
3	-	3	-	3	3	-	-	-	-	-	-	-	-	3
4	-	3	3	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

22CIC17 - COMPUTER VISION AND ROBOTICS				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To understand the Fundamental Concepts Related To sources, shadows and shading. • To understand the Geometry of Multiple Views.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement fundamental image processing techniques required for computer vision.	An	20%
CO2	Implement boundary tracking techniques.	An	20%
CO3	Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections	Ap	20%
CO4	Apply 3D vision techniques and Implement motion related techniques.	Ap	20%
CO5	Develop applications using computer vision techniques	Ap	20%

UNIT I - FUNDAMENTALS OF IMAGING: FROM LIGHT MEASUREMENT TO COLOR REPRESENTATION	(9)
CAMERAS: Pinhole Cameras. Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases. Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models. Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	
UNIT II - ADVANCED IMAGE PROCESSING: FILTERS, EDGE DETECTION, AND TEXTURE ANALYSIS	**(9)**
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates. Edge Detection: Noise, Estimating Derivatives, Detecting Edges. Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	
UNIT III - MULTI-VIEW GEOMETRY AND SEGMENTATION TECHNIQUES IN IMAGING	**(9)**
The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras Segmentation by Clustering: Segmentation, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	

UNIT IV - MODEL-BASED SEGMENTATION AND TRACKING TECHNIQUES	(9)
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice. Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples	
UNIT V - GEOMETRIC CAMERA MODELS AND CALIBRATION	**(9)**
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations. Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3				3										3
4				3									3	
5							3							
CO (W.A)	3	3		3			3						3	3

22CIP09-MOBILE APPLICATION DEVELOPMENT FOR IoT LABORATORY					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PRE-REQUISITE : NIL					
Course Objective:	• To explore various Hybrid App Development Platforms. • To acquire the knowledge of app releases and publishing an app to the play store.				

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Demonstrate the configuration of Android Software Development tools.	Ap
CO2	Design and develop Mobile Applications using Android and Kotlin.	An
CO3	Develop a complex android application by using APIs, Libraries, and message handling techniques.	Ap
CO4	Construct the mobile application using a hybrid framework or SDK release.	An
CO5	Publish the mobile application on Google Play Store.	C

LIST OF EXPERIMENTS :

1. Install Android Studio and Configure Latest Android SDKs and Android Virtual Devices.
2. Create an application that takes the name from a text box and shows "hello message" along with the name entered in the text box, when the user clicks the OK button.
3. Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout).
4. Design a complete Student Management Application using Android and provide effective navigation between various Activities.
5. Design a mobile IoT APP for a smart home.
6. Design a mobile IoT App for Agriculture motor control from a remote location.
7. Design a mobile IoT APP for home protection which monitors for intruders and sends a message to your phone immediately and also sends an email.
8. Design a Green leaf disease detection using Rasberry Pi.
9. Develop an Android Application that stores Student Details into the hosting server and retrieve student details from the server.
10. Prepare and Publish Your Android Apps in Google Play Store.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
3	-	3	-	3	3	-	-	-	-	-	-	-	-	3
4	-	3	3	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

22CIP12 - COMPUTER VISION LABORATORY				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To Make students acquainted with practical aspects of computing with images. • To Improve quality of image by applying enhancement techniques. • To understand Feature Extraction algorithms.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Understand the basic image processing techniques and enhance images by adjusting contrast	Ap
CO2	Detects edges using various kernels using transformation	Ap
CO3	Apply histogram processing, convert between various color spaces.	Ap
CO4	Partition dataset by classification and clustering	An
CO5	Comprehend computer vision systems for real world problems.	An

LIST OF EXPERIMENTS :

1. Implement basic image operations
   a. Loading and displaying an image.
   b. Color formats
   c. Image enhancement.
2. Implement smoothing filters on an image using
   a.Gaussian filter
   b. Median filter
   c. Mean Filter
3. Demonstrate fourier Transformations
4. Implement histogram calculation and equalization for the given image.
5. Implement morphological operations like dilation, erosion, opening and closing on the given image
6. Implement edge detection on images using any two edge detection masks.
7. Detection of motion from structure.
8. Implement texture extraction of a given image.
9. Implement object detection like recognizing pedestrians.
10. Implement face recognition of an image using K-Means clustering.
11. Implement dimensionality reduction using PCA for the given images.
12. Demonstrate model based reconstruction using tensor flow.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3											3	
3		3	3											3
4				3									3	
5							3							
CO (W.A)	**3**	**3**	**3**				**3**						**3**	**3**

22GEA01 UNIVERSAL HUMAN VALUES (For Common To All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the significance of value inputs informal education and start applying them in their life and profession.	E	Internal Assessment
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	Ap	

UNIT I- INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL-ENCOMPASSING RESOLUTION	**(6)**
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II- RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	**(6)**
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	

UNIT III- UNDERSTANDING HUMAN BEING	(6)
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	
UNIT IV- Understanding Nature and Existence	**(6)**
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V- Understanding Human Conduct, All-encompassing Resolution and Holistic Way of Living	**(6)**
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) : 30 PERIODS	

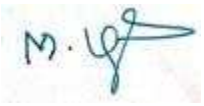
TEXT BOOK:

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi

REFERENCES:

1. IvanIllich,1974, Energy& Equity, The Trinity Press, Worcester, and Harper Collins ,USA
2. E.F. Schumacher,1973, Smallis Beautiful: a studyofeconomicsasifpeoplemattered, Blond& Briggs,Britain.
3. Sussan George, 1976,Howthe Other Half Dies, Penguin Press. Reprinted1986,1991
4. DonellaH.Meadows,DennisL.Meadows,JorgenRanders,WilliamW.BehrensIII,1972, LimitstoGrowth–ClubofRome'sreport,UniverseBooks.
5. ANagraj,1998,JeevanVidyaEkParichay,DivyaPathSansthan,Amarkantak.
6. PLDhar,RRGaur,1990,ScienceandHumanism,CommonwealthPublishers.
7. ANTripathy,2003,HumanValues,NewAgeInternationalPublishers
8. EGSeebauer&RobertL.Berry,2000,FundamentalsofEthicsforScientists&Engineers, OxfordUniversityPress
9. MGovindrajran,SNatrajan&V.S.SenthilKumar,EngineeringEthics(includingHumanValues), Eastern EconomyEdition, Prentice HallofIndia Ltd.
10. SubhasPalekar,2000,HowtopracticeNaturalFarming,Pracheen(Vaidik)KrishiTantraShodh,Amravati
11. BPBanerjee,2005,FoundationsofEthicsandManagement,ExcelBooks
12. BLBajpai,2004,IndianEthosandModernManagement,NewRoyalBookCo.,Lucknow. Reprinted2008.

Mapping of COs with POs / PSOs														
	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
CO (W.A)						**2**	**2**	**3**	**2**	**2**		**3**		



22GED02 – INTERNSHIP / INDUSTRIAL TRAINING					
		L	**T**	**P**	**C**
		0	**0**	**0**	**2**
PRE-REQUISITE : NIL					
Course Objective:	• To obtain a broad understanding of the emerging technologies in Industry • To gain knowledge about I/O models.				
Course Outcomes The Student will be able to		**Cognitive Level**			
CO1	Engage in Industrial activity which is a community service.	U			
CO2	Prepare the project report, three minute video and the poster of the work.	Ap			
CO3	Identify and specify an engineering product that can make their life comfortable.	An			
CO4	Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms.	Ap			
CO5	Identify the community that shall benefit from the product.	E			

During semester breaks, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple products to make their life comfortable and convert new ideas into projects.

Every student is required to complete 12 to 16 weeks of internship (with about 40 hours per week), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports and Seminars during the VI and VIII semesters. The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs/Training Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute.
- Participation in Inter-Institute innovation related competitions like Hackathons.
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests

- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2								
2										3				
3		1												
4							2	3			2			
5						2								
CO (W.A)		**1**				**2**	**2**	**3**		**3**	**2**			

22CID01- PROJECT WORK					
		L	**T**	**P**	**C**
		0	**0**	**20**	**10**
PRE-REQUISITE : NIL					
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem.	Ap	20 % - First Review (Internal)		
CO2	Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment	Ap, E	20 % - Second Review (Internal)		
CO3	Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project, design, implement, analyze and interpret results of the implemented project	Ap, An, C	20 % - Third Review (Internal)		
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE format of the work and effective oral communication through presentation of the project work and demonstration of the project.	E	20 % - Final Review (External)		
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work (leading to start-up/ product/ research paper/ patent)	Ap, An	20 % - Final Review (External)		

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide.

The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make

presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations
TOTAL (P: 300) = 300 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3										3	3	3
2						3	3				3		3	3
3	3	3	3	3	3								3	3
4								3		3			3	3
5									3		3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

22CIX01-INDUSTRIAL & MEDICAL IOT (Common to 22CSX31,22ITX31,22AIX31 and 22CCX31)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with good depth of knowledge of Designing Industrial and Medical IoT Systems for various applications. • Students will learn the new evolution in hardware, software, and data				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply data management techniques to analyze and manipulate IIoT data, using tools for basic analytics and mining.	Ap	20%
CO2	Analyze various attack types targeting IoMT devices and systems, demonstrating the ability to identify specific vulnerabilities in real-world scenarios.	An	20%
CO3	Apply the IoMT system architecture by designing a basic framework that includes data collection, management, and server layers, ensuring proper integration of each component.	Ap	40%
CO4	Analyze the impact of smart medicinal packages on medication adherence, examining data on patient outcomes and adherence rates.	An	20%
CO5	Analyze case studies from various industrial IoT domains, focusing on operational efficiency, safety improvements, and sustainability impacts.	An	Internal Assessment

UNIT I- INTRODUCTION TO INDUSTIAL IOT (IIOT)	**(9)**
Introduction to IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT	
UNIT II - INTERNET OF MEDICAL THINGS SECURITY THREATS, SECURITY CHALLENGES AND POTENTIAL SOLUTIONS	**(9)**
IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.	

UNIT III - INTERNET OF MEDICAL THINGS INTRODUCTION AND SYSTEM ARCHITECTURE	(9)
Introduction, IoMT Devices-On-Body Devices, In-Home Devices, Community Devices, In-Clinic Devices, In-Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer.	
UNIT IV – HEALTH CARE TECHNOLOGIES & IoMT	**(9)**
Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases-What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare.	
UNIT V – APPLICATION DESIGN & CASE STUDY	**(9)**
Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process. Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.
2. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.
3. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.

REFERENCES:

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
2. Aboul Ella Hassanien, Nilanjan Dey and Sureaka Boara, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3											3	
3		3	3											3
4				3									3	
5							3							
CO (W.A)	**3**	**3**	**3**				**3**						**3**	**3**

22CIX02-BLOCKCHAIN TECHNOLOGY (Common to 22CSX32,22ITX32 and 22AIX32)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To impart knowledge of distributed ledgers in business • To acquire knowledge in emerging concepts using blockchain			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of blockchain technology to articulate their significance.	Ap	20%
CO2	Evaluate the effectiveness of different consensus algorithms in specific blockchain applications.	An	20%
CO3	Evaluate their impact on security and privacy in digital transactions.	An	20%
CO4	Implement a strategic plan for integrating specific distributed ledger technologies into a business environment, considering operational efficiency, security, and regulatory compliance.	Ap	20%
CO5	Apply appropriate techniques to manage trust-based business networks, considering societal, environmental, economic, and global perspectives.	Ap	20%

UNIT I – INTRODUCTION TO BLOCKCHAIN	**(9)**
The growth of blockchain technology – Distributed Systems – P2P – Distributed Ledger – Cryptographically Secure - Generic Element of Blockchain – Benefits and limitations of blockchain - Block chain Challenges - Tiers of BT – Types of Blockchain - Consensus.	
UNIT II – DECENTRALIZATION	**(9)**
Methods of Decentralization – Routes to Decentralization – Smart Contract – Decentralized Organization – Platforms for Decentralization – Consensus Algorithms.	
UNIT III – CRYPTOCURRENCIES	**(9)**
Cryptographic Hash Functions – Cryptography basic and Concepts – Introduction Bitcoin – Bitcoin Network and Payments – Bitcoin clients and APIs – Alternative Coins	
UNIT IV - DISTRIBUTED LEDGERS FOR BUSINESS	**(9)**
Ethereum: Introduction – Ethereum Network – Components – Programming Languages; Hyperledger: Introduction – Reference Architecture – Fabric – Sawtooth Lake – Corda.	

UNIT V - BLOCKCHAIN DEVELOPMENT TOOLS AND FRAMEWORKS	(9)
Compilers: Solidity Complier – Ganache – Metamask – Truffle; Languages: Solidity – Go – Java – NodeJS; Blockchain Use case: Financials – Insurance - Supply Chain Management – HealthCare – IoT.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
2. Imran Bashir, "Mastering Blockchain" Packt 2nd Ediction, 2018.

REFERENCES:

1 . Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.

2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
4	-	-	3	3	3	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

22CIX03-BEYOND 5G AND IOT TECHNOLOGIES (Common to 22CSX33,22ITX33,22AIX33 and 22CCX33)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Explore the evolution from 5G to 6G and the implications for data rates, latency, and connectivity. • Examine the role of edge computing in reducing latency and improving real-time data processing in IoT systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of key capabilities and requirements of 5G to evaluate their implications for specific industry applications, such as IoT, smart cities, and autonomous vehicles.	Ap	20%
CO2	Analyze the specific requirements for 5G waveform design, including spectral efficiency, flexibility, and resilience to interference.	An	20%
CO3	Apply knowledge of the 5G architecture framework to design a basic model of a 5G network, incorporating elements such as the Radio Access Network (RAN) and core network components.	Ap	40%
CO4	Analyze the theoretical foundations of multi-antenna systems, identifying key requirements and performance indicators essential for effective MIMO operation.	An	20%
CO5	Conduct a detailed case study on a specific implementation of V2X or terahertz communication technology, evaluating its design, performance outcomes, and lessons learned.	An	Internal Assessment

UNIT I- OVERVIEW OF 5G WIRELESS COMMUNICATIONS	**(9)**
Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.	
UNIT II- WAVEFORM DESIGN FOR 5G & BEYOND	**(9)**
Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multicarriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods.	

UNIT III - 5G ARCHITECTURE AND 5G NEXTGEN CORE NETWORK	(9)
5G Architecture: Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements	
UNIT IV - MASSIVE MIMO SYSTEMS	**(9)**
Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming.	
UNIT V - V2X COMMUNICATIONS AND NOVEL ASPECTS IN TERAHERTZ WIRELESS COMMUNICATIONS	**(9)**
Vehicle-to-Vehicle (V2V) Communications, Vehicle-to-Infrastructure (V2I) Communications, Vehicle-to-Pedestrian (V2P) Communication, Self-driving Vehicles & its challenges, Vehicle-to-Network (V2N) Communications. Overview, potential spectral windows at THz frequencies, Terahertz wave propagation characteristics, opportunities & challenges, application	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
2. Suvra Sekhar Das and Ramjee Prasad, "Evolution of Air Interface Towards 5G: Radio Access Technology and Performance Analysis", Gistrup, Denmark: River Publishers series in Communication, 2018.
3. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, **"**5G Mobile Communications", Springer publications-2016.
4. William Stallings "5G Wireless: A Comprehensive Introduction", Pearson Education, 2021.
5. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology" Cambridge University Press-2016**.**

REFERENCES:

1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK, 2017.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.

Mapping of COs with POs / PSOs														
	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1													3	
2	3		3										3	
3		3												3
4				3									3	
5									2					
CO (W.A)	**3**	**3**	**3**	**3**					**2**				**3**	**3**

22CIX04 – PROGRAMMING FOR IoT BOARDS (Common to 22CSX34,22ITX34,22AIX34 and 22CCX34)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To introduce Internet of Things (IoT) environment and its technologies for designing smart systems • To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Investigate various challenges and explore open source hardware prototyping platforms for designing IoT devices	Ap	20%
CO2	Analyze basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world	An	20%
CO3	Apply knowledge on Tkinter GUI using python in different sensors	Ap	20%
CO4	Program SBC by exploring protocols, data conversion process, API and expansion boards for practical IoT devices using Python	Ap	20%
CO5	Apply embedded programming constructs and constraints in real time systems for real world socio-economic problems	Ap	20%

UNIT I- INTRODUCTION TO RASPBERRY PI	**(9)**
Raspberry Pi components-Installation of NOOBS and Raspbian on SD card- Terminal commands-Installation of Libraries on Raspberry pi- Getting the static IP address of Raspberry Pi-run a program-Installing the remote desktop server.	
UNIT II - INTERFACING WITH RASPBERRY PI	**(9)**
Interfacing of relay with raspberry Pi-LCD-DHT11 sensor-ultrasonic sensor- camera-play with digital sensor, analog sensor and actuator.	
UNIT III – PYTHON GUI WITH TKINTER	**(9)**
Tkinter for GUI design-LED Blink-brightness control-selection from multiple options-Reading a PIR sensor- Reading a analog sensor.	
UNIT IV – DATA ACQUISITION WITH PYTHON	**(9)**
Basics-CSV File- Storing Arduino data with CSV file- plotting random numbers using Matplotlib-Plotting real time from arduino- Integrating the plots in the TKinter window.	

UNIT V – CONNECTING TO THE CLOUD	(9)
Smart IoT systems- DHT11 data logger with thinkspeak server-ultrasonic sensor data logger-air quality monitoring system-landslide detection and disaster management system-smart motion detector and upload image to gmail.com.	
TEXT BOOKS :	
1. Rajesh singh, Anitha Gehlot, Lovi raj gupta, Bhupendra singh and MahendranSwain "Internet of things with Raspberry Pi and Arduino" CRC Press 2020.	
REFERENCES:	
1. Sai Yamanoor, Srihari Yamanoor " Python programming with Raspberry Pi" Packet Publishing Ltd, Ist edition, 2017. 2. Wolfram Donat "Learn raspberry Pi programming in python" A Press 2014.	

Mapping of COs with POs / PSOs														
	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3												3
3				3										3
4			3										3	
5									3	3				
CO (W.A)	**3**	**3**	**3**	**3**					**3**	**3**			**3**	**3**

22CIX05-WEARABLE COMPUTING (Common to 22CSX36,22ITX36,22AIX36 and 22CCX36)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Explore various applications of wearable computing across industries, such as healthcare, sports, entertainment, and fitness. • Examine the technical challenges associated with wearable systems, including power management, data accuracy, and user comfort.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply theoretical knowledge to practical situations, fostering skills in design, evaluation, and innovative thinking within the field of wearable technology.	Ap	20%
CO2	Analyze different signal processing techniques can be integrated into wearable systems to improve data quality and user experience.	An	20%
CO3	Apply knowledge of different wireless communication techniques to evaluate their suitability for implementing BANs in healthcare settings.	Ap	40%
CO4	Apply theoretical knowledge to practical challenges in wireless health systems, fostering skills in design, problem-solving, and innovation within the context of healthcare technology.	An	20%
CO5	Analyze case studies focused on wearable technologies used for monitoring patients with chronic diseases, assessing their impact on patient care and management.	An	Internal Assessment

UNIT-I INTRODUCTION TO WEARABLE SYSTEMS	**(9)**
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems- Wearable ground reaction force sensor.	
UNIT-II SIGNAL PROCESSING	**(9)**
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation.	

UNIT-III WIRELESS HEALTH SYSTEM	(9)
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.	
UNIT-IV SMART TEXTILE	**(9)**
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study- smart fabric for monitoring biological parameters - ECG, respiration.	
UNIT-V APPLICATIONS OF WEARABLE COMPUTING	**(9)**
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Title: "Wearable Sensors: Fundamentals, Implementation and Applications" Author: Edward Sazonov, Sergey G. Togov Publisher: Elsevier Year: 2014

REFERENCES:

1. Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Subhas Chandra Mukhopadhyay.
2. "Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Robert Matthews and Alberto Piaggesi.
3. "Wearable Sensors and Systems" edited by Mehmet R. Yuce.

Mapping of COs with POs / PSOs

	Pos												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3		3										3	
3		3												3
4				3									3	
5							3							
CO (W.A)	**3**	**3**	**3**	**3**			**3**						**3**	**3**

22CIX06– FOG AND EDGE COMPUTING (Common to 22CSX37,22ITX37,22AIX37 and 22CCX37)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To introduce IoT enabling technologies and its opportunities. • To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explore technologies behind the communication and management of fogs and edge resources.	Ap	20%
CO2	Analyze the techniques for storage and computation in fogs, edges and clouds.	An	20%
CO3	Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same	Ap	40%
CO4	Analyze the goals of middleware for fog and edge computing.	An	20%
CO5	Review the performance and issues of the applications developed using fog and edge architecture.	Ap	Internal Assessment

UNIT I- INTERNET OF THINGS (IOT) AND NEW COMPUTING PARADIGMS	**(9)**
Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges	
UNIT II - CHALLENGES IN FEDERATING EDGE RESOURCES	**(9)**
Introduction –the networking challenge - the management challenge- Miscellaneous challenges - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics.	
UNIT III – OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING	**(9)**
Introduction- Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing – optimization Techniques.	

UNIT IV – MIDDLEWARE FOR FOG AND EDGE COMPUTING	(9)
Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Fog Data Management - Smart Building - Predictive Analysis with FogTorch .	
UNIT V – APPLICATIONS OF FOG AND EDGE COMPUTING	**(9)**
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.	

TEXT BOOKS :

1. Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.

REFERENCES:

1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2ndedition, CreateSpace Independent Publishing Platform, USA
2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India

Mapping of COs with POs / PSOs

	Pos												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3												3
3				3										3
4			3										3	
5									3	3				
CO (W.A)	**3**	**3**	**3**	**3**					**3**	**3**			**3**	**3**

22CIX07 – WIRELESS AD-HOC AND SENSOR NETWORKS (Common to 22CSX35,22ITX35 and 22CCX32)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				

Course Objective:	• Understand the design issues in ad hoc and sensor networks. • Learn the different types of MAC protocols

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understanding the concepts, network architectures and applications of ad hoc and wireless sensor networks	U	20%
CO2	Understanding the working of MAC Protocols for ad hoc networks	U	20%
CO3	Understanding the working of Routing Protocols for ad hoc networks	U	20%
CO4	Analyze the protocol design issues of ad hoc and sensor networks	An	20%
CO5	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues	Ap	20%

UNIT I- FUNDAMENTALS OF WIRELESSS COMMUNICATION TECHNOLOGY	**(9)**
Introduction – Spectrum Allocation-characteristics of wireless channel-modulation techniques-multiple accesss techniques-wireless internet- mobile IP.	
UNIT II – AD-HOC WIRELESS NETWORK AND MAC PROTOCOLS	**(9)**
Cellular and Ad hoc wireless networks-Applications- Issues in Ad-Hoc wireless network. MAC Protocols: Issues-classifications-other MAC Protocols.	
UNIT III – ROUTING PROTOCOLS FOR AD-HOC WIRELESS NETWORKS	**(9)**
Introduction- Issues in designing a routing protocol-classifications of routing protocols-table driven routing protocol-on-demand routing protocol-hybrid routing protocols-routing protocols with efficient flooding mechanisms.	
UNIT IV – TRANSPORT LAYER PROTOCOLS	**(9)**
Design goals of transport layer protocols-TCP over Ad-hoc wireless networks-other transport layer protocols-Security in Ad-hoc wireless networks-network security attacks-key management-secure routing in in Ad-hoc wireless networks.	

UNIT V – WIRELESS SENSOR NETWORKS	(9)
Sensor network architecture-data dissemination-data gathering-MAC protocols for sensor networks-Location discovery-Quality of a sensor network-evolving standards.	

TEXT BOOKS :

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Dargie, Waltenegus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.

REFERENCES:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3												3	
3	3												3	
4		3												3
5				3	3				2	2				3
CO (W.A)	**3**	**3**		**3**	**3**				**2**	**2**			**3**	**3**

22CIX08-IMAGE PROCESSING (Common to 22CSX38,22ITX38 and 22CCX35)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide the basic knowledge on image processing concepts. • To develop the ability to apprehend and implement various image processing algorithms.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understand different components of image processing system	U	20%
CO2	Describe various image transforms, enhancement techniques using various processing methods	U	20%
CO3	Illustrate the compression and segmentation techniques on a given image	Ap	40%
CO4	Demonstrate the filtering and restoration of images(pixels) with examples	Ap	20%
CO5	Illustrate the various schemes for image representation and detection techniques with examples	An	20%

UNIT-I DIGITAL IMAGE FUNDAMENTALS	**(9)**
Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.	
UNIT-II IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN	**(9)**
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering, Implementation.	
UNIT-III IMAGE RESTORATION	**(9)**
Image Restoration: A Model of the Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and Multi resolution Processing: Multi resolution	

Expansions, Wavelet Transforms in one Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.	
UNIT-IV IMAGE COMPRESSION & SEGMENTATION	**(9)**
Image Compression: Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	
UNIT-V REPRESENTATION AND DESCRIPTION	**(9)**
Various schemes for representation-chain codes-polygonal approximation-signatures –boundry segments- boundary descriptors: shape numbers-fourier descriptors and regional descriptors-topological descriptors-texture-moments of two dimentional functions.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:
1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Prentice Hall India/Pearson Education.
REFERENCES:
1. A.K.Jain, Fundamentals of Digital Image Processing. Prentice Hall India. 2. Madhuri.A.Joshi, Digital Image Processing, PHI. 3. Sonka, Image Processing, Analysis and Machine Vision. Cengage Publications.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1														
2	3		3										3	
3		3												3
4				3									3	
5							3							
CO (W.A)	**3**	**3**	**3**				**3**						**3**	**3**

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2017

CHOICE BASED CREDIT SYSTEM

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULAM: I – VIII SEMESTERS SYLLABUS: 1 to 8 SEMESTERS

SEMESTER: I									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17EYA01	Professional English- I	HS	-	4	2	0	2	3
2.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4
3.	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3
4.	17CYB02	Applied Electrochemistry	BS	-	3	3	0	0	3
5.	17CSC02	Python Programming	ES	-	3	3	0	0	3
6.	17ECC01	Electronic Devices	ES	-	3	3	0	0	3
PRACTICAL									
7.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2
8.	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2
9.	17GEP01	Personal Values	HS	-	2	0	0	2	0
				TOTAL	31	17	2	12	23

SEMESTER: II									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17EYA02	Professional English – II	HS	17EYA01	4	2	0	2	3
2.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4
3.	17PYB05	Physics of Solids	BS	17PYB01	3	3	0	0	3
4.	17CYB03	Environmental Science	BS	-	3	3	0	0	3
5.	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3
6.	17ECC03	Circuit Theory	ES	-	3	3	0	0	3
PRACTICAL									
7.	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2
8.	17ECP01	Circuits and Devices Laboratory	ES	17ECC01	4	0	0	4	2
9.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0
				TOTAL	32	16	4	12	23

Approved by Ninth Academic Council

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SEMESTER: III									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17MYB05	Transforms and Partial Differential Equations	BS	17MYB02	4	2	2	0	3
2.	17ITC03	Data Structures and Algorithms	ES	-	4	2	0	2	3
3.	17ECC05	Electrical Machines and instruments	ES	-	3	3	0	0	3
4.	17ECC06	Digital Logic Design	PC	17ECC01	3	3	0	0	3
5.	17ECC07	Signals and Systems	PC	17MYB02	4	2	2	0	3
6.	17ECC08	Analog Electronics	PC	17ECC01	3	3	0	0	3
PRACTICAL									
7.	17ECP03	Digital Logic Design Laboratory	PC	17ECP01	4	0	0	4	2
8.	17ECP04	Analog Electronics Laboratory	PC	17ECP01	4	0	0	4	2
9.	17GED02	Soft Skills-Reading and Writing	EEC	-	2	0	0	2	0
				TOTAL	31	15	4	12	22

SEMESTER: IV									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17MYB09	Probability and Random Processes	BS	17MYB02	4	2	2	0	3
2.	17ITC08	Fundamentals of Java Programming	ES	-	4	2	0	2	3
3.	17ECC10	Electromagnetic Fields	ES	17PYB01	4	2	2	0	3
4.	17ECC11	Analog Circuit Design	PC	17ECC01	3	3	0	0	3
5.	17ECC12	Digital Signal Processing	PC	-	4	2	2	0	3
6.	E1	Elective I (PSE)	PSE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP06	Analog Circuit Design Laboratory	PC	17ECP01	4	0	0	4	2
8.	17ECP07	Digital Signal Processing Laboratory	PC	17ECC07	4	0	0	4	2
9.	17GED01	Soft Skills-Listening and Speaking	EEC	-	2	0	0	2	0
10.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0
				TOTAL	33	14	6	13	22

SEMESTER: V									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17GEA02	Principles of Management	HS	-	3	3	0	0	3
2.	17ECC13	Microprocessors and Microcontrollers Interfacing	PC	17ECC06	3	3	0	0	3
3.	17ECC14	Data Communication and Networks	PC	17ECC06	3	3	0	0	3
4.	17ECC15	Transmission Lines and Waveguides	PC	17ECC10	4	2	2	0	3
5.	E2	Elective II (PSE)	PSE	-	3	3	0	0	3
6.	E3	Elective III (PSE)	PSE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP08	Microprocessors and Microcontrollers Interfacing Laboratory	PC	17ECP03	4	0	0	4	2
8.	17ECP09	Data Communication and Networks Laboratory	PC	17ECP03	4	0	0	4	2
9.	17GED08	Essence of Indian Traditional Knowledge	EEC	-	2	0	0	2	0
				TOTAL	29	17	2	10	22

SEMESTER: VI									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17ECC16	Analog and Digital Communication	PC	17ECC06	3	3	0	0	3
2.	17ECC17	VLSI Design	PC	17ECC13	3	3	0	0	3
3.	E4	Elective IV (PSE)	PSE	-	3	3	0	0	3
4.	E5	Elective V (PSE)	PSE	-	3	3	0	0	3
5.	E6	Elective VI (PSE)	PSE	-	3	3	0	0	3
6.	E 7	Elective VII	PSE/OE	-	3	3	0	0	3
PRACTICAL									
7.	17ECP10	Analog and Digital Communication Laboratory	PC	17ECP03	4	0	0	4	2
8.	17ECP11	VLSI Design Laboratory	PC	17ECP08	4	0	0	4	2
9.	17GED06	Comprehension	EEC	ALL CORE SUBJECT	2	0	0	2	0
10.	17GED07	Constitution of India	EEC	-	2	0	0	2	0
				TOTAL	31	17	0	14	22

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SEMESTER: VII									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17ECC19	Microwave Engineering	PC	17ECC18	3	3	0	0	3
2.	17ECC20	Optical Communication	PC	17ECC16	3	3	0	0	3
3.	17ECC21	Embedded and Real Time Systems	PC	17ECC13	3	3	0	0	3
4.	17ECC18	Antenna and Wave Propagation	PC	17ECC15	4	2	0	2	3
5.	E 8	Elective VIII	PSE/OE	-	3	3	0	0	3
PRACTICAL									
6.	17ECP12	Microwave and Optical Laboratory	PC	17ECP10	4	0	0	4	2
7.	17ECP13	Embedded Systems Laboratory	PC	17ECP08	4	0	0	4	2
8.	17ECD01	Project work-I	EEC	-	8	0	0	8	4
				TOTAL	31	15	0	16	23

SEMESTER: VIII									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	E 9	Elective IX (OE)	OE	-	3	3	0	0	3
PRACTICAL									
2.	17ECD02	Project work-II	EEC	17ECD01	16	0	0	16	8
				TOTAL	19	3	0	16	11

TOTAL NO. OF CREDITS: 168

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2017 **CHOICE BASED CREDIT SYSTEM**

(A) HS,BS, and ES Courses

(a) Humanities and Social Sciences (HS)			AICTE Credit Distribution Norm:12							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17EYA01	Professional English-I	HS	-	4	2	0	2	3	I
2.	17GEP01	Personal Values	HS	-	2	0	0	2	0	I
3.	17EYA02	Professional English-II	HS	17EYA01	4	2	0	2	3	II
4.	17GEP02	Inter Personal Values	HS	17GEP01	2	0	0	2	0	II
5.	17GEA02	Principles of Management	HS		3	3	0	0	3	V

(b) Basic Sciences (BS)			AICTE Credit Distribution Norm:25							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4	I
2.	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3	I
3.	17CYB02	Applied Electrochemistry	BS	-	3	3	0	0	3	I
4.	17MYB02	Complex Analysis and Laplace Transforms	BS	17MYB01	5	3	2	0	4	II
5.	17PYB05	Physics of Solids	BS	17PYB01	3	3	0	0	3	II
6.	17CYB03	Environmental Science	BS	-	3	3	0	0	3	II
7.	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2	II
8.	17MYB05	Transforms and Partial Differential Equations	BS	17MYB02	4	2	2	0	3	III
9.	17MYB09	Probability and Random Processes	BS	17MYB02	4	2	2	0	3	IV

(c) Engineering Sciences (ES)			AICTE Credit Distribution Norm:24							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CSC02	Python Programming	ES	-	3	3	0	0	3	I
2.	17ECC01	Electronic Devices	ES	-	3	3	0	0	3	I
3.	17CSP02	Python Programming Laboratory	ES	-	4	0	0	4	2	I
4.	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2	I
5.	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3	II
6.	17ECC03	Circuit Theory	ES	-	3	3	0	0	3	II
7.	17ECP01	Circuits and Devices	ES	17ECC01	4	0	0	4	2	II

Approved by Ninth Academic Council

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		Laboratory								
8.	17ECC05	Electrical Machines and instruments	ES	-	3	3	0	0	3	III
9.	17ITC03	Data Structures and Algorithms	ES	-	3	3	0	0	3	III
10.	17ECC10	Electromagnetic Fields	ES	17PYB01	3	3	0	0	3	IV
11.	17ITC08	Fundamentals of Java Programming	ES	-	3	2	0	2	3	IV

(B) Programme Core Courses (PC)			AICTE Credit Distribution Norm:48							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17ECC06	Digital Logic Design	PC	17ECC01	3	3	0	0	3	III
2.	17ECP03	Digital Logic Design Laboratory	PC	17ECP01	4	0	0	4	2	III
3.	17ECC07	Signals and Systems	PC	17MYB02	3	3	0	0	3	III
4.	17ECC08	Analog Electronics	PC	17ECC01	3	3	0	0	3	III
5.	17ECP04	Analog Electronics Laboratory	PC	17ECP01	4	0	0	4	2	III
6.	17ECC11	Analog Circuit Design	PC	17ECC01	3	3	0	0	3	IV
7.	17ECP06	Analog Circuit Design Laboratory	PC	17ECP01	4	0	0	4	2	IV
8.	17ECC12	Digital Signal Processing	PC	-	3	3	0	0	3	IV
9.	17ECP07	Digital Signal Processing Laboratory	PC	17ECC07	4	0	0	4	2	IV
10.	17ECC13	Microprocessor and Microcontroller Interfacing	PC	17ECC06	3	3	0	0	3	V
11.	17ECP08	Microprocessors and Microcontrollers Interfacing Laboratory	PC	17ECP03	4	0	0	4	2	V
12.	17ECC14	Data Communication and Networks	PC	17ECC06	3	3	0	0	3	V
13.	17ECP09	Data Communication and Networks Laboratory	PC	17ECP03	3	3	0	0	3	V
14.	17ECC14	Transmission Lines and Waveguides	PC	17ECC10	3	3	0	0	3	V
15.	17ECC16	Analog and Digital Communication	PC	17ECC06	3	3	0	0	3	VI
16.	17ECP10	Analog and Digital Communication Laboratory	PC	17ECC06	3	3	0	0	3	VI
17.	17ECC17	VLSI Design	PC	17ECC13	3	3	0	0	3	VI
18.	17ECP11	VLSI Design Laboratory	PC	17ECP08	4	0	0	4	2	VI
19.	17ECC18	Antenna and Wave Propagation	PC	17ECC15	3	3	0	0	3	VI
20.	17ECC19	Microwave Engineering	PC	17ECC18	3	3	0	0	3	VII
21.	17ECC20	Optical Communication	PC	17ECC16	3	3	0	0	3	VII
22.	17ECC21	Embedded and Real Time Systems	PC	17ECC13	3	3	0	0	3	VII
23.	17ECP12	Microwave and Optical	PC	17ECP10,	4	0	0	4	2	VII

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		Laboratory		17ECC18						
24.	17ECP13	Embedded Systems Laboratory	PC	17ECP13	4	3	0	4	2	VII

(C) Elective Courses										
(a)Program Specific Electives(PSE)			AICTE Credit Distribution Norm:18							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17ECX01	Medical Electronics	PSE	-	3	3	0	0	3	IV
2.	17ECX02	Nano Electronics	PSE	-	3	3	0	0	3	IV
3.	17ECX03	Radar and Navigational Aids	PSE	-	3	3	0	0	3	V
4.	17ECX04	Sensor and its Applications	PSE	-	3	3	0	0	3	V
5.	17ECX05	MEMS and its Application	PSE	-	3	3	0	0	3	VI
6.	17ECX06	Computer Hardware Interfacing	PSE	-	3	3	0	0	3	VI
7.	17ECX07	Control Systems Engineering	PSE	-	3	3	0	0	3	VI
8.	17ECX08	Digital Image Processing	PSE	-	3	3	0	0	3	VI
9.	17ECX09	Wireless Communication	PSE	-	3	3	0	0	3	VII
10.	17ECX10	High Speed Networks	PSE	-	3	3	0	0	3	VII
11.	17ECX11	Modern Microprocessors and Microcontrollers	PSE	-	3	3	0	0	3	VII
12.	17ECX12	Protocols and Architectures for Wireless Sensor Networks	PSE	-	3	3	0	0	3	VII
13.	17ECX13	Telecommunication Switching and Networks	PSE	-	3	3	0	0	3	VII
14.	17ECX14	Multimedia Compression Techniques	PSE	-	3	3	0	0	3	VIII
15.	17ECX15	Satellite Communication	PSE	-	3	3	0	0	3	VIII
16.	17ECX16	Internet of Things and its applications	PSE	-	3	3	0	0	3	VII
17.	17ECX17	Speech Processing	PSE	-	3	3	0	0	3	VII
18.	17ECX18	Opto Electronic Devices	PSE	-	3	3	0	0	3	VII
19.	17ECX19	Cryptography and Network Security	PSE	-	3	3	0	0	3	VI
20.	17ECX20	Statistical Theory of Communication	PSE	-	3	3	0	0	3	VII
21.	17ECX21	Cognitive Radio	PSE	-	3	3	0	0	3	VI
22.	17CSX01	Data Science	PSE	-	3	3	0	0	3	VIII
23.	17CSX26	HADOOP Distributed Environment	PSE	-	3	3	0	0	3	VIII
24.	17CSX31	Problem Solving And Programming	PSE	-	3	3	0	0	3	III
25.	17ITC12	Database Systems Concepts	PSE	-	3	3	0	0	3	VIII
26.	17ITX26	Problem Solving And Algorithmic Skills	PSE	-	3	3	0	0	3	VI
27.	17GEA03	Total Quality Management	PSE	-	3	3	0	0	3	VIII

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28.	17GEA04	Professional Ethics and Human Values	PSE	-	3	3	0	0	3	VI
29.	17MYB12	Basic Statistics and Numerical Analysis	PSE	-	3	3	0	0	3	VI

(b)Open Electives			AICTE Credit Distribution Norm:18							
1.	17AGZ01	Baking and Confectionery Technology	OE	-	3	3	0	0	3	VII
2.	17AGZ02	Food safety and quality control system	OE	-	3	3	0	0	3	VII
3.	17AGZ03	Farm Mechanization	OE	-	3	3	0	0	3	VIII
4.	17AGZ04	Processing of Fruits and Vegetables	OE	-	3	3	0	0	3	VIII
5.	17CHZ01	Waste Water Treatment	OE	-	3	3	0	0	3	VII
6.	17CHZ02	Piping Engineering	OE	-	3	3	0	0	3	VII
7.	17CHZ03	Process Automation	OE	-	3	3	0	0	3	VII
8.	17CHZ04	Process Instrumentation	OE	-	3	3	0	0	3	VII
9.	17CEZ01	Energy conservation in buildings	OE	-	3	3	0	0	3	VII
10.	17CEZ02	Air Pollution Management	OE	-	3	3	0	0	3	VIII
11.	17CEZ03	Building Services	OE	-	3	3	0	0	3	VIII
12.	17CEZ04	Road Safety Management	OE	-	3	3	0	0	3	VII
13	17CEZ05	Waste Management	OE	-	3	3	0	0	3	VII/ VIII
14.	17CSZ01	Design Thinking	OE	-	3	3	0	0	3	VII
15.	17CSZ02	Digital Marketing	OE	-	3	3	0	0	3	VII
16.	17CSZ03	Software Engineering	OE	-	3	3	0	0	3	VIII
17.	17CSZ04	Unified Functional Testing	OE	-	3	3	0	0	3	VIII
18	17CSZ05	C Programming	OE	-	3	3	0	0	3	VI
19.	17CSZ06	Data Structures	OE	-	3	3	0	0	3	VI
20.	17ECZ01	Modern wireless communication system	OE	-	3	3	0	0	3	VII
21.	17ECZ02	Consumer Electronics	OE	-	3	3	0	0	3	VII
22.	17ECZ03	Automotive Electronics	OE	-	3	3	0	0	3	VIII
23.	17ECZ04	Electronic Testing	OE	-	3	3	0	0	3	VIII
24.	17EEZ01	Renewable Energy Technology	OE	-	3	3	0	0	3	VII
25.	17EEZ02	Smart Grid	OE	-	3	3	0	0	3	VII
26.	17EEZ03	Energy Auditing, Conservation and Management	OE	-	3	3	0	0	3	VIII

27	17EEZ04	Electrical Machines	OE	-	3	3	0	0	3	VIII
28	17EIZ01	Autotronix	OE	-	3	3	0	0	3	VII
29	17EIZ02	Industrial Automation	OE	-	3	3	0	0	3	VII
30	17EIZ03	Fiber Optic Sensors	OE	-	3	3	0	0	3	VIII
31.	17EIZ04	Ultrasonic Instrumentation	OE	-	3	3	0	0	3	VIII
32.	17ITZ01	Software Testing Tool	OE	-	3	3	0	0	3	VII
33.	17ITZ02	User Experience	OE	-	3	3	0	0	3	VII
34.	17ITZ03	Developing Mobile Apps	OE	-	3	3	0	0	3	VIII
35.	17ITZ04	Software Project Management	OE	-	3	3	0	0	3	VIII
36.	17ITZ05	Java Programming	OE	-	3	3	0	0	3	VII
37.	17MEZ01	Engineering Ergonomics	OE	-	3	3	0	0	3	VII / VIII
38.	17MEZ02	Energy Audit and Resource Management	OE	-	3	3	0	0	3	VII / VIII
39.	17MEZ03	Electric Vehicle Technology	OE	-	3	3	0	0	3	VII / VIII
40.	17MEZ04	Value Engineering	OE	-	3	3	0	0	3	VII / VIII
41.	17MEZ05	Smart Mobility	OE	-	3	3	0	0	3	VII / VIII
42.	17MEZ06	Smart Sensor Systems	OE	-	3	3	0	0	3	VII / VIII
43.	17MYZ01	Mathematical Structures	OE	-	3	3	0	0	3	VII
44.	17MYZ02	Optimization Techniques	OE	-	3	3	0	0	3	VII
45.	17MYZ03	Statics for Engineers	OE	-	3	3	0	0	3	VII
46.	17MYZ04	Statistics for Engineers	OE	-	3	3	0	0	3	VII
47.	17PYZ01	Nanomaterials	OE	-	3	3	0	0	3	VII
48.	17PYZ02	Nuclear physics and Reactors	OE	-	3	3	0	0	3	VII
49.	17PYZ03	Space science and technology	OE	-	3	3	0	0	3	VII
50..	17CYZ01	Chemistry for Every Day Life	OE	-	3	3	0	0	3	VII
51	17CYZ02	E - Waste Management	OE	-	3	3	0	0	3	VII
52	17CYZ03	Industrial Chemistry	OE	-	3	3	0	0	3	VII
53	17EYZ01	Communicative Hindi	OE	-	3	3	0	0	3	VII
54	17EYZ02	Fundamentals of German	OE	-	3	3	0	0	3	VII
55	17EYZ03	Basics of Japanese	OE	-	3	3	0	0	3	VII

56	17EYZ04	Employability Enhancement and Analytical Skills	OE	-	3	3	0	0	3	VII
57	17EYX01	Effective Communication	OE	-	3	3	0	0	3	VII
58	17GYZ01	Biology for Engineers	OE	-	3	3	0	0	3	VII
59.	17BMZ01	Health care technology	OE	-	3	3	0	0	3	VII
60.	17BMZ02	Telemedicine	OE	-	3	3	0	0	3	VII
61.	17BMZ03	Epidemiology and Pandemic Management	OE	-	3	3	0	0	3	VII
62.	17BMZ04	Medical Ethics	OE	-	3	3	0	0	3	VII

(D) Employability Enhancement Courses			AICTE Credit Distribution Norm:15							
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0	VI
2.	17GED06	Comprehension	EEC	ALL CORE SUBJECS	2	0	0	2	0	VII
3.	17ECD01	Project Work-I	EEC	-	8	0	0	8	4	VII
4.	17ECD02	Project Work-II	EEC	17ECD01	16	0	0	16	8	VIII
5.	17GED07	Constitution of India	EEC	-	2	2	0	0	0	VI
6.	17GED08	Essence of Indian traditional knowledge	EEC	-	2	2	0	0	0	V

SUMMARY

S. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	3	3	0	0	3	0	0	0	9
2.	BS	10	12	3	3	0	0	0	0	28
3.	ES	10	8	6	6	0	0	0	0	30
4.	PC	0	0	13	10	13	13	13	0	62
5.	PSE	0	0	0	3	6	9	3	0	21
6.	OE	0	0	0	0	0	0	3	3	6
7.	EEC	0	0	0	0	0	0	4	8	12
CREDITS TOTAL		23	23	22	22	22	22	23	11	168

17ECC13 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING			
L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC06	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	Understand the concepts of internal architecture of Microprocessor and Microcontroller.	1.1	The students will be able to apply the basic concepts of peripherals and develop the real time applications	a,c,d,k
2.0	Understand the concepts of assembly language programming	2.1	The students will be able to program Microprocessor and Microcontroller for different applications using assembly language programming.	b,c,k
3.0	Understand the concepts of high level language programming	3.1	The students will be able to develop Microcontroller based system using higher level language	b,c,e,k
4.0	Illustrate how the different peripherals are interfaced with microcontroller.	4.1	The students will be able to design and develop real time applications using Microcontrollers	b,c,d,k
5.0	Familiar with the concepts of RISC based Microcontroller architecture	5.1	The students will be able to acquire knowledge about peripherals and develop the real time applications	a,c,d,k

UNIT I – 8 BIT MICROPROCESSOR & MICROCONTROLLER	**(9)**
Origin and classification of Microprocessor - 8085 Architecture - 8051 Microcontroller: Architecture – Signals – Memory Organization - Interrupts – Timer/counter -Serial communication	
UNIT II – 8051 ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
8051 Addressing mode – Instruction Set – Programming 8051 Timers – Serial Port programming – Interrupt Programming.	
UNIT III- 8051 HIGH LEVEL LANGUAGE PROGRAMMING	**(9)**
Data types and time delay in 8051 C – I/O Programming in 8051 C – Logical operations in 8051 C – Accessing code ROM space in 8051 C – Timer programming in C – Serial port programming in C – Interrupt programming in C	
UNIT IV - 8051 EXTERNAL INTERFACING	**(9)**
LCD & Keyboard Interfacing - ADC, DAC & LM35 Temperature Sensor Interfacing - External Memory Interface- Stepper Motor Interfacing	
UNIT V- PIC MICROCONTROLLER	**(9)**
PIC 16F877 Microcontroller Architecture - Memory organization -Interrupts Timer/Counter - Compare/Capture/PWM modules (CCP) - Master Synchronous Serial Port module (MSSP).	
TOTAL (L: 45) = 45 PERIODS	

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TEXT BOOKS:

1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
2. John B Peatman, "Design with PIC Microcontrollers", Pearson Education Asia, 2013, Twenty third Impression.

REFERENCES :

1. Ramesh S. Goankar, "Microprocessor Architecture: Programming and Applications with the8085", Sixth edition, Penram International, 2015 Reprint
2. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", Tata McGraw – Hill, 2012, Twentieth Reprint.
3. Senthilkumar, Saravanan, Jeevanantham, Shan "Microprocessor & Interfacing", Oxford University press, 2012.
4. K.Uma Rao. Andhe Pallavi, "The 8051 Microcontroller Architecture, Programming and Applications" Pearson Education 2011, Second Impression.

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17ECC14 - DATA COMMUNICATION AND NETWORKS			
L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC06	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To provide in-depth understanding of the underlying concepts of computer networks.	1.1	The students will be able to Comprehend Processes To Communicate With Each Other Across A Computer Networks.	a,c,g,k
2.0	To extend the students' knowledge in the areas of multiple access techniques, network protocols.	2.1	The students will be able to Analyze The Services, Roles And Features Of The Data Link Layers Of Data Networks.	a,c,d,i
3.0	To analysis the upper layers of the OSI model.	3.1	The students will be able to Identify solution for each routing/switching functionality at network layer.	b,c,g,k,l
4.0	To treat certain key related areas such as performance of internetworking.	4.1	The students will be able to Trace the flow of information from one node to another node in the network.	a,i,k,l
5.0	To familiar with emerging trends in networking technologies.	5.1	The students will be able to Choose the required functionality at each layer for given application.	a,c,d,h,k

UNIT I – INTRODUCTION TO COMMUNICATION NETWORKS	(9)
Data communications – Networks – Network types - Networking devices : hubs , switches, gateways, repeaters, Bridges and routers - Modem and its types – Internet history – standards and administration- TCP/IP protocol suite- ISO / OSI Reference Model - Transmission Media : Guided Media and Unguided Media, Switching: Circuit switched networks, Packet switched networks.	
UNIT II - DATA LINK LAYER	**(9)**
Introduction –Link layer Addressing - Error Detection & Correction – Block coding – cyclic codes – checksum – Forward Error Correction –DLC services - DLL Protocol – Media access Control – Wired LAN's: Ethernet – ATM - Wireless LAN : IEEE 802.11 – Bluetooth,WiMAX.	
UNIT III - NETWORK LAYER	**(9)**
Network Layer services – Packet Switching –Network Layer performance - IPv4 Addresses- Forwarding of IP Packets- Internet Protocol-ICMPv4-Routing Algorithms : Unicast Routing Protocols - IGMP –Multicast Routing – IPv6 addressing.	
UNIT IV - TRANSPORT LAYER	**(9)**
Introduction - User Datagram Protocol - Transmission Control Protocol – SCTP -- Quality of service – Data flow characteristics – Flow control to improve QoS: Token Bucket and Leaky Bucket.	
UNIT V - APPLICATION LAYER	**(9)**
World wide web and HTTP – FTP- Email – Telnet – SSH- Domain Name System- Cryptography and Network security: Introduction –Confidentiality – Other aspects of Security – Transport layer security: SSL Architecture.	
TOTAL :(L: 45) = 45 PERIODS	

TEXT BOOK:

1. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2013.

REFERENCES:

1. Tanenbaum, Andrew S and David Wetherall, —Computer Networks, 5th Edition, PHI Learning, New Delhi, 2010.
2. Kurose, James F. and Ross, Keith W., —Computer Networking: A Top-Down Approach Featuring the Internet, 6th Edition, Pearson Education, New Delhi, 2012.

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17ECC15 - TRANSMISSION LINES AND WAVEGUIDES					
		L	T	P	C
		2	2	0	3
PREREQUISITE : 17ECC10	QUESTION PATTERN : TYPE - 1				

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To introduce various types of transmission lines and analyze the lumped circuit model of a transmission line and their characteristics	1.1	The student will be able to Interpret the lumped circuit model of a transmission line with circuit theory and determine characteristic impedance, propagation constant and reflection coefficient.	a,b,c,d,e,h,l,k,l
2.0	To illustrate the concept of planar transmission lines.	2.1	The students will be able to realize E and H field distribution in Microstrip, Strip lines and Coplanar lines and Calculate losses and Q-factor of Microstrip line	a,b,g,i,l
3.0	To find SWR, Reflection Coefficient, Return loss and impedance matching.	3.1	The students will be able to Compute the SWR, reflection coefficient parameters using smith chart and design single stub matching and double stub matching	a,b,c,d,e,h,i,k,l
4.0	To investigate the propagation of electromagnetic waves in Parallel plane waveguides	4.1	The students will be able to Deduce the field configuration of parallel plate waveguide.	a,b,c,g,i,k,l
5.0	To investigate the propagation of electromagnetic waves in Rectangular waveguides	5.1	The students will be able to Deduce the field configuration of rectangular waveguide and resonant cavities	a,b,c,g,i,k,l

UNIT I - FILTERS	(6+6)
The neper - the decibel -Characteristic impedance of Symmetrical Networks – current and voltage ratios - Propagation constant - Properties of Symmetrical Networks - Filter fundamentals - Pass and Stop bands. Behaviour of the Characteristic impedance. Constant K Filters Low pass, High pass band, pass band elimination filters - m - derived sections –Filter circuit design – Filter performance – Crystal Filters-Two port networks.	
UNIT II - TRANSMISSION LINE THEORY	**(6+6)**
Line Parameters, The transmission line – general solution, Physical significance of the equation, Wavelength and velocity of wave propagation, Waveform distortion, The distortion less line, the telephone cable, Reflection of line not terminated in Z_0- Reflection coefficient, Open circuit and short circuit line reflection factor and reflection loss, insertion loss.	
UNIT III - IMPEDANCE MATCHING AND TUNING	**(6+6)**
Standing waves – nodes – standing wave ratio, Impedance matching- Half wavelength and Quarter wave transformer, single stub matching. Smith chart - Measurement of VSWR, impedance, single stub and double stub matching problems.	
UNIT IV - GUIDED WAVES BETWEEN PARALLEL PLANES	**(6+6)**
Application of the restrictions to Maxwell's equations – Types of propagation - Transmission of TM waves between Parallel planes – Transmission of TE waves between Parallel planes. Transmission of TEM waves between Parallel planes –Velocities of the waves. Characteristic impedance of plane.	

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UNIT V - GUIDED WAVES BETWEEN RECTANGULAR PLANES	(6+6)
Applications of Maxwell's equations to the rectangular waveguide. TM waves in rectangular waveguide. TE waves in rectangular waveguide – Dominant mode in rectangular waveguide-The TEM wave coaxial lines. Excitation modes. Guide termination and resonant cavities. Introduction to circular waveguides	
	TOTAL (L: 30+T:30) = 60 PERIODS

TEXT BOOKS:

1. John D. Ryder, "Network lines and Fields", PHI, Second Edition reprint 2013.
2. F. Olyslager, "Electromagnetic Waveguides and Transmission Lines" Clarandon Press. Oxford reprint 2003

REFERENCES:

1. E.C.Jordan, K.G. Balmain: "E.M.waves & Radiating systems", Pearson education, 2006.
2. Simon Ramo, John R. Whinnery"Fields And Waves In Communication Electronics", Wiley student Edition publications third edition 2008
3. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006
4. Dr.P.Dhananjayan, "Transmission lines and waveguides", Laxmi publication Fifth Edition June 2012.

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17ITC12 - DATABASE SYSTEMS CONCEPTS			
L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the different issues involved in the design and implementation of a database system.	1.1	The students will be able to describe the role of Database Management System in an Organization.	a,c,j,k
2.0	To study the physical and logical database designs, database modeling.	2.1	The students will be able to study basic database concepts including the structure and operations of the relational data model.	a,c,j,k
3.0	To understand and use data manipulation language to query, update, and manage a database	3.1	The students will be able to construct simple and Moderately advanced database queries using SQL.	a,b,c,j,k
4.0	To develop an understanding of essential DBMS concepts.	4.1	The students will be able to apply logical database design principles includes E-R diagrams & Normalization.	a,b,c,k
5.0	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.	5.1	The students will be able to explain various file organizing & Indexing structure.	a,b,c,k

UNIT I - INTRODUCTION	(9)
Introduction to database systems - Definition of DBMS - Advantages of dbms - Views of data - Levels of data abstraction - Data Models and types - Database architecture - Entity relationship model - ER diagram.	
UNIT II - RELATIONAL DATA MODEL	**(9)**
Relational database structure - Procedural and Non procedural languages - Relational algebra : operations - Relational Calculus - Tuple relational calculus - Domain Relational Calculus - Integrity Constraints - SQL Commands - DDL - DML - TCL.	
UNIT III - DATABASE DESIGN	**(9)**
Functional dependency: Full functional Dependency - Partial dependency - Transitive dependency - multi valued dependency - Decomposition - Normalization - Normal Forms: 1NF - 2NF - 3NF - BCNF - 4NF - 5NF.	
UNIT IV - TRANSACTIONAL PROCESSING	**(9)**
Transaction - Properties of transaction - Transaction state - Serialization : types - Need for Serialization - Two Phase Commit - Save Point - Concurrency - Advantages of concurrency - Concurrency control mechanism - Locking protocols	
UNIT V - MEMORY STRUCTURES AND FILE ORGANIZATION	**(9)**
Memory hierarchy - Disk storage - Raid levels - Indexing: types - Hashing techniques - Query Processing tool - Query Evaluation.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2010.

REFERENCES:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.

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17ECX08 - DIGITAL IMAGE PROCESSING				
L	T	P	C	
3	0	0	3	
PREREQUISITE : NIL	QUESTION PATTERN : TYPE - 1			

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To study the image fundamentals necessary for image processing	1.1	The students will be able to know the image formation and the role human visual system plays in perception of Gray and color image data	a,b,i,j,l
2.0	To enable the student to Know about Image transforms and its properties	2.1	The students will be able to apply transform-domain representation of images	a,b,c,f,j
3.0	To study the concept of enhancement and restoration techniques.	3.1	The students will be able to perform image analysis by designing spatial and frequency domain filters.	a,b,d,k,l
4.0	To analyze image compression procedures.	4.1	The students will be able to describe how digital images are represented and stored efficiently depending on the desired quality	a,b,c,d,k
5.0	Gain experience in applying image processing algorithms to real problems	5.1	The students will be able to detect/extract regions of interest from an image using various thresholding and Segmentation Techniques	a,b,i,j,l

UNIT I - DIGITAL IMAGE FUNDAMENTALS	**(9)**
Elements of digital image processing systems - Elements of visual perception - brightness-contrast-hue-saturation-mach band effect - Image sampling-Quantization-Basic relationship between pixels - Color image fundamentals-RGB-HSI models.	
UNIT II -IMAGE TRANSFORMS	**(9)**
2D transforms-DFT-DCT-Discrete Sine, Walsh-Hadamard, Slant-Haar, KL transforms-properties of all transforms.	
UNIT III-IMAGE ENHANCEMENT AND RESTORATION	**(9)**
Spatial Domain enhancement: gray level transformations–histogram equalization-Image averaging-Spatial filtering: Smoothing, Sharpening filters. Frequency domain filters: Smoothing-Sharpening filters-Homomorphic filtering. Image Restoration: Degradation model-Unconstrained and Constrained restoration-Inverse filtering-Wiener filtering.	
UNIT IV -IMAGE COMPRESSION	**(9)**
Need for data compression-Error free compression-Variable length coding-Bit-Plane coding-Lossless and Lossy Predictive coding, JPEG and MPEG Compression Standards.	
UNIT V-IMAGE SEGMENTATION AND REPRESENTATION	**(9)**
Point- Line and edge detection- Thresholding – Region based segmentation. Region splitting and merging. Image representation: chain codes-polygonal approximations-signatures-boundary segments-skeletons.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, 3rd Edition, 2016.

REFERENCES :

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd., 3rd Edition, 2011.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., Second Edition, 2004.
3. William K Pratt, "Digital Image Processing", Willey India Pvt Ltd., Fourth Edition, 2010.

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17ECX16 – INTERNET OF THINGS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make the students to know about basics of Electrical and Electronic devices	1.1	The students will be able to understand basics of Electrical circuits and Electronic devices	a,c,d,i
2.0	To make the students to know about basics and block diagram of IoT	2.1	The students will be able to understand IOT characteristics and its essential components.	a,b,d,e
3.0	To make the students to know about Arduino processor and working of Analog and Digital I/O pins	3.1	The students will be able to describe Arduino processor and working of Analog and Digital I/O pins	a,b,c,g
4.0	To make the students to know about Raspberry pi and its interface with other devices	4.1	The students will be able to understand Raspberry pi and its interface with other devices	a,b,c,j
5.0	To motivate the students to implement the IoT using Arduino/ Raspberry Pi.	5.1	The students will be able to implement a IoT system using Arduino/Raspberry Pi.	a,f,k,l

UNIT I - BASIC ELECTRICAL CIRCUITS AND ELECTRONICS (9)

Introduction - Current, voltage and resistance - Analog and Digital Signal - conductors Vs Insulators – KCL- KVL - Basic Electronics components - calculating equivalent resistance for series and parallel circuits- Ohm's law- Color coding for a resistor – LED – LCD - LDR.

UNIT II - INTRODUCTION TO INTERNET OF THINGS (9)

Introduction - Definition and characteristics of Internet of Things - General Block Diagram and essential components of IOT - Role of microprocessor & Micro controller- communication of things - IOT connection with internet.

UNIT III- ARDUINO PROCESSOR (9)

Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART) , I2C Communications and SPI communication - Arduino Boards Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming.

UNIT IV - RASPBERRY PI (9)

Technical Description of Raspberry Pi - comparison of Raspberry Pi Vs Arduino - Operating Systems for RPi - Preparing SD Card for Pi - Connecting Raspberry Pi as PC - Exploring Raspberry Pi Environment- Logical design using Python.

UNIT V- APPLICATIONS OF IOT (9)

Various Real time applications of IoT- automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES :

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd edition, 2013.
3. Marco Schwartz, – Internet of Things with the Arduino Yun, Packt Publishing, 2014.
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

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17ECP08 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING LABORATORY			
L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP03	QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make students to learn and practice the basics of 8085 programming concepts	1.1	The students will be able to develop applications using 8085 processor program.	a,b,i
2.0	To enable the student to analyze the various arithmetic & Logical operations in 8085 processor.	2.1	The students will be able to evaluate various arithmetic & Logical operations using 8085 processor.	b,c,d,k
3.0	To provide the student with practice in the 8051 microcontroller.	3.1	The students will be able to verify the various arithmetic & Logical operations using 8051 controller.	b,c,d,k
4.0	To make the students to learn and practice with 8051 peripherals	4.1	The Students will be able to verify the basic peripherals in 8051 using HLP.	c,d,e,k
5.0	To motivate the students to learn the I/O interfacing concepts in 8051.	5.1	The Students will be able to implement the interfacing concepts for various real world applications.	d,e,f,k

LIST OF EXPERIMENTS:

Assembly Language Programming:

1. Study of 8085 microprocessor (Addressing modes & Instruction set).
2. Assembly language programming for 8/16 bit Arithmetic operators Using 8085.
3. Assembly language programming with control instructions Using 8085 (Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers.
4. Assembly language programming for arithmetic and logical operations using 8051.
5. Interfacing and Programming of DC Motor Speed control using 8051.
6. Interfacing and Programming of Stepper Motor control using 8051.

High Level Language Programming

The following programs have to be tested on 8051 Development board/equivalenting Embedded C Language on KEIL IDE or Equivalent.

1. Program to toggle all the bits of Port P1 continuously with delay.
2. Program to toggle P1.5 continuously with delay. Use Timer in mode 0, mode 1, mode 2 and mode 3 to create delay using 8051.
3. Program to interface 7 segment display to display a message on it using 8051.
4. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD using 8051.
5. Program to get analog input from Temperature sensor and display the temperature Value on LCD using ADC with 8051 Microcontroller.
6. Program to handle interrupts with 8051 Microcontroller.

TOTAL (P: 60) = 60 PERIODS

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17ECP09 - DATA COMMUNICATION AND NETWORKS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP03 | **QUESTION PATTERN : TYPE -NIL**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the concepts of computer networks and data transmission.	1.1	The students will be able to Obtain the working knowledge of computer hardware & Operating Systems, software and networking skills.	a,b,c,g,j
2.0	To understand the peer to peer communication application using different protocols.	2.1	The students will be able to Build some simple networking models using the Network simulator modeling tool and perform simulations that help them evaluate their design approaches and expected network performance.	a,b,g,i,l
3.0	To analysis the socket programming to build a network application.	3.1	The students will be able to Implement and compare the various routing algorithms for wire/wireless networks.	b,c,e,k,l
4.0	To get knowledge about the various open source simulation tools for packet tracing and network design.	4.1	The students will be able to Master the concepts of protocols, network interfaces and design LAN, MAN and WAN.	a,e,i,k,l
5.0	To learn the various routing algorithms and simulation tools.	5.1	The students will be able to Troubleshoot and repair network problems.	b,g,i,k,l

LIST OF EXPERIMENTS:

1. Performance analysis of stop and wait protocol.
2. Performance analysis of Go back-N protocol.
3. Performance analysis of selective repeat protocol.
4. Performance analysis distance vector routing algorithm & Link state routing algorithm.
5. Performance analysis of Data encryption and decryption.
6. To create scenario Transfer of files from PC to PC using Windows socket processing.
7. Wired LAN protocol. To create scenario and study the performance of CSMA/CD protocol through simulation.
8. Wireless LAN protocols. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
9. Study of Network simulator (NS) and create scenario Ethernet LAN using n nodes (6), change error rate and data rate and compare the throughput using NS-2
10. Constructing the point-to-point networks using network simulator packages – NS2
    a. Simulate the nodes in the network with duplex links between them.
    b. Set the queue size, packet size and packet interval time.

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c. Choose suitable link parameters such as link delay and link bandwidth for CBR traffic with UDP / TCP agent and observe the packet dropping phenomena. 11. Capturing data traffic for Protocol Analysis using Sniffer Tools - Wireshark/ NETMON a. Exploring HTTP, DNS b. Exploring TCP, UDP c. Exploring ICMP, ARP, IP d. Exploring Ethernet
TOTAL (P: 60) = 60 PERIODS

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17ECC16 - ANALOG AND DIGITAL COMMUNICATION				
L	T	P	C	
3	0	0	3	

PREREQUISITE : 17ECC06	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To provide knowledge on complete analysis of Analog communications.	1.1	The students will be able to acquire the knowledge about Analog modulation and demodulation schemes	a,c,d,i
2.0	To acquire knowledge about Pulse modulation.	2.1	The students will be able to acquire the knowledge about Pulse modulation and demodulation schemes	b,l,f,j
3.0	To learn the concepts of noise theory and basics of error control coding.	3.1	The students will be able to calculate SNR of various communication systems and perform error control coding.	a,d,i
4.0	To analyze the performance of Baseband Transmission.	4.1	The students will be able to analyze the methods of baseband data transmission and reception.	b,c,j,k,
5.0	To analyze the performance of Pass band Transmission.	5.1	The students will be able to analyze the performance of various Pass band data transmission and reception techniques.	a,e,f

UNIT I - ANALOG MODULATION SCHEMES	(9)
Functional block diagram of communication systems- Linear modulation schemes: Generation of AM: DSBFC using balanced modulator- Introduction to DSBSC, SSBSC and VSB Signals-Comparison of Amplitude Modulation Systems. Principle of frequency and phase modulation– Relation between FM and PM waves-Frequency modulation: Narrowband and wide band FM-Transmission bandwidth of FM.	
UNIT II - PULSE MODULATION SYSTEMS	**(9)**
Pulse amplitude modulation-generation and detection of PWM and PPM-Basic signal processing operations in Digital Communications–Sampling theorem-Quantization: Uniform and Non-uniform (A-law & μ-law) - Pulse code modulation, Differential pulse code modulation, Delta Modulation, Adaptive Delta modulation -Classification of line coding and Decoding.	
UNIT-III - NOISE THEORY AND CODING TECHNIQUES	**(9)**
Types of noise in communication systems, Noise temperature, Noise in CW modulation systems- signal to noise ratio (SNR), noise figure, noise in AM –SSB & FM receivers, pre-emphasis and de-emphasis. Coding Techniques : Shannon- Fano coding, Linear Block Codes.	
UNIT IV - BASEBAND DATA TRANSMISSION AND RECEPTION	**(9)**
Matched Filter -Error rate due to noise –Inter symbol Interference- Nyquist criterion for distortion less base band Binary Transmission-Correlative level coding: Duo binary with and without precoder- Modified duo binary with and without precoder –Eye patterns.	
UNIT V- PASSBAND DATA TRANSMISSION AND RECEPTION	**(9)**
Pass band Transmission model-Generation, detection ,signal space diagram, bit error probability and power spectra of Binary Modulation schemes (ASK,FSK,PSK), Quadrature Modulation schemes (QPSK,QAM) – Comparison of Binary and Quadrature modulation techniques.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Simon Haykin, "Communications Systems", Wiley Education, 4th Edition, 2008
2. T L Singal, "Analog & Digital Communications", Tata McGraw-Hill Education, 4th Edition, 2012

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REFERENCES :

1. Taub and Schilling, "Principles of Communication Systems", McGraw Hill, 3rd Edition, 2007.
2. Wayne Tomasi, "Electronic Communications Systems–Fundamentals Through advanced", Pearson Education, 4th Edition, 2007.
3. Praokis J.G., "Digital Communications" 4th Edition, McGraw Hill, 2000.
4. Bernard Sklar, Pabitra Kumar Ray "Digital Communications: Fundamentals & Applications", Pearson Education, 2nd Edition, 2009.

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17ECC17 - VLSI DESIGN
(Common to ECE and E&I Branches)

L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC13 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make students to learn CMOS devices and its manufacturing technology	1.1	The students will be able to create models of moderately sized CMOS circuits that realize specified digital functions.	a,b,c,l,l
2.0	To enable the student to evaluate the Basic electrical properties of MOS and BICMOS Circuits	2.1	The students will be able to identify the interactions between process parameters, device structures, circuit performance, and system design	a,b,c,e,j
3.0	To enable the student to design Sub System Design and Layout	3.1	The students will be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and Interconnect.	a,b,d,i,k
4.0	To motivate the students to implement the Subsystem design and Layout.	4.1	The students will be able to complete a significant VLSI design project having a set of objective criteria and design Constraints.	a,b,c,d,j
5.0	To make the students to analyze the Ultra fast circuits and systems.	5.1	The students will be able to analyze the physical design process of ultra fast circuits and systems	a,b,c,d,l

UNIT I - MOS TECHNOLOGY AND DESIGN PROCESS (9)

Basic MOS Transistors – Enhancement and Depletion Mode Transistor Action – nMOS Fabrication – CMOS Fabrication: n-well – p-well – twin tub – Bi CMOS Technology – Transient Response – Rise Time – Fall Time – Stick Diagrams: n MOS Design Style – CMOS Design Style – Design Rules and Layout.

UNIT II - BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS (9)

Drain to Source Current Vs Voltage Relationships – MOS Transistor Characteristics – MOS Transistor Transconductance gm and Output Conductance gds – Pass Transistor and The nMOS Inverter – Determination of Pullup to Pull-down Ratio – Alternative forms of Pull-up – The CMOS inverter – Latch up in CMOS Circuits. Types of Power Dissipation. Static and Dynamic Power Dissipation.

UNIT III- CMOS LOGIC STRUCTURES (9)

Switch Logic – Pass Transistors and Transmission Gates – Gate Logic: The Inverter – Two-input nMOS, CMOS and BICMOS Nand Gates – Two-input nMOS, CMOS and BICMOS Nor Gates – Pseudo nMOS Logic – Dynamic CMOS Logic – Clocked CMOS Logic: CMOS domino Logic – n-p CMOS Logic.

UNIT IV - CMOS MEMORIES AND CLOCKING (9)

The Dynamic Shift Register stage- A Three transistor Dynamic RAM Cell- A One transistor Dynamic Memory Cell – A Pseudo –static RAM/Register Cell-Four transistor Dynamic and Six-transistor Static CMOS Memory Cells- JK Flip-flop Circuit – D Flip-flop circuit- Forming Arrays of Memory Cells-Building up the Floor plan for a 4 x 4-bit register array-Selection and Control of the 4 x 4-bit register array – Random Access Memory(RAM) Arrays – Two Phase clocking – Charge storage- Dynamic Register Element- A Dynamic shift Register.

UNIT V- CMOS SUB SYSTEM DESIGN	(9)
Overview of Verilog HDL-Modeling Concepts- Adders: Carry look ahead – Carry Select– Design of multipliers: The Serial - Parallel Multiplier – Braun array – Baugh-Woolley – Pipelined Multiplier Array – Wallace Tree Multiplier.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Neil H.E. Weste , David Harris, "CMOS VLSI Design : A circuits and systems perspective " Pearson Education, 4th Edition, 2015..
2. Douglas A. Pucknell, "Basic VLSI Systems and Circuits", Prentice Hall of India, Third Edition, Reprint 2008.

REFERENCES :

1. John P.Uyemera, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Reprint 2009.
2. John n Rabaey, Anantha Chandrekasan, Borivoje Nikolic " Digital integrated circuits a design perspective" PHI New Delhi , second Edition
3. Wayne Wolf," Modern VLSI Design – System On Chip", PHI New Delhi Third Edition, 2006.

17ECX14 - MULTIMEDIA COMPRESSION TECHNIQUES

L	T	P	C
3	0	0	3

PREREQUISITE : Nil | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make students to learn and understand the basics of information and coding.	1.1	The students will be able to understand the concept of information theory, models and coding.	a,b,e,f,l
2.0	To enable the student to Evaluate the text compression techniques	2.1	The students can acquire the knowledge of text compression coding techniques.	a,b,c,f,l
3.0	To enable the student to Evaluate the audio compression techniques	3.1	The students can able to study the audio compression coding and speech compression techniques.	a,f,g
4.0	To motivate the students to implement coding and compression approaches.	4.1	The students will be able to know the image compression approaches, coding and JPEG standards.	b,g,l
5.0	To make the students to learn wavelet based video compression.	5.1	The students will be Identify the wavelet based video compression.	a,b,f

UNIT I - INTRODUCTION (9)

Overview of Information theory-models and coding- rate distortion theory-scalar quantization-vector quantization-structured vector quantizers.

UNIT II - TEXT COMPRESSION (9)

Compaction techniques - Static Huffman coding - Dynamic Huffman coding - Arithmetic coding - Lempel-Ziv coding - Lempel-Ziv Welsh coding.

UNIT III - AUDIO AND SPEECH COMPRESSION (9)

Audio compression techniques – frequency domain and filtering - Basic sub band coding - Application to speech coding - G.722 - Application of audio coding: MPEG audio - Silence compression – Speech compression techniques - Vocoders - Linear predictive coder.

UNIT IV - IMAGE COMPRESSION (9)

Approaches to image compression - Predictive techniques - PCM, DPCM, Graphics Interchange Format, Tagged image file format, Digitized documents, Digitized pictures, JPEG, Quad tree DCT coding-EZW coding- SPIHT coding- JPEG 2000 standards.

UNIT V- VIDEO COMPRESSION (9)

Video signal representation - Video compression techniques - MPEG1, 2, 4 - Motion estimation - H.261, H.263, and H.264 - Overview of wavelet based compression- Real time compression.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Sayood Khaleed, "Introduction to Data Compression", Morgan Kauffman, 4th Edition, Morgan Kaufmann publishers 2014.
2. Fred Halsall, James F. Kurose, "Multimedia communication - Applications, Networks, Protocols and standards", Pearson Education Limited, 2004

REFERENCES :

1. David Solomon, "Data Compression the complete reference", Springer, 4th Edition, 2007.
2. Jerry D. Gibson, "Multimedia Communications: Directions and Innovations", Morgan Kaufmann, 2nd Edition, 2001.

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17ITX26- PROBLEM SOLVING AND ALGORITHMIC SKILLS			
L	T	P	C
3	0	0	3

PREREQUISITE: NIL	QUESTION PATTERN : TYPE - 1

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To impart fundamental concepts of OOP using python	1.1	The students will be able to understand the basics of object oriented concepts in python.	a,c,l
2.0	To gain exposure about inheritance and polymorphism	2.1	The students will be able to develop applications using inheritance and polymorphism	a,b,c,d,e,k,l
3.0	To understand the abstract data types and tree data structures	3.1	The students will be able to implement the ADTs and trees	a,b,c,d,e,k,l
4.0	To see how graphs and heaps can be used to solve a wide variety of problems	4.1	The students will be able to design graph abstract data type and heap	a,b,c,d,e,k,l
5.0	To understand the sorting techniques and shortest path algorithms.	5.1	The students will be able to implement the sorting techniques and shortest path algorithms.	a,b,c,d,e,k,l

UNIT I - MOTIVATION OF FUNDAMENTAL CONCEPT IN PROGRAMMING	**(9)**
Implementation of Classes and Objects in Python - Class Attributes and Instance Attributes - 'self ' parameter - Static Methods and Instance Methods - init() method	
UNIT II - ADVANCED FEATURES IN CONCEPT OF PROGRAMMING	**(9)**
Performing Abstraction and Encapsulation in Python - Single Inheritance - Multiple Inheritance - Multilevel Inheritance - Public, Protected and Private - Naming Conventions. Polymorphism- Overriding and the super() method - Diamond Shape Problem in Multiple Inheritance - Overloading an Operator - Implementing an Abstract Base Class (ABC)	
UNIT III - INTRODUCTION TO ALGORITHMIC THINKING AND PEAK FINDING	**(9)**
Array data structure - Linked List Data Structure and Its Implementation - Stacks and Queues - Binary Search Trees - Balanced Trees: AVL Trees and Red-Black Trees	
UNIT IV - MAPPING VALUES AND PRINCIPLE OF OPTIMALITY	**(9)**
Heaps - Heapsort Algorithm - Associative Arrays and Dictionaries - Ternary Search Trees as Associative Arrays - Basic Graph Algorithms - Breadth - First And Depth - First Search - Spanning Trees	
UNIT V - ANALYZING NUMBER OF EXCHANGES IN CRAZY-SORT	**(9)**
Shortest Path Algorithms: Dijkstra's Algorithm - Bellman-Ford Algorithm - Kruskal Algorithm - Sorting Algorithms- Bubble Sort, Selection Sort and Insertion Sort - Quicksort and Merge Sort, Non-Comparison Based Sorting Algorithms, Counting Sort and Radix Sort	
TOTAL (L: 45) = 45 PERIODS	

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TEXT BOOKS:

1. Dusty Phillips, Python 3 Object-oriented Programming, Packt Publishing, Second Edition.
2. Bradley N. Miller, David L. Ranum,- Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, 2011.

REFERENCES:

1. Mark Summerfield - Programming in Python 3, Pearson Education, 2nd Edition
2. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, - Data Structures and Algorithms in Pythonll 2013 edition.

17CSX31- PROBLEM SOLVING AND PROGRAMMING			
L	T	P	C
3	0	0	3

PREREQUISITE : 17CSC01 / 17CSC02	QUESTION PATTERN : TYPE 1

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To gain knowledge about the basics of programming	1.1	The students will be able to understand the basics of Python Programming constructs.	a,c,l
2.0	To gain exposure about selection structure	2.1	The students will be able to design programs involving selection structure	a,b,c,d,l
3.0	To get knowledge about repetition structure, function and modules	3.1	The students will be able to design programs involving function, modules and loops.	a,b,c,d,k,l
4.0	To gain exposure about string	4.1	The students will be able to realize the need of strings.	a,b,c,d,k,l
5.0	To get knowledge about mutable and Immutable types	5.1	The students will be able to realize the need of list, tuples and dictionary.	a,b,c,d,k,l

UNIT I - INTRODUCTION TO BASICS OF PROGRAMMING	(9)
Basics - Variables and Assignment - Basic Data Types - Comments - Operators - print() - Floats	
UNIT II - SELECTION STRUCTURE	**(9)**
Introduction to Selection Structure - if statements, else statements, nested elif statements, truthy and falsey values, Control Structure	
UNIT III - VALUE – REPETITION AND RETURNING STRUCTURE	**(9)**
Loops - while loops, for loops - Nested Loops - Functions - modules - variable scope	
UNIT IV - DATA AND STRING PROCESSING	**(9)**
Strings - Accessing the Strings - Traversing the Strings - Working with Strings - Formatting Strings	
UNIT V - MUTABLE AND IMMUTABLE TYPES AND METHODS	**(9)**
Introduction to lists - indexing and slicing of list, del and list methods, Tuples, Dictionary and its methods.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, —Core Python Programming, Dreamtech Press, 2017 Edition.
2. Reema Thareja - Problem Solving and Programming – Python, Oxford University Press, 2nd Edition.

REFERENCES:

1. Wesley J. Chun, —Core Python Programming, Pearson Education, 2nd edition, 2010.

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17ECP10 - ANALOG AND DIGITAL COMMUNICATION LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP03

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To demonstrate the concepts of generation and detection of analog modulation schemes	1.1	The students will be able to transmit and receive the signal using Analog modulation and demodulation schemes	a,c,j
2.0	To understand the concepts of Emphasis Techniques	2.1	The students will be able to analysis the response of pre - Emphasis and de-emphasis	b,e,i
3.0	To demonstrate the concepts of generation and detection of digital modulation schemes	3.1	The students will be able to transmit and receive the signal using digital modulation and demodulation schemes	e,k
4.0	To demonstrate the concepts of pulse modulation schemes	4.1	The students will be able to transmit and receive the signal using Analog and digital pulse modulation and demodulation schemes	a,d,g
5.0	To acquire the knowledge about error control coding using MATLAB	5.1	The students will be able to apply the Error control coding techniques using MATLAB in communication	e,f

LIST OF EXPERIMENTS:

1. Generation and Detection of Amplitude modulation signals.
2. Generation and Detection of Frequency Modulation.
3. Response of Pre-Emphasis / De-emphasis Circuits.
4. Sampling process: Generation of Pulse Modulation waveforms–PAM / PWM / PPM.
5. Generation of Line Coding and Decoding techniques.
6. Generation and detection of digital modulation schemes- ASK, PSK, FSK.
7. Generation and detection of QPSK waveforms.
8. Generation and detection of Delta Modulation waveforms.
9. Implementation of Pulse Code modulation/TDM for digital input.
10. Implementation of DSB modulator and demodulator.
11. Implementation of Error control coding using MATLAB.
12. Analysis of PLL and Frequency synthesizer.

TOTAL (P: 60) = 60 PERIODS

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17ECP11 - VLSI DESIGN LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP08

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To gain expertise in design, development and simulation of Combination Logic Circuit using Verilog HDL	1.1	Design and simulation of Combination Logic Circuit using Verilog HDL.	a,b,c,d,e,l
2.0	To enable the student to design and analyze Sequential Logic Circuit using Verilog HDL	2.1	Design and simulation of Sequential Logic Circuit using Verilog HDL.	a,b,c,d,e,l
3.0	To provide the student with practice in the Tanner spice	3.1	Design, Simulate and Extract the layouts of Analog IC Blocks using Tanner spice.	a,b,c,d,e,g,l
4.0	To make the students to learn and analyze transient characteristics response	4.1	Analyze transient characteristics.	a,b,c,d,e
5.0	To motivate the students to implement the logic modules into FPGA boards	5.1	Import the logic modules into FPGA boards.	a,b,c,d,e,g,h,l

LIST OF EXPERIMENTS:

I. **Design and simulation of Combinational Logic Circuit using Verilog HDL**

1. Adder – Carry Select & Carry Save
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Multiplier – Array, Braun Array & Baugh Wooley

II. **Design and simulation of Sequential Logic Circuit using Verilog HDL**

5. Flip-flops
6. Counters
7. Shift Registers
8. Frequency Dividers

III. **CMOS Circuit design using SPICE (DC and Transient Analysis)**

9. CMOS Inverter
10. CMOS NAND and NOR Gates
11. CMOS Latch

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IV.	**FPGA Implementation**	
	12	4 bit Adder
	13	4x4 Multiplier
	14	ALU Design
		TOTAL (P: 60) = 60 PERIODS

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17ECC18 - ANTENNA AND WAVE PROPAGATION

L	T	P	C
2	0	2	3

PREREQUISITE : 17ECC15 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make the students to understand the basic radiation mechanism and antenna parameters.	1.1	The students will able to know the basic radiation mechanism and antenna parameters.	a,b,c,d,j,k,l
2.0	To make the students to design and characterize the various antenna arrays.	2.1	The students will be able to design and characterize the various antenna arrays.	a,b,c,d,e,j,k,l
3.0	To make the students to analyze the wire antennas and aperture antennas	3.1	The students will be able to analyze the wire antennas and aperture antennas.	b,c,d,e,f,g,h,j,k,l
4.0	To make the students to gain knowledge on the measurements of Antenna parameters.	4.1	The students will be gain knowledge on the measurements of Antenna parameters.	b,d,e,g,h,l
5.0	To make the students to compare the wave propagation and analyse the electromagnetic wave propagated in free space.	5.1	The students will be able to compare the wave propagation and analyse the electromagnetic wave propagated in free space.	b,c,d,f,g,h,j,l

UNIT I - ANTENNA FUNDAMENTALS (6)

Radiation mechanism - single wire, two wire, dipole and current distribution on thin wire, Radiated field components - Hertzian dipole, Half wave Dipole and Monopole Antenna. Antenna Parameters: Radiation Pattern, Beam Width, Radiation Power Density, Directivity and Gain, Bandwidth, Polarization, Input Impedance, Efficiency, Antenna Effective Length and Area, Antenna Temperature, Reciprocity Principle.

UNIT II -DESIGN OF ARRAYS (6)

Linear Array - Two element array, N-element linear array- Broadside array, End fire array- Directivity Pattern Multiplication, Non-uniform excitation- Binomial Array.

UNIT III-SPECIAL ANTENNAS (6)

Wire Antennas- Small Loop Antenna, V-Antenna, Rhombic antenna, Helical antenna and Yagi-Uda antenna, Frequency Independent Antenna, Horn antenna, Parabolic Reflector antenna, Microstrip antenna, MEMS antenna

UNIT IV - ANTENNA MEASUREMENTS (6)

Antenna Measurements: Measurement of antenna impedance - Pattern measurements - Measurement of Antenna Gain - Beam width - Radiation resistance - Antenna efficiency – Directivity – Polarization - Measurement of Noise Figure and Noise Temperature.

UNIT V- WAVE PROPAGATION (6)

Fundamentals of Free Space Propagation, Ground Wave Propagation, Sky Wave propagation- Structure of ionosphere, Critical frequency, Virtual height , MUF, Skip distance, Effects of earth"s magnetic fields: Fading, Whistlers, Space Wave Propagation, Duct Propagation.

LIST OF EXPERIMENTS:

1. Verify the electromagnetic wave propagation in different types of wave guides.
2. Design a rectangular wave guide with given parameters.
3. Design and analyze the radiation pattern of a dipole antenna.
4. Calculate the gain of micro strip patch antenna.
5. Analyze the directivity of a dipole array antenna.

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17ECC19 - MICROWAVE ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC18 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand and gain complete knowledge about microwave devices	1.1	The students will be able to calculate the power distribution in microwave components	a,b,c,d,j,l
2.0	To enhance the basic knowledge about the microwave and its systems.	2.1	The students will be able to analyze the different types of microwave tubes	a,b,f,g
3.0	To provide the basic concepts of microwave networks.	3.1	The students will be able to compute the impedance and loss measurements	a,b,c,d,e,j,l
4.0	To develop an ability to understand the basic source of communication systems.	4.1	The students will be able to identify the various microwave semiconductor devices and its characteristics	a,b,c,e,l
5.0	To apply the concept microwave and its systems on various applications.	5.1	The students will be able to formulate the application of microwave systems.	a,b,c,e,j,l

UNIT I - MICROWAVE NETWORK THEORY AND PASSIVE COMPONENTS	**(9)**
Introduction to Microwave Engineering-Scattering or S matrix representation of multiport Network-Properties of S-parameters - Relations between Z,Y and ABCD parameters with S parameter-Microwave hybrid circuits- S Matrix of Waveguide Tees-Directional Couplers - S Matrix of a Directional Coupler -Microwave Isolator.	
UNIT II – MICROWAVE LINEAR BEAM & CROSSED FIELD TUBES	**(9)**
Klystrons-Velocity Modulation Process-Bunching Process-Two cavity Klystron- Reflex Klystron -Helix Traveling-Wave Tubes-Crossed field device –Magnetron Oscillators.	
UNIT III- MICROWAVE MEASUREMENTS	**(9)**
Spectrum Analyzer-Insertion loss and attenuation measurements-VSWR measurement-Impedance measurement-Slotted line method-Frequency Measurement-Microwave Antenna measurement.	
UNIT IV - MICROWAVE SEMICONDUCTOR DEVICES	**(9)**
Transferred Electron Devices-Gunn Diodes - Avalanche time transit devices-Read Diode-IMPATT Diodes-TRAPATT Diode-BARITT Diode –Parametric Devices- Manley –Rowe Power Relations.	
UNIT V- APPLICATIONS OF MICROWAVE SYSTEMS	**(9)**
Microwave Radar Systems:-The Radar Equation-Pulsed Radar-Doppler Radar-Radar Cross Section-Industrial application of Microwaves-Microwave heating-Industrial control and measurements-Medial Applications-Hazards of Electromagnetic Radiation.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Annapurna Das and Sisir K-Das,"Microwave Engineering" Tata McGraw-Hill 2013
2. David M Pozar, " Microwave Engineering" , John Wiley & Sons, 2nd Edition, 2003

REFERENCES:

1. R-E-Collin, "Foundations for Microwave Engineering", IEEE Press 2nd Edition, 2002
2. Samuel Y-LIAO, "Microwave Devices and Circuits", Pearson/Prentice Hall of India,3rdEdition Reprint 2011.

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17ECC20 - OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC16 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To make students to learn and understand the basic concepts in optical fiber cable.	1.1	The Students can understand the structure of optical fibers and wave propagation mechanisms.	a,b,l
2.0	To enable the students to gain knowledge on different losses encounter by an optical cable.	2.1	The Students will be able to obtain the knowledge on the losses and dispersions occurred in the optical cable.	a,b,c,g,l
3.0	To enable the student to design the optical sources and detectors.	3.1	The Students will be able to characterize the Optical sources and detectors.	b,f,h,i,k,l
4.0	To motivate the students to identify the problems occur in receiver section.	4.1	The students will be able to Calculate the link budget analysis of optical receiver section.	b,e,g,j
5.0	To make the students to familiar with design considerations of fiber optic systems.	5.1	The Students can familiar with design considerations of fiber optical system.	c,e,g,h,j

UNIT I - OPTICAL FIBERS - STRUCTURE (9)

Evolution of Fiber Optic Systems , Elements of an Optical fiber Transmission link , Basic laws and definitions, Optical fiber modes and configurations , Mode theory of circular waveguides - Overview of modes, Key modal concepts Linearly Polarized waves , Single Mode and Multi Mode Fibers, Graded Index Fiber Structure.

UNIT II - ATTENUATION AND DISPERSION (9)

Attenuation, Signal dispersion in fibers – Overview of Dispersion origins, Modal Delay, Group delay , material dispersion , Wave Guide dispersion , Dispersion in single mode fibers, Polarization mode dispersion , RI profile and cut off wavelength, Dispersion Management, Dispersion Shifted Fibers.

UNIT III- OPTICAL SOURCES (9)

LED's - Surface and Edge emitters, Modulation of LED, LASER Diodes - Fabry-Perot Lasers , Distributed Feedback (DFB) Lasers , Modulation of LASER diodes , Power Launching and Coupling - Source to fiber power launching , Lensing Schemes for Coupling improvement , LED coupling to single mode fibers, Fiber connectors, Fiber splicing.

UNIT IV - PHOTODETECTOR AND OPTICAL RECEIVER OPERATION (9)

PIN Photo detector, Avalanche Photodiodes, Photodetector noise - Detector response time, Avalanche multiplication of Noise, Fundamental Receiver operation Error sources, Front End Amplifiers, Digital Receiver Performance - Probability of error, Quantum limit, Point to point link systems considerations - Link Power budget, Rise time budget..

UNIT V- OPTICAL NETWORKS AND PERFORMANCE MEASUREMENTS (9)

Operational principles of WDM, EDFA"s, Solitons, Basic concepts of SONET/SDH, Performance Measurement - Measurement standards, Test Equipments, Power Measurements, Attenuation Measurements, Dispersion Measurements, OTDR.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Gerd Keiser, "Optical Fiber Communications", McGraw-Hill Education, 5th Edition, 2013.

REFERENCES:

1. John M. Senior, "Optical Fiber Communications", Pearson Education, 3rd Edition, 2009.
2. Govind P.Agrawal, "Fiber-optic Communication Systems", A John Wiley & Sons, 3rd Edition, 2004.
3. R.P.Khare, "Fiber Optics and Optoelectronics", Oxford University, 2007.

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17ECC21 - EMBEDDED AND REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

PREREQUISITE : 17ECC13 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	Learn the architecture and programming of ARM processor	1.1	The students will be able to Describe the architecture of different ARM processor cores.	a,b,f,i,k
2.0	Be familiar with the embedded computing platform design and analysis.	2.1	The students will be able to Understand the instruction set and Assembly Language Programming in ARM.	a,c,f,j
3.0	Be exposed to the basic concepts of real time Operating system.	3.1	The students will be able to Categorize and understand the recent trends in Embedded Systems.	a,d,i,k
4.0	Learn the system design techniques and networks for embedded systems.	4.1	The students will be able to Outline the concepts of embedded systems and explain the basic concepts of real time Operating system design.	a,b,f,k
5.0	To make the students to develop the real time solutions	5.1	The students will be able to Develop real time solutions in different RTOS environment.	a,b,c,i,l

UNIT- I ARCHITECTURE OF EMBEDDED SYSTEMS	**(9)**
Categories of Embedded Systems- Specialties of Embedded systems-Recent trends in Embedded Systems-Hardware Architecture-Software Architecture-Communication software-Process of generation of executable image-development/testing tools.	
UNIT-II THE ARM RISC ARCHITECTURE	**(9)**
The Reduced Instruction Set Computer – Architectural inheritance-The ARM programmers model - ARM Development Tools -ARM organization and implementation- 3 stage and 5 stage pipeline ARM organization-ARM instruction execution- ARM processor cores: ARM7 TDMI- Comparison of ARM8 TDMI-ARM9 TDMI.	
UNIT-III ARM INSTRUCTION AND ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
Exceptions-Conditional execution-Branch and branch with link and exchange-Software interrupt-Data processing instructions-Single word and unsigned byte data transfer and half word and signed byte data transfer instructions-Multiple register transfer instructions-Swap instructions-The thumb instruction set - Thumb applications	
UNIT-IV RTOS CONCEPTS	**(9)**
Architecture of the Kernel-task and task scheduler-Interrupt Service Routines-Semaphores-Mutex- Mailboxes-Message Queues-Event Registers-Pipes-Signals-Timers-Memory Management – Priority Inversion Problem.	
UNIT V- RTOS IMPLEMENTATION	**(9)**
Off the shelf operating system - embedded operating system – Real time operating system:VX works- Micro C/OS-II hand held operating system : Palm OS- Symbian OS - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS -RTOS- Case study of an Embedded system for an Adaptive Cruise Control Systems in a Car- Case study of an Embedded Systems for a Smart Card.	
	TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Dr.K.V.K.K Prasad "Embedded Real-Time systems: concept, design & Programming" Dream tech Press, Reprint Edition, 2010.
2. Steve furber "ARM system On Chip Architecture" Pearson 16th Edition 2013

REFERENCES :

1. Raj Kamal "Embedded Systems Architecture Programming and Design" 2nd Edition TMH, 2010
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2nd Edition 2006.

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17ECP12 - MICROWAVE AND OPTICAL LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE:17ECP10 | QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To make students to apply knowledge of optical communication to various application areas.	1.1	The Students can apply knowledge of optical communication to various application areas.	a,d,j,l
2.0	To enable the student to implement and maintain the various microwave components.	2.1	The Student will be able to implement and maintain the various microwave components.	a,b,c,d,j,l
3.0	To provide the student to solve problems in maintaining the optical and microwave components.	3.1	The Students will be able to solve problems in maintaining the optical and microwave components.	a,b,c,d,l
4.0	To make the students to learn and calculate the numerical aperture of a fiber.	4.1	The students can obtain knowledge to calculate the numerical aperture of a fiber.	a,b,f,l
5.0	To motivate the students understand the characteristics of Gunn diode and Reflex Klystron.	5.1	The Students can understand the characteristics of Gunn diode and Reflex Klystron.	a,b,f,g,l

LIST OF EXPERIMENTS:

Microwave Lab Experiments:

1. Mode Characteristics of Reflex Klystron.
2. Measurement of standing wave ratio and reflection coefficient.
3. V-I characteristics of Gunn diode oscillator.
4. Measurement of frequency & wavelength in a rectangular waveguide Working on TE10 mode
5. Impedance measurement using slotted line method.
6. Radiation pattern of a Horn Antenna.

Optical Experiments:

1. Measure the Numerical Aperture of Optical Fiber
2. DC Characteristics of LED and Photo detector.
3. Characteristics of optical signal using analog and digital link.
4. Measurement of system bandwidth by intensity modulation using optical fiber.
5. Measurement of attenuation in a single mode fiber.
6. Mode characteristics of fiber.

TOTAL (P: 60) = 60 PERIODS

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17ECP13 - EMBEDDED SYSTEMS LABORATORY			
L	T	P	C
0	0	4	2

PREREQUISITE : 17ECP08	QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To obtain a broad understanding of the emerging technologies in embedded system	1.1	The students will be able to Develop applications using I/O ports in Microcontrollers	a,c,d,k
2.0	To acquire knowledge on 8bit Microcontroller and interfacing.	2.1	The students will be able to Design embedded systems with wireless applications	b,c,d,k
3.0	To gain knowledge about automation using embedded systems.	3.1	The students will be able to Design system for real world applications using peripherals.	b,c,e,k
4.0	To gain knowledge about wired networks	4.1	The students will be able to Design embedded systems using wired protocols.	b,c,e,k
5.0	To gain knowledge about I/O models	5.1	The students will be able to Made automation and provide solution to problems in design	a,d,f

LIST OF EXPERIMENTS:

1. Study the function of I/O ports of ARM Processor and Program to control the external devices using GPIO ports.
2. Program to interface 7 segment display to display a message on it using ARM Processor.
3. Program to interface the stepper motor and control the direction of rotation using ARM Processor.
4. Study the function of I/O ports of an Arduino & Design a Heart Beat sensor.
5. Design a fire sensor system using Arduino controller.
6. Study the function of I/O ports of PIC16FXX Microcontroller and Program to control the external devices using GPIO ports.
7. Program to interface Traffic Light Controller using PIC Microcontroller.
8. Study the basic Linux commands in Raspberry pi & install the Operating systems for RPi in a SD card preparation and configure the Raspberry Pi during first booting.
9. Program to control the external devices with GPIO using Raspberry pi.
10. Interfacing and Programming of Sensors using Raspberry pi.

TOTAL (P: 60) = 60 PERIODS

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17ECD01 – PROJECT WORK-I			
L	T	P	C
0	0	8	4

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE -NIL**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To practice the fundamental electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	1.1	The students will be able to study problems in the field of Electronics and communication Engineering through literature survey and its reviews.	a,b,e,f
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	2.1	The students will be able Undertake problem identification, formulation and solution.	a,b,e,f
3.0	To Study various types of methodology based on the problem.	3.1	The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects	a,c,d,f,i
4.0	To create platform to communicate and present the ideas in written and oral form	4.1	The students will be able to Communicate effectively and to present ideas clearly	a,c,d,g,j
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	5.1	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	c,d,f,h

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations

TOTAL (P: 120) = 120 PERIODS

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17ECD02 – PROJECT WORK-II			
L	T	P	C
0	0	16	8

PREREQUISITE : 17ECD01	QUESTION PATTERN : TYPE -NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To practice the fundamental electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	1.1	The students will be able to study problems in the field of Electronics and communication Engineering through literature survey and its reviews.	a,b,e,f
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	2.1	The students will be able Undertake problem identification, formulation and solution.	a,b,e,f
3.0	To Study various types of methodology based on the problem.	3.1	The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects	a,c,d,f,i
4.0	To create platform to communicate and present the ideas in written and oral form	4.1	The students will be able to Communicate effectively and to present ideas clearly	a,c,d,g,j
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	5.1	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	c,d,f,h

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work (same title as in project work-I if the same project is continued in project work-II or the title will be selected based on different project) is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P: 240) = 240 PERIODS

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NANDHA ENGINEERING COLLEGE (AUTONOMOUS) ERODE-52

NANDHA ENGINEERING COLLEGE

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Curriculum and Syllabi

for

B.E – Electronics and Communication Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the Academic year 2024- 2025 onwards)

July 2024

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – R22 **CHOICE BASED CREDIT SYSTEM**

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2	22MYB01	Calculus and Linear Algebra*	BSC	-	4	3	1	0	4
3	22CYB04	Engineering Chemistry	BSC	-	3	3	0	0	3
4	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
5	22ECC02	Basics of Electrical and Instrumentation Engineering	ESC	-	3	3	0	0	3
6	22GYA01	தமிழர் மரபு/Heritage of Tamils	HSMC	-	1	1	0	0	1
PRACTICALS									
7	22CSP01	Problem Solving and C Programming Laboratory*	ESC	-	4	0	0	4	2
8	22CYP01	Chemistry Laboratory*	BSC	-	2	0	0	2	1
9	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
MANDATORY NON CREDIT COURSES									
10	22MAN01	Induction Programme	MC	-	0	0	0	0	0
11	22MAN03	Yoga – I *	MC	-	1	0	0	1	0
				TOTAL	**31**	**15**	**1**	**15**	**22**

*** Ratified by Eleventh Academic Council**

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
2	22MYB04	Transforms and Partial Differential Equations*	BSC	-	4	3	1	0	4
3	22PYB03	Solid State Physics	BSC	-	3	3	0	0	3
4	22CSC02	Data Structures using C*	ESC		3	3	0	0	3
5	22ECC04	Electronic Devices and Circuits (Theory + Lab)	PCC	-	5	3	0	2	4
6	22GYA02	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICALS									
7	22PYP01	Physics Laboratory*	BSC	-	2	0	0	2	1
8	22CSP02	Data Structures Laboratory*	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
MANDATORY NON CREDIT COURSES									
10	22MAN02R	Soft /Analytical Skills - I	MC	-	3	1	0	2	0
11	22MAN05	Yoga - II*	MC	-	1	0	0	1	0
				TOTAL	**33**	**16**	**1**	**1**	**23**

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SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22MYB06	Probability and Random Processes	BSC	-	4	3	1	0	4
2	22ECC05	Digital Logic Design	PCC	-	3	3	0	0	3
3	22ECC06	Signals and Systems	PCC	22MYB01, 22MYB04	3	3	0	0	3
4	22ECC07	Analog Electronics	PCC	22ECC04	3	3	0	0	3
5	22ECC08	Electromagnetic Waves	PCC	-	3	3	0	0	3
6	22ITC04	Algorithms	ESC	-	3	3	0	0	3

PRACTICALS									
7	22ECP02	Digital Logic Design Laboratory	PCC	-	4	0	0	4	2
8	22ECP03	Analog Electronics Laboratory	PCC	22ECC04	4	0	0	4	2
MANDATORY NON CREDIT COURSES									
9	22MAN04R	Soft / Analytical Skills - II	MC	-	3	1	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**31**	**20**	**1**	**10**	**23**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22ITC06	Java Programming	ESC	-	3	3	0	0	3
2	22ECC09	Analog Circuit Design	PCC	22ECC04	3	3	0	0	3
3	22ECC10	Transmission Lines and RF Systems	PCC	22ECC08	3	3	0	0	3
4	22ECC11	Digital Signal Processing*	PCC	22ECC06	5	3	0	2	4
5	22ECC12	Analog and Digital Communication*	PCC	22ECC06	3	3	0	0	3
PRACTICALS									
6	22ITP04	Java Programming Laboratory	ESC	-	4	0	0	4	2
7	22ECP04	Analog Circuit Design Laboratory	PCC	22ECC04	4	0	0	4	2
8	22ECP05	Analog and Digital Communication Laboratory*	PCC	22ECC06	4	0	0	4	2
MANDATORY NON CREDIT COURSES									
9	22MAN07R	Soft/Analytical Skills - III	MC	-	5	3	0	2	0
10	22GED01	Personality and Character Development	MC	-	1	0	0	1	0
				TOTAL	**35**	**20**	**0**	**15**	**22**

* **Ratified by Twelfth Academic Council**

SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22ECC13	Microprocessors and Microcontroller Interfacing	PCC	-	3	3	0	0	3
2	22ECC14	Data Communication Networks	PCC	-	3	3	0	0	3
3	22CYB06	Environmental Science and Sustainability	BSC	-	3	3	0	0	3
4	E1	Elective(PEC)	PEC	-	3	3	0	0	3
5	E2	Elective(PEC)	PEC	-	3	3	0	0	3
6	E3	Elective(PEC)	PEC	-	3	3	0	0	3
PRACTICALS									
7	22ECP06	Microprocessors and Microcontrollers Laboratory	PCC	-	4	0	0	4	2
8	22ECP07	Data Communication Networks Laboratory	PCC	-	4	0	0	2	2
MANDATORY NON CREDIT COURSES									
9	22MAN08R	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0
				TOTAL	**29**	**19**	**0**	**11**	**22**

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22ECC15	VLSI and Chip Design	PCC	-	3	3	0	0	3
2	22ECC16	Embedded Systems and IOT Design	PCC	-	3	3	0	0	3
3	E4	Elective (PEC)	PEC	-	3	3	0	0	3
4	E5	Elective(PEC)	PEC	-	3	3	0	0	3
5	E6	Elective(PEC)	PEC		3	3	0	0	3
6	E7	Elective(OEC/PEC)	OEC/PEC	-	3	3	0	0	3
PRACTICALS									
7	22ECP08	VLSI Design Laboratory	PCC	-	4	0	0	4	2
8	22ECP09	Embedded Systems and IOT Design Laboratory	PCC	-	4	0	0	4	2
				TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY & EMBEDDED COURSES									
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	EM1	Elective (Management)	HSMC	-	3	3	0	0	3
3	E8	Elective(OEC)	OEC	-	3	3	0	0	3
4	E9	Elective(OEC)	OEC		3	3	0	0	3
5	E10	Elective(OEC)	OEC	-	3	3	0	0	3
PRACTICALS									
6	22GED02	Internship/ Industrial Training	EEC	-	-	0	0	0	2
7	22ECD01	Project Work - I	EEC	-	4	0	0	4	2
				TOTAL	**23**	**15**	**0**	**8**	**18**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICALS									
1	22ECD02	Project Work - II	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

(C) Programme Elective Courses (PEC)									
Vertical 1: Semiconductors									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECX01	ASIC Design	PEC	-	3	3	0	0	3
2.	22ECX02	System on Chip Design	PEC	-	3	3	0	0	3
3.	22ECX03	System Verilog	PEC	-	3	3	0	0	3
4.	22ECX04	VLSI Testing and Testability	PEC	-	3	3	0	0	3
5.	22ECX05	Electronic System Design	PEC	-	3	3	0	0	3
6.	22ECX06	Electronic Circuit Board Design	PEC	-	3	3	0	0	3
7.	22ECX07	Semiconductor Device Modelling and Simulation	PEC	-	3	3	0	0	3
8.	22ECX08	Electronic System Packaging	PEC	-	3	3	0	0	3
Vertical 2: Communication									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECX11	Mobile Communication	PEC	-	3	3	0		3
2.	22ECX12	Satellite Communication	PEC	-	3	3	0		3
3.	22ECX13	Optical Communication	PEC	-	3	3	0		3
4.	22ECX14	Information Theory and Coding	PEC	-	3	3	0		3
5.	22ECX15	Radar Communication	PEC	-	3	3	0		3
6.	22ECX16	Digital Communication receivers	PEC	-	3	3	0		3
7.	22ECX17	Software Defined Radio	PEC	-	3	3	0		3
8.	22ECX18	4G / 5G Communication Networks	PEC	-	3	3	0		3
Vertical 3: Networks									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECX21	Computer System and Hardware	PEC	-	3	3	0	0	3
2.	22ECX22	Network Information Security	PEC	-	3	3	0	0	3
3.	22ECX23	Cryptography and Network Security	PEC	-	3	3	0	0	3
4.	22ECX24	High Performance Communication Networks	PEC	-	3	3	0	0	3
5.	22ECX25	Wireless Adhoc and Sensor Networks	PEC	-	3	3	0	0	3
6.	22ECX26	Automotive Electronics and Networking	PEC	-	3	3	0	0	3
7.	22ECX27	Neural Networks	PEC	-	3	3	0	0	3
8.	22ECX28	Artificial Intelligence	PEC	-	3	3	0	0	3

Vertical 4: Signal and Image Processing									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECX31	Digital Image Processing	PEC	-	3	3	0	0	3
2.	22ECX32	Speech Signal Processing	PEC	-	3	3	0	0	3
3.	22ECX33	Multimedia Compression Techniques	PEC	-	3	3	0	0	3
4.	22ECX34	Deep Learning	PEC	-	3	3	0	0	3
5.	22ECX35	Computer Vision	PEC	-	3	3	0	0	3
6.	22ECX36	Machine Learning	PEC	-	3	3	0	0	3
7.	22ECX37	Soft Computing	PEC	-	3	3	0	0	3
8.	22ECX38	Pattern Recognition	PEC	-	3	3	0	0	3
Vertical 5: Embedded and IOT									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECX41	Control Systems	PEC	-	3	3	0	0	3
2.	22ECX42	Virtual Instrumentation	PEC	-	3	3	0	0	3
3.	22ECX43	Wearable Devices	PEC	-	3	3	0	0	3
4.	22ECX44	Real Time Embedded Systems	PEC	-	3	3	0	0	3
5.	22ECX45	Internet Of Things & Its Applications	PEC	-	3	3	0	0	3
6.	22ECX46	IOT With Single Board Computers	PEC	-	3	3	0	0	3
7.	22ECX47	Industrial IOT And Industry 4.0	PEC	-	3	3	0	0	3
8.	22ECX48	Automation for Robotics	PEC	-	3	3	0	0	3

(C) MANAGEMENT ELECTIVES									
1.	22GEA02	Principles of Management	MEC	-	3	3	0	0	3
2.	22GEA03	Total Quality Management	MEC	-	3	3	0	0	3
3.	22GEA04	Professional Ethics and Human Values	MEC	-	3	3	0	0	3
(D) OPEN ELECTIVES									
1.	22ECZ01	Fundamentals of IoT	OEC	-	3	3	0	0	3
2.	22ECZ02	Sensors and transducers	OEC	-	3	3	0	0	3
3.	22ECZ03	Principles of Communication	OEC	-	3	3	0	0	3
4.	22ECZ04	VLSI technology	OEC	-	3	3	0	0	3

22ECC13 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To know the internal architecture, instruction set, and operational principles of 8-bit Microprocessor, 8-bit Microcontroller and their associated peripherals. • To expertise in assembly language and high level language programming for 8-bit Microprocessor and Microcontroller. • To illustrate the methods and techniques for interfacing various peripherals with microcontrollers and providing practical examples.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the Architectural concepts to operate and interface an 8-bit microprocessor, microcontroller, and its peripherals in various practical scenarios.	Ap	20%
CO2	Apply diverse programming techniques for developing Microprocessor and Microcontroller based systems.	AP	30%
CO3	Analyze memory and input/output systems for efficient data handling and processing in Microprocessor and Microcontroller environment.	An	30%
CO4	Design Microprocessor and Microcontroller based real time applications using modern engineering tools.	C	20%
CO5	Engage independently or collaboratively, demonstrate designs and deliver oral presentations on the applications of Microprocessor and Microcontroller based systems.	U	Internal Assessment

UNIT I - 8 BIT MICROPROCESSOR &MEMORY ORGANIZATION	**(9)**
Origin and classification of Microprocessor - 8085 Architecture- Addressing mode – Instruction Set- Computer system Memory Overview- Cache Memory Principles – Elements of Cache Design.	
UNIT II - 8051 MICROCONTROLLER	**(9)**
8051 Microcontroller: Architecture– Signals – Memory Organization - Interrupts – Timer/counter - Serial communication	
UNIT III - 8051 ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
8051 Addressing mode – Instruction Set – Programming 8051 Timers – Serial Port programming – Interrupt Programming.	
UNIT IV - HIGH LEVEL LANGUAGE PROGRAMMING	**(9)**
Data types and time delay in 8051 C – I/O Programming in 8051 C – Logical operations in 8051 C – Accessing code ROM space in 8051 C – Timer programming in C – Serial port programming in C – Interrupt programming in C	
UNIT V- UNIT V - 8051 EXTERNAL INTERFACING	**(9)**
LCD & Keyboard Interfacing - ADC, DAC & LM35 Temperature Sensor Interfacing - External Memory Interface- Stepper Motor Interfacing	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
1. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011 2. Ramesh S. Goankar, "Microprocessor Architecture: Programming and Applications with the8085", Sixth edition, Penram International, 2015 Reprint 3. William Stallings, "Computer organization and architecture Designing for Performance", Tenth Edition, Pearson Education, 2016.
REFERENCES:
1. Senthilkumar, Saravanan, Jeevanantham, Shan "Microprocessor & Interfacing", Oxford University press, 2012. 2. K.UmaRao. AndhePallavi, "The 8051 Microcontroller Architecture, Programming and Applications" Pearson Education 2011, Second Impression.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3												3	
3		3											3	
4			3								2			3
5				3	2				3	2		1		3
CO (W.A)	**3**	**3**	**3**	**3**	**2**				**3**	**2**	**2**	**1**	**3**	**3**

22ECC14 – DATA COMMUNICATION AND NETWORKS				
	L	T	P	C
	3	0	0	3

PREREQUISITE :NIL

Course Objective:	• To understand the concepts of computer networks. • To study about multipleaccess techniques, network protocols. • To get awareness about the performance of internetworking and networking technologies.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the Communication and Networking concepts to Communicate across computer networks.	Ap	20%
CO2	Analyze the data communication systems, including network architecture, Protocols and performance metrics	An	30%
CO3	Implement network protocols and technologies to ensure efficient data transfer.	An	30%
CO4	Evaluate and analyze the security and privacy aspects of data communication systems including encryption, firewalls and access control	E	20%
CO5	Give a presentation on recent technological development in data communication and network protocols	U	Internal Assessment

UNIT I –FUNDAMENTALS OF DATA COMMUNICATION	**(9)**
Introduction – Data communication-network types – Connecting devices: Hubs-Link layer Switches, Routers- ISO/OSI model-TCP/IP- Transmission Media: Guided and Unguided media-Switching Techniques	
UNIT II –DATA LINK LAYER	**(9)**
Introduction –- Data Link Control-Error Control: types of errors-Redundancy- coding: block coding-Hamming Distance- parity check codes – cyclic codes – Media Access Control-Link layer Addressing-Ethernet – WiFi, IEEE 802.11 Project – Bluetooth	
UNIT III –NETWORK LAYER	**(9)**
Network Layer services – Packet Switching –Network Layer performance - IPv4 Addresses- ICMPv4-Forwarding of IP Packets- Next Generation Internet Protocol(IPV6)- Transition from IPV4 to IPV6 - Routing Algorithms: Distance Vector Routing, Link State Routing, Path Vector Routing	
UNIT IV –TRANSPORT LAYER	**(9)**
Transport Layer Services- Transport Layer Protocols: – User Datagram Protocol (UDP) –Transmission Control Protocol (TCP) –SCTP- Quality of service – Data flow characteristics – Flow control to improve QoS: Token Bucket and Leaky Bucket	
UNIT V- APPLICATION LAYER	**(9)**
Introduction- Client/Server Paradigm- Standard Applications: World wide web and HTTP – FTP- Email – Telnet – SSH- Domain Name System- Multimedia Data- Multimedia in the Internet -Cryptography and Network security: Introduction –Confidentiality – Other aspects of Security	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
1. Behrouz A. Forouzan, "Data Communication and Networking", 6th India Edition, Tata McGraw-Hill, 2017.
REFERENCES:
1. Tanenbaum, Andrew S and David Wetherall, —Computer Networks, 5th Edition, PHI Learning, New Delhi,2010. 2. Kurose, James F. and Ross, Keith W., —Computer Networking: A Top-Down Approach Featuring the Internet,6th Edition, Pearson Education, New Delhi, 2012.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		3											3	
3			3										3	
4				3	3								3	
5							2		2				2	
CO (W.A)	**3**	**3**	**3**	**3**	**3**		**2**		**2**				**2.8**	

22CYB06 - ENVIRONMENTAL SCIENCE AND SUSTAINABILITY *(Common to CHEM-2nd, BME-3rd, ECE-5th AND EEE-4th SEM)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL				
Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity.	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Analyze the renewable and non-renewable resources and preserve them for future generations.	An	20%
CO4	Examine the different goals of sustainable development and apply them for suitable technological advancement and societal development.	Ap	20%
CO5	Execute the sustainability practices, identify green materials and energy cycles.	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	(9)
Environment - scope and importance - Eco-system- Structure and function of an ecosystem - types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(9)
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(9)
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	
UNIT IV – SUSTAINABILITY AND MANAGEMENT	(9)
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - from unsustainability to sustainability - millennium development goal - Sustainable Development goals - Climate change – Concept of carbon credit – carbon footprint - Environmental management.	

UNIT V – SUSTAINABILITY PRACTICES	(9)
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable habitat - Green buildings - Green materials- Sustainable energy - Non-conventional Sources - Energy Cycles- carbon cycle and carbon emission - Green Engineering - Sustainable urbanization.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing Co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

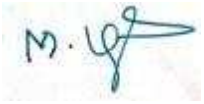
1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
3. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic- issues/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2		2					2						
4							3							
5						3						2		
CO (W.A)	2	2	2			3	3	2				2		



22ECP06 - MICROPROCESSOR AND MICROCONTROLLER INTERFACING LABORATORY

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To enable the student to analyze various arithmetic, logical and control transfer operations using 8085 Microprocessor. • To provide the student with practice in the 8051 Microcontroller arithmetic, Logical operations. • To motivate the students to learn the I/O interfacing concepts in 8051 using HLP.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply theassembly language programming knowledge to operate and interface an 8-bit Microprocessor, Microcontroller, and its peripherals	Ap
CO2	Apply the diverse programming techniques in Microprocessor and Microcontroller based system development for various real-world applications.	An
CO3	Examine the functionalities of arithmetic, logical, and control transfer operations performed by 8-bit Microprocessors and Microcontrollers.	E
CO4	Verify the operational capabilities of different peripherals within a Microcontroller environment through High level language programming.	E
CO5	Implement the functionality of fundamental peripherals for various real-world applications using modern engineering tools.	C

LIST OF EXPERIMENTS :

1. Assembly language programming for 8/16 bit Arithmetic operators Using 8085.
2. Assembly language programming with control instructions Using 8085 (Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers.
3. Assembly language programming for arithmetic and logical operations using 8051.
4. Interfacing and Programming of DC Motor Speed control using 8051.
5. Interfacing and Programming of Stepper Motor control using 8051.

High Level Language Programming:

The following programs have to be tested on 8051 Development board/equivalent using Embedded C Language on KEIL IDE or Equivalent.

1. Program to toggle all the bits of Port P1 continuously with delay.
2. Program to toggle P1.5 continuously with delay. Use Timer in mode 0, mode 1, mode 2 and mode 3 to create delay using 8051.
3. Program to interface 7 segments display to display a message on it using 8051.
4. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD using 8051.
5. Program to get analog input from Temperature sensor and display the temperature Value on LCD using ADC with 8051 Microcontroller.
6. Program to handle interrupts with 8051 Microcontroller.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3												3	
3		3											3	
4				3										3
5			3		2									3
CO (W.A)	**3**	**3**	**3**	**3**	**2**								**3**	**3**

22ECP07 – DATA COMMUNICATION AND NETWORKS LABORATORY				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To learn the various routing algorithms. • To gain knowledge about the various open source simulation tools for packet tracing and network design. • To understand the peer to peer communication application using different protocols.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Demonstrate working knowledge of computer hardware & Operating Systems, software and networking skills.	U
CO2	Design and simulate simple networking models using the Network simulator modeling.	Ap
CO3	Compare and analyze the concepts of protocols, network interfaces and design LAN, MAN and WAN.	An
CO4	Troubleshoot and repair network problems demonstrating professionalism, team work and adaptability.	E
CO5	Develop and test network applications using socket programming.	C

LIST OF EXPERIMENTS :

1. Implementation of Stop and Wait Protocol and sliding window.
2. Implementation and study of Go back-N and selective repeat protocols.
3. Create scenario Transfer of files from PC to PC using Windows socket processing.
4. Analyze the performance of CSMA/CD protocol through simulation.
5. Evaluate the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
6. Implementation of distance vector routing algorithm.
7. Implementation of Link state routing algorithm.
8. Data encryption and decryption using Data Encryption Standard algorithm.
9. Implement and realize the Network Topology - Star, Bus and Ring using NS2.
10. Implement and perform the operation of CSMA/CD and CSMA/CA using NS2.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												2	
2			3		3								3	
3			3										3	
4		3		2									3	
5									2				2	
CO (W.A)	**3**	**3**	**3**	**2**	**3**				**2**				**3**	

22MAN08R - SOFT/ANALYTICAL SKILLS – IV *(Common to All Branches)*				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**
PREREQUISITE : NIL				
Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts • To develop quantitative aptitude and analytical reasoning skills			

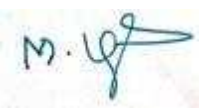
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I – VERBAL ABILITY	**(15)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II – APTITUDE	**(15)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(15)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf, "Effective Technical Communication", Tata McGraw-Hill Education, 2017.
2. Aggarwal R S., "Quantitative Aptitude for Competitive Examinations", S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun, "How to Prepare for Quantitative Aptitude for the CAT", Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				



22ECC15 - VLSI AND CHIP DESIGN				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the I-V and DC characteristics of MOS transistors and layout of CMOS Circuits by means of stick diagram • To study about the static and dynamic CMOS combinational and sequential circuits using different logic styles • To obtain knowledge about Interconnects, Floor planning, routing and Verilog HDL-modeling Concepts

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic knowledge of digital and analog electronics to analyze MOS transistor characteristics and design the layout of CMOS circuits.	Ap	20%
CO2	Apply the various combinational and sequential circuit concepts to realize different logic styles.	An	30%
CO3	Analyze the diverse static and dynamic combinational and sequential CMOS circuits using different logic styles	An	30%
CO4	Design system level physical design and implement the modeling concepts using modern software tools.	C	20%
CO5	Engage independently to deliver oral presentations on the applications of VLSI systems.	U	Internal Assessment

UNIT I - MOS TRANSISTORS AND FABRICATION	**(9)**
Basic MOS Transistors – Enhancement and Depletion Mode Transistor Action - Ideal I-V Characteristics of MOS Transistors - Non Ideal I-V Effects - DC transfer characteristics - CMOS Fabrication: n-well – p-well – twin tub - stick diagram and layout design rules.	
UNIT II - COMBINATIONAL CIRCUITS DESIGN	**(9)**
Circuit Families - Static CMOS - Pseudo NMOS Logic - Clocked CMOS Logic - Domino Logic - Cascode Voltage Switch Logic - Dynamic Logic - Pass transistor Logic -Transmission gate logic.	
UNIT III - SEQUENTIAL CIRCUITS DESIGN	**(9)**
Sequencing static circuits - Circuit design of latches and flip-flops - Conventional CMOS Latches and flip-flops: Pulsed latches - Resettable latches and flip-flops - enabled latches and flip flops - Incorporating Logic into latches - TSPC Latches and flip-flops - Sequencing dynamic circuits	
UNIT IV - VLSI SUBSYSTEMS DESIGN AND MEMORIES	**(9)**
Bit Adders - Ripple Carry Adder - Carry look-ahead adder - Subtractor -One/Zero detectors - Comparators- Shifters - 2's complement array multipliers - Wallace tree multiplier - Series multiplier -Series and Parallel division - SRAM and Dynamic RAM	
UNIT V- SYSTEM LEVEL PHYSICAL DESIGN AND MODELING CONCEPTS	**(9)**
Large Scale physical design - Interconnect delay modeling - cross talk - Interconnect scaling – Floor planning and routing – Power distribution and consumption - Low power design considerations - Overview of Verilog HDL-Modeling Concepts	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Neil H.E.Weste, David Harris "CMOS VLSI Design - A Circuits and Systems Perspective", Pearson Education, 4th Edition, 2015.
2. John P.Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, 2009.

REFERENCES:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits A Design Perspective", Prentice Hallof India, 2nd Edition, 2012.
2. Eugene D.Fabricius," Introduction to VLSI Design", Tata McGraw Hill, 1st Edition, 1990.
3. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, Boston, 1st Ediiton, 1998.
4. Neil H.E. Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design: A System Perspective", Addison Wesley, New Delhi, 2nd Edition, 2009.
5. Charles H.Roth and Lizy Kurian John, "Digital System design using VHDL", John Wiley& Sons, 2nd Edition, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2	3													
3		3											1	3
4			3										1	3
5									2	1				1
CO (W.A)	3	3	3						2	1			1	2

22ECC16 - EMBEDDED SYSTEMS AND IOT DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To gain knowledge about PIC Microcontroller. • To understand the embedded systems and IoT.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of 16-bit microcontroller with necessary Input/Output and Memory Operations to build an embedded processor.	Ap	20%
CO2	Analyze the combinational, sequential, and timing circuits in recognizing functional blocks of embedded systems and their working mechanisms	An	20%
CO3	Design simple programming modules in machine and higher-level programming language using simulators to develop logical skills and testing skills	Ap	40%
CO4	Select and implement appropriate IoT techniques to provide valid conclusions.	An	20%
CO5	Build simple Embedded Applications using Input and output devices with IoT and a controller.	U	Internal Assessment

UNIT I- PIC MICROCONTROLLER	**(9)**
PIC 16F877 Microcontroller Architecture - Memory organization -Interrupts Timer/Counter - Compare/Capture/PWM modules (CCP) - Master Synchronous Serial Port module (MSSP).	
UNIT II - EMBEDDED SYSTEMS	**(9)**
Embedded System Design Process – Model Train Controller – Instruction Set : Preliminaries – ARM Processor – CPU: Programming Input and Output – Supervisor Mode, Exceptions and Trap – Co-Processors – Memory System Mechanisms – CPU Performance.	
UNIT III - PROCESSES AND OPERATING SYSTEMS	**(9)**
Introduction – Multiple Tasks and Multiple Processes – Preemptive real time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms– Design Example – Audio Player, Engine Control Unit and Video Accelerator.	
UNIT IV – INTERNET OF THINGS	**(9)**
Introduction – Physical Design – Logical Design – IoT Enabling Technologies – Domain Specific IoTs: Retail, Logistics, Industry, Health and Lifestyle – IoT and M2M – IoT System Management with NETCONF-YANG – IoT Platform Design Methodology: IoT Level Specification, Domain Model.	
UNIT V - IOT SYSTEM DESIGN	**(9)**
Basic building blocks of an IoT device – Raspberry Pi – Board – Linux on Raspberry Pi – Interfaces – Programming with Python – Case Studies: Home Automation, Smart Cities, Environment and Agriculture.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. John B Peatman, "Design with PIC Microcontrollers", Pearson Education Asia, 2013, Twenty third Impression
2. Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition, Morgan Kaufmann, 2012
3. Arshdeep Bahga, Vijay Madisetti, "Internet – of- Things – A Hands on Approach", Universities Press, 2015.

REFERENCES:

1. Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, First Edition, Pearson Education, 2020.
2. Lyla B.Das, Embedded Systems: An Integrated Approach, Pearson Education 2013.
3. Jane.W.S .Liu, Real – Time Systems, Pearson Education, 2003.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												2
3			2		2									3
4				2										
5					2									
CO (W.A)	3	3	2	2	2									3

22ECP08 - VLSI DESIGN LABORATORY				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22ECC05				

Course Objective:	• To design and simulate combinational logic and sequential logic circuits using Verilog HDL. • To implement the digital logic circuits using Xilinx FPGA. • To understand and design the CMOS logic circuits using Tanner software.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of digital design and develop code for digital logic circuits using Hardware Description Language.	Ap
CO2	Simulate and Synthesize the place and route for digital logic circuits using ModelSim.	Ap
CO3	Analyze the digital modules in Xilinx FPGA kit.	An
CO4	Design and simulate the CMOS blocks using EDA tool.	Ev
CO5	Prepare an effective record for all the experiments.	U

LIST OF EXPERIMENTS :

1. Design an 8-bit Adder and 8-bit Subtractor and simulate using Xilinx software
2. Design an ALU and simulate using Xilinx software.
3. Simulation and Implementation of Encoder and Decoder using Xilinx.
4. Simulation and Implementation of 4 * 4 Multiplier using Xilinx.
5. Design T, JK and SR flipflops. Simulate and Implement using Xilinx.
6. Design and implementation of Shift registers using Xilinx.
7. Design 3-bit synchronous up/down counters. Simulate and implement using Xilinx.
8. Design 4-bit Asynchronous up/down counter. Simulate and implement using Xilinx.
9. Design and simulation of Frequency Dividers and implement using Xilinx.
10. Design and simulation of CMOS Inverter using Tanner software.
11. Design CMOS NAND and NOR Gates using PMOS and NMOS Transistors and simulate using Tanner software.
12. Design and simulation of CMOS Latch using Tanner software.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3								2					
2					3				2					2
3					3									
4			3		3									3
5								3	2	3		2		
CO (W.A)			**3**		**3**			**3**	**2**	**3**		**2**		**2.5**

22ECP09 - EMBEDDED SYSTEMS AND IOT DESIGN LABORATORY				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To obtain a broad understanding of the emerging technologies in embedded system • To gain knowledge about I/O models.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of PIC, ARM, IoT and Arduino using IDE platform.	Ap
CO2	Analyze the virtual circuits of digital devices using Proteus.	An
CO3	Design and synthesize a digital circuit for the given specifications and conduct the experiment.	Ap
CO4	Develop the high level programming knowledge using Keil and MPLAB.	An
CO5	Involve in independent / team learning, communicate effectively and engage in life long learning.	C

LIST OF EXPERIMENTS :

1. Program to interface Traffic Light Controller using PIC Microcontroller.
2. Program to control the external devices using GPIO ports of PIC16FXX Microcontroller.
3. Program to Develop an IoT Dashboard for Sensors on Android Phone.
4. Program to Develop an IoT Camera System using Android Phones.
5. Program to control the external devices using GPIO ports of ARM Processor.
6. Program to interface the ADC using ARM Processor.
7. Program to interface the DAC using ARM Processor.
8. Program to interface the keyboard using ARM Processor.
9. Program to Design a Heart Beat sensor using Arduino controller.
10. Program to Design a fire detecting system using Arduino controller.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		3												2
3			3											2
4			3											
5									2	2		1		2
CO (W.A)	**3**	**3**	**3**						**2**	**2**		**1**		**2**

22GEA01- UNIVERSAL HUMAN VALUES *(Common To All Branches)*				
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**
PREREQUISITE : NIL				

Course Objective:	• To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession.	E	Internal Assessment
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethicallife and profession.	Ap	

UNIT I - INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL- ENCOMPASSING RESOLUTION	**(6)**
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II - RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	**(6)**
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	
UNIT III - UNDERSTANDING HUMAN BEING	**(6)**
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	
UNIT IV - UNDERSTANDING NATURE AND EXISTENCE	**(6)**
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly	

awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V - UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION AND HOLISTIC WAY OF LIVING	**(6)**
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOK:

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi

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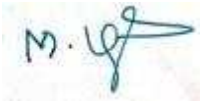
1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins,USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if peoplemattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers
8. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
9. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
10. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co.,Lucknow. Reprinted 2008.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
CO (W.A)						**2**	**2**	**3**	**2**	**2**		**3**		



22GED02- INTERNSHIP/INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	4	2
PREREQUISITE : NIL					
Course Objective:	• To obtain a broad understanding of the emerging technologies in Industry • To gain knowledge about I/O models.				
Course Outcomes The Student will be able to		**Cognitive Level**			
CO1	Engage in Industrial activity which is a community service.	U			
CO2	Prepare the project report, three minute video and the poster of the work.	Ap			
CO3	Identify and specify an engineering product that can make their life comfortable.	An			
CO4	Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms.	Ap			
CO5	Identify the community that shall benefit from the product.	E			

During semester break, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple Electronic (or other) products to make their life comfortable and convert new ideas into projects.

Every student is required to complete 12 to 16 weeks of internship (with about 40 hours per week), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports and Seminars during the VI and VIII semesters. The internships can be taken up in an industry, government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs/Training
- Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute
- Participation in Inter-Institute innovation related competitions like Hackathons
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests
- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2								
2										3				
3		1												
4							2	3			2			
5						2								
CO (W.A)		**1**				**2**	**2**	**3**		**3**	**2**			

22ECD01- PROJECT WORK - I					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem.	Ap	10 % - First Review (Internal)		
CO2	Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment	Ap, E	15 % - Second Review (Internal)		
CO3	Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project.	Ap, An, C	15 % - Third Review (Internal)		
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and effective oral communication through presentation of the project work and demonstration of the project.	E	30 % - Final Review (External)		
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work	Ap, An	30 % - Final Review (External)		

DESCRIPTION
Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three internal reviews and one external review during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations
TOTAL (P: 120) = 120 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3										3	3	3
2						3	3				3		3	3
3	3	3	3	3	3								3	3
4								3		3			3	3
5									3		3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

22ECD02- PROJECT WORK - II					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Design, implement, analyze and interpret results of the implemented project and improvise the performance of the project.	Ap, An, C	10 % - First Review (Internal)
CO2	Preparation of the four page IEEE format of the work, presentation of the project work and demonstration of the project in Project Expo, Presentation in International/ National Conferences, Conversion of project to start-up/ product/ research paper/ patent.	Ap, An, E	15 % - Second Review (Internal)
CO3	Design, implement, analyze and interpret results of the implemented project and improvise the performance of the project.	Ap, An, C	15 % - Third Review (Internal)
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and effective oral communication through presentation of the project work and demonstration of the project.	E	30 % - Final Review (External)
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work.	Ap, An	30 % - Final Review (External)

DESCRIPTION
Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three internal reviews and one external review during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations
TOTAL (P:300) = 300 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3										3	3	3
2						3	3				3		3	3
3	3	3	3	3	3								3	3
4								3		3			3	3
5									3		3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

VERTICAL 1: SEMICONDUCTORS

22ECX01 - ASIC DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To understand ASICs, CMOS Logic, ASIC Library and Programmable ASICs. • To identify, apply and design a system using different VLSI design methodologies such as Full custom and Semi-custom approaches. • To apply industry standard CAD tools for designing VLSI systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of VLSI to design digital integrated circuits.	Ap	20%
CO2	Ability to identify, apply and design a system using different VLSI design methodologies such as Full custom and Semi-custom approaches.	An	30%
CO3	Ability to apply industry standard CAD tools for designing VLSI systems.	An	30%
CO4	Ability to analyze and investigate the performance of VLSI systems.	E	20%
CO5	Understand ASICs, CMOS Logic, ASIC Library and Programmable ASICs.	U	Internal Assessment

UNIT I - Introduction to ASICs, CMOS Logic, ASIC Library Design, Programmable ASICs	**(9)**
Types of ASICs - Design flow – CMOS transistors- Transistor as resistors - Transistor parasitic capacitance – Logical effort-Antifuse - Static RAM - EPROM and EEPROM technology.	
UNIT II - Programmable ASICs, logic cells and I/O Cells	**(9)**
Actel ACT: Multiplexer Logic,ACT2 and ACT3 Logic Modules, timing model, critical path, speed grading, worst case timing,Actel logic module analysis, Xilinx LCA:XC3000CLB, XC4000, XC5200, Xilinx CLB, DC & AC inputs and outputs – Clock & power inputs.	
UNIT III - Programmable Interconnects and Logic Synthesis	**(9)**
Actel ACT – Xilinx LCA – Design synthesis:Xilinx, Actel, Altera, logic synthesis,Combinational logic, multiplexers, Case statement, decoders, arithmetic and Sequential logic.	
UNIT IV - Partitioning, Floorplanning and Placement	**(9)**
Physical design flow -System partitioning - FPGA partitioning:KL algorithm –Floorplanning –Placement : Constructive and iterative placement algorithms.	
UNIT V- Routing	**(9)**
Global routing - Detailed routing –Area routing-Maze Algorithm-Channel routing- Left Edge Algorithm-Special routing.	
TOTAL (L:45) =45 PERIODS	

TEXT BOOKS:

1. 1. Smith M.J.S, "Application Specific Integrated Circuits", 12th Edition, Pearson Education Pvt. Ltd, New Delhi, 2013.

REFERENCES:

1. Wayne Wolf, "FPGA-Based System Design", 1st Edition, PHI, New Delhi, 2009.
2. Erik larson, "Introduction to Advanced System-on-Chip Test Design and Optimization", 1st Edition, Springer, USA, 2005.
3. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003
4. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
5. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs).Prentice Hall PTR, 1999.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2	3													3
3		2	2											3
4			2											3
5												1		3
CO (W.A)	3	2	2									1		3

22ECX02– SYSTEM ON CHIP DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE :Nil				
Course Objective:	• To understand the system architectures and components in system design. • To study about system level design and co design concepts. • To get awareness about the implementation of SoC and its Testing.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply SoC testing techniques.	Ap	20%
CO2	Discern system level interconnection and co-design concepts.	An	30%
CO3	Compare system level design and interconnection.	An	30%
CO4	Illustrate the co-design concepts.	E	20%
CO5	Understand system architectures and components in system design.	U	Internal Assessment

UNIT I - SYSTEM ARCHITECTURE	**(9)**
Introduction to system Architecture, Components of a system, Hardware and Software: Programmability Versus Performance, Processor Architectures, Memory and Addressing, System-Level Interconnection, An Approach for SOC Design, System Architecture and Complexity	
UNIT II - SYSTEM-LEVEL DESIGN	**(9)**
Processor selection-Concepts in Processor Architecture: Instruction set architecture (ISA), elements in Instruction Handing-Robust processors: Vector processor, VLIW, Superscalar, CISC, RISC—Processor evolution: Soft and Firm processors, Custom-Designed processors-IP based design - on - chip memory.	
UNIT III - SYSTEM-LEVEL INTERCONNECTION	**(9)**
Overview: Interconnect Architecture, On-chip Buses: basic architecture, Bus standards: AMBA, Core Connect, Wishbone, Avalon-Network-on-chip – Architecture – topologies - switching strategies - routing algorithms - flow control, quality-of-service - Reconfigurability in communication architectures	
UNIT IV - CO-DESIGN CONCEPTS	**(9)**
Nature of hardware & software- quest for energy efficiency- driving factors for hardware-software co-design- Co-design space-Dualism of Hardware design and Software design - Modeling Abstraction Level-Concurrency and Parallelism- Hardware Software tradeoffs- Introducing Dataflow modeling.	
UNIT V- SOC IMPLEMENTATION AND TESTING	**(9)**
Study of Microblaze RISC processor - Real-time operating system (RTOS), peripheral interface and components, High-density FPGAs-Introduction to tools used for SOC design: Xilinx SOC based development kit. Manufacturing test of SOC: Core layer, system layer, application layer-P1500 Wrapper Standardization- SOC Test Automation (STAT).	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Michael J.Flynn, Wayne Luk, "Computer system Design: System-on-Chip", Wiley- India, 2012.

REFERENCES:

1. Patrick Schaumont "A Practical Introduction to Hardware/Software Co-design", 2nd Edition, Springer, 2012.
2. Lin, Y-L.S. (ed.), "Essential issues in SOC design: designing complex systems-on- chip", Springer, 2006
3. SudeepPasricha, NikilDutt, "On Chip Communication Architectures: System on Chip Interconnect", Morghan Kaufmann Publishers, 2008
4. W.H.Wolf, "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2	3													3
3		3	3											3
4				1	3									3
5												2		3
CO (W.A)	**3**	**3**	**2**	**1**	**3**							**2**		**3**

22ECX03 –SYSTEM VERILOG				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22ECC05				

Course Objective:	• To apply the fundamentals of digital electronics and through programming the designs. • To apply object oriented programming concepts for VLSI designs. • To create the test benches to analysis the designs • To implement the advanced design using modern tools. • To enhance their design skill through lifelong learning.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamentals of digital electronics and through programming the designs.	Ap	25%
CO2	Apply object oriented programming concepts for VLSI designs.	Ap	25%
CO3	Create the test benches to analysis the designs.	C	30%
CO4	Implement the advanced design using modern tools.	D	20%
CO5	Enhance their design skill through lifelong learning.	U	Internal Assessment

UNIT I - VERIFICATION GUIDELINES	**(9)**
Introduction, The Verification Process, The Verification Plan, The Verification Methodology, Manual, Basic Testbench Functionality, Directed Testing, Methodology Basics, Constrained-Random Stimulus, Functional Coverage, Testbench Components, Layered Testbench, Building a Layered Testbench, Simulation Environment Phases, Maximum Code Reuse, Testbench Performance.	
UNIT II - DATA TYPES	**(9)**
Introduction to data types, Built-in Data Types, Fixed-Size Arrays, Dynamic Arrays, Queues, Associative Arrays, Linked Lists, Array Methods, choosing a Storage Type, Creating New Types with typedef, Creating User-Defined Structures, Enumerated Types, Constants, Strings, Expression Width, Net Types. Array manipulation methods, Array querying functions, Queue.	
UNIT III - PROCEDURAL STATEMENTS AND ROUTINES	**(9)**
Introduction, Procedural Statements, Tasks, Functions, and Void Functions, Task and Function Overview, Routine Arguments, Returning from a Routine, Local Data Storage, Time Values. Process and process control.	
UNIT IV - BASIC OOPS	**(9)**
Introduction, Think of Nouns, not Verbs, Your First Class, Where to Define a Class, OOP Terminology, Creating New Objects, Object Deallocation, Using Objects, Static Variables vs. Global Variables, Class Routines, Defining Routines Outside of the Class, Scoping Rules, Using One Class Inside Another, Understanding Dynamic Objects, Copying Objects, Public vs. Private Straying Off Course, Building a Testbench.	
UNIT V- CONNECTING THE TEST BENCH AND DESIGN	**(9)**
introduction, Separating the Testbench and Design, The Interface Construct, virtual interface, Stimulus Timing, Interface Driving and Sampling, Connecting It All Together, Top-Level Scope, Program – Module Interactions, System Verilog Assertions, Call back. The Four-Port ATM Router. Modport and Clocking block. Mailbox.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Chris Spear, Greg Tumbush, "System Verilog for Verification: A Guide to Learning the Test bench Language Features", 3rd Edition, Springer, US, 2012.
REFERENCES:
1. Stuart Sutherland, Simon Davidmann, "System Verilog for design: a guide to using System Verilog for hardware design and modeling", Springer, 2004. 2. Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2	3													3
3		2	3											3
4					2									3
5												2		3
CO (W.A)	**3**	**2**	**3**		**2**							**2**		**3**

22ECX04 – VLSI TESTING AND TESTABILITY				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22ECC05				
Course Objective:	• To apply the various techniques to diagnosis fault in digital circuit. • To analysis the faults presence and investigate system level faults. • To design testable digital circuit by testability techniques. • To design the self checking systems. • To develop new fault diagnosing algorithms through lifelong learning.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the various techniques to diagnosis fault in digital circuit.	Ap	25%
CO2	Analysis the faults presence and investigate system level faults.	Ap	25%
CO3	Design testable digital circuit by testability techniques.	C	30%
CO4	Design the self checking systems.	E	20%
CO5	Develop new fault diagnosing algorithms through lifelong learning.	E	Internal Assessment

UNIT I - FAULT MODELLING AND SIMULATION	**(9)**
Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection- Fault location - Fault dominance – Single stuck fault model and multiple stuck fault model - Logic Simulation- Types of simulation - Delay models - Gate level Event-driven simulation- Fault Simulation Techniques Serial , Parallel and Deductive	
UNIT II - TESTING FOR SINGLE STUCK AT FAULTS	**(9)**
Test Generation algorithms for combinational circuits – Fault oriented ATG – D Algorithm-Examples – PODEM - Fault independent ATG - Random Test generation - ATGs for SSFs in sequential circuits – TG using iterative array models- Random Test Generation.	
UNIT III - DELAY TEST	**(9)**
Delay test problem – Path delay test – Test generation for Combinational circuits, Number of paths in a circuit Transition fault – Delay test methodologies-Slow clock combinational test, Enhanced scan test, normal scan sequential test, Variable- clock Non-scan sequential test, Rated- clock Non-scan sequential test.	
UNIT IV- DESIGN FOR TESTABILITY	**(9)**
Testability- Controllability and observability, Ad-hoc design for testability Techniques – Controllability and observability by means of scan registers- Storage cells for scan design- Level sensitive scan design (LSSD)- Partial scan using I-Paths – Boundary scan standards.	
UNIT V-FAULT DIAGNOSIS	**(9)**
Logical Level Diagnosis – Diagnosis by UUT reduction – Fault Diagnosis for Combinational Circuits – Self checking design – System Level Diagnosis.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Parag K. Lala "An Introduction to Logic Circuit Testing" Springer International Publishing, 2022. 2. Abramovici, M., Brever, A., and Friedman, D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 2002.
REFERENCES:
1. Michael L Bushnell and Vishwani D Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal Circuits", Springer, verlag 2000. 2. Parag K Lala, "Fault Tolerant and Fault Testable Hardware Design" BS Publications, 2002 3. Sebastian Huhn, Rolf Drechsler "Design for Testability, Debug and Reliability", Springer International Publishing, 2021.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3												3
3			3											3
4			3											3
5												2		3
CO (W.A)	**3**	**3**	**3**									**2**		**3**

22ECX05 – ELECTRONIC SYSTEM DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22ECC04				
Course Objective:	• To apply design rules for PCB designing of circuits. • To perform various analysis on the designed circuits. • To design the layouts of PCB including R, L, C spacing and spacing requirements. • To design the PCB using different PCB technology. • To Utilize the SPICE tool to design and analysis the electronic circuits.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design rules for PCB designing of circuits.	Ap	20%
CO2	Perform various analyses on the designed circuits.	An	20%
CO3	Design the layouts of PCB including R, L, C, spacing and spacing requirements.	D	20%
CO4	Design the PCB using different PCB technology.	D	20%
CO5	Utilize the SPICE tool to design and analysis the electronic circuits.	Ap	20%

UNIT I – BASIC ANALYSIS OF CIRCUITS	**(9)**
Introduction to Or CAD capture – DC bias point analysis – DC analysis- AC analysis – Stimulus Editor – Transient Analysis –Convergence problems and Error Messages - Transformers.	
UNIT II – ADVANCED ANALYSIS OF CIRCUITS	**(9)**
Monte Carlo analysis – Worst case analysis – Performance analysis – Noise Analysis – Temperature analysis – Transmission lines – Digital simulation – Mixed simulation.	
UNIT III - PRINTED CIRCUIT BOARD	**(9)**
Layout planning: General considerations - PCB sizes - Layout approaches - Layout, General rules and parameters: Resistance, capacitance, inductance, conductor spacing, cooling requirements and package density, layout check.	
UNIT IV- DESIGN RULES FOR DIGITAL & ANALOG CIRCUIT PCB's	**(9)**
Digital circuit PCB: Introduction – Reflection - Cross talk - Around and supply line noise - Electromagnetic interference from pulse type EM fields. Analog circuit PCB: Component placing - Signal conductor - Supply and ground conductors.	
UNIT V-PCB TECHNOLOGY TRENDS	**(9)**
Introduction - Fine line conductors with ultra-thin copper foil - Multilayer board - Multi wire board - Subtractive additive process - Semi additive process - Additive process - Flexible PCB - Metal core circuit boards - Mechanical milling of PCB.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Dennis Fitzpatrick "Analog Design and Simulation using OrCAD Capture and PSpice" Elsevier Science Publication, 2017
2. Reinhold Luduig and PavelBretchko, "RF Circuit Design – Theory and Applications", Pearson Education, USASecond Edition, 2012.
3. Walter C.Bosshart, "Printed circuit Boards – Design and Technology", Tata McGraw-Hill, New Delhi, SecondEdition, 2012.
4. Douglas Brooks, Johannes Adam "PCB Design Guide to Via and Trace Currents and Temperatures" Artech House, 2021

REFERENCES:

1. Keith H.Billings, "Handbook of Switched Mode Power Supplies" McGraw-Hill Publishing Co., New Delhi, ThirdEdition 2011.
2. Michael Jacob, "Applications and Design with Analog Integrated Circuits", PHI, New Delhi, Second Edition, 1999.
3. F.H.Mitchell, "Introduction to Electronic Design", Prentice Hall of India, New Delhi, Second Edition, 1992.
4. Sydney Soclof, "Design of Applications of Analog Integrated Circuits", Prentice Hall of India, New Delhi, Second Edition 1997.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	3
2		3											2	3
3			3										2	
4			3										2	
5					3									
CO (W.A)	**3**	**3**	**3**		**3**								**2**	**3**

22ECX06 - ELECTRONIC CIRCUIT BOARD DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To know the basics of electro-magnetic components • To acquire knowledge in basics of PCB and partitioning and traces • To expertise in basics of electrical parameters • To illustrate the methods and effects in PCB design

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts on fundamental components of electro magnetics to the solution of PCB designing and router topology	Ap	20%
CO2	Apply techniques to minimize crosstalk and ensure reliable circuit operation.	Ap	30%
CO3	Analyze the combined effects of parallel capacitors on circuit performance.	An	30%
CO4	Design and implement grounded heat sinks effectively in PCB layouts.	E	20%
CO5	Communicate effectively as an individual and as a part of team during oral presentations	U	Internal Assessment

UNIT I - FUNDAMENTALS	**(9)**
Electromagnetic Compatibility, Electromagnetic Interference, Radio Frequency (RF). Immunity-types-Elements of the electromagnetic environment-Nature of interference-EMC analysis-Standards-Classification of ITE Products-Immunity requirements -Printed circuit board basics-Hidden RF characteristics of passive components	
UNIT II - ROUTING TOPOLOGY CONFIGURATIONS	**(9)**
Microstrip, stripline, Layer stackup assignment, Single-sided assembly, Double-sided assembly, Four-layer stackup, Six-layer stackup, Eight-layer stackup, Radial migration, Common-mode and differential-mode currents, RF current density distribution, Grounding methodologies, Single-point grounding-Multipoint grounding, Ground and signal loops, Functional partitioning	
UNIT III - BYPASSING AND DECOUPLING	**(9)**
Review of resonance- Series resonance, Parallel resonance, Parallel C-Series RL resonance -Physical Characteristics-Impedance, Capacitor types, Energy storage, Resonance, Capacitors in parallel, Power and ground planes, Selecting a capacitor, Power and ground planes-Calculating power and ground plane capacitance, Combined effects of planar and Discrete capacitors	
UNIT IV - CLOCK CIRCUITS, TRACE ROUTING, AND TERMINATIONS	**(9)**
Topology configurations, Component placement- Calculating trace lengths (electrically long traces), Trace routing, Routing layers, Crosstalk, Trace separation, Partitioning, Isolation and partitioning (moating), Filtering and grounding, Local Area Network I/O layout, Electrostatic discharge protection, Design techniques for ESD protection, Guard band implementation	

UNIT V - DESIGN TECHNIQUES	(9)
Localized decoupling, Capacitor implementation, 20-H rule, Trace routing for corners, selecting ferrite components, Grounded heatsinks, Lithium battery circuits, BNC connectors, Creepage and clearance distances current, Carrying capacity of copper traces, Film, Footprint Design for High-Speed Boards- Component Footprint Shapes, Pad Shapes for High-Speed PCB Design, Best Routing Practices for High Speed Routing	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Mark I. Montrose and Edward M. Nakauchi. "Printed Circuit Board Design Techniques for EMC Compliance", 2nd Edition 2004.

REFERENCES:

1. Amit Bahl "High-Speed PCB Design Guide" Sierra Circuits Inc 2020.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												3	
3		3											3	
4			3											3
5									3	2				3
CO (W.A)	3	3	3	3					2	2			3	3

22ECX07 - SEMICONDUCTOR DEVICE MODELLING AND SIMULATION				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To know the basics of Si based nano electronics and devices • To acquire knowledge in fundamentals of density of states • Apply principles of metal-semiconductor contacts to design • To understand the semiclassical transport theory and various simulation tools.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of nanoscale devices to model nanoscale devices	Ap	20%
CO2	Analyze the characteristics of semiconductor devices and BJT for design for engineering problem	An	30%
CO3	Apply quantum mechanical models relevant to modern semiconductor devices and technologies.	Ap	30%
CO4	Design and use modern tools to provide solutions in semiclassical transport theory	E	20%
CO5	Communicate effectively about modern semiconductor devices as individual and team	U	Internal Assessment

UNIT I - SI BASED NANOELECTRONICS	**(9)**
Si-Based Nanoelectronics and Device Scaling, Beyond Conventional Silicon-Nanoscale and Heterostructure Devices, Modeling of Nanoscale Devices, Crystal structure - Classification of Crystals-Miller Indices, Doping, Band Structure, Effective Mass - density of states.	
UNIT II - SEMICONDUCTOR THEORY	**(9)**
Diode - Electron Mobility, Semiconductor Statistics- Fermi - Dirac function and carrier concentration calculation, PN junction under equilibrium, I-V Characteristics-derivation of I-V relation, Minority carrier diffusion equation, Zener diode characteristics, Breakdown - Applications of Zener diode.	
UNIT III - BIPOLAR JUNCTION TRANSISTOR	**(9)**
Transistor configuration-Ebers-Moll model, Non-idealities in BJT, Gummel Poon Model, HBT, BJT Transient and small signal behaviour, Metal-Semiconductor contact (Schottky Barrier/Diode, Ohmic Contacts) and capacitance characteristics, Thermionic emission current flow and fermi-level pinning, Field Effect Transistors (JFET, MESFET, HEMT), MOS Band diagram and C-V characteristics, Threshold voltage and Interface charges, MOSFET I-V characteristics.	
UNIT IV - SEMICLASSICAL TRANSPORT THEORY	**(9)**
Distribution Function, Boltzmann Transport Equation (BTE), Relaxation-Time Approximation (RTA), Drift-Diffusion Model Derivation - Normalization and Scaling Linearization of Poisson's Equation- Scharfetter - Gummel Discretization of the Continuity Equation Newton's Method	

UNIT V - QUANTUM TRANSPORT MODELS	(9)
Tunnelling, Stationary states for a free particle, Potential step, Tunnelling through a single barrier. Transfer matrix approach - Basic description of the method - Piecewise constant potential barrier tool-Quantum mechanical corrections to standard approach. simulation tools, Models for DD, Hydrodynamic simulations, Mobility and G-R models.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. D Vasileska, SM. Goodnick, G Klimeck, "Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation," CRC Press 2010.
2. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.

REFERENCES:

1. S.Salivahanan, N. Suresh kumar and A. Vallavanraj, —Electronic Devices and Circuitsll, Tata McGraw Hill Third Edition (2013).
2. D Vasileska, SM. Goodnick, G Klimeck, "Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation", CRC Press ,2017
3. https://onlinecourses.nptel.ac.in/noc23_ee35/preview

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3	3												3	
4			3		3									3
5									3	2				
CO (W.A)	3	3	3		3				3	2			3	3

22ECX08 - ELECTRONIC SYSTEM PACKAGING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To know the concepts of IC Packaging systemand system level PWP technologies • To gain comprehensive knowledge about failure mechanism and thermal management • To expertise in various types of packaging techniques • To illustrate the methods and techniques of packaging material and processes

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design principles for reliability, thermal management and electronic cooling methods	Ap	20%
CO2	Apply knowledge to conduct life-cycle assessments to ensure performance of microsystems	Ap	30%
CO3	Analyze the properties and characteristics of packaging systems relevant to microsystems.	An	30%
CO4	Utilize CAD tools for PWB design and understand the limitations and processes involved in standard and microvia board assembly.	E	20%
CO5	Communicate effectively about electronic packaging systems as an individual and team	U	Internal Assessment

UNIT I - INTRODUCTION TO PACKAGING SYSTEM	**(9)**
Introduction to Microsystems - microsystem technologies-microsystem packaging, Importance of micropackaging - System level microsystem technologies - Future trends-Role of packaging in microelectronics - Microelectronic devices - Semiconductor road map-IC packaging challenges	
UNIT II - FAILURE MECHANISM AND THERMAL MANAGEMENT	**(9)**
Microsystems failure and failure mechanism - Fundamentals of design for reliability - Thermo Mechanically-Induced Failures – Electrically Induced Failures – Chemically Induced Failures - Future trends - Thermal Management - Cooling Requirements for Microsystems - Thermal Management Fundamentals - Electronic Cooling Methods	
UNIT III - SINGLE CHIP AND MULTICHIP PACKAGING	**(9)**
Functions of Single Chip Packages, Types of Single Chip Packages, Fundamentals of Single Chip Packaging Materials, Processes, and Properties - Characteristics of Single Chip Packages Multichip Module Functionality - Multichip Module Advantages- Multichip Modules at the System Level - Types of Multichip Module Substrates –Multichip Module Design –Multichip Module Technology Comparisons	
UNIT IV - SYSTEM LEVEL PWB TECHNOLOGIES	**(9)**
System Level Printed Wiring Board - Types of Printed Wiring Boards -Anatomy of a Printed Wiring Board -Fundamentals of Printed Wiring Boards - CAD Tools for Printed Wiring Board Design-Printed Wiring Board Materials - Standard Printed Wiring Board Fabrication - Limitations in Standard Printed Wiring Board - Process - Microvia Boards - Fundamentals of board assembly - Surface Mount Technology-Through - Hole Assembly.	

UNIT V - PACKAGING MATERIALS AND PROCESSES	(9)
The Role of Materials in Microsystems Packaging - Packaging Materials and Properties - Materials Processes - Future Trends-Electrical Testing- Anatomy of System - Level Electrical Testing - Fundamentals of Electrical Tests - Interconnection Tests -Active Circuit Testing - Design for Testability- Life - Cycle Assessment	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. Rao R. Tummala, Fundamentals of Microsystems Packaging, The McGraw-Hill (2001)
REFERENCES:
1. The Electronic Packaging Handbook Ed. Blackwell, G.R.Boca Raton: CRC Press LLC, 2000

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												3	
3		3											3	
4			3		3									3
5									3	2		1		
CO (W.A)	3	3	3		3				3	2		1	3	3

VERTICAL 2: COMMUNICATION

22ECX11 - MOBILE COMMUNICATION				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To understand the mobile radio communication principles and the recent trends adopted in cellular systems and investigate different radio propagation models. • To explore the concept of Equalizers and Diversity techniques. • To analyze the different multiple access concepts in wireless communication and design the modern wireless networks.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the knowledge of communication techniques to understand the different cellular technology and solve problems.	Ap	30%
CO2	Analyze the given parameters for different propagation models of wireless networks.	An	30%
CO3	Analyze the architecture of software radio and develop architecture according to the needs.	An	20%
CO4	Compare the performance of Equalizers and diversity techniques and design components to adapt modern wireless networks.	An	20%
CO5	Perform in a team to prepare a report and make an effective oral presentation of the study on topics related to Networks protocols, contribution of cellular systems to the society and its effect on environment.	U	Internal Assessment

UNIT I - CELLULAR CONCEPT	**(9)**
Introduction to wireless communication systems - Modern wireless communication systems: 2G/3G/4G cellular networks - Cellular concept: Frequency reuse - channel assignment - hand off -interference & system capacity – trunking & grade of service - Coverage and capacity improvement - Basics of 5G technology: requirements.	
UNIT II - MOBILE RADIO PROPAGATION	**(9)**
Free space propagation model - Three basic propagation mechanisms: Reflection - Two-Ray model - Diffraction - Knife-edge diffraction model - Scattering - Log-normal shadowing - Okumara model - Hata model - Log-distance path loss model - Small-scale multipath propagation - Parameters of mobile multipath channels - Types of small scale fading - Rayleigh and Rician distributions.	
UNIT III - MULTIPLE ACCESS SCHEMES AND DIVERSITY	**(9)**
FDMA, TDMA, CDMA, SDMA and CSMA, OFDMA. Diversity Techniques – Frequency diversity, Time diversity, Code diversity, Antenna diversity –RAKE Receiver - SIMO, MISO, MIMO, MIMO-OFDM Technique.	

UNIT IV - CAPACITY OF WIRELESS CHANNELS	(9)
AWGN channel capacity – capacity of flat fading channels , Frequency- selective fading channels, Multiuser capacity, Downlink channel capacity, Uplink channel capacity, Outage capacity.	
UNIT V - MODERN WIRELESS NETWORKS	**(9)**
IEEE 802.11a/b/g/n/ac wireless local area networks - 60 GHz millimeter wave gigabit wireless networks - Vehicular wireless networks - Wireless protocols for Internet of Things including Bluetooth, BLE, 802.15.4, Zigbee, LoRA and SigFox.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rappaport S. Theodore, "Wireless Communications", Pearson Education, 2nd Edition, 2010.
2. Erik Dahlman, Stefan Parkvall and Johan Skold, "4G, LTE-Advanced Pro and The Road to 5G", Elsevier, 3rd Edition, 2016. Rao R. Tummala, Fundamentals of Microsystems Packaging, The McGraw-Hill (2001)

REFERENCES:

1. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications", McGraw-Hill International, 2nd Edition, 2009.
2. Martin Sauter, "From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell, 2016".
3. Erik Dahlman, Stefan Parkvall and Johan Skold, "5G NR: The Next Generation Wireless Access Technology", Elsevier, 1st Edition, 2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2		3											3	
3		3											3	3
4		3											2	3
5							2	2	2					1
CO (W.A)	**3**	**3**					**2**	**2**	**2**				**2.6**	**2**

22ECX12 - SATELLITE COMMUNICATION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the orbital mechanics and orbital effects on communication system. • To recognize the satellite power design and earth station systems • To gain knowledge about different multiplexing techniques for satellite communication

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the fundamental concepts of satellite orbits to determine the orbital parameters of different satellite types	Ap	20%
CO2	Analyze the subsystems of uplink & downlink satellite communication systems and earth station systems	An	30%
CO3	Analyze the link design for signal to noise ratio calculations	An	20%
CO4	Design a satellite system that utilizes various multiplexing techniques	E	20%
CO5	Evaluate the contributions of satellite communication to sustainability for various applications	E	10%

UNIT I - SATELLITE ORBITS AND TRAJECTORIES	**(9)**
Orbital Mechanics: Orbit Equations, Kepler's Laws, Orbital Period, Orbit types - Look angle determination - Orbital effects on communication system performance - Satellite Launch.	
UNIT II - SATELLITE AND EARTH STATION SUBSYSTEMS	**(9)**
Satellite Subsystems: Power, Transponders, Antennas - AOCS, TTC&M - Control - Effects of earth - Perturbation, sun transit, moon transit - Satellite power design, Reliability - MTBF Basic Equations - System Noise and G/T ratio - Earth Station subsystems Uplink, Downlink and Design for a specified C/N ratio with GEO and LEO examples	
UNIT III - LINK DESIGN, MODULATION AND ERROR CONTROL	**(9)**
Single link design - Double link design aspects - PAM, Baseband processing - Digital Modulation for satellite links: BPSK, QPSK and QAM - TDM standards for satellite systems - Error control for satellite link: Requirements, ARQ, Concatenated Codes, Interleaving, Turbo codes.	
UNIT IV - MULTIPLE ACCESS FOR SATELLITE COMMUNICATIONS	**(9)**
FDM - FM-FDMA - TDMA - Structure and system design, Onboard Processing systems - DAMA and PAMA - CDMA system design and capacity	

UNIT V- APPLICATIONS	(9)
Remote sensing - Navigation - Scientific and military application - VSAT: Network architecture, Access Control protocols and techniques, VSAT Earth stations - Satellite Mobile Telephony - Global star - DBS/DTH Television - GPS - Weather satellites	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. T.Pratt, C. Bostian and J.Allnutt, "Satellite Communications", John Wiley and Sons, 3rd Edition, 2021.
2. Dennis Roddy, "Satellite Communications", Mc Graw Hill, 4th Edition, 2017

REFERENCES:

1. W.L.Pritchard, H G Suyderhoud and R A Nelson, "Satellite Communication System Engineering", 2nd Edition, PrenticeHall, 2013.
2. Tri. T. Ha, "Digital Satellite Communications", McGraw Hill, 2nd Edition, 2017.
3. Manojit Mithra ,"Satellite Communication", Prentice Hall,2005.
4. M. Richharia, "Satellite systems for Personal Applications", John Wiley, 2010

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	
4			3										2	
5			3		2		3							
CO (W.A)	3	3	3		2		3						2	

22ECX13 - OPTICAL COMMUNICATION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To learn and understand the basic concepts in optical fiber cable. • To gain knowledge on different losses in fiber optic cable. • To know about optical sources, coupling mechanisms, optical networks and optical measurement standards.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply field theory concepts in optical signal, optical sources and detectors.	Ap	30%
CO2	Apply the modal concepts in different mode fibers and determine the losses encountered in optical cable	Ap	30%
CO3	Use the optical equipments to measure the parameters in optical networks.	Ap	20%
CO4	Analyze analog and digital links using link design and rise time budget analysis for a given Optical Fiber communication link.	An	20%
CO5	Give an oral presentation of developments in Optical Fiber Communication with respect to standards, applications, challenges and impacts.	U	Internal Assessment

UNIT I - OPTICAL FIBERS - STRUCTURE	**(9)**
Evolution of Fiber Optic Systems , Elements of an Optical fiber Transmission link , Basic laws and definitions, Optical fiber modes and configurations , Mode theory of circular waveguides - Overview of modes, Key modal concepts , Linearly Polarized waves , Single Mode and Multi Mode Fibers, Graded Index Fiber Structure.	
UNIT II - ATTENUATION AND DISPERSION	**(9)**
Attenuation, Signal dispersion in fibers – Modal Delay, Group delay , Material dispersion , Wave Guide dispersion , Dispersion in single mode fibers, Polarization mode dispersion , RI profile and cut off wavelength, Dispersion Management, Dispersion Shifted Fibers.	
UNIT III - OPTICAL SOURCES	**(9)**
LED's - Surface and Edge emitters, Modulation of LED, LASER Diodes - Fabry-Perot Lasers , Distributed Feedback (DFB) Lasers , Modulation of LASER diodes , Power Launching and Coupling - Source to fiber power launching , Lensing Schemes for Coupling improvement , LED coupling to single mode fibers, Fiber connectors, Fiber splicers.	
UNIT IV - PHOTODETECTOR AND OPTICAL RECEIVER OPERATION	**(9)**
PIN Photo detector, Avalanche Photodiodes, Photodetector noise - Detector response time, Avalanche multiplication of Noise, Fundamental Receiver operation-Error sources, Front End Amplifiers, Digital Receiver Performance- Probability of error, Quantum limit, Point to point link systems considerations - Link Power budget, Rise time budget.	

UNIT V- OPTICAL NETWORKS AND PERFORMANCE MEASUREMENTS	(9)
Operational principles of WDM, EDFA, Solitons, Basic concepts of SONET/SDH, Performance Measurement- Measurement standards, Test Equipments, Power Measurements, Attenuation Measurements, Dispersion Measurements, OTDR.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communications", McGraw-Hill Education, 5th Edition, 2017.

REFERENCES:

1. John M. Senior, "Optical Fiber Communications", Pearson Education, 3rd Edition, 2014.
2. Govind P.Agrawal, "Fiber-optic Communication Systems", A John Wiley & Sons, 3rd Edition, 2015.
3. R.P.Khare, "Fiber Optics and Optoelectronics", Oxford University, 2004.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3	2												
3	3	2											3	
4		3											2	
5								3	2	3		2		
CO (W.A)	3	2.6						3	2	3		2	2.5	

22ECX14 - INFORMATION THEORY AND CODING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To enable the student to investigate different channel coding techniques in text, audio and video. • To make the students to analyze the different block coding techniques. • To make the students to investigate different convolutional codes.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	The Students will be able to apply the coding techniques and design a channel.	Ap	20%
CO2	The Students will be able to analyze and implement the different source coding techniques.	An	20%
CO3	The Students will be able to analyze and solve the different channel coding techniques.	An	20%
CO4	The students will be able to apply different block coding techniques and design.	Ap	20%
CO5	The students will be able to design the convolutional codes.	C	20%

UNIT I - INFORMATION THEORY	**(9)**
Information – Information rate - Entropy – Classification of codes – K-raft McMillan inequality –source coding theorem Shannon Fano coding - Huffman coding - Extended Huffman coding – joint and conditional entropies- Mutual Information Discrete memory less channels: BSC, BEC and channel capacity - Shannon limit.	
UNIT II - SOURCE CODING	**(9)**
Text: Adaptive Huffman coding, arithmetic coding and latex format - Audio: Perceptual coding, masking techniques, psychoacoustic model, MPEG audio layers - I,II & III - Dolby AC3 – Image and video formats: GIF, TI F, BMP, PNG , SIF, CIF & QCIF – Image compression: JPEG – Video compression: Principles-I,B,P frame s and motion estimation.	
UNIT III - CHANNEL CODING	**(9)**
Characteristics of speech signals - Quantization techniques – Channel vocoder - Linear predictive coding – Information capacity theorem – Implication of the information capacity theorem- Information capacity of colored noise channel – Rate distortion theory - Data compression.	
UNIT IV - BLOCK CODES	**(9)**
Hamming codes: Hamming weight, hamming distance, minimum distance decoding – Single parity Codes Repetition codes: Linear block codes, cyclic codes – Syndrome calculation, encoder and decoder - CRC	

UNIT V- CONVOLUTIONAL CODES	(9)
Convolutional codes – Code tree, trellis, state diagram - Encoding - Decoding: Sequential search and Viterbi algorithm - Principle of turbo coding – Other codes: RS code, Gola y code and Burst error correcting code.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. R. Bose, Information Theory, Coding and Cryptography, Tata McGraw Hill, New Delhi, Third Edition, 2016
1. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, Pearson Education Asia, Fourth Edition, 2009.

REFERENCES:

1. K.Sayood, Introduction to Data Compression, Elsevier, Netherlands, Fifth Edition, 2017.
2. S.Gravano, Introduction to Error Control Codes, Oxford University Press, England, First Edition, 2007.
3. Amitabha Bhattacharya, Digital Communications, Tata McGraw Hill, New Delhi, First Edition, 2013.
4. Theodore Rappaport, Wireless Communications - Principles and Practice, Pearson Education, Bengaluru, Second Edition, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	
4			3										3	
5									2	2	2	2	2	
CO (W.A)	3	3	3						2	2	2	2	2.2	

22ECX15 - RADAR COMMUNICATION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To enable the student to explore the concept RADAR transmitters and detectors. • To make the students to analyze the different antennas used for RADAR applications. • To make the students to learn and understand the different types of RADAR and Doppler concepts.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	The Students will be able to discuss and summarize the RADAR communication principles.	Ap	20%
CO2	The Students will be able to analyze the different probabilities and calculate the amount of noise and RADAR signals.	An	20%
CO3	The Students will be able to design RADAR receivers and transmitters for specified application.	An	20%
CO4	The students will be able to construct different antenna for various RADAR applications.	C	20%
CO5	The students will be able to design RADAR by applying the Doppler concepts.	C	20%

UNIT I - INTRODUCTION TO RADAR	**(9)**
Basics of RADAR, EM Waves & properties- applications of RADAR, RADAR frequencies- RADAR block diagram, RADAR Coordinates, Radar equation for hard targets and the SNR- RADAR cross section of targets, RADAR Resolution Elements, Pulse, CW and FMCW RADARS –configurations, transmitter power- pulse repetition frequency, Duty Ratio, Pulse Compression, Coding	
UNIT II - DETECTION OF SIGNALS IN NOISE AND RADAR WAVEFORMS	**(9)**
Probability density functions – probabilities of detection and false alarm-matched filter receiver-detection criteria – integration of radar pulses - constant-false alarm rate receivers - RADAR Waveforms, Pulse Compression, Ambiguity Diagram.	
UNIT III - RADAR TRANSMITTER AND RECEIVER	**(9)**
Introduction- Types of Transmitters - linear-beam power tubes- solid-state RF power sources- magnetron-Klystron, crossed-filed amplifier- RADAR receiver- receiver noise figure- super heterodyne receiver, Digital Receivers, duplexers and receiver protectors- RADAR displays-Human Machine Interface(HMI)	
UNIT IV - RADAR ANTENNA	**(9)**
Functions of RADAR antenna- antenna parameters- antenna radiation pattern and aperture illumination - reflector antennas- electronically steered phased array antennas- phase shifters – frequency - scan arrays-- architectures for phased arrays, radiators for phased arrays- mechanically steered planar array antennas- radiation pattern synthesis -effect of errors on radiation patterns - low side lobes antennas.	

UNIT V- MTI AND PULSE DOPPLER RADAR	(9)
Introduction to Doppler and MTI RADAR - delay –line cancellers- staggered pulse repetition frequencies- doppler filter banks- digital MTI processing - Moving target detector- limitations to MTI performance pulse Doppler radar- MTD, Tracking radar- mono pulse tracking- conical scan and sequential lobing- comparison of trackers. Tracking accuracy- low-angle tracking- Atmospheric & Weather RADARS: Precipitation RADAR, Doppler Weather RADAR, Polarimetric RADAR, Clear Air RADARS.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Merril I Skolnik , "Introduction to Radar Systems", Mc Graw-Hill, 2017.
2. Peebles P Z , "Radar Principles", Wiley, 2016.

REFERENCES:

1. Richard J Doviak , Dusan S Zrnic , "Doppler Radar and Weather Observations", Academic Press, 2014.
2. Bringi V N, Chandrasekar V , "Polarimetric Doppler Weather Radar", Cambridge University Press, 2012.
3. Richards M A, Scheer J A and Holm W A , "Principles of Modern Radar", Scitech Publishing, 2014.
4. Levanon N , "Radar Signals", Wiley-IEEE Press, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	
4			3										3	
5									2	2	2	2	2	
CO (W.A)	3	3	3						2	2	2	2	2.2	

22ECX16 - DIGITAL COMMUNICATION RECEIVERS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To provide knowledge on complete analysis of synchronization techniques. • To deliberate the performance of Pass band, base band and spread spectrum communication. • To learn and design the fading channels.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	The students will be able to describe Baseband data transmission and reception.	Ap	20%
CO2	The students will be able to analyze the performance of various Pass band data transmission, reception techniques.	An	20%
CO3	The Students will be able to compare the performance of synchronization algorithms .	An	40%
CO4	The students will be able to analyze the performance of synchronizers.	An	20%
CO5	The students will be able to design the receivers of fading channels.	U	Internal Assessment

UNIT I - BASEBAND COMMUNICATION	**(9)**
Baseband PAM, Clock Synchronizers - Error tracking and spectral line generating synchronizers, Squaring synchronizers, Mueller and Muller synchronizers.	
UNIT II - PASSBAND COMMUNICATION	**(9)**
Pass band Transmission, Receivers for PAM, Sufficient Statistics for Reception in Gaussian Noise, Optimum ML receivers - Synchronized detection, Digital matched filter.	
UNIT III - SYNCHRONIZATION ALGORITHMS	**(9)**
ML synchronization algorithms – Estimator Structures for Slowly Varying Synchronization Parameters, Non-Data Aided and Data Aided algorithms. Timing parameter and carrier phase estimation, Phasor Locked Loop.	
UNIT IV - PERFORMANCE ANALYSIS OF SYNCHRONIZERS	**(9)**
Tracking Performance of Carrier and Symbol Synchronizers, Feedback and feed forward synchronizers. Cycle slipping, Acquisition of carrier phase and symbol timing.	
UNIT V- RECEIVERS FOR FADING CHANNELS	**(9)**
Characterization of Fading channels, Detection and parameter synchronization on Fading channels, Receiver structures for fading channels – Outer and Inner receivers, parameter synchronization for flat fading and selective fading channels.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. H.Meyer, M. Moeneclaey, S. A. Fechtel , "Digital Communication Receivers", Wiley, 2015.
2. U.Mengali, A.N.D.Andrea , "Synchronization Techniques for Digital Receivers", Kluwer, 2014.

REFERENCES:

1. Proakis J G, Salehi M , "Digital communications", Tata McGraw Hill, New York, 2018.
2. Rohde U L, Whitaker J C, Zahnd H , "Communications Receivers", McGraw-Hill, 2017.
3. Bernard Sklar , "Digital Communications- Fundamentals and applications", Prentice Hall, 2017.
4. Lathi B P, "Modern Digital and Analog communication Systems", Oxford University Press, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	
4			3										3	
5									2	2	2	2	2	
CO (W.A)	3	3	3						2	2	2	2	2.2	

22ECX17 - SOFTWARE DEFINED RADIO				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To learn and understand the concept of the evolution and technology needs and investigate the essential functional components and architecture of Software Defined Radio. • To comprehend the concepts, architecture, components, radio procedure knowledge and design considerations of Cognitive Radio. • To explore the concepts of next generation wireless networks.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of analog and digital technologies to the systems required by a software-defined radio to function and the trade-offs and limitations encountered in the design of a software-defined radio system.	Ap	30%
CO2	Apply the cognitive radio design concepts to develop a cognitive radio environment.	Ap	30%
CO3	Analyze the architecture of software radio and develop architecture according to the needs.	An	20%
CO4	Design next generation wireless network with the application of spectrum management techniques	E	20%
CO5	Conduct experiments using simulation tools to demonstrate the implementation of Cognitive Radio.	U	Internal Assessment

UNIT I - SDR EVOLUTION	**(9)**
Definitions and potential benefits - software radio architecture evolution - foundations - technology tradeoffs and architecture implications - Antenna for Cognitive Radio.	
UNIT II - SDR ARCHITECTURE	**(9)**
Essential functions of the software radio - architecture goals - quantifying degrees of programmability - top level component topology - computational properties of functional components - interface topologies among plug and play modules – architecture partitions.	
UNIT III - INTRODUCTION TO COGNITIVE RADIOS	**(9)**
Marking radio self-aware - cognition cycle - organization of cognition tasks - structuring knowledge for cognition tasks – Enabling location and environment awareness in cognitive radios - concepts - architecture - design considerations.	
UNIT IV - COGNITIVE RADIO ARCHITECTURE	**(9)**
Primary Cognitive Radio functions - Behaviors - Components - A-Priori Knowledge taxonomy - observe - phase data structures - Radio procedure knowledge encapsulation - components of orient - plan - decide phases - act phase knowledge representation - design rules	

UNIT V - NEXT GENERATION (XG) WIRELESS NETWORKS	(9)
The XG Network architecture - spectrum sensing - spectrum management - spectrum mobility - spectrum sharing - upper- layer issues - cross-layer design.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Alexander M. Wyglinski, Maziar Nekovee, and Y. Thomas Hou, "Cognitive Radio Communications and Networks – Principles and Practice", Elsevier Inc., 2010.
2. Huseyin Arslan , "Cognitive Radio, Software Defined Radio and Adaptive wireless system, Springer, 1st Edition, 2007.

REFERENCES:

1. Bruce A Fette, "Cognitive Radio Technology", Academic Press, 2009.
2. E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, "Principles of Cognitive Radio", Cambridge University Press, 2013.
3. Kwang- Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, "Cognitive Radio Networks - From Theory to Practice", Springer Series: Analog Circuits and Signal Processing, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												3	
3		3											3	
4			3										2	
5					3			2	2				2	
CO (W.A)	**3**	**3**	**3**		**3**			**2**	**2**				**2.5**	

22ECX18 - 4G / 5G COMMUNICATION NETWORKS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To familiar with evolution of wireless networks and fundamentals of 5G networks. • To acquire knowledge on spectrum sharing, spectrum trading and the processes associated with 5G architecture. • To understand the security features in 5G networks.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of communication in finding the protocols and spectrum management.	Ap	30%
CO2	Apply the concepts of wireless networks in 5G through its architecture.	Ap	20%
CO3	Determine the specifications of 5G components.	Ap	30%
CO4	Analyze different network architecture, security features and threats in 5G networks.	An	20%
CO5	Perform in a team to prepare an effective oral presentation on topics related to 5G concepts, spectrum sharing and trading.	U	Internal Assessment

UNIT I - EVOLUTION OF WIRELESS NETWORKS	**(9)**
Networks evolution: 2G, 3G, 4G, evolution of radio access networks, need for 5G. 4G versus 5G, Next Generation core (NG-core), visualized Evolved Packet Core (vEPC).	
UNIT II - 5G CONCEPTS AND CHALLENGES	**(9)**
Fundamentals of 5G technologies, overview of 5G core network architecture, 5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.	
UNIT III - NETWORK ARCHITECTURE AND THE PROCESSES	**(9)**
5G architecture and core, network slicing, Multi Access Edge Computing (MEC), visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, edge computing. 5G protocols: 5G NAS, NGAP, GTP-U, IPSec and GRE.	
UNIT IV - DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES	**(9)**
Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.	
UNIT V- SECURITY IN 5G NETWORKS	**(9)**
Security features in 5G networks, network domain security, user domain security, flow based QoS framework, mitigating the threats in 5G.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. Stephen Rommer, "5G Core networks: Powering Digitalization", Academic Press,2019 2. Saro Velrajan, "An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases", First Edition, 2020.
REFERENCES:
1. Jyrki. T.J.Penttinen, "5G Simplified: ABCs of Advanced Mobile Communications", Copyrighted Material. 2. Wan Lee Anthony, "5G system Design: An end to end Perspective", Springer Publications, 2019.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													2
3	3													2
4	2	3												3
5								2	3	3		2		
CO (W.A)	**2.3**	**3**						**2**	**3**	**3**		**2**		**2.6**

VERTICAL 3: NETWORKS

22ECX21 - COMPUTER SYSTEMS AND HARDWARE				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To understand the concepts of computer hardware and motherboards. • To provide an adequate knowledge of processors and memory. • To accord basic knowledge in obtaining the features, working and installation concepts of various storage devices. • To learn the concepts of the type, features, specification, working of various input and output devices			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of effective troubleshooting and maintenance of hardware components.	Ap	20%
CO2	Analyzethe developmental stages and architectural details of CPUs and memory to solve related hardware issues.	An	30%
CO3	Apply the knowledge ofelaborate features, installation, and maintenance of input and output devices.	Ap	30%
CO4	Design assemble, and configure complete computer systems, ensuring proper installation of components, operating systems, and device drivers.	E	20%
CO5	Give a presentation on self-learning, collaborate in teamwork, and ethically assemble hardware systems to address complex technical challenges.	U	Internal Assessment

UNIT I - HARDWARE AND MOTHERBOARDS	**(9)**
Basic computer hardware structure - Hardware and software - Different type of computers- Features of computer systems: Features of desktop system, Features of server computer, Features of laptops, Features of tablets - Motherboards: Features, components, processor support, controller, BIOS -Trouble shooting and maintenance of motherboards.	
UNIT II - PROCESSING UNIT AND MEMORY	**(9)**
Processor features - Developmental stages of CPU - Towards multiple core processors - Processor architectural details -Processor specifications – Installing and uninstalling CPU – CPU overheating issues – Memory: Features, types, working, memory map, installing and uninstalling memory modules, troubleshooting and maintenance of memory.	
UNIT III -STORAGE DEVICES	**(9)**
Storage Devices, Hard Disks: Details, working, feature, installation, selection, specifications, partitioning and formatting, maintenance and troubleshooting – optical storage devices features, working of optical storage drives, installing optical drives, troubleshooting and maintenance.	

UNIT IV - INPUT AND OUTPUT DEVICES	(9)
LCD monitors: Installing, specification, maintenance and troubleshooting of LCD monitors – LED monitors and touchscreens – Keyboard: Types and features, interfaces, installing, maintenance and troubleshooting – Mouse: types, working, features, interfaces, maintenance and troubleshooting	
UNIT V - ASSEMBLING AND CONFIGURING COMPUTERS	**(9)**
Assembling and configuring: Caution and safety, Setting up the cabinet - Installing heat sink and cooling fan – Installing memory module - Mounting motherboard – Installing hard disk – Connecting motherboard - Connecting to front panel – Connecting mouse, keyboard and monitor – Switching on the computer – Configuring – BIOS Installing operating system – Installing device drivers –Installing add-on cards.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. K. L. James, "Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance", PHI Learning, Delhi, 1st edition, 2013.
2. B. Govindarajalu, "IBM PC and Clones – Hardware, Troubleshooting and Maintenance", Tata McGraw-Hill, NewDelhi, 1st edition, 2002..

REFERENCES:

1. Jean Andrews, "Guide to Hardware Managing, Maintaining and Troubleshooting", Cengage Learning (Course Technology), Noida, 9th Edition, 2016.
2. Craig Zacker and John Rourke, "PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, 1st edition2017.
3. Michael W. Graves, "A+ Guide to PC Hardware Maintenance and Repair", Cengage Learning, Noida, 1st edition, 2004.
4. Scott M. Mueller, "Upgrading and Repairing PCs", Que Publishing, Ahmedabad, 22nd Edition, 2015..

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3	3												2	
4			3										2	
5							2	1	2				2	
CO (W.A)	3	3	3				2	1	2				2	

22ECX22 - NETWORK INFORMATION SECURITY				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the different security model. • To study about risk management

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of network security to protect data.	Ap	20%
CO2	Analyze the threat factors in the network system	An	20%
CO3	Analyze the security technology in information theory	An	40%
CO4	Develop skills in securing communication protocols.	An	20%
CO5	Oral presentation on the application of network security	U	Internal Assessment

UNIT I - INTRODUCTION TO INFORMATION SECURITY	**(9)**
The History of Information Security- Critical Characteristics of Information - CNSS Security Model - Components of an Information System - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle.	
UNIT II - RISK MANAGEMENT	**(9)**
Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points- Recommended Practices in Controlling Risk.	
UNIT III - PLANNING FOR SECURITY	**(9)**
Introduction - Information Security Policy, Standards and Practices - The Information Security Blueprint: The ISO 27000 Series, NIST Security Models, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies.	
UNIT IV - SECURITY TECHNOLOGY	**(9)**
Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools - Biometric Access Controls.	
UNIT V - IMPLEMENTING INFORMATION SECURITY	**(9)**
Introduction - Information Security Project Management - Technical Aspects of Implementation - Nontechnical Aspects of Implementation - Information Systems Security Certification and Accreditation.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Seventh Edition, 2021 Reprint.

REFERENCES:

1. Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.(Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)
2. Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.
3. Micki Krause and Harold F.Tipton, "Information Security Management Handbook", Auerbach Publications, Sixth Edition,2008.
4. Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Second Edition, Pearson Education,2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											2	
3		2											2	
4			3											
5										2				
CO (W.A)	3	3	3							2			2	

22ECX23 - CRYPTOGRAPHY AND NETWORK SECURITY				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To learn and understand the concepts and mechanism of security services and attacks in computing and various Network and System Security methods. • To investigate Symmetric Cryptography, its types and Public Key Cryptography Algorithms. • To analyze the Message Authentication algorithms like HASH function and HMAC.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of mathematics to cryptography, examine the various system security schemes and apply in the design of communication networks.	Ap	30%
CO2	Analyze algorithms and techniques of Block and Stream ciphers to solve problems in simple substitution ciphers.	An	30%
CO3	Analyze the concepts of message integrity, digital signature and key management schemes to improve the security mechanism.	An	20%
CO4	Examine the various system security schemes and apply in the design of communication networks.	E	20%
CO5	Give oral presentation in teams on a case study of a real time security applied in network platforms.	U	Internal Assessment

UNIT I – SECURITY IN COMPUTING	**(9)**
Security services- Attacks- Mechanism- Points of Security Vulnerability - Methods of Defense- Controls, Effectiveness of Control- Introduction to Cryptography and Steganography- Plan of attack - Attack on Encryption – Standards: Standard Setting Organizations - IEC 62443, ISO 27001.	
UNIT II – SYMMETRIC CRYPTOGRAPHY	**(9)**
Encryption and Decryption- Substitution- Transposition- Traditional Block Cipher Structure- Data Encryption Standard- Advance Encryption Standard- Triple DES, Stream Ciphers, RC4 Ciphers.	
UNIT III – PUBLIC KEY CRYPTOGRAPHY	**(9)**
Introduction to Number Theory-Requirements of Public Key Cryptography - Rivest-Shamir-Adleman(RSA) algorithm - Key Management – Diffie - Hellman Key Exchange - Elliptic Curve Cryptography.	
UNIT IV – MESSAGE AUTHENTICATION	**(9)**
Hash functions –Secure Hash algorithm- Message Authentication Requirements, Functions - HMAC- Digital signatures.	

UNIT V – NETWORK AND SYSTEM SECURITY	(9)
Authentication applications - E-mail Security - IP security - Web security – Malicious Software - Intruders - Firewalls- Art cyber security- Defense in depth.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. William Stallings, "Cryptography & Network Security: Principles & Practices", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A Forouson, "Cryptography & Network Security", Tata McGraw Hill, New Delhi, 2010.
2. Charles P Pleeger, "Security in Computing", Prentice Hall, New Delhi, 2011.
3. Paul C Van Oorschot and Scott A Vanstone, "Handbook of Applied Cryptography", CRC Press.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3		3											3	
4			3										2	
5							2	2	2				2	
CO (W.A)	3	3	3				2	2	2				2.5	

22ECX24 - HIGH PERFORMANCE COMMUNICATION NETWORKS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the concept of networks and functionalities of high speed networks. • To study about different types protocols for real time operations, queuing disciplines and differentiated services • To explore connection-oriented services with reference to MPLS & VPN

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply networking concepts to configure, troubleshoot, and optimize network systems and protocols.	Ap	20%
CO2	Apply the principles and concepts of high speed networks in performance computing.	An	30%
CO3	Analyze various networking technologies, protocols, and services for their effectiveness in meeting specific network requirements.	An	30%
CO4	Ability to analyze the different levels of quality of service (QoS) to different applications.	E	20%
CO5	Perform as an individual or in team, prepare a report on connection-oriented services and give oral presentation.	U	Internal Assessment

UNIT I - NETWORK CONCEPTS	**(9)**
Introduction - Principles - Applications - Services: Network Types- Network architectures - Layered architecture: layered network - Limitations	
UNIT II - HIGH SPEED NETWORKS	**(9)**
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture,– ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11	
UNIT III - PROTOCOLS FOR QOS SUPPORT	**(9)**
RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture.	
UNIT IV - INTEGRATED AND DIFFERENTIATED SERVICES	**(9)**
services - Queuing discipline: Fair queuing, processor sharing, bit round fair queuing, generalized processor sharing, weighted fair queuing - Random early detection - Differentiated services.	
UNIT V- ADVANCED NETWORK CONCEPTS	**(9)**
VPN: Remote access, site-to-site, tunneling and point to point protocol - Security in VPN - MPLS: Operation, routing, tunneling and use of FEC, traffic engineering and MPLS based VPNs - Peer to peer connection.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOK:
1. Jean Warland, Pravin Varaiya, "High Performance Communication Networks", Morgan Kaufmann Publishers, San Francisco ,2nd edition, 2011.
REFERENCES:
1. Lenon Garcia Widjaja, "Communication Networks", Tata McGraw-Hill, New Delhi, 2nd edition, 2007. 2. Ranier Handel Manfred N Huber, Stefan Schroder, "ATM Networks - Concepts, Protocols Applications", Addison Wesley, New York, 3rd edition, 2006. 3. Irvan Pepelnjk, Jim Guichard& Jeff Apcar, "MPLS and VPN Architecture", Volume 1 and 2, Cisco Press, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3		3												3
4			3											2
5						2			2		2			
CO (W.A)	3	3	3			2			2		2			2.5

22ECX25 - WIRELESS ADHOC AND SENSOR NETWORKS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To understand the concept of networks • To study about different types sensor networks. • To study about sensor network security and tools.			

	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the challenges and considerations of various routing protocols to design routing protocols for ad hoc networks.	Ap	20%
CO2	Apply layer-wise attack concepts to propose solutions to counteract threats such as jamming and tampering.	Ap	30%
CO3	Analyze the energy consumption factors of sensor nodes and discuss strategies for energy optimization.	An	30%
CO4	Evaluate various routing and MAC protocols, security measures, and platform tools to make informed decisions based on network requirements.	E	20%
CO5	Develop solutions for real-world problems related to energy efficiency, security, and performance optimization in ad hoc and sensor networks and give oral presentation as an individual or in groups.	C	Internal Assessment

UNIT I - AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS	**(9)**
Elements of Ad hoc Wireless Networks, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV)–Ad hoc On–Demand Distance Vector Routing (AODV).	
UNIT II - SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES	**(9)**
Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture –,Transceiver Design Considerations, Optimization Goals and Figures of Merit.	
UNIT III - WSN NETWORKING CONCEPTS AND PROTOCOLS	**(9)**
MAC Protocols for Wireless Sensor Networks– S-MAC, The Mediation Device Protocol, PAMAS, Schedule based protocols –IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.	
UNIT IV - SENSOR NETWORK SECURITY	**(9)**
Network Security Requirements,-Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, -Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks	

UNIT V- SENSOR NETWORK PLATFORMS AND TOOLS	(9)
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, CONTIKIOS, Node-level Simulators -TOSSIM, Programming beyond individual nodes – State centric programming.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley publication, Jan 2006.

REFERENCES:

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", Computer Networks, Elsevier, 2002

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												3	
3		3											3	
4					3									3
5									3	2		1		
CO (W.A)	3	3			3				3	2		1	3	3

22ECX26 - AUTOMOTIVE ELECTRONICS AND NETWORKING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To apply fundamentals and innovative concept to optimize the automotive industry • To analyze the ignition system and enhance them with new techniques • To develop the electronic control for vehicle system • To evaluate the physical parameters of automobile system using advanced sensors • To design a advanced automotive communication network

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamentals and innovative concept to optimize the automotive industry	Ap	20%
CO2	Analyze the ignition system and enhance them with new techniques	An	20%
CO3	Develop the electronic control for vehicle system	C	20%
CO4	Evaluate the physical parameters of automobile system using advanced sensors	E	20%
CO5	Design a advanced automotive communication network	C	20%

UNIT I - FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS	**(9)**
Automobile systems: Engine and its control - Ignition systems - Steering systems - Control systems: proportion controller, Proportional Integral controller and Proportional Integral differential controller.	
UNIT II - AUTOMOTIVE SENSORS	**(9)**
Sensor basics & its Functions - Air mass flow sensor- Crankshaft angular position sensor - Throttle valve sensor - Eddy	
UNIT III - AUTOMOTIVE ACTUATORS	**(9)**
Fuel Injectors - Exhaust gas recirculation Actuator - Electronic Ignition sub-systems - Digital Engine control systems: Speed density method - Idle speed control method- EGR control - Distributor-less Ignition control	
UNIT IV - VEHICULAR ELECTRONICS ARCHITECTURE	**(9)**
Intelligent Power distribution module - Supplemental restraint systems - Body control module – Engine control modules - Automatic drive positioned control unit - Driver seat control module - Front air control unit and transmission control unit	
UNIT V- AUTOMOTIVE NETWORKING	**(9)**
Networking basics topologies - Addressing - Control mechanisms: Event control & Timer control - Network topologies for new generation vehicles - Bus systems: CAN Bus, High speed CAN, LIN bus, MOST bus, Bluetooth: Piconet and scatternet.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Konrad Reif, "Automotive Mechatronics Automotive Networking, Driving Stability Systems, Electronics",Vieweg-Teubner Verlag (2015).
2. Najamuz Zaman (auth.), "Automotive Electronics Design Fundamentals", Springer International Publishing (2015)

REFERENCES:

1. Robert Bosch GmbH, Bosch, "Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive", Springer Vieweg (2014)
2. William Ribbens, "Understanding Automotive Electronics, Fifth Edition-Newnes (1998).
3. W.H.Crouse, "Automobile Electrical Equipment", McGraw-Hill, 1996.
4. P.L.Kholi, "Automotive Electrical Equipment", Tata McGraw-Hill, 1995.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			2										3	2
4				3									3	2
5				3									3	
CO (W.A)	3	3	2	3									3	2

22ECX27 - NEURAL NETWORKS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand artificial neural model and architecture of neural networks • To study about to develop learning algorithms of neural networks. • To learn about the application areas of neural networks.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply neural network concepts through analysis and implementation of neural network models	Ap	20%
CO2	Apply the steps needed to improve performance of the selected neural network.	Ap	20%
CO3	Analyze vector quantization and self organization feature maps.	An	20%
CO4	Design appropriate neural networks to specific application.	E	20%
CO5	Develop neural network models for complex real-world problems, considering societal impacts and ethics.	E	20%

UNIT I – ARCHITECTURE	**(9)**
Biological Neuron- Artificial Neural Model- Types of activation functions- Feedforward and Feedback- Convex Sets- Convex Hull and Linear Separability- Non-Linear Separable Problem- XOR Problem- Multilayer Networks- Convolutional Neural Networks- Backpropagation Neural Network	
UNIT II - SUPERVISED LEARNING	**(9)**
Perceptron learning and Non Separable sets- Least Mean Square Learning- MSE Error surface- Steepest Descent Search- JL-LMS approximate to gradient descent- Application of LMS to Noise Cancelling- Multi-layered Network Architecture	
UNIT III - SUPPORT VECTOR MACHINES	**(9)**
Statistical Learning Theory- Support Vector Machines- SVM application to Image Classification- Radial Basis Function Regularization theory- Generalized RBF Networks- Learning in RBFNs- RBF application to face recognition.	
UNIT IV - ATTRACTOR NEURAL NETWORKS	**(9)**
Associative Learning- Attractor Associative Memory- Linear Associative memory- Hopfield Network- application of Hopfield Network- Brain State in a Box neural Network- Simulated Annealing- Boltzmann Machine- Bidirectional Associative Memory.	
UNIT V- VECTOR QUANTIZATION	**(9)**
Maximal Eigenvector Filtering- Extracting Principal Components- Generalized Learning Laws- Vector Quantization- Self organization Feature Maps- Application of SOM- Growing Neural Gas	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. Satish Kumar, "Neural Networks A Classroom Approach", McGraw Hill Education Pvt. Ltd, 2nd Edition, 2017
REFERENCES:
1. J.M. Zurada," Introduction to Artificial Neural Systems", Jaico Publications, 1994. 2. B. Yegnanarayana, "Artificial Neural Networks", 2nd Edition, Pearson Education / PHI, 2004. 3. S. Sivanandam," Introduction to Artificial Neural Networks", 1st Edition, Sangam Ltd, 2003.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												2	
2	3												2	
3		3												
4			3										3	
5			3			2		2						
CO (W.A)	**3**	**3**	**3**			**2**		**2**					**2.3**	

22ECX28 - ARTIFICIAL INTELLIGENCE				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To understand the core concepts and historical evolution of AI, principles of logical reasoning, and methods for quantifying uncertainty using probability and Bayes' Rule. • To master informed and uninformed search techniques, applying them to solve various AI problems effectively. • To gain proficiency in classical planning methods, including state space search and planning graphs, for effective problem-solving in AI.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply AI fundamentals to real-world scenarios, demonstrating an understanding of its history, definitions, and key components.	Ap	20%
CO2	Analyze un-informed and informed search strategies to solve AI and constraint satisfaction problems, avoiding repeated states and searching with partial information.	An	30%
CO3	Design logical reasoning systems using knowledge-based agents and first-order logic to solve problems with incomplete or uncertain information.	An	30%
CO4	Formulate and solve planning problems using classical planning algorithms and graph-based methods.	Ap	20%
CO5	Engage in independent learning to stay updated with AI advancements and continuously improve problem-solving skills.	E	Internal Assessment

UNIT I - FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	**(9)**
Introduction–Definition – History of AI - Intelligence, Knowledge, and Human artifice -Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Searching for solutions -Un-informed search strategies –Avoiding repeated states -Searching with partial information.	
UNIT II - INFORMED SEARCHING TECHNIQUES	**(9)**
Informed search and search strategies -Heuristic function -Local search algorithms and optimistic problems –Constraint Satisfaction Problems (CSP) -Backtracking search -Structure of problems.	
UNIT III - LOGICAL REASONING	**(9)**
Logical agents: Knowledge-based agents – The Wumpus world. Logic – Propositional logic: A very simple logic Propositional theorem proving. First order logic: Representation – Syntax and semantics of first order logic –Inference in first order logic: Propositional versus first order inference– Unification and lifting – Forward chaining – Backward chaining – Resolution.	

UNIT IV - PLANNING AND DECISION MAKING	(9)
Classical Planning: Definition – Algorithms for planning as state space search- Planning graphs –classical planning approaches. Making simple Decisions-Combining beliefs and desires under Uncertainty-Utility theory, Utility functions-Multi attribute utility functions-Decision networks- The value of information-Decision theoretic expert systems.	
UNIT V- LEARNING	**(9)**
Quantifying uncertainty: Acting under uncertainty - Probability basics – Bayes' Rule. Probabilistic reasoning: Representing knowledge in uncertain domain- The semantics of Bayesian networks. Forms of learning - Supervised learning - Learning decision trees.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, 'Artificial Intelligence –A Modern Approach', 3rd Edition, Pearson Education, 2016.
2. Deepak Khemani, 'Artificial Intelligence', Tata McGraw Hill Education, 2013

REFERENCES:

1. Kevin Night and Elaine Rich, Nair B., 'Artificial Intelligence (SIE)', 3rd Edition, McGraw Hill,2008.
2. Dan W. Patterson, 'Introduction to AI and ES', 3rd Edition, Pearson Education, 2007.
3. Peter Jackson, 'Introduction to Expert Systems', 3rd Edition, Pearson Education, 2007.
4. Nils J. Nilsson, 'Artificial Intelligence: A new Synthesis', Harcourt Asia Pvt. Ltd., 2000.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1										2	
2	3			3	2									2
3		3	3		2								2	2
4	3		3								1		1	
5									2		3		1	
CO (W.A)	3	2.5	2.3	3	2				2		2		1.5	2

VERTICAL 4: SIGNAL AND IMAGE PROCESSING

22ECX31 - DIGITAL IMAGE PROCESSING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To gain knowledge about different image processing techniques. • To understand use of various transforms for different types of images.			

	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply transform-domain representation of images using different transformation techniques.	Ap	20%
CO2	Analyze various techniques in image enhancement in spatial and frequency domain.	An	20%
CO3	Implement the compression techniques for images and videos.	Ap	40%
CO4	Design various segmentation algorithms and representation techniques.	C	20%
CO5	Apply the concepts of image processing in gray and color data	U	Internal Assessment

UNIT I - DIGITAL IMAGE FUNDAMENTALS	**(9)**
Elements of digital image processing systems - Elements of visual perception - Brightness-Contrast-Hue-Saturation-Mach band effect - Image sampling-Quantization-Basic relationship between pixels - Zooming and Shrinking of Digital Images - Color image fundamentals- RGB-HSI models.	
UNIT II - IMAGE TRANSFORMS	**(9)**
2D transforms-DFT-DCT-Discrete Sine, Walsh-Hadamard, Slant-Haar, KL transforms and SVD -properties of all transforms.	
UNIT III - IMAGE ENHANCEMENT AND RESTORATION	**(9)**
Spatial Domain enhancement: gray level transformations–histogram equalization-Image averaging-Spatial filtering: Smoothing, Sharpening filters- Frequency domain filters: Smoothing-Sharpening filters-Homomorphic filtering. Image Restoration: Degradation model-Unconstrained and Constrained restoration-Inverse filtering-Wiener filtering.	
UNIT IV - IMAGE COMPRESSION	**(9)**
Need for data compression-Error free compression-Variable length coding-Bit-Plane coding-Lossless and Lossy Predictive coding, JPEG and MPEG Compression Standards.	
UNIT V - IMAGE SEGMENTATION AND REPRESENTATION	**(9)**
Point- Line and edge detection- Thresholding – Region based segmentation: Region splitting and merging. Image representation: chain codes-polygonal approximations-signatures-boundary segments-skeletons	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, 4th Edition, 2018.
REFERENCES:
1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd., 3rd Edition, 2011. 2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., Second Edition, 2004. 3. William K Pratt, "Digital Image Processing", Willey India Pvt Ltd., Fourth Edition, 2010.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3												
2			2										2	
3			2										2	
4					3									
5							2							
CO (W.A)		**3**	**2**		**3**		**2**						**2**	

22ECX32 - SPEECH SIGNAL PROCESSING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the speech production mechanism and the various speech analysis techniques and speech models. • To acquire concepts of the speech compression techniques and linear predictive coding. • To study the speaker recognition and text to speech synthesis techniques.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply knowledge of speech production mechanisms to optimize speech processing.	Ap	20%
CO2	Apply speech compression techniques using various modulation methods.	Ap	20%
CO3	Analyze Hidden Markov Model using speech recognition techniques	An	20%
CO4	Analyze speaker recognition and text to speech synthesis systems.	An	30%
CO5	Design speech signal processing systems with consideration for environmental sustainability	E	10%

UNIT I - SPEECH SIGNAL CHARACTERISTICS & ANALYSIS	**(9)**
Speech production process - Speech sounds and features- - Phonetic representation of speech - Representing- speech in time and frequency domains - Short-Time Analysis of Speech - Short-Time Energy and Zero-Crossing Rate - Short-Time Fourier Transform(STFT) - Speech Spectrum- Cepstrum - Mel-Frequency Cepstrum Coefficients -Hearing and Auditory Perception	
UNIT II - SPEECH COMPRESSION	**(9)**
Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation -Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding(CELP)	
UNIT III - SPEECH RECOGNITION	**(9)**
LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM- subword unit model based on HMM- language models for large vocabulary speech recognition – Overall recognition system based on subword units - Context dependent subword units	
UNIT IV - SPEAKER RECOGNITION	**(9)**
Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures-Text dependent speaker verification-Text independent speaker verification techniques	

UNIT V- TEXT TO SPEECH SYNTHESIS	(9)
Text to speech synthesis(TTS)- Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody- Natural Language Processing	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. L. R. Rabiner and R. W. Schafer, "Introduction to Digital Speech Processing", Vol.1, Now publishers inc, 2007.
2. Ben Gold and Nelson Morgan "Speech and Audio signal processing : processing and perception of speech and music", John Wiley and sons 2011

REFERENCES:

1. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana, "Fundamentals of Speech Recognition", Pearson Education, 2009.
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
3. Donglos O shanhnessy, "Speech Communication: Human and Machine ", 2nd Ed. University press 2001.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	
3		3											2	
4		3			2								2	
5			2				3	2						
CO (W.A)	3	3	2		2		3	2					2	

22ECX33 - MULTIMEDIA COMPRESSION TECHNIQUES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To gain deep knowledge about various compression techniques. • To learn the representations, perceptions and applications of multimedia.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply different compression techniques for text files.	Ap	20%
CO2	Analyze the different audio compression coding and speech compression techniques.	An	20%
CO3	Implement the different compression approaches, coding and JPEG standards.	C	40%
CO4	Analyze the techniques used for video compressions.	An	20%
CO5	Apply the concepts of information theory, models and coding.	Ap	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Overview of Information theory-models and coding- rate distortion theory-scalar quantization-vector quantization structured vector quantizes.	
UNIT II - TEXT COMPRESSION	**(9)**
Compaction techniques - Static Huffman coding - Dynamic Huffman coding - Arithmetic coding - Lempel-Ziv coding - Lempel-Ziv Welsh coding.	
UNIT III-AUDIO AND SPEECH COMPRESSION	**(9)**
Audio compression techniques – frequency domain and filtering - Basic sub band coding - Application to speech coding - G.722 - Application of audio coding: MPEG audio - Silence compression – Speech compression techniques.	
UNIT IV -IMAGE COMPRESSION	**(9)**
Approaches to image compression - Predictive techniques - PCM, DPCM, JPEG, Quad tree DCT coding-EZW coding- SPIHT coding- JPEG 2000 standards.	
UNIT V- VIDEO COMPRESSION	**(9)**
Video signal representation - Video compression techniques - MPEG1, 2, 4 - Motion estimation - H.261, H.263, and H.264 - Overview of wavelet based compression- Real time compression.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. I Sayood Khaleed, "Introduction to Data Compression", Morgan Kauffman, 4th Edition, Morgan Kaufmann publishers2014. 2. Fred Halsall, James F. Kurose, "Multimedia communication - Applications, Networks, Protocols and standards", Pearson Education Limited, 2004
REFERENCES:
1. I David Solomon, "Data Compression the complete reference", Springer, 4th Edition, 2007. 2. Jerry D. Gibson, "Multimedia Communications: Directions and Innovations", Morgan Kaufmann, 2nd Edition, 2001.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			3										1	3
2					2									
3					2								1	
4				2										
5												2		
CO (W.A)			3	2	2							2	1	3

22ECX34 - DEEP LEARNING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To equip students with a comprehensive understanding of fundamental deep learning concepts, including backpropagation and optimization algorithms for training neural networks. • To enable students to apply regularization techniques and diverse hyperparameter tuning strategies to improve model performance. • To empower students to practically implement convolutional neural networks (CNN) and recurrent neural networks (RNN) in real-world applications related to speech and computer vision.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply machine learning concepts such as overfitting, underfitting, and hyper parameter tuning to improve learning algorithms.	Ap	20%
CO2	Analyze gradient-based learning techniques and deep learning fundamentals, including back propagation, regularization, and optimization algorithms.	An	30%
CO3	Design optimization strategies using advanced techniques like momentum-based gradient descent, stochastic gradient descent, and learning rate schedulers.	An	30%
CO4	Implement regularization methods to address challenges like vanishing and exploding gradients, and optimize neural network performance using techniques such as dropout and batch normalization.	Ap	20%
CO5	Explore advanced architectures like CNNs, RNNs, and Transformers, and apply them to vision and speech tasks.	E	Internal Assessment

UNIT I –INTRODUCTION TO MACHINE LEARNING	**(9)**
Machine learning Basics: Learning algorithms - Overfitting - Underfitting -digital camera and lightning, Hyper parameters Estimators - Validation - Maximum Likelihood estimation - Bayesian Statistics - Challenges in MachineLearning	
UNIT II - DEEP LEARNING FUNDAMENTALS	**(9)**
Gradient based learning - Hidden Units - Architectural design - Back - propagation for MLP - Regularization - Parameter Regularization - Data Augmentation - Dropout - Optimization algorithms - Adaptive learning rates.	
UNIT III - OPTIMIZATION	**(9)**
Introduction to Optimization – Convex Optimization - Drawback of Gradient Descent – Momentum based GD - Nesterov Accelerated GD – Stochastic GD- mini batch GD-learning rate schedulers.	

UNIT IV - REGULARIZATION	(9)
Vanishing and exploding gradients-Activation functions (tanh, relu ,leaky relu)-bias-variance tradeoff – L2-Regularization- Batch Normalization –Dropout- Initialization Strategies.	
UNIT V- ADVANCED ARCHITECTURES	**(9)**
CNN-Basic of Convolution – Cross entropy loss – Architectures: LeNet - AlexNet .Resnet, RNN: BPTT – LSTM - GRU–Transformers. Applications to vision and speech.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville , "Deep Learning", MIT Press, USA, 2016.
2. Adam Gibson, Josh Patterson , "Deep Learning A practitioner's approach", O'Reilly, USA, 2016

REFERENCES:

1. Yusuke Sugomori , "Deep Learning: Practical Neural Networks with Java", Packt Publisher, New York, 2016.
2. Jeff Heaton , "Artificial Intelligence for Humans: Deep Learning and Neural Networks", Lightning Source Inc, Tennessee, 2015

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				2						1		2	
2		3		3	2									2
3			3		2				2					2
4	3		3								1		2	
5											2	3		1
CO (W.A)	**3**	**3**	**3**	**3**	**2**				**2**		**1.3**	**3**	**2**	**1.6**

22ECC35 – COMPUTER VISION				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To equip students with fundamental concepts related to image formation and processing, as well as feature detection, matching, and detection. • To gain a comprehensive understanding of feature-based alignment, motion estimation, and 3D reconstruction principles, including various techniques and model-based reconstruction. • To become familiar with image-based rendering and recognition.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply image processing techniques like geometric transformations, photometric image formation, and digital camera operations to solve computer vision problems.	Ap	20%
CO2	Analyze feature detection, matching, and segmentation methods to identify significant image features.	An	30%
CO3	Design alignment and motion estimation systems using 2D/3D alignment, pose estimation, and optical flow to track motion in visual data.	An	30%
CO4	Implement 3D reconstruction techniques to recover 3D models from visual data.	Ap	20%
CO5	Engage in independent learning to stay updated with advancements in image-based rendering and recognition, improving computer vision systems.	E	Internal Assessment

UNIT I - IMAGE PROCESSING FOUNDATIONS	**(9)**
Computer Vision - Geometric primitives and transformations - Photometric image formation – Thedigital camera - Point operators - Linear filtering - Neighborhood operators - Pyramids and wavelets - Geometric transformations - Global optimization.	
UNIT II - FEATURE DETECTION, MATCHING AND SEGMENTATION	**(9)**
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shiftand mode finding - Normalized cuts - Graph cuts and energy-based methods.	
UNIT III - FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	**(9)**
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation- Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and123motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow – Layeredmotion.	
UNIT IV - 3D RECONSTRUCTION	**(9)**
Shape from X - Active rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps	

UNIT V- IMAGE-BASED RENDERING AND RECOGNITION	(9)
Interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes -Video-based rendering-Object detection - Face recognition - Instance recognition – Categoryrecognition - Context and scene understanding- Recognition databases and test sets.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1. D. L. Baggio et al., Mastering OpenCV with Practical Computer Vision Projectsǁ, Packt Publishing, 2012.
2. Simon J. D. Prince, —Computer Vision: Models, Learning, and Inferenceǁ, Cambridge University Press, 2012

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2						1		2	
2		3		3	2									2
3			3		2				2					2
4	3		3								1		2	
5											2	3		1
CO (W.A)	**3**	**3**	**3**	**3**	**2**				**2**		**1.3**	**3**	**2**	**1.6**

22ECX36 - MACHINE LEARNING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the Machine Learning Concepts. • To obtain knowledge about reinforcement learning techniques and its applications • To get awareness Graphical Model and Ensemble methods

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply appropriate techniques for classification and regression.	Ap	20%
CO2	Analyze basic concepts of Machine Learning	An	30%
CO3	Evaluate and analyze various learning algorithms for the graphical model.	An	30%
CO4	Design and implement various unsupervised models.	E	20%
CO5	Implement the developments of various machine learning algorithms in real time applications and prepare a report for the same.	E	Internal Assessment

UNIT I – INTRODUCTION TO MACHINE LEARNING	**(9)**
Introduction-Types of Machine Learning – Supervised and unsupervised Learning– theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve.	
UNIT II – SUPERVISED LEARNING	**(9)**
Linear regression- Bayesian regression- Regression with Basis functions- Logistic regression- Perceptrons- Large margin classification- Kernel methods- Support Vector Machines-hard SVM, soft SVM- Classification and Regression Trees, Radial Basis Functions.	
UNIT III - UNSUPERVISED LEARNING AND DIMENSIONALITY REDUCTION	**(9)**
Nearest neighbour models - K means - hierarchical clustering - Dimensionality reduction - principle component analysis - linear discriminant analysis- factor Analysis – Independent Component Analysis.	
UNIT IV - GRAPHICAL MODEL AND ENSEMBLE METHODS	**(9)**
Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution-Bayesian Belief Networks-Markov Random Fields- Hidden Markov Models -Boosting - Adaboost, Gradient Boosting; Bagging - Simple methods, Random Forest.	
UNIT V- REINFORCEMENT LEARNING	**(9)**
Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in Health care – applications in robot control.	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOK:
1. Ethem Alpaydin, 'Introduction to Machine Learning', 4th Edition, MIT Press, 2020.
REFERENCES:
1. Tom M Mitchell, 'Machine Learning', 1st Edition, McGraw Hill Education, 2017. 2. Peter Flach, 'Machine Learning: The art and science of algorithms that make sense of data', Cambridge University Press, 2012. 3. K. P. Murphy, 'Machine Learning: A probabilistic perspective', MIT Press, 2012.. 4. Christopher M. Bishop, Pattern Recognition and Machine Learning , Springer,2014. 5. Stephen Marsland, Machine Learning: An Algorithmic Perspective, 2nd Edition, 2014

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3		3											3	
4			3										3	
5			3					2		2				
CO (W.A)	**3**	**3**	**3**					**2**		**2**			**3**	

22ECX37 - SOFT COMPUTING				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To understand Artificial Neural Network & Fuzzy Logic models. • To obtain knowledge about Hybrid Soft Computing techniques and its applications. • To get awareness genetic algorithms.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply various soft computing frame works.	Ap	20%
CO2	Analyze various Neural Networks training algorithms.	An	30%
CO3	Develop systems using fuzzy logic.	E	30%
CO4	Evaluate and analyze various genetic algorithm and Hybrid Soft Computing techniques	E	20%
CO5	Give oral presentation as an individual or in groups in implementing the developments of various Computing algorithms.	U	Internal Assessment

UNIT I - ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC	**(9)**
Artificial neural network: Introduction, characteristics- learning methods - taxonomy - Evolution of neural networks- basic models- important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.	
UNIT II - NEURAL NETWORKS	**(9)**
McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network - unsupervised learning networks: Kohonen self organizing feature maps, LVQ - CP networks, ART network.	
UNIT III - FUZZY SYSTEMS	**(9)**
Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods- fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.	
UNIT IV - GENETIC ALGORITHM	**(9)**
Genetic algorithm and search space - general genetic algorithm - operators - Generational cycle - stopping condition - constraints- classification - genetic programming - multilevel optimization - real life problem- advances in GA	

UNIT V- HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS	(9)
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOK:

1. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
3. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" , Prentice Hall, 1997.
4. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
5. Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3										3	
4			3										3	
5						2			2			2	2	
CO (W.A)	3	3	3			2			2			2	2.6	

22ECX38 - PATTERN RECOGNITION				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To gain knowledge about pattern classification. • To understand use of supervised and unsupervised algorithm.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the clustering concepts in unsupervised learning and classification.	Ap	20%
CO2	Apply appropriate algorithms and techniques for analyzing structural patterns.	Ap	20%
CO3	Implement the concepts of pattern recognition and analyze the type of pattern given.	An	40%
CO4	Implement various feature extraction algorithms for different types of data.	C	20%
CO5	Explore advanced tools in pattern recognition through research projects, or case studies,	U	Internal Assessment

UNIT I – PATTERN CLASSIFIER	**(9)**
Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm -Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.	
UNIT II - UNSUPERVISED CLASSIFICATION	**(9)**
Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm - Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.	
UNIT III-STRUCTURAL PATTERN RECOGNITION	**(9)**
Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications	
UNIT IV - FEATURE EXTRACTION AND SELECTION	**(9)**
Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.	

UNIT V- NON-METRIC METHODS FOR PATTERN CLASSIFICATION AND APPLICATIONS	(9)
Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART), Applications: Face recognition - preprocessing, face detection algorithms, selection of representative patterns, classification algorithms.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2009.
2. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.

REFERENCES:

1. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. P.A Devijver and J. Kittler, "Pattern Recognition: A Statistical Approach", Prentice-Hall International, EnglewoodCliffs, NJ, 1980
3. K. Fukunaga, "Introduction to Statistical Pattern Recognition", 2nd Edition, Academic Press, New York, 1990.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2											1	
3			3										1	
4			3		3									
5									2					
CO (W.A)	2	2	3		3				2				1	

22ECX41 - CONTROL SYSTEMS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To understand the concepts of mathematical models, transfer functions, block diagram reduction techniques, and signal flow graphs. • To provide adequate knowledge of systems in the time domain. • To accord basic knowledge in obtaining the open loop and closed loop frequency responses of systems. • To learn the concepts of stability analysis in the time domain.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of the elements of control systems and their impact on system performance.	Ap	30%
CO2	Apply reduction techniques and, root locus method to simplify and analyze system stability	Ap	20%
CO3	Analyze the state equations, and interpret plot techniques for controllability and observability.	An	20%
CO4	Design controllers using various methods such as PID, lead-lag compensation, and state feedback.	E	20%
CO5	Give a presentation on a comprehensive understanding of control systems, incorporating recent technological advancements and practical applications	U	Internal Assessment

UNIT I - CONTROL SYSTEM MODELLING	**(9)**
Basic elements in control systems – Open and closed loop systems -Mathematical modelling of physical systems: Transfer function model of Mechanical and Electrical systems- Block diagram reduction techniques – Signal flow graphs.	
UNIT II - TIME RESPONSE ANALYSIS	**(9)**
Standard test signals - Type and order of systems -Time domain study of first and second order feedback control systems – Time domain specifications - Steady state errors - Error constants- Introduction to P, PI and PID Controllers.	
UNIT III - FREQUENCY RESPONSE ANALYSIS	**(9)**
Frequency response - Frequency domain specifications - Bode plot- Polar plot - Gain Margin - Phase Margin - Introduction to Compensators - Lead, Lag, and Lag- Lead Compensators.	
UNIT IV - STABILITY ANALYSIS	**(9)**
Concepts of stability - Location of roots on S-plane for stability - Necessary conditions for stability- Routh Hurwitz criterion-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.	

UNIT V- CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS	(9)
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to canonical state variable models-Solution of state equations-state transition matrix - Kalman test for Controllability and Observability.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

2. I.J. Nagrath& M. Gopal, "Control Systems Engineering", 6th Edition, New Age International Publishers, 2018.
2. M.Gopal, "Control Systems, Principles & Design", 4th Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. 1. Norman S.Nise, "Control Systems Engineering", 8th Edition, Wiley, 2019.
2. K.Ogata, "Modern Control Engineering", 5th Edition, Pearson Education India,2015
3. Benjamin.C. Kuo, FaridGolnaraghi, "Automatic Control Systems", 10th Edition, McGraw-Hill Education, 2017.
4. S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2	3													2
3		3											2	2
4			3										2	2
5							2	1	2					1
CO (W.A)	3	3	3				2	1	2				2	2

22ECX42 - VIRTUAL INSTRUMENTATION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To make students to gain knowledge on various traditional instrumentation and software for instrumentation. • To make the students to understand basic data acquisition systems. • To enable the student to acquire knowledge on IMAQ Vision. • To make the students to gain knowledge on real time control systems. • To motivate the students to acquire knowledge on Hardware & Operating systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply virtual instrumentation concepts using modular programming	Ap	20%
CO2	Apply A/D, D/A Converters with timers and counters for data acquisition system	Ap	20%
CO3	Apply PC hardware and operating system for virtual instrumentation	Ap	20%
CO4	Analyze the given images using different image processing tools	An	20%
CO5	Analyze the implementation methods for virtual instrumentation	An	20%

UNIT I - INTRODUCTION	**(9)**
Virtual Instrumentation- Comparison with Traditional Instrumentation - Definition and Flexibility - Architecture - software for Virtual Instrumentation - Modular Programming, Loop and Charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, String and File Input / Output.	
UNIT II - DATA ACQUISITION	**(9)**
A/D and D/A converters, Plug-in Analog Input / Output cards – Digital Input and Output Cards, Organization – Performing analog input and analog output – Scanning multiple analog channels – Issues involved in selection of Data acquisition cards – Data acquisition modules with serial communication – Design of digital voltmeter with transducer input –Timers and Counters	
UNIT III - IMAQ VISION	**(9)**
Vision basics- Image processing and analysis, particle analysis – Machine vision, Hardware modules, Building machine vision system - Image processing tools, Acquisition and implementation using NI- Driver software- Applications.	
UNIT IV - REAL TIME CONTROL	**(9)**
Designs using VI Software – ON/OFF controller – Proportional controller – Modeling and basic control of level and reactor processes – Case studies on development of HMI, SCADA in VI.	

UNIT V- HARWARE & OPERATING SYSTEM OVERVIEW	(9)
PC architecture, operating system requirements, PC based instrumentation, analog and digital interfaces-PXI and SCXI main frame - modular instruments-Real time I/O and compact RIO-Introduction to NI-ELVIS – Transducers – power, speed and timing considerations.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jovitha Jerome, "Virtual Instrumentation using LABVIEW", PHI Learning, New Delhi, 2010.
2. Gary W. Johnson and Richard Jennings, "LabVIEW Graphical Programming", 4th edition, McGraw-Hill Professional Publishing, 2011.

REFERENCES:

1. Barry Paton, "Sensor, transducers and Lab view", Prentice Hall of India 2000.
2. Buchanan, W. "Computer buses", CRC Press 2000.
3. Lisa K Wells, "Lab view for Everyone", Prentice Hall of India,1996.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													2
4		3												
5		3	1									-	2	
CO (W.A)	3	3	1	-	-	-	-	-	-	-	-	-	2	2

22ECX43 - WEARABLE DEVICES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To make students to gain knowledge on wearable systems and sensors. • To make students to signal processing and energy harvesting for wearable devices. • To enable the student to wireless health systems. • To make the students to Smart Textile. • To motivate the students to applications of wearable systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Develop skills in signal acquisition, processing, and analysis specific to wearable devices	Ap	20%
CO2	Apply the concept of reactive sensors employed for real life applications	Ap	20%
CO3	Design and implement wearable devices for health monitoring	Ap	20%
CO4	Analyze taxonomy of the wearable devices and its design constraints for measuring physical and biological signals.	An	20%
CO5	Analyze special purpose sensors and the need for developing smart sensors	An	20%

UNIT I - INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS	**(9)**
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Impedance plethysmography, Wearable ground reaction force sensor.	
UNIT II - SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES	**(9)**
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.	
UNIT III - WIRELESS HEALTH SYSTEMS	**(9)**
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.	
UNIT IV - SMART TEXTILE	**(9)**
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, And Conductive Inks. Case study- smart fabric for monitoring biological parameters - ECG, respiration.	

UNIT V- APPLICATIONS OF WEARABLE SYSTEMS	(9)
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
2. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013
3. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014
4. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES:

1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.
2. Guang-Zhong Yang, Body Sensor Networks, Springer, 2006
3. NPTEL Course "https://onlinecourses.nptel.ac.in/noc23_ee95/preview"

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													
3	3		1											2
4		3												
5		3											3	
CO (W.A)	**3**	**3**	**1**										**3**	**2**

22ECX44 - REAL TIME EMBEDDED SYSTEMS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : 22ECC13

Course Objective:	• To Learn the architecture and programming of ARM processor. • To familiar with the embedded computing platform design and analysis. • To exposed to the basic concepts of real time Operating system. • To Learn the system design techniques and networks for embedded systems. • To make the students to develop the real time solutions

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of functional blocks in embedded system architecture.	Ap	20%
CO2	Apply instruction set and Assembly Language Programming in ARM Processors.	Ap	20%
CO3	Apply the concepts of embedded systems and explain concepts of real time Operating system design.	Ap	30%
CO4	Analyze architecture of different ARM processor cores.	An	20%
CO5	Develop and debug applications on an RTOS platform	E	10%

UNIT I - ARCHITECTURE OF EMBEDDED SYSTEMS	**(9)**
Categories of Embedded Systems- Characteristics of Embedded system -Recent trends in Embedded Systems Hardware Architecture - Software Architecture - Communication software - Process of generation of executable image development / testing tools	
UNIT II - THE ARM RISC ARCHITECTURE	**(9)**
The Reduced Instruction Set Computer –Embedded System Design Process - The ARM programmers model - ARM Development Tools.-ARM organization and implementation: 3 stage and 5 stage pipeline ARM organization-ARM instruction execution- ARM processor cores: ARM7 TDMI- Comparison of ARM8 TDMI-ARM9 TDMI.	
UNIT III - ARM INSTRUCTION AND ASSEMBLY LANGUAGE PROGRAMMING	**(9)**
Exceptions-Conditional execution-Branch and branch with link and exchange - Software interrupt-Data processing Instructions - Single word and unsigned byte data transfer and half word and signed byte data transfer instructions Multiple Register transfer instructions – Swap instructions – The thumb instruction set - Thumb applications.	
UNIT IV - RTOS CONCEPTS	**(9)**
Architecture of the Kernel-task and task scheduler-Interrupt Service Routines-Semaphores-Mutex-Mailboxes- Message Queues - Event Registers – Pipes -Signals-Timers- Memory Management – Priority Inversion Problem.	

UNIT V- RTOS IMPLEMENTATION	(9)
Off the shelf operating system - embedded operating system - Real time operating system: VX works- Micro C/OS-11 hand held operating system : Palm OS- Symbian OS - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS -RTOS- Case study of an Embedded system for an Adaptive Cruise Control Systems in a Car- Case study of an Embedded Systems for a Smart Card.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Dr.K.V.K.K Prasad "Embedded Real-Time systems: concept, design & programming", Dream tech Reprint, 2010.
2. Steve furber "ARM system on Chip Architecture", Pearson 16th Edition 2013.

REFERENCES:

1. Rajkamal, "Embedded Systems Architecture Programming and Design", 2nd edition TMH, 2010.
2. Wayne Wolf, "Computers as Components – Principles of Embedded Computer System Design", Morgon Kaufmann Publisher, 2nd Edition 2006.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													3
4		3												
5									2			3	3	
CO (W.A)	3	3							2			3	3	3

22ECX45 - INTERNET OF THINGS & ITS APPLICATIONS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To study the fundamentals of IoT, M2M and IoT Design Methodology • To learn about different IoT components and network management protocols, interfacing of IoT using Arduino/ Raspberry Pi • To study about various IoT case studies and industrial applications

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply IoT components and networks based on fundamental principles, incorporating various IoT protocols and communication models to facilitate IoT technologies.	Ap	20%
CO2	Analyze the necessity of software-defined networking (SDN) and network function virtualization (NFV) in the design methodology of IoT.	An	30%
CO3	Analyze the network operator requirements, communication modules for IoT network management, and the integration of NETCONF sensors and actuators.	An	30%
CO4	Design an IoT system using Arduino or Raspberry Pi platforms, employing Python for programming.	E	20%
CO5	Collaborate in team-based learning environments, effectively communicate concepts, and adopt continuous learning to develop foundational IoT applications.	U	Internal Assessment

UNIT I - FUNDAMENTALS OF IoT	**(9)**
Introduction-Definition and Characteristics of IoT- Physical design- IoT Protocols-Logical design - IoT communication models, IoT Communication APIs- Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates	
UNIT II - M2M AND IoT DESIGN METHODOLOGY	**(9)**
IoT and M2M- difference between IoT and M2M - Software defined networks, network function virtualization– Needs IoT design methodology – SDN-NFV for IOT- software defined networking – Network function virtualization.	
UNIT III - IoT COMPONENTS AND NETWORKS	**(9)**
IoT System Management- Simple Network Management Protocol – Network operator requirement – NETCONF Sensors and actuators - Communication modules – Zigbee- Architecture – Zigbee and 802.15.4 – protocol layers – Introduction to RFIDs- Wi-Fi- Power sources.	

UNIT IV - BUILDING IoT WITH HARDWARE PLATFORMS	(9)
Logical Design using Phython – Data types & structures – control flow – functions- modules - Platform - Arduino/Raspberry Pi- Physical devices - Interfaces - Programming – Serial- SPI – I2C	
UNIT V- CASE STUDIES	**(9)**
Various Real time applications of IoT- Home automation-Automatic lighting-Home intrusion detection-Cities-Smart parking-Environment-Weather monitoring system- Agriculture- Smart irrigation	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
3. Rajkamal, "Internet of Things: Architecture, Design Principles And Applications", McGraw Hill Higher Education

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley Publications 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols",Wiley Publications 2nd edition, 2013.
3. Manoel Carlos Ramon, "Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for LinuxProgrammers", Apress, 2014.
4. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
5. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	2
4			3											
5									1	1		1	2	
CO (W.A)	3	3	3						1	1		1	2	2

22ECX46 - IOT WITH SINGLE BOARD COMPUTERS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To describe the concepts of IoT along with its applications and various sensors • To Identify different technologies used in IoT and communication Protocols, Build a prototype using Arduino Uno and Raspberry Pi • To Design an IoT application to interact with Django.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply IoT fundamentals by deploying various microcontrollers in conjunction with sensors and actuators	Ap	20%
CO2	Analyze different IoT protocols and technologies suitable for implementing diverse applications.	An	30%
CO3	Analyze the various Arduino prototypes that integrate with interfacing devices.	An	30%
CO4	Design IoT physical devices and endpoints using Linux on Raspberry Pi, incorporating interfacing devices.	E	20%
CO5	Participate in team learning, effectively communicate, and commit to lifelong learning to develop basic Embedded Applications with Raspberry Pi and Arduino.	U	Internal Assessment

UNIT I - INTRODUCTION TO IOT	**(9)**
Microprocessor, Microcontroller, Embedded System, Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT levels & Deployment Templates, IoT Applications. Sensors and Actuators- Introduction, Sensor, Types of Sensors, Actuators, classification of Actuators	
UNIT II – IOT TECHNOLOGIES	**(9)**
Bluetooth, Bluetooth Low Energy (BLE), WiFi, LiFi, Cellular Networks, Z-Wave, ZigBee, LoRaWAN, 6LowPAN, LPWAN, RFID and NFC,WSN. COMMUNICATION PROTOCOLS: CoAP, MQTT, XMPP, HTTP	
UNIT III - IOT WITH ARDUINO	**(9)**
Introduction to the Arduino-Types of Arduino, Creating an Arduino program Using the Arduino IDE, Using Libraries, Working with Digital Interfaces, Interfacing with Analog devices, Adding Interrupts, Communicating with devices- sensors, DC Motor, Servo motor, LCD	
UNIT IV - IOT WITH RASPBERRY PI	**(9)**
IoT physical devices & endpoints: Architecture of Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi	

UNIT V- IOT PHYSICAL SERVERS & CLOUD OFFERINGS	(9)
Python Packages for IoT, WAMP - AutoBahn for IoT, Python Web Application Framework – Django, Amazon Web Services for IoT, SkyNet IoT messaging platform	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2016.
2. Richard Blum, "Arduino Programming in 24 Hours, Sams Teach Yourself", Pearson Education, 2017.
3. Jain, Prof. Satish, Singh, Shashi," Internet of Things and its Applications", 1st Edition, BPB, 2020.

REFERENCES:

1. 11.Donald Norris, "Internet of things do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black", 1st Edition, McGraw-Hill,2015.
2. Adeal Javed Lake Zurich, Illinois, "Building Arduino Projects for the Internet: Experiments with Real-World Applications", 1st Edition, USA, A press,2016.
3. Yashavant Kanetkar, Shrirang Korde, "21 IOT Experiments", 1st Edition, BPB Publications, 2018.
4. 4. Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta, Navjot Rathour, Mahendra Swain, Bhupendra Singh, "IoT based Projects Realization with Raspberry Pi, NodeMCU and Arduino", 1 st Edition, BPB Publications, 2020.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	2
4			3											
5									1	1		1	2	
CO (W.A)	3	3	3						1	1		1	2	2

22ECX47 - INDUSTRIAL IOT AND INDUSTRY 4.0				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart basic idea in Industry 4.0. and Cyber Physical System • To study about Big Data Analytics and Software Defined Networks, design and development of smart grid • To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various application

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the foundational principles of Industrial Internet of Things (IIoT) and Industry 4.0 across diverse applications.	Ap	20%
CO2	Apply Cyber Physical Systems (CPS) and advanced sensors to strengthen the security of Augmented Reality (AR) and Virtual Reality (VR) environments.	Ap	30%
CO3	Analyze the utilization of machine learning, data science, and fog computing in IoT networks, focusing on R programming and data management with Hadoop	An	30%
CO4	Design and develop industrial IoT applications for smart grids, addressing their associated challenges.	E	20%
CO5	Engage in team-based learning, proficiently communicate ideas, and embrace lifelong learning to cultivate fundamental IoT applications tailored for diverse sectors such as the food industry, healthcare, power plants and quality control.	U	Internal Assessment

UNIT I - INTRODUCTION TO INDUSTRY 4.0	**(9)**
Introduction to Industry 4.0 -Historical Context, General framework- Sensing & actuation- Globalization and Emerging Issues, The Fourth Revolution- LEAN Production Systems,-Smart and Connected Business Perspective- Application areas, Dissemination of Industry 4.0, Artificial intelligence, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0, Industry 5.0 Advances	
UNIT II - INDUSTRY 4.0 AND CYBER PHYSICAL SYSTEM	**(9)**
Introduction to Cyber Physical Systems (CPS) and Next Generation Sensors, Architecture of CPS-Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Collaborative Platform and Product Lifecycle Management- Augmented Reality and Virtual Reality	
UNIT III - BIG DATA ANALYTICS AND SOFTWARE DEFINED NETWORKS	**(9)**
Introduction to Big Data Analytics and Software Defined Networks, Artificial Intelligence, Big Data and Advanced Analysis ,Introduction- Machine Learning and Data Science, R Programming, Data Management with Hadoop. Data Center Networks, Security and Fog Computing: Cloud Computing in IIoT	

UNIT IV - SMART GRID	(9)
Smart grid definition - Smart Grid development, Smart grid solutions, Design challenges of smart grid and Industry 4.0	
UNIT V- Industrial IoT- Smart applications	**(9)**
Understanding smart appliances, Smart operation, Smart monitoring and maintenance, Factories and Assembly Line, Food Industry. Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Case study- Google's Self-Driving Car, Milk Processing and Packaging Industries	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jean-Claude André, "Industry 4.0", Wiley- ISTE, July 2019, ISBN: 781786304827, 2019.
2. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, "Handbook of Industry 4.0 and SMART Systems", Taylor and Francis,2020.
3. S. Misra, C. Roy, and A. Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", CRC Press.

REFERENCES:

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2. Pengwei Du and Ning Lu, —Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs ll, Academic Press, 2018, Reprint edition.
3. Hossam A. Gabbar, —Smart Energy Grid Engineeringll, Academic Press, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2	3												2	
3		3											2	2
4			3											
5									1	1		1	2	2
CO (W.A)	3	3	3						1	1		1	2	2

22ECX48 – AUTOMATION FOR ROBOTICS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To make the students to understand the concept of robotics. • To facilitate the students to study about technologies applicable for robotics. • To know about different sensing devices of robot. • To study the algorithms applicable for robotics. • To encourage the students to develop 4-axis and 6-axis robot.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of motion and potential functions to model and control robot movements.	Ap	20%
CO2	Apply mobile robot navigation techniques to real-world scenarios and applications.	Ap	30%
CO3	Implement vision systems for pattern detection and processing, and integrate these systems into robotic applications.	Ap	30%
CO4	Analyze and enhance images by implementing edge detection algorithms and digital filtering techniques.	An	20%
CO5	Develop 4-axis and 6-axis robot for Various Applications.	C	Internal Assessment

UNIT I - INTRODUCTION TO ROBOTICS	**(9)**
Motion - Potential function -Representing Position and Orientation - Cell decomposition sensor and sensor planning - Kinematics - types- Transformation matrix - Inverse kinematics - Geometric methods and algebraic methods - Varying Pose –Applications.	
UNIT II - COMPUTER VISION	**(9)**
Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - - Blob filling – Thresholding - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Mono and stereo vision - Face detection.	
UNIT III - MOBILE ROBOT VEHICLES	**(9)**
Introduction to various Mobile Robot Vehicles- Flying Robots - Navigation – Map-Based Planning - Dead Reckoning - Creating a Map - Rao-Blackwellized SLAM - Pose Graph SLAM - Carlo Localization – Applications.	
UNIT IV –TYPES OF ROBOTICS	**(9)**
Arm -Type Robots - Forward Kinematics -Inverse Kinematics - Jacobian Condition and Manipulability - Resolved-Rate Motion Control - Computing the Manipulator Jacobian Using Twists - Independent Joint Control - RigidBody Dynamics Compensation.	
UNIT V- INTEGRATION TO ROBOT	**(9)**
Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - Decision making.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence-A Modern Approach", Pearson Education Series in Artificial Intelligence, London, 3rd Edition, 2016.
2. Robert Schilling and Craig, "Fundamentals of Robotics, Analysis and control", PHI, New Delhi, 3rd Edition, 2015.
3. Kevin M. Lynch and Frank C. Park, "Modern Robotics: Mechanics, Planning, and Control", Cambridge University Press, 2017.

REFERENCES:

1. S K Saha, Introduction To Robotics, 2nd Ed., McGraw-Hill, 2014
2. Forsyth. and Ponce., "Computer Vision, A modern Approach", Pearson Education, London, 2nd Edition, 2011.
3. Mallot., "Computational Vision Information Processing in Perception and Visual Behavior", MIT Press, Cambridge, 2nd Edition, 2000.
4. Duda. Hart. and Stork., "Pattern Recognition", Wiley-Inter science, UK, 2nd Edition, 2000.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													
4		3											3	
5				3	2				1			1	1	
CO (W.A)	**3**	**3**		**3**	**2**				**1**			**1**	**2**	

22GEA02 - PRINCIPLES OF MANAGEMENT				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To provide with a foundational understanding of management concepts and practices. • To equip students with the knowledge and skills necessary to manage and lead organizations effectively, understanding both theoretical frameworks and practical applications in management. • To learn about various planning tools and decision-making processes crucial for organizational success. • To gain insights into human resource management functions. • To study effective communication strategies and the impact of information technology on communication and how effective control can lead to improved productivity and organizational performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key management theories and practices to real-world business scenarios, demonstrating the ability to implement management functions.	Ap	20%
CO2	Analyze human resource management practices, evaluating how recruitment, training, performance appraisal, and employee relations contribute to organizational success.	An	30%
CO3	Evaluate strategic decisions and their impacts on organizational performance, the effectiveness of communication strategies and the use of information technology in facilitating efficient and effective communication within organizations.	E	30%
CO4	Create comprehensive strategic plans and organizational policies and design control systems to ensure continuous improvement in productivity and organizational performance.	C	20%
CO5	Engage in independent study as a member of a team and develop higher-order thinking skills that are crucial for effective management and leadership in complex organizational settings with assignments or case studies.	U	Internal Assessment

UNIT I -INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**(9)**
Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers -managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization-Organization culture and Environment - Current trends and issues in Management.	
UNIT II -PLANNING	**(9)**
Nature and purpose of planning - planning process - types of planning - objectives - setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.	

UNIT III -ORGANISING	(9)
Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization -delegation of authority - centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management	
UNIT IV - DIRECTING	**(9)**
Foundations of individual and group behaviour - motivation -motivation theories - motivational techniques - job satisfaction - job enrichment - leadership - types and theories of leadership -communication - process of communication - barrier in communication - effective communication -communication and IT.	
UNIT V - CONTROLLING	**(9)**
System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance -direct and preventive control -reporting.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrichand Mark V. Cannice, "Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018

REFERENCES:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										3			
2		3									3			
3										3				
4			3							3				
5											3	3		
CO (W.A)	3	3	3							3	3	3		

22GEA03 - TOTAL QUALITY MANAGEMENT				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To recognize the importance of quality councils and strategic planning in TQM. • To explore the elements and historical development of TQM. • To foster employee involvement through motivation, empowerment, teamwork, and recognition. • To implement continuous process improvement methods like Juran's Trilogy, PDSA Cycle, 5S, and Kaizen. • To Conduct quality audits and understand the introduction to other ISO standards like ISO 14000, IATF 16949, TL 9000, IEC 17025, ISO 18000, ISO 20000, ISO 22000, and ISO 21001.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	30%
CO2	Apply continuous process improvement methodologies such as Juran's Trilogy, PDSA Cycle, 5S, and Kaizen.	Ap	20%
CO3	Apply various quality tools and techniques in both manufacturing and service industry.	Ap	20%
CO4	Develop strong supplier partnerships and understand supplier selection, rating, and relationship development.	An	20%
CO5	Choose appropriate quality standards and implement them in the respective industry Applications.	E	10%

UNIT I - QUALITY CONCEPTS AND PRINCIPLES	**(9)**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.	
UNIT II -TQM-PRINCIPLES AND STRATEGIES	**(9)**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.	
UNIT III - CONTROL CHARTS FOR PROCESS CONTROL	**(9)**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study- Introduction to Six Sigma.	

UNIT IV - TQM-MODERN TOOLS	(9)
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.	
UNIT V - QUALITY SYSTEMS	**(9)**
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOK:

1. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, UrdhwareshеHemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1. Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3. David Goetsch & Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8thEdition, Pearson, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													
4		3												
5	3													
CO (W.A)	3	3												

22GEA04 - PROFESSIONAL ETHICS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	30%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	30%
CO3	Analyze the importance of ethics in professional practice.	An	20%
CO4	Develop the ability to make informed and ethical decisions in engineering practice.	An	10%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	10%

UNIT I - INTRODUCTION TO PROFESSIONAL ETHICS	**(9)**
Definition and Importance of Ethics, Ethical Theories and Principles, Ethics vs. Morals vs. Values, Role of Ethics in Engineering.	
UNIT II - PROFESSIONAL RESPONSIBILITY AND CODES OF CONDUCT	**(9)**
Professional Responsibility and Accountability, Codes of Conduct in Engineering (e.g., IEEE, NSPE), Conflicts of Interest and Whistle blowing, Case Studies.	
UNIT III - ETHICAL DECISION-MAKING AND PROBLEM-SOLVING	**(9)**
Ethical Decision-Making Models, Tools and Frameworks for Ethical Analysis, Resolving Ethical Dilemmas, Case Studies	
UNIT IV - LEGAL AND REGULATORY ASPECTS	**(9)**
Legal Frameworks Governing Engineering Practice, Intellectual Property Rights, Health, Safety, and Environmental Regulations, Case Studies.	

UNIT V: SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	(9)
Social Responsibility of Engineers, Sustainable Engineering Practices, Impact of Engineering on Society and Environment,Case Studies.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins,"Engineering Ethics: Concepts and Cases", 6th edition, 2018.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 5thEdition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. SenthilKumar, "Professional Ethics and Human Values", Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3												
4		3												
5								3						
CO (W.A)	3	3						3						

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabus
for
M.E. – VLSI Design [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-2023) onwards)

AUGUST 2022

INSTITUTE VISION AND MISSION	
VISION	•To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	•To provide quality education to produce ethical and competent professionals with social Responsibility •To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. •To create a learner centric environment and improve continually to meet the changing global needs.

M.E. – VLSI DESIGN	
VISION	•To foster academic excellence imparting knowledge in Electronics, Communication and allied disciplines to meet the ever growing needs of the society.
MISSION	Post graduate programme in ME VLSI Design is committed: •To impart quality education and develop an aptitude for professional career and continuous learning with ethics and social responsibility. •To provide a framework for research and innovation to meet the emerging challenges through regular interaction with industry. •To be a learner centric environment by upgrading knowledge and skills to cater the needs and challenges of the society.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	Post graduate of VLSI Design programme will be **PEO1: Core Competency:** Successful in industry by applying knowledge of VLSI Design Techniques. **PEO2: Research, Innovation and Entrepreneurship:** Able to identify, design and provide innovative solutions to solve real world social problems through research. **PEO3: Ethics, Human values and Life-long learning:** Demonstrate soft skills, professional and ethical values for a successful career through lifelong learning.
PROGRAMME SPECIFIC OUTCOMES (PSO)	At the end of this program, the students will be able to •Apply a systematic approach to solve the problems in the field of VLSI Domain. •Design an ASIC and FPGA based system using modern Electronic Design Automation tools with knowledge, techniques and skills for the benefit of industry and society.

PROGRAM OUTCOMES:

At the end of a programme the students will be

a-f	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Research aptitude	PO1	An ability to Independently carry out research / investigation and development work to solve practical problems.
b	Technical documentation	PO2	An ability to write and present a substantial technical report/document
c	Technical competence	PO3	Able to demonstrate a degree of mastery over the areas of VLSI Systems, IC fabrication, design, testing, verification and prototype development focusing on applications.
d	Engineering Design	PO4	An ability to Identify and apply modern hardware & software tools related to create innovative products/ systems to solve real world problems in VLSI domain
e	The engineer and society	PO5	Apply technical knowledge towards the development of socially relevant products
f	Environment and sustainability	PO6	Apply appropriate managerial and technical skills in the domain of VLSI design incorporating safety and sustainability to become a successful Professional / entrepreneur through lifelong learning

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES					
	A	B	C	D	E	F
1	3	3	3	3	3	2
2	2	3	3	2	3	3
3	3	2	1	1	2	2

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OUTCOMES	PROGRAMME OUTCOMES					
	A	**B**	**C**	**D**	**E**	**F**
1	3	3	3	3	2	2
2	3	3	2	3	3	2

Contribution 1: Reasonable 2: Significant 3: Strong

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22VLA01	Graph Theory And Optimization Techniques	FC	NIL	4	3	1	0	4
2	22VLB01	Digital CMOS VLSI Design	PC	NIL	3	3	0	0	3
3	22VLB02	Semiconductor Devices and Modeling	PC	NIL	3	3	0	0	3
4	22VLA02	Digital System Design	FC	NIL	3	3	0	0	3
5	22VLB03	VLSI Signal Processing	PC	NIL	3	3	0	0	3
6	E1	Elective I	PE	Ref. PE	3	3	0	0	3
PRACTICAL									
7	22VLP01	VLSI Design Laboratory - I	PC	NIL	4	0	0	4	2
Mandatory Non Credit Courses									
8	A1	Audit Course	EEC	Ref. AC	2	2	0	0	0
				TOTAL	**25**	**20**	**1**	**4**	**21**

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22VLB04	Computer Aided Design for VLSI systems	PC	NIL	3	3	0	0	3
2	22VLB05	Analog VLSI Circuits	PC	22VLB02	3	3	0	0	3
3	22VLB06	Embedded System Design	PC	NIL	3	3	0	0	3
4	22VLB07	VLSI Testing	PC	NIL	3	3	0	0	3
5	E2	Elective II	PE / OE	Ref. PE/OE	3	3	0	0	3

6	E3	Elective III	PE	Ref. PE	3	3	0	0	3
PRACTICAL									
7	22VLP02	VLSI Design Laboratory - II	PC	22VLP01	4	0	0	4	2
8	22VLE01	Term Paper and Seminar	EEC		2	0	0	2	1
				TOTAL	**24**	**18**	**0**	**6**	**21**

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	E4	Elective IV	PE	Ref. PE	3	3	0	0	3
2	E5	Elective V	PE	Ref. PE	3	3	0	0	3
3	E6	Elective VI	PE	Ref. PE	3	3	0	0	3
PRACTICAL									
4	22VLE02	Project Work (Phase- I)	EEC	NIL	12	0	0	12	6
				TOTAL	**21**	**9**	**0**	**12**	**15**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22VLE03	Project Work (Phase- II)	EEC	22VLE02	24	0	0	24	12
				TOTAL	**24**	**0**	**0**	**24**	**12**

(A) FC,PC, PE,OE, and EEC Courses									
(a) Foundation Courses (FC)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22VLA01	Graph Theory And Optimization Techniques	**FC**	NIL	4	3	1	0	4
2.	22VLA02	Digital System Design	**FC**	NIL	3	3	0	0	3

(b) Professional Core (PC)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22VLB01	Digital CMOS VLSI Design	**PC**	NIL	3	3	0	0	3
2.	22VLB02	Semiconductor Devices and Modeling	**PC**	NIL	3	3	0	0	3
3.	22VLB03	VLSI Signal Processing	**PC**	NIL	3	3	0	0	3
4.	22VLB04	Computer Aided Design for VLSI systems	**PC**	NIL	3	3	0	0	3
5.	22VLB05	Analog VLSI Circuits	**PC**	22VLB02	3	3	0	0	3
6.	22VLB06	Embedded System Design	**PC**	NIL	3	3	0	0	3
7.	22VLB07	VLSI Testing	**PC**	NIL	3	3	0	0	3
8.	22VLP01	VLSI Design Laboratory - I	**PC**	NIL	4	0	0	4	2
9.	22VLP02	VLSI Design Laboratory - II	**PC**	22VLP01	4	0	0	4	2

(c)Professional Electives (PE)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22VLX01	Advanced Wireless Sensor Networks	**PE**	NIL	3	3	0	0	3
2.	22VLX02	ASIC Design	**PE**	NIL	3	3	0	0	3
3.	22VLX03	Design Of Analog Filters And Signal Conditioning Circuits	**PE**	NIL	3	3	0	0	3
4.	22VLX04	DSP with VLSI Structure	**PE**	NIL	3	3	0	0	3

5.	22VLX05	Electromagnetic Interference and Compatibility in Electronic System Design	**PE**	NIL	3	3	0	0	3
6.	22VLX06	Electronics Packaging	**PE**	NIL	3	3	0	0	3
7.	22VLX07	Genetic Algorithms for VLSI Design	**PE**	NIL	3	3	0	0	3
8.	22VLX08	Low Power VLSI Design	**PE**	22VLB01	3	3	0	0	3
9.	22VLX09	MEMS and NEMS	**PE**	NIL	3	3	0	0	3
10.	22VLX10	Nano Scale Devices	**PE**	NIL	3	3	0	0	3
11.	22VLX11	Networks On Chip	**PE**	NIL	3	3	0	0	3
12.	22VLX12	Physical Design of VLSI Circuits	**PE**	22VLB04	3	3	0	0	3
13.	22VLX13	Reconfigurable Architectures	**PE**	22VLX02	3	3	0	0	3
14.	22VLX14	RFIC Design	**PE**	NIL	3	3	0	0	3
15.	22VLX15	Power Management and Clock Distribution Circuits	**PE**	NIL	3	3	0	0	3
16.	22VLX16	System Verilog	**PE**	NIL	3	3	0	0	3
17.	22VLX17	System On Chip	**PE**	NIL	3	3	0	0	3
18.	22VLX18	VLSI for IOT Systems	**PE**	NIL	3	3	0	0	3
19.	22VLX19	Soft Computing and Optimization Techniques	**PE**	NIL	3	3	0	0	3
20.	22VLX20	Hardware and Software Co-Design for FPGA	**PE**	NIL	3	3	0	0	3
21.	22VLX21	VLSI for Wireless Communication	**PE**	NIL	3	3	0	0	3
22.	22VLX22	Signal Integrity for High Speed Design	**PE**	NIL	3	3	0	0	3
23.	22VLX23	Digital Image and Video Processing	**PE**	NIL	3	3	0	0	3

(d)Open Elective Courses (OE)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22BAZ01	Research Methodology and IPR	**OE**	NIL	3	3	0	0	3
2.	22CPZ01	Machine Vision	**OE**	NIL	3	3	0	0	3

(e)Employability Enhancement Courses (EEC)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	Ref. AC	Audit Course	**EEC**	NIL	2	2	0	0	0
2.	22VLE01	Term Paper and Seminar	**EEC**	NIL	2	0	0	2	1
3.	22VLE02	Project Work(Phase - I)	**EEC**	NIL	12	0	0	12	6
4.	22VLE03	Project Work (Phase - II)	**EEC**	22VLE02	24	0	0	24	12

(f) Audit Courses (AC)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22PGA01	English for Research Paper Writing	**EEC**	NIL	2	2	0	0	0
2.	22PGA02	Disaster Management	**EEC**	NIL	2	2	0	0	0
3.	22PGA03	Constitution of India	**EEC**	NIL	2	2	0	0	0

SUMMARY						
SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	FC	7	0	0	0	7
2	PC	11	14	0	0	25
3	PE	3	6	6	0	15
4	OE	0	0	3	0	3
5	EEC	0	1	6	12	19
TOTAL CREDITS		21	21	15	12	69

22VLB01 DIGITAL CMOS VLSI DESIGN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To enable the student to understand fabrication process of CMOS technology and its layout design rules.	**1.1**	The Students will be able to a Learn CMOS design rules and fabrication process.
2.0	To make students to understand the concepts of MOS transistors operations and their models	**2.1**	The Students will be able to aware about the trends in MOS transistor theory and its operation
3.0	To introduce the principles and design methodology in static and dynamic CMOS design.	**3.1**	The Students will be able to design Combinational circuits.
4.0	To introduce the principles and design methodology in sequential MOS logic circuits.	**4.1**	The Students will be able to design sequential circuits at the transistor level and compare the tradeoffs of sequencing elements including registers and latches.
5.0	To make the students to understand the concepts of arithmetic components and system level physical design	**5.1**	The Students will be examine the physical design process and analyze Adders, Multipliers and Shifters

UNIT I - FABRICATION TECHNOLOGIES	**(9)**
VLSI Manufacturing Process Steps - Crystal Growth - Wafer cleaning – Oxidation - Thermal Diffusion - Ion Implantation – Lithography –Epitaxy – Metallization -Dry and Wet etching and Packaging – P -Well process, N -Well process, twin -tub process	
UNIT II – MOS TRANSISTOR THEORY	**(9)**
NMOS and PMOS transistors, CMOS logic, MOS transistor theory –Introduction, Enhancement mode transistor action, Ideal I-V characteristics, DC transfer characteristics, Threshold voltage-Body effect-Design equations-Second order effects. Detailed MOS gate capacitance model – Stick Diagram -and Layout Diagram and Layout Design Rules.	
UNIT III - STATIC & DYNAMIC CMOS DESIGN	**(9)**
CMOS Static & Complementary logic-CMOS Transmission Gates-Pass Transistor Circuit-Synchronous Dynamic Circuit-Dynamic CMOS Circuit Techniques-High performance CMOS Circuits.	

UNIT IV - SEQUENTIAL MOS LOGIC CIRCUITS	(9)
Static latches and registers, dynamic latches and registers, timing issues, pipelines, clocking strategies, nonbistable sequential circuits.	
UNIT V - VLSI SYSTEM COMPONENTS AND SYSTEM LEVEL PHYSICAL DESIGN	**(9)**
Arithmetic circuits–Adders, Multipliers and Shifters - Physical design –Delay modeling, cross talk, floor planning, power distribution. Clock distribution. Basics of CMOS testing.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Neil H.E. "Weste and Kamran Eshraghian, Principles of CMOS VLSI Design", Pearson Education ASIA, 3rd edition, 2007.
2. Jan M. Rabaey, AnanthaChadrakasan, Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", PHI, 2nd Edition, 2016.
3. Sung-Mokang, Yusuf Leblebici, Chulwoo Kim "CMOS Digital Integrated Circuits Analysis and Design", McGraw Hill, 4th Edition, 2016.
4. S.M.Sze, "VLSI Technology", Mc.Graw.Hill 2nd Edition. 2002.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3		3	2	1		3	1
2	3	1	2	1	1		2	1
3	2	1	2	3	3	1	1	3
4	2	1	2	3	3	1	1	3
5	1	1	3	2	1	1	2	3
CO (W.A)	2	1	2	2	2	1	2	2

22VLB02 SEMICONDUCTOR DEVICES AND MODELING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To Learn the basics of MOS capacitors.	**1.1**	The students will be able to know about the basics of MOSFET Operation and Modeling.
2.0	To acquire sound knowledge in MOSFET Fabrication.	**2.1**	The students will be analyze the various characteristics of Small-signal Modeling.
3.0	To understand the concept of BSIM4 MOSFET.	**3.1**	The students will be understand the Gate Dielectric Model.
4.0	To study the concept of EKV model.	**4.1**	The students will be able to know about the characteristics of Non-quasi-static Modeling.
5.0	To study the concept of Quality Assurance of MOSFET.	**5.1**	The students will be applying the Device Mismatch for Analog/RF Applications.

UNIT I - MOSFET DEVICE	**(9)**
MOS Capacitor, Interface charge, Threshold Voltage, MOS Capacitance, MOS Charge Control Model, Basic MOSFET Operation and Modeling, Advanced MOSFET Modeling.	
UNIT II -MOSFET FABRICATION AND RF MODELING	**(9)**
Typical Planar Digital CMOS Process Flow, RF CMOS Technology, Equivalent Circuit Representation of MOS Transistors, High-frequency Behavior of MOS Transistors and AC Small-signal Modeling, Model Parameter Extraction, NQS Model for RF Applications.	
UNIT III-BSIM4 MOSFET MODEL	**(9)**
Gate Dielectric Model, Enhanced Models for Effective DC and AC Channel Length and Width, Threshold Voltage Model, Channel Charge Model, Mobility Model, Source/Drain Resistance Model, I–VModel, Gate Tunneling Current Model, Substrate Current Models, RF Model.	
UNIT IV - EKV MODEL	**(9)**
Model Features, Long-channel Drain Current Model, Modeling Second-order Effects of the Drain Current, SPICE Example: The Effect of Charge-sharing, Modeling of Charge Storage Effects, Non-quasi-static Modeling, he Noise Model, Temperature Effects, Version 3.0 of the EKV Model	

UNIT V-QUALITY ASSURANCE OF MOSFET MODELS	(9)
Effects and Modeling of Process Variation and Device Mismatch, Influence of Process Variation and Device Mismatch, Modeling of Device Mismatch for Analog/RF Applications, Motivation, Benchmark Circuits, Automation of the Tests	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Trond Ytterdal, Yuhua Cheng and Tor A. Fjeldly Wayne Wolf, "Device Modeling for Analog and RF CMOS Circuit Design", John Wiley & Sons Ltd, 2003.
2. A.B. Bhattacharyya "Compact MOSFET Models for VLSI Design", John Wiley & Sons Ltd, 2009.
3. Yuan Taur and Tak H.Ning, "Fundamentals of Modern VLSI Devices", Cambridge University Press, 3rd Edition 2012.
4. Behzad Razavi, "Fundamentals of Microelectronics" Wiley Student Edition, 3rd Edition,2021
5. Arora, N., "MOSFET Models for VLSI Circuit Simulation", Springer-Verlag, 1993

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2	3			3	2	3	2
2	3		2	2	3		3	2
3	2	3		3	2		3	2
4	2	3	2	3			3	2
5	2	2		2		3	3	2
CO (W.A)	2.2	2.75	2	2.5	2.66	2.5	3	2

22VLA02 DIGITAL SYSTEM DESIGN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make the students able to analysis and design of Synchronous sequential machines	**1.1**	The students will be able to analysis and design of Synchronous sequential machines
2.0	To make the students able to analysis and design of hazard free Asynchronous sequential machines	**2.1**	The students will be able to analysis and design of hazard free Asynchronous sequential machines.
3.0	To make the students able to classify the faults, fault detection and diagnosing	**3.1**	The students will be able to classify the faults, fault detection and diagnosing
4.0	To make the students able to classify and describe the PLD's and FPGA's	**4.1**	The students will be able to classify and describe the PLD's and FPGA's
5.0	To make the students able to write program using Verilog code to design a digital system.	**5.1**	The students will be to write program using Verilog code to design a digital system.

UNIT I - SEQUENTIAL CIRCUIT DESIGN	**(9)**
Analysis of clocked synchronous sequential circuits and modeling-State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuits- ASM chart and System design using ASM Realization by using Multiplexer & PLA.	
UNIT II - ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN	**(9)**
Analysis of asynchronous sequential circuit – flow table reduction – races - state assignment transition table and problems in transition table - design of asynchronous sequential circuit-Static, dynamic and essential hazards – data synchronizers – mixed operating mode asynchronous circuits – designing vending machine controller	
UNIT III- FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS	**(9)**
Fault table method - path sensitization method – Boolean difference method - D algorithm - Tolerance techniques – Fault in PLA –Test generation - DFT schemes – Built in self test	

UNIT IV - SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES	(9)
Programming logic device families–Designing a synchronous sequential circuit using PLA/PAL Altera MAX 7000 –FPGA –Xilinx FPGA-Xilinx 4000.	
UNIT V- SYSTEM DESIGN USING VERILOG	**(9)**
Verilog operators – Arrays – concurrent and sequential statements –Data flow – Behavioral – structural modeling – Test bench - Using Sub circuits - Realization of combinational and sequential circuits – Registers – counters – sequential machine – serial adder – Multiplier-Divider- Introduction To System Verilog.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Stephen Brown, Zvonko Vranesic, " Fundamentals of Digital Logic with Verilog Design" , 2nd Edition Tata McGraw Hill, 2007.
2. Donald D. Givone "Digital Principles and Design" Tata McGraw Hill, 2003.
3. Floyd, Floyd Thomas L." Digital Fundamentals "Pearson Education India, 2009.
4. J. Baskar "A System Verilog Primer" Star Galaxy Publishing, India, 2018.
5. Parag K.Lala "Fault Tolerant and Fault Testable Hardware Design" B S Publications, 2002.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3		3	3		2	3	
2	3		3	3		2	3	
3	3		3		1	3	3	
4	3		3	2	2	3	2	3
5	3		3	3	3	3	3	3
CO (W.A)	3	0	3	2.75	2	2.6	2.8	3

22VLB03 VLSI SIGNAL PROCESSING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make students to learn and understand the various VLSI architectures for digital signal processing.	**1.1**	The students will be able to implement the various DSP design using FPGA technology.
2.0	To make the students to understand the reduction of critical path architecture design.	**2.1**	The students will be able to design arithmetic operations using critical path reduction.
3.0	To make the students to understand the reduction of critical path architecture design.	**3.1**	The students will be able to design recursive IIR filters using Algorithmic strength reduction methods.
4.0	To make the students to design various filters required for particular application.	**4.1**	The students will be able to design FIR filters using Pipelined Digital techniques.
5.0	To motivate the students to study the performance parameters, viz. area, speed and power.	**5.1**	The students will be able study the performance parameters, viz. area, speed and power through Synchronous and asynchronous pipelining.

UNIT I - INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS	**(9)**
Introduction to DSP systems – typical DSP algorithms, data flow and dependence graphs – critical path, loop bound, iteration bound, longest path matrix algorithm, pipelining and parallel processing of FIR filters, pipelining and parallel processing for low power.	
UNIT II - RETIMING, ALGORITHMIC STRENGTH REDUCTION	**(9)**
Retiming – definitions and properties, unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even, Merge-Sort architecture, parallel rank-order filters.	
UNIT III - FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS	**(9)**
Computer arithmetic techniques for low power system – reducing power consumption in combinational logic, sequential logic, memories – low power clock – advanced techniques – special techniques, adiabatic techniques – physical design, floor planning, placement and routing.	

UNIT IV - BIT-LEVEL ARITHMETIC ARCHITECTURES	(9)
Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, design of lyon‟s bit-serial multipliers using Horner‟s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner‟s rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters	
UNIT V -NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS WAVE AND ASYNCHRONOUS PIPELINING	**(9)**
Numerical strength reduction – sub-expression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase clocking, two-phase clocking, wave pipelining. Asynchronous pipelining - Bundled Data versus Dual-Rail protocol.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Yashavant Kanetkar, “Let us C”, BPB publications, New Delhi, 3rd edition, 2019.
2. PradipDey, ManasGhosh, “Fundamentals of Computing and Programming in C”, 1st edition, Oxford University Press, 2018.
3. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, 2nd edition, Tata McGraw-Hill, 2017.
4. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, 4th Reprint, 2018.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	-	2	3	-	3	2
2	3	2	1	2	3	-	3	2
3	-	-	1	-	-	1	3	2
4	3	3	2	2	3	2	3	2
5	3	3	-	2	3	-	3	2
CO (W.A)	3	2.5	1.33	2	3	1.5	3	2

22VLP01 VLSI DESIGN LABORATORY- I				
	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make the students to design and simulate the digital system using HDL codes	**1.1**	The Students will be able to design simulate the digital system using HDL codes
2.0	To make the students to able to analysis the SPICE modeling of Logic gates	**2.1**	The Students will be able to able to analysis the SPICE modeling of Logic gates
3.0	To make the student to able to implement the digital systems in FPGA hardware	**3.1**	The Students will be able to implement the digital systems in FPGA hardware
4.0	To make the student to able to interface the sensor with FPGA hardware	**4.1**	The Students will be able to interface the sensor with FPGA hardware
5.0	To make the student to able to interface the motors and sign boards with FPGA hardware	**5.1**	The Students will able to able to interface the motors and sign boards with FPGA hardware

List of Experiments

1. Modeling of Sequential Digital system using Verilog VHDL.
2. Modeling of Sequential Digital system using System Verilog.
3. Design and Implementation of ALU unit using FPGA.
4. Modeling of CMOS and NMOS Inverter and Logic gates using Tanner.
5. Modeling and analysis of MOS capacitor
6. Interfacing of Proximity sensor with FPGA to detect an object
7. Implementation of Stepper Motor control using FPGA.
8. Implementation of Traffic light control using FPGA.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3		3	3		2	3	
2	3		3	3		2	3	
3	3		3		1	3	3	
4	3		3	2	2	3	2	3
5	3		3	3	3	3	3	3
CO (W.A)	3		3	2.75	2	2.6	2.8	3

22VLB04 COMPUTER AIDED DESIGN FOR VLSI SYSTEMS				
	L	T	P	C
	3	0	0	3
PRE REQUISITE : NIL				

Course Objectives		Course Outcomes	
1.0	To introduce the VLSI design methodologies and design methods.	**1.1**	The Students will be able to use various VLSI design methodologies
2.0	To introduce data structures and algorithms required for VLSI design.	**2.1**	The Students will be able to understand different data structures and algorithms required for VLSI design.
3.0	To study algorithms for partitioning and placement	**3.1**	The Students will be able to develop algorithms for partitioning and placement
4.0	To study algorithms for floor planning and routing.	**4.1**	The Students will be able to develop algorithms for floor planning and routing
5.0	To study algorithms for modeling, simulation and synthesis.	**5.1**	The Students will be able to design algorithms for modeling, simulation and synthesis.

UNIT I - INTRODUCTION	**(9)**
Introduction to VLSI Design Methodologies – VLSI Design Cycle – New Trends in VLSI Design Cycle – Physical Design Cycle – New Trends in Physical Design Cycle – Design Styles – Review of VLSI Design Automation Tools.	
UNIT II -DATA STRUCTURES AND BASIC ALGORITHMS	**(9)**
Introduction to Data Structures and Algorithms – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable Problems – General Purpose Methods for Combinatorial Optimization.	
UNIT III -ALGORITHMS FOR PARTITIONING AND PLACEMENT	**(9)**
Layout Compaction – Problem Formulation – Algorithms for Constraint Graph Compaction – Partitioning – Placement – Placement Algorithms.	
UNIT IV - ALGORITHMS FOR FLOORPLANNING AND ROUTING	**(9)**
Floor planning – Problem Formulation – Floor planning Algorithms – Routing – Area Routing – Global Routing – Detailed Routing.	

UNIT V -MODELLING, SIMULATION AND SYNTHESIS	(9)
Simulation – Gate Level Modeling and Simulation – Logic Synthesis and Verification – Binary Decision Diagrams – High Level Synthesis.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Sabih H. Gerez, "Algorithms for VLSI Design Automation", 2nd Edition, Wiley-India, 2017.
2. Naveed a. Sherwani, "Algorithms for VLSI Physical Design Automation", 3rd Edition, Springer, 2017.
3. Charles J. Alpert, Dinesh P. Mehta and Sachin S Sapatnekar, "Handbook of Algorithms for Physical Design Automation, CRC Press, 1st Edition.
4. N.a. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	-	2	3	-	3	2
2	3	2	1	2	3	-	3	2
3	-	-	1	-	-	1	3	2
4	3	3	2	2	3	2	3	2
5	3	3	-	2	3	-	3	2
CO (W.A)	3	2.5	1.33	2	3	1.5	3	2

22VLB05 ANALOG VLSI CIRCUITS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22VLB02 SEMICONDUCTOR DEVICES AND MODELING

Course Objectives		Course Outcomes	
1.0	To study the basis of various MOS devices modeling.	1.1	The Students can be able to design MOS single stage, multistage amplifiers.
2.0	To understand the single stage and multi stage amplifier	2.1	The Students will be able to develop design single stage and multi stage amplifier
3.0	To expose the students to acquire knowledge in design of single stage and multistage MOS amplifier	3.1	The Students will be able to analyze Stability of single stage & multistage amplifiers.
4.0	To analyze the current mirrors and reference circuits	4.1	The students will be able to analyze effect of transistor mismatch in analog design
5.0	To study about the characteristics of different design parameters in designing voltage reference and OPAMP circuits	5.1	The Students will be able to design parameters common mode and differential mode gain, frequency response of OPAMP

UNIT I - MOSFET METRICS	**(9)**
Simple long channel MOSFET theory – SPICE Models – Technology trend, Need for Analog design - Sub-micron transistor theory, Short channel effects, Narrow width effect, Drain induced barrier lowering, Sub-threshold conduction, Reliability, Small signal parameters, Unity Gain Frequency, Miller's approximation.	
UNIT II - SINGLE STAGE AND TWO STAGE AMPLIFIERS	**(9)**
Single Stage Amplifiers – Common source amplifier with resistive load, diode load, constant current load, Source degeneration Source follower, Input and output impedance, Common gate amplifier - Differential Amplifiers-differential and common mode response, Input swing, gain, diode load and constant current load-Basic Two Stage Amplifier Cut-off frequency.	
UNIT III - FREQUENCY RESPONSE OF SINGLE STAGE AND TWO STAGE AMPLIFIERS	**(9)**
Frequency Response of Single Stage Amplifiers – Noise in Single stage Amplifiers – Stability and Frequency Compensation in Single stage Amplifiers, Frequency Response of Two Stage Amplifiers – Noise in two stage Amplifiers – Stability, gain and phase margins, Frequency Compensation in two stage Amplifiers, Effect of loading in feedback networks	

UNIT IV - CURRENT MIRRORS AND REFERENCE CIRCUITS	(9)
Cascode, Negative feedback, Wilson, Regulated cascode, Bandgap voltage reference, Constant Gm biasing, supply and temperature independent reference, curvature compensation, trimming, Effect of transistor mismatch in analog design	
UNIT V - OP AMPS	**(9)**
Gilbert cell and applications, Basic two stage OPAMP, two-pole system response, common mode and differential gain, Frequency response of OPAMP, CMFB circuits, slew rate, power supply rejection ratio, random offset, systematic offset, OTA and OPAMP circuits - Low voltage OPAMP	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2000
2. Philip E.Allen, "CMOS Analog Circuit Design", Oxford University Press, 2013
3. Kenneth Martin Chan Carusone, David Johns ," Analog Integrated Circuit Design", Wiley Edition 2nd Edition, January 2013
4. Paul R.Gray, "Analysis and Design of Analog Integrated Circuits", Wiley Student edition, 5th edition, 2009.
5. R.Jacob Baker, "CMOS: Circuit Design, Layout , and Simulation", Wiley Student Edition, 2009

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	1			1	3	2
2	3	2			2		3	2
3	3		1	3		3	3	2
4		3	2	2		3	3	2
5			3	3			3	2
CO (W>A)	3	2.3	1.7	2.6	2	2.3	3	2

22VLB06 EMBEDDED SYSTEM DESIGN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the design challenges in embedded systems.	**1.1**	The student will be able to know about various design challenges in embedded system design process.
2.0	To program the Application Specific Instruction Set Processors.	**2.1**	The student will be able to understand and apply knowledge of embedded hardware development tools in system design
3.0	To understand the bus structures and protocols.	**3.1**	The student will be able to realize concepts about the networking principles and different protocols in embedded devices.
4.0	To model processes using a state – machine model.	**4.1**	The student will be able to apply state machine techniques and design process models.
5.0	To design a real time embedded system.	**5.1**	The student will be able to design suitable embedded systems for real world applications.

UNIT I - EMBEDDED SYSTEM OVERVIEW	**(9)**
Embedded System Overview, Design Challenges – Optimizing Design Metrics, Design Methodology, RT-Level Combinational and Sequential Components, Optimizing Custom Components, Optimizing Custom Single-Purpose Processors	
UNIT II - GENERAL AND SINGLE PURPOSE PROCESSOR	**(9)**
Basic Architecture, Pipelining, Superscalar and VLIW Architectures, Programmer's View, Development Environment, Application-Specific Instruction-Set Processors (ASIPS) Microcontrollers, Timers, Counters and Watchdog Timer, UART, LCD Controllers and Analog-to- Digital Converters, Memory Concepts	
UNIT III - BUS STRUCTURES	**(9)**
Basic Protocol Concepts, Microprocessor Interfacing – I/O Addressing, Port and Bus - based I/O, Arbitration, Serial Protocols, I2C, CAN and USB, Parallel Protocols – PCI and ARM bus, Wireless Protocols – IRDA, Bluetooth, IEEE 802.11.	

UNIT IV - STATE MACHINE AND CONCURRENT PROCESS MODELS	(9)
Basic State Machine Model, Finite-State Machine with Data path Model, Capturing State Machine in Sequential Programming Language, Program-State Machine Model, Concurrent Process Model, Communication among Processes, Synchronization among processes, RTOS – System design using RTOS	
UNIT V - SYSTEM DESIGN	**(9)**
Burglar alarm system-Design goals -Development strategy-Software development-Relevance to more complex designs- Need for emulation -Digital echo unit-Creating echo and reverb-Design requirements-Designing the codecs - The overall system design	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & Sons, 2009.
2. Steve Heath, "Embedded System Design", Elsevier, 2nd Edition, 2004.
3. Bruce Powel Douglas, "Real Time UML, Second Edition: Developing Efficient Objects for Embedded Systems", 3rd Edition 2004, Pearson Education.
4. Daniel W.Lewis, "Fundamentals of Embedded Software where C and Assembly Meet", Pearson Education, 2004.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	3	2	1	1	3	1
2	3	1	2	1	1	1	2	1
3	2	1	2	3	3	1	1	3
4	2	1	2	3	3	1	1	3
5	1	1	3	2	1	1	2	3
CO (W.A)	2	1	2	2	2	1	2	2

22VLB07 VLSI TESTING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To introduce the VLSI testing.	**1.1**	The student will be able to know about VLSI Testing Process
2.0	To introduce logic and fault simulation and testability measures.	**2.1**	The student will be able to develop Logic Simulation and Fault Simulation.
3.0	To study the test generation for combinational and sequential circuits.	**3.1**	The student will be able to develop Test for Combinational and Sequential Circuits.
4.0	To study the design for testability.	**4.1**	The student will be able to apply the design for Testability.
5.0	To study the fault diagnosis.	**5.1**	The student will be able to Perform Fault Diagnosis.

UNIT I - INTRODUCTION TO TESTING	**(9)**
Introduction – VLSI Testing Process and Test Equipment – Challenges in VLSI Testing – Test Economics and Product Quality – Fault Modeling – Relationship Among Fault Models.	
UNIT II - LOGIC & FAULT SIMULATION & TESTABILITY MEASURES	**(9)**
Simulation for Design Verification and Test Evaluation – Modeling Circuits for Simulation – Algorithms for True Value and Fault Simulation – Scoap Controllability and Observability	
UNIT III -TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS	**(9)**
.Algorithms and Representations – Redundancy Identification – Combinational ATPG Algorithms – Sequential ATPG Algorithms – Simulation Based ATPG – Genetic Algorithm Based ATPG	
UNIT IV - DESIGN FOR TESTABILITY	**(9)**
Design for Testability Basics – Testability Analysis - Scan Cell Designs – Scan Architecture – Built in Self-Test – Random Logic BIST – DFT for Other Test Objectives.	

UNIT V -FAULT DIAGNOSIS	(9)
Introduction and Basic Definitions – Fault Models for Diagnosis – Generation of Vectors for Diagnosis – Combinational Logic Diagnosis - Scan Chain Diagnosis – Logic BIST Diagnosis.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Laung-Terng Wang, Cheng-Wen Wu and Xiaoqing Wen, "VLSI Test Principles and Architectures", Elsevier, 2017
2. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits" , Kluwer Academic Publishers, 2017.
3. Niraj K. Jha and Sandeep Gupta, "Testing of Digital Systems", Cambridge University Press, 2017.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	1	3	2	1	1	3	1
2	3	1	2	1	1	1	2	1
3	2	1	2	3	3	1	1	3
4	2	1	2	3	3	1	1	3
5	1	1	3	2	1	1	2	3
CO (W.A)	2	1	2	2	2	1	2	2

22VLP02 VLSI DESIGN LABORATORY- II				
	L	T	P	C
	0	0	4	2

PRE REQUISITE : 22VLP01 VLSI DESIGN LABORATORY- I

Course Objectives		Course Outcomes	
1.0	To make the student to able to interface the Relay with FPGA hardware	1.1	The Students will able to able to interface the Relay with FPGA hardware
2.0	To make the student to able to interface the LCD display with FPGA hardware	2.1	The Students will able to able to interface the LCD display with FPGA hardware
3.0	To make the student to able to interface the buzzer with FPGA hardware	3.1	The Students will be able to interface the buzzer with FPGA hardware
4.0	To make the student to able to analysis the Layout model of logic gates	4.1	The Students will be able to analysis the Layout model of logic gates
5.0	To make the student to able to analysis the Layout model of latch circuit	5.1	The Students will able to able to analysis the Layout model of latch circuit

List of Experiments

1. Implementation of the Relay control system in FPGA.
2. Implementation of the LCD display interface using FPGA.
3. Implementation of Seven segment display interface using FPGA.
4. Implementation of the Buzzer control using FPGA.
5. Implementation of the DC motor control using FPGA.
6. Layout level design of CMOS Inverter & NAND Gate using T-SPICE.
7. Layout level design of D- Latch Gate T-SPICE.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3		2	3		2	3	
2	2		3	2		2	2	
3	2		2		1	3	2	1
4	2		3	2	2	3	2	2
5	2		2	2	3	3	2	2
CO (W.A)	2	0	2	2	2	2.4	2	2

22VLE02 - PROJECT PHASE I				
	L	T	P	C
	0	0	12	6

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature, the methodology to solve the identified problem and preparing project reports and to face reviews and viva-voce examination.	1.1	At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the phase II project work in a systematic way.

SYLLABUS:

- Student individually works on a specific topic approved by the head of the department under the guidance of a faculty member who is familiar in this area.
- The student can select any topic which is relevant to the area of VLSI Design. The topic may be executed through simulators or real time hardware.
- At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.
- The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL (P:180) : 180 PERIODS

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	3	3
CO(W.A)	3	3	3	3	3	3	3	3

22VLE03- PROJECT PHASE II				
	L	T	P	C
	0	0	24	12

PRE REQUISITE : 22VLE02

Course Objectives		Course Outcomes	
1.0	To solve the identified problem based on the formulated methodology.	1.1	On completion of the project work students will be in a position to take up any challenging practical problem in the field of Engineering design and find better solutions to it.

SYLLABUS:

- Student should continue the phase - I work on the selected topic as per the formulated methodology. At the end of the semester,
- After completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.
- The students will be evaluated based on the report submitted and the viva -voce examination by a panel of examiners including one external examiner.

TOTAL (P:360) : 360 PERIODS

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	3	3	3	3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3

22VLX02 ASIC DESIGN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To study about Logical Effort Technique for predicting Delay, Delay Minimization and FPGA Architectures.	**1.1**	The student will be able to apply Logical Effort Technique for predicting Delay, Delay Minimization and FPGA Architectures.
2.0	To familiarize the design the different types of cells.	**2.1**	The student will be able to Design Logic Cells and I/O Cells.
3.0	To learn the interconnect architecture for different types of FPGA and Programmable ASIC Design software.	**3.1**	The student will be able to analyze the various resources of recent FPGAs.
4.0	To gain knowledge about floor planning, placement and Routing algorithms for optimization of length and speed.	**4.1**	The student will be able to use algorithms for floor planning and placement of cells and to apply routing algorithms for optimization of length and speed.
5.0	To know about SoC Design and performance.	**5.1**	The student will be able to analyze SoC design and its Performance.

UNIT I - INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN	**(9)**
Types of ASICs - Design flow -CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.	
UNIT II - PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS	**(9)**
Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.	
UNIT III - PROGRAMMABLE ASIC ARCHITECTURE	**(9)**
Architecture and Configuration of ARTIX / Cyclone and KINTEX Ultra Scale / STRATIX FPGA – Micro-Blaze / NIOS Based Embedded Systems – Signal Probing Techniques.	

UNIT IV - LOGIC SYNTHESIS, PLACEMENT AND ROUTING	(9)
Logic Synthesis - Floor Planning Goals and Objectives, Measurement of Delay in Floor Planning, Floor Planning Tools, I/O and Power Planning, Clock Planning, Placement Algorithms. Routing: Global Routing, Detailed Routing, Special Routing.	
UNIT V - SYSTEM-ON-CHIP DESIGN	**(9)**
SoC Design Flow, Platform-Based and IP Based SoC Designs, Basic Concepts of Bus-Based Communication Architectures, High Performance Filters using Delta-Sigma Modulators. Case Studies: Digital Camera, SDRAM, High Speed Data standards.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. M.J.S.Smith, " Application - Specific Integrated Circuits", Pearson, 2003.
2. Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science.
3. Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, "FPGA-based Implementation of Signal Processing Systems", Wiley, 2008.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", Mc Graw Hill, 1994.
5. Douglas J. Smith, "HDL Chip Design", Madison, AL, USA: Doone Publications, 1996.
6. Jose E. France, Yannis Tsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
7. S.Pasricha and N.Dutt, "On-Chip Communication Architectures System on Chip Interconnect", Elsveir, 2008.

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	-	2	1	-	-	-	1
2	3	-	2	1	-	-	3	2
3	3	-	2	2	1	1	1	2
4	3	-	3	2	1	1	3	2
5	3	-	3	2	1	1	3	2
CO(W.A)	3	-	2.4	1.6	1	1	2.5	1.8

22VLX08 LOW POWER VLSI DESIGN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22VLB01 DIGITAL CMOS VLSI DESIGN

Course Objectives		Course Outcomes	
1.0	Identify sources of power in an IC.	**1.1**	The student will be able to ability to find the power dissipation of MOS circuits.
2.0	Identify the power reduction techniques based on technology independent and technology dependent methods.	**2.1**	The student will be able to design and analyze various MOS logic circuits.
3.0	Identify suitable techniques to reduce the power dissipation.	**3.1**	The student will be able to apply low power techniques for low power dissipation.
4.0	Estimate Power dissipation of various MOS logic circuits.	**4.1**	The student will be able to able to estimate the power dissipation of ICs.
5.0	Develop algorithms for low power dissipation.	**5.1**	The student will be able to ability to develop algorithm to reduce power dissipation by software.

UNIT I - POWER DISSIPATION IN CMOS	**(9)**
Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design.	
UNIT II - POWER OPTIMIZATION	**(9)**
Logic level power optimization – Circuit level low power design – Gate level low power design – Architecture level low power design – VLSI subsystem design of adders, multipliers, PLL, low power design.	
UNIT III - DESIGN OF LOW POWER CMOS CIRCUITS	**(9)**
Computer arithmetic techniques for low power system – reducing power consumption in combinational logic, sequential logic, memories – low power clock – Advanced techniques – Special techniques, Adiabatic techniques.	
UNIT IV - POWER ESTIMATION	**(9)**
Power Estimation techniques, circuit level, gate level, architecture level, behavioral level, – logic power estimation – Simulation power analysis –Probabilistic power analysis.	

UNIT V - SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER	(9)
Synthesis for low power – Behavioral level transform –Algorithms for low power – software design for low power.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Kaushik Roy and S.C.Prasad, "Low power CMOS VLSI circuit design", Wiley, 2000.
2. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999.
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995.
4. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.
5. Abdelatif Belaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995.
6. James B.Kulo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc. 2001.
7. J.Rabaey, "Low Power Design Essentials (Integrated Circuits and Systems)", Springer, 2009

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	-	2	2	-	-	-	1
2	2	-	2	1	-	-	1	2
3	3	-	2	2	1	-	2	1
4	3	-	2	2	1	1	3	3
5	3	-	3	2	2	1	2	3
CO (W.A)	3	-	2.4	1.6	1	1	2.5	2.4

22VLX12 PHYSICAL DESIGN OF VLSI CIRCUITS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22VLB04 COMPUTER AIDED DESIGN FOR VLSI SYSTEMS

Course Objectives		Course Outcomes	
1.0	To Learn the basics of Layout Rules.	**1.1**	The student will be able to know about the basics of Layout Methodologies.
2.0	To acquire sound knowledge in Top-Down Approach.	**2.1**	The student will be able to analyze the various characteristics of FPGA.
3.0	To understand the concept of Performance Issues in Circuit Layout.	**3.1**	The student will be able to understand the various Power Minimization techniques.
4.0	To study the concept of Single-Layer Routing and Applications.	**4.1**	The students will be able to know about the characteristics of Planar Subset Problem.
5.0	To study the concept of Cell Generation and Programmable Structures.	**5.1**	The student will be able to apply the CMOS Cell Layout Generation Techniques in various applications.

UNIT I – VLSI TECHNOLOGY	**(9)**
Layout Rules and Circuit Abstraction, Cell Generation, Programmable Logic Arrays, Transistor Chaining, Weinberger Arrays and Gate Matrices, Layout Environments, Layout Methodologies, Packaging, Computational Complexity, Algorithmic Paradigms.	
UNIT II - THE TOP-DOWN APPROACH	**(9)**
Partitioning, Floor planning, Placement, Fundamentals, Maze Running, Line Searching, Steiner Trees, Global Routing, Detailed Routing, Channel Routing, Switchbox Routing, Routing in Field-Programmable Gate Arrays, Array-based FPGAs, Row-based FPGAs.	
UNIT III- PERFORMANCE ISSUES IN CIRCUIT LAYOUT	**(9)**
Delay Models, Timing-Driven Placement, Timing-Driven Routing, Delay Minimization, Clock Skew Problem, Buffered Clock Trees, Via Minimization, Power Minimization, Discussion and Other Performance Issues, ID Compaction, 2D Compaction.	
UNIT IV - SINGLE-LAYER ROUTING AND APPLICATIONS	**(9)**
Planar Subset Problem(PSP), Single-Layer Global Routing, Single-Layer Detailed Routing, Wire-Length and Bend Minimization Techniques, Length Minimization, Bend Minimization, Over-the-Cell(OTC)Routing, Physical Model of OTC Routing, Basic Steps in OTC Routing, Multichip Modules (MCMs).	

UNIT V- CELL GENERATION AND PROGRAMMABLE STRUCTURES	(9)
Programmable Logic Arrays, Transistor Chaining, Weinberger Arrays and Gate Matrix Layout, Other CMOS Cell Layout Generation Techniques, CMOS Cell Layout Styles Considering Performance Issues.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Sarafzadeh, C.K. Wong, "An Introduction to VLSI Physical Design" , Mc Graw Hill International Edition 1995
2. Preas M. Lorenzatti, "Physical Design and Automation of VLSI systems" , The Benjamin Cummins Publishers, 1998.
3. H.Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002
4. N.A Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.
5. R .Drechsler, "Evolutionary Algorithms for VLSI CAD", Boston, Kluwer Academic Publishers, 2010.
6. D.Hill, D.Shugard, J.Fishburn and K.Keutzer, "Algorithms and Techniques for VLSI Layout Synthesis", Kluwer Academic Publishers, Boston, 1990.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2	3			3		3	2
2	3	2			2		3	2
3	2			3			3	2
4	2	3				3	3	2
5	3	2	2				3	2
CO (W.A)_	2.4	2.5	2	3	2.5	3	3	2

22VLX18 VLSI FOR IOT SYSTEMS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To Learn the introduction of IoT.	**1.1**	The student will be able to infer the components of IOT and integrate it to integrated circuits to design an electronic system.
2.0	To acquire sound knowledge in Types of sensors used in IoT.	**2.1**	The student will be able to analyze the performance of SoC based design by various advanced techniques.
3.0	To understand the concept of Application Processors.	**3.1**	The student will be able to apply System C for system design
4.0	To study the concept of FPGA.	**4.1**	The students will be able to know about the characteristics of Non-quasi-static Modeling.
5.0	To study the applications of IoT.	**5.1**	The student will be able to apply the static timing analysis for a SoC based design

UNIT I – INTRODUCTION of IoT	**(9)**
Concept of connected world - Need, Legacy systems for connected world-features and limitations, Key features of IoT architecture, Merits and Demerits of IoT technology. Applications driven by IoT technology	
UNIT II - COMPONENTS OF IoT	**(9)**
Basic building blocks of an IoT system - Artificial Intelligence, Connectivity. Sensors and Computing nodes. Sensors used in IoT systems characteristics and requirements. Types of sensors properties for IoT systems – compute nodes of IoT, Connectivity technologies in IoT	
UNIT III - IC TECHNOLOGY FOR IoT	**(9)**
SoC architecture for Iot Devices - Application Processors, Microcontrollers, Smart Analog, Memory architecture for IoT - Non Volatile Memories (NVM). Embedded Non-Volatile Memories – Low Dropout Regulator, DC-to-DC Converters, Voltage References, Power Management Units (PMUS) in IC's and Systems, Role of Field Programmability in IoT systems.	
UNIT IV - ELECTRONIC SYSTEM DESIGN FOR IoT	**(9)**
Electronic System Design for IoT - Requirements, Computing blocks in IoT systems - MCU's, DSPS and FPGA, System Power Supply Design for IoT systems, Component models & System Design - System Level Integration, Operating conditions of IoT devices and impact on Electronic System Design, Hardware Security issues, EMI/EMC, SI/PI and Reliability Analysis in IOT systems.	

UNIT V - APPLICATIONS of IoT	(9)
Automated Design of Reconfigurable Micro architectures for Accelerators Under Wide-Voltage Scaling - Approximate Adder Circuits Using Clocked CMOS Adiabatic Logic (CCAL) for IoT Applications -Battery Management Technique to Reduce Standby Energy Consumption in Ultra-Low Power IoT and Sensory Applications.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Alloto. "Enabling the Internet of Things- From Integrated Circuits to Integrated Systems", Springer Publications, 1st Edition, 2017.
2. Pieter Harpe, Kofi A. A Makinwa, Andrea Baschirotto, "Hybrid ADCs, Smart Sensors for the IoT, and Sub-1V & Advanced Node Analog Circuit Design". Springer International Publishing AG, 2017.
3. Rashid Khan, Kajari Ghosh dastidar, AjithVasudevan, "Learning Iot with Particle Photon and Electron". Packt Publishing Limited (Verlag), 2016.
4. Apekmulay, "Sustaining Moore's Law : Uncertainty Leading to a Certainty of IoT Revolution", Morgan and Claypool Publishers, 2015.
5. Jim Lipman sidense Corp, "NVM Memory : A Critival Design consideration for IoT Applications"- https://www.design-reuse.com/articles/32614/nvm-memory-iot-applications.html

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	2	3	3	-	3	2
2	3	2	1	2	3	-	3	1
3	2		2		1	1	2	2
4	2	3	2	2	3	2	3	2
5	3	2	-	1	2	-	3	2
CO(W.A)	2.6	2.3	1.8	2.0	2.4	1.5	2.8	1.8

22VLX20 HARDWARE AND SOFTWARE CO-DESIGN FOR FPGA				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To study and compare the co-design approaches for single processor and multiprocessor architectures.	**1.1**	The student will be able to describe The Broad Range of System Architectures and Design Methodologies that currently exist and define their fundamental attributes.
2.0	To know the various techniques of Hardware and software partitioning.	**2.1**	The student will be able to discuss the Dataflow Models as a State-of-the-Art Methodology to Solve Co-Design Problems and to Optimize the balance between Software and Hardware.
3.0	To acquire the knowledge about hardware and software co-synthesis.	**3.1**	The student will be able to understand in Translating between Software and Hardware Descriptions through Co-Design Methodologies.
4.0	To study the various proto type techniques and architectures.	**4.1**	The student will be able to understand the State-of-The-Art practices in developing Co-Design Solutions to problems using modern Hardware/Software Tools for building prototypes.
5.0	To learn and implement the design specific language.	**5.1**	The student will be able to understand the Concurrent Specification from an Algorithm, Analyze its behavior and partition the Specification into Software (C Code) and Hardware (HDL) Components

UNIT I - SYSTEM SPECIFICATION AND MODELLING	**(9)**
Embedded Systems, Hardware/Software Co-Design, Co - Design for System Specification and Modeling, Co – Design for Heterogeneous Implementation - Processor Synthesis, Single – Processor Architectures with one ASIC, Single Processor Architectures with many ASICs Processor Architectures, Comparison of Co-Design Approaches, Models of Computation, Requirements for Embedded System Specification	
UNIT II - HARDWARE/SOFTWARE PARTITIONING	**(9)**
The Hardware/Software Partitioning Problem, Hardware-Software Cost Estimation, Generation of the Partitioning Graph , Formulation of the HW/SW Partitioning Problem , Optimization , HW/SW Partitioning based on Heuristic Scheduling, HW/SW Partitioning based on Genetic Algorithms.	
UNIT III - HARDWARE/SOFTWARE CO-SYNTHESIS	**(9)**
The Co - Synthesis Problem, State - Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis	

UNIT IV - PROTOTYPING AND EMULATION	(9)
Introduction, Prototyping and Emulation Techniques, Prototyping and Emulation Environments ,Future Developments in Emulation and Prototyping, Target Architecture Specialization Techniques ,System Communication Infrastructure, Target Architectures and Application System Classes, Architectures for Control-Dominated Systems, Architectures for Data-Dominated Systems ,Mixed Systems and Less Specialized Systems	
UNIT V - DESIGN SPECIFICATION AND VERIFICATION	**(9)**
Concurrency, Coordinating Concurrent Computations, Interfacing Components, Verification, Languages for System Level Specification and Design System - Level Specification ,Design Representation for System Level Synthesis, System Level Specification Languages, Heterogeneous Specification and Multi-Language Co-simulation	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Ralf Niemann, "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Pub, 1998.
2. Jorgen Staunstrup, Wayne Wolf ,"Hardware/Software Co-Design: Principles and Practice" , Kluwer Academic Pub, 1997.
3. Giovanni De Micheli, Rolf Ernst Morgon," Reading in Hardware/Software Co-Design" Kaufmann Publishers, 2001.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	-	3	-	3	3	3	3
2	1	-	2	-	3	2	3	3
3	3	-	3	-	3	3	2	3
4	3	-	3	-	2	3	3	2
5	2	-	3	-	2	3	2	3
CO (W.A)	1.8	-	2.8	-	2.6	2.8	2.6	2.8

22VLX21 VLSI FOR WIRELESS COMMUNICATION				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make students to learn and design low noise amplifiers.	**1.1**	The student will be able to design components using low noise amplifiers.
2.0	To enable the student to understand various types of mixers.	**2.1**	The Students will be able to analyze characteristics of mixers for various operations.
3.0	To enable the student to understand the concept of PLL and Oscillators.	**3.1**	The Students will be able to design concept of PLL and various Oscillators.
4.0	To make the students to analyze data convertors and equalizers.	**4.1**	The students will be able to analyze the operation data convertors and equalizers.
5.0	To motivate the students to implement the project using VLSI architecture for Multitier Wireless System.	**5.1**	The student will be able to implement the project using VLSI architecture for Multitier Wireless System.

UNIT I - COMPONENTS AND DEVICES	**(9)**
Integrated inductors, resistors, MOSFET and BJT AMPLIFIER DESIGN Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers.	
UNIT II - MIXERS	**(9)**
Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer -Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer -Extrinsic Noise in Single Ended Sampling Mixer.	
UNIT III - FREQUENCY SYNTHESIZERS	**(9)**
Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).	

UNIT IV - UB SYSTEMS	(9)
Data converters in communications, adaptive Filters, equalizers and transceivers.	
UNIT V - IMPLEMENTATIONS	**(9)**
VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System.	
TOTAL (L:45) :45 PERIODS	

REFERENCES:

1. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002.
2. B.Razavi ,"RF Microelectronics" , Prentice-Hall ,1998.
3. homas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits", Cambridge University Press, 2003.
4. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design -Circuits and Systems", Kluwer Academic Publishers, 2000.
5. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 1999.
6. J. Crols and M. Steyaert, "CMOS Wireless Transceiver Design," Boston, Kluwer Academic Pub., 1997.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1			2			1	1	2
2				2		2	2	
3				2			2	2
4			2	2			1	1
5	1			2	1		2	3
CO (W.A)	1		2	2	1	1.5	1.6	2

22PGA01 ENGLISH FOR RESEARCH PAPER WRITING				
	L	T	P	C
	2	0	0	0

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make the students to improve writing skills and level of readability	**1.1**	The students will be able to improve writing skills and level of readability
2.0	To explain the strategic planning process and apply different presentation method	**2.1**	The students will be able to describe what to write in each section
3.0	To foster the ability to understand and to utilize the mechanics of writing	**3.1**	The students will be able to explain the skills needed for writing quality research paper
4.0	To Infer the skills needed when writing the Conclusion	**4.1**	The students will be able to explore the recent areas of research
5.0	To focus research and its key variables, guiding through research process	**5.1**	The students will be able to illustrate the good quality of paper at very first-time submission

UNIT I - INTRODUCTION	**(6)**
Planning and Preparation - Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	
UNIT II - PRESENTATION SKILLS	**(6)**
Clarifying Who Did What- Highlighting Findings - Hedging and Criticizing- Paraphrasing - Sections of a Paper – Abstracts - Introduction	
UNIT III- MECHANICS OF RESEARCH	**(6)**
Key skills needed for writing - Title, Abstract, Introduction, Discussion, Conclusion, The Final Check	
UNIT IV - PROCESS OF RESEARCH WRITING	**(6)**
Skills needed for writing Methods - skills needed when writing Results - skills needed when writing Discussion - skills needed when writing Conclusion.	
UNIT V- QUALITY RESEARCH PAPER	**(6)**
Useful phrases, Checking Plagiarism - Bibliography- Citation- how to ensure paper is as good as it could possibly be the first- time submission	
TOTAL (L:30) :30 PERIODS	

REFERENCES:

1. Adrian Wallwork , "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011
2. Day R., " How to Write and Publish a Scientific Paper", Cambridge University Press 2006
3. Goldbort R., " Writing for Science", Yale University Press (available on Google Books) 2006
4. Highman N., " Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book 1998.

22VLE01 TERM PAPER AND SEMINAR				
	L	T	P	C
	0	0	2	1

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To provide exposure to the students to refer, read and review the research articles in referred journals and conference proceedings.	1.1	The student will be able to write a technical report and to enhance their presentation skills.

METHODOLOGY	• Each student is allotted to a faculty of the department by the HOD. By mutual discussions, the faculty guide will assign a topic in the general / Subject area to the student. • The students have to refer the Journals and Conference proceedings can collect the published literature. • The student is expected to collect at least20 such Research Papers published in the last 5 years. • Using OHP/PowerPoint, the student has to make presentationfor15-20 minutes followed by10 minutes discussion. • The student has to make two presentations, one at the middle and other at the end of the semester. • The student has to write a technical Report for about 30-50 pages (Title page, one page Abstract, Review of Research paper under various subheadings, Concluding Remarks and List of References).The technical report hast o be submitted to the HOD one week before the final presentation ,after the approval of the faculty guide.

EXECUTION	Week	Activity
	I	Allotment of Faculty Guide by the HoD
	II	Finalizing the topic with the approval of Faculty Guide
	III-IV	Collection of Technical papers
	V-VI	Mid semester presentation
	VII-VIII	Report writing
	IX	Report submission
	X-XI	Final presentation

EVALUATION	**100% by Continuous Assessment 3 Hrs/week**	
	Component	Weightage
	Mid semester presentation	25%
	Final presentation (Internal)	25%
	End Semester Examination Report	30%
	Presentation	20%
	Total	100%

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi
for
B.E – Electrical and Electronics Engineering [R17]
[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

SEPTEMBER 2021

17EEX26-EMBEDDED SYSTEMS DESIGN					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To know the overview of embedded system and its challenging principles.	**1.1**	The students will be able to understand and Integrate new knowledge within the field.	a,b,c,d,e,f,g,h,k,l	
2.0	To learn various concepts of processor and its designing Principles.	**2.1**	The students will be able to design, execute and evaluate experiments on embedded Platforms	a,b,c,d,e,f,g,h,i,k,l	
3.0	To gain the basic knowledge about memories and their applications	**3.1**	The students will be able to learn the basic of memories and their applications	a,b,c,d,e,f,g,h,i,l	
4.0	To know about various interfacing techniques and various interfacing peripherals	**4.1**	The students will be able to use various interfacing techniques with numerous peripherals	a,b,c,d,e,f,g,h,i,k,l	
5.0	To acquire practical skills on embedded systems in various fields	**5.1**	The students will be able to gain practical knowledge on embedded systems	a,b,c,d,e,f,g,h,i,k,l	

UNIT I - INTRODUCTION	**(9)**
Embedded systems overview - Design challenges - Optimizing metrics - Processor technology - IC technology - Design technology- Automation- Synthesis - Verification: hardware,software co-simulation-trade-offs.	
UNIT II - PROCESSING ELEMENTS	**(9)**
Custom single purpose processor design - RT level custom single purpose processor design-Optimizing custom single purpose processors-General purpose processor's software: architecture, operation, programmer's view and development environment – ASIPs - selecting a microprocessor - General purpose processor design.	
UNIT III – MEMORIES	**(9)**
Introduction-Memory writes ability and storage Permanence-Common memory types-Composing memory-Memory hierarchy and caches-Advanced RAM.	
UNIT IV – INTERFACING	**(9)**
Introduction-Communication basics-Microprocessor interfacing: I/O addressing, interrupts,DMA-Arbitration Multilevel bus architectures-Advanced communication principles-Serial protocols-Parallel protocols-Wireless protocols-Standard single purpose processor's peripherals: Timers, PWM, LCD controllers, stepper motor controllers, RTC.	
UNIT V – APPLICATIONS	**(9)**
Digital camera-Washing machine-Cell phones-Home security systems-Finger print identifiers-Cruise control -Automated teller machine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:
1. Jonathan.W.Valvano, "Embedded Microcomputer systems: Real Time Interfacing", Cengage learning,3 rd ed. 2012.
REFERENCES:
1. Vahid and Tony Givargis, "Embedded system design: A unified hardware/Software Introduction" John Wiley & sons,3rd edition, 2010. 2. Daniel D. Gajski, Samar and Abdi, Andreas. Gerstlauer, "Embedded system design: Modeling, synthesis and verification", Springer, 2009.

17EEX27-EMBEDDED SYSTEM FOR AUTOMOTIVE APPLICATIONS					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To expose the students to the fundamentals and building of Electronic Engine Control systems	**1.1**	The students will be able to insight into the significance of the role of embedded system for automotive applications		a,b,c,d,e,f,g,h,i,j,k,l
2.0	To teach on functional components and circuits for vehicles	**2.1**	The students will be able to illustrate the need, selection of sensors and actuators and interfacing with ECU		a,b,c,d,e,f,g,h,i,j,k,l
3.0	To discuss on programmable controllers for vehicles management systems	**3.1**	The students will be able to develop the Embedded concepts for vehicle management and control systems		a,b,c,d,e,f,g,h,i,l
4.0	To teach logics of automation & commercial techniques for vehicle communication.	**4.1**	The students will be able to demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs		a,b,c,d,e,f,g,h,i,l
5.0	To introduce the embedded systems concepts for E-vehicle system development	**5.1**	The students will be able to improve Employability and Entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.		a,b,c,d,e,f,g,h,i,j,k,l

UNIT I -BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS	**(9)**
Overview of Automotive systems - Fuel economy-Air-fuel ratio-Emission limits and vehicle performance: Automotive microcontrollers- Electronic control Unit- Hardware & software selection and requirements for Automotive applications - Introduction to AUTOSAR - Introduction to Society SAE- Functional safety ISO 26262.	
UNIT II- SENSORS AND ACTUATORS FOR AUTOMOTIVES	**(9)**
Review of sensors- sensors interface to the ECU-Conventional sensors and actuators-Modern sensor and actuators - LIDAR sensor- Smart sensors- MEMS/NEMS sensors and actuators for automotive applications.	
UNIT III -VEHICLE MANAGEMENT SYSTEMS	**(9)**
Electronic Engine Control - Engine mapping-fuel control-Electronic ignition - Adaptive cruise control - Speed control-anti-locking braking system-Electronic suspension - Electronic steering, Automatic wiper control- Body control system - Vehicle system schematic for interfacing with EMS, ECU - Electrically assisted power steering system- Adaptive lighting system - Safety and Collision Avoidance.	
UNIT IV -ONBOARD DIAGONSTICS	**(9)**
On board diagnosis of vehicles - Vehicle communication protocols -Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 - Recent trends in vehicle communications-Navigation-Tracking Security for data communication- Dashboard display and Virtual Instrumentation - Role of IOT in Automotive systems.	
UNIT V- ELECTRIC VEHICLES	**(9)**
Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuel cells,Solar powered vehicles- Autonomous vehicles.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. William B. Ribbens,"Understanding Automotive Electronics", Elseiver,2017. 2. Automotive Electricals / Electronics System and Components, Tom Denton, 5 rd Edition, 2017. 3. A. Galip Ulsoy , Huei Peng , Melih Cakmakci ,"Automotive Control Systems: For Engine, Driveline, and Vehicle", March 30, 2012.
REFERENCES:
1. Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 5 th Edition, 2007. 2. Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection– Ford,2004 3. Jack Erjavec, JeffArias,"Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles",Cengage ,2012.

17EEX28- SIGNAL PROCESSING					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To impart basic knowledge about signals and systems	**1.1**	The student will be able to explain the various basic signals and systems parameters	a,b,c,d,f,g,j	
2.0	To develop in students the ability to analyze various types of Fourier transform techniques	**2.1**	The student will be able to describe the properties and realize the filter structures	a,b,c,d,f,g,j	
3.0	To make the students to understand the design of Infinite Impulse Response filters	**3.1**	The student will be able to design the IIR filters like butterworth and chebyshev approximations	a,b,c,d,f,g,j	
4.0	To make the students to understand the design of Finite Impulse Response filters	**4.1**	The student will be able to design FIR filters and window functions.	a,b,c,d,f,g,j	
5.0	To gain the knowledge about the digital signal processors	**5.1**	The student will be able to examine the functional blocks of digital signal processor and its internal features.	c,g,j	

UNIT I – INTRODUCTION TO SIGNALS AND SYSTEMS.	**(9)**
Energy and power signals- Continuous and discrete time signal-Continuous and discrete amplitude signals-System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability- Effects of sampling and quantization in discrete domain.	
UNIT II – DISCRETE FOURIER TRANSFORM	**(9)**
DTFT - frequency domain sampling-DFT :properties, frequency analysis, Radix-2 FFT algorithms, applications, Realization of filter structures: Direct forms I and II, cascade, parallel and lattice structures.	
UNIT III – DESIGN OF IIR FILTERS	**(9)**
Design techniques for analog low pass filter-Butterworth and Chebyshev approximations-frequency transformation, approximation of derivatives, Bilinear transformation and impulse invariant technique	
UNIT IV – DESIGN OF FIR FILTERS	**(9)**
FIR Filter Design: Phase and group delay, design characteristics of FIR filters with linear phase, frequency response-FIR filters using window functions: Rectangular, Hamming, Hanning, Bartlett, Blackman and Kaiser.	
UNIT V – DIGITAL SIGNAL PROCESSORS.	**(9)**
Digital signal processor architectures: TMS320C series, General purpose processors: fixed point and floating point, MAC, pipelining, addressing modes- Typical implementation of DSP algorithms.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. John G. Proakis, D. G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, 4th edition, Pearson Education,2016 2. Oppenheim V.A.V and Schaffer R.W, Discrete – time Signal Processing,3 rd Edition, Pearson,2014
REFERENCES:
1. Lawrence R Rabiner and Bernard Gold, Theory and Application of Digital Signal. Processing Pearson Education,2016 2. Steven W Smith, Digital Signal Processing: A Practical Guide for Engineers and Scientists, Newnes,2014

17EEX29-EMBEDDED CONTROL SYSTEM				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the basics of sensors and actuators in embedded platform.	**1.1**	The students will be able to apply the basics of Sensors and actuators in embedded platform.	a,b,c,d,e,f,g,h,i,j,k,l
2.0	To know the interfacing techniques using communication Buses.	**2.1**	The students will be able to interface various Peripherals using communication buses.	a,b,c,d,e,f,g,h,i,j,k, l
3.0	To acquire knowledge on embedded controller and their Applications.	**3.1**	The students will be able to develop applications based on embedded controller.	a,b,c,d,e,f,g,h,i,l
4.0	To learn various software tools for controlling embedded based applications.	**4.1**	The students will be learn various software tools for controlling embedded based applications.	a,b,c,d,e,f,g,h,i,l
5.0	To understand the basics of contemporary RTOS.	**5.1**	The students will be make a Survey on basics of contemporary RTOS.	a,b,c,d,e,f,g,h,i,j,k,l

UNIT I – INTRODUCTION	**(9)**
Embedded systems - Interfacing a microprocessor to the analog world-Position and Velocity measurements - The world of sensors-Actuators-Motor control - Feedback systems - Haptic interfaces and Virtual environments Applications of embedded control systems	
UNIT II - INTERFACE WITH COMMUNICATION PROTOCOL	**(9)**
Design methodologies and tools – Design flow – Designing hardware and software interface – System integration – SPI - High speed data acquisition and interface - SPI read/write protocol - RTC interfacing and programming	
UNIT III - EMBEDDED SYSTEM ORGANIZATION	**(9)**
Embedded computing – Characteristics of embedded computing applications–Embedded system design challenges - Build process of real-time embedded system – Selection of processor – Memory - I/O devices -RS 485 - MODEM-Bus communication system using I2C- CAN- USB -ISA- EISA.	
UNIT IV - DESIGN OF SOFTWARE FOR EMBEDDED CONTROL	**(9)**
Software abstraction using Mealy - Moore FSM controller - Layered software development - Basic concepts of developing device driver – SCI – Interfacing & porting using standard C & C++ - Functional and performance debugging with benchmarking- Real-time system software – Survey on basics of contemporary RTOS – VXWorks - UC/OS-II.	
UNIT V - CASE STUDIES WITH EMBEDDED CONTROLLER	**(9)**
A low - cost web – Based infrared remote control system for energy management of aggregated air conditioners – PWM Motor speed controller – Serial communication interface.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. Steven F. Barrett, Daniel J. Pack, “Embedded Systems – Design and Applications with the 68HC12 and HCS12”, Pearson Education, 2008 2. Muhammad Ali Mazidi, Rolin D. Mckinlay, and Danny Causey, “PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18”, Pearson Education, 2008.
REFERENCE:
1. Raj Kamal, “Embedded Systems- Architecture, Programming and Design”, Tata McGraw Hill, 2017.

17EEX30-EMBEDDED PROCESSORS						
				L	T	P	C
				3	0	0	3
PRE REQUISITE : NIL						
Course Objectives		**Course Outcomes**		**Related Program outcomes**		
1.0	To impart basic knowledge about ARM architecture and cortex	**1.1**	The student will be able to explain the ARM and Cortex	a,b,c,d,e		
2.0	To impart the knowledge on timers, RTC, ADC & QEI	**2.1**	The student will be able to describe the operation of timers, RTC, ADC and QEI	a,b,c,d,e		
3.0	To make the students to understand the memory model and caches	**3.1**	The student will be able to explain the memory management and caches of ARM Cortex A architecture	a,b,c,d,e		
4.0	To make the students to understand the internal features of ARM Cortex A	**4.1**	The student will be able to explain the concepts of booting, power management and debugging	a,b,c,d,e,i		
5.0	To gain the knowledge about the functional blocks and tools of DSP processor	**5.1**	The student will be able to enumerate the various functions of DSP processor with its internal characteristics	a,b,c,d,e,i		

UNIT I – ARM ARCHITECTURE AND CORTEX	**(9)**
Introduction to the ARM Cortex M4 -ARM Cortex M4 architecture: address space, on- chip peripherals (analog and digital) Register sets, addressing modes and instruction set .	
UNIT II - TIMERS, PWM AND MIXED SIGNAL PROCESSING	**(9)**
Timer- Basic Timer, Real Time Clock (RTC), Timing generation and measurements, ADC-PWM Module - Quadrature Encoder Interface (QEI)	
UNIT III - ARM CORTEX A ARCHITECTURE	**(9)**
Introduction to ARMv8A- Memory Management-Memory Model, Caches and Branch Prediction, Synchronization and Cache coherency.	
UNIT IV - GUIDE LINES TO ARM CORTEX 64 BIT ARCHITECTURE	**(9)**
Booting- Power Management,-Virtualization,-Security- Debugging.	
UNIT V - DSP PROCESSORS	**(9)**
Architecture of TMS320CXX Processor – Addressing modes – Assembly language Instructions – Assembler directives, Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals – Code Composer Studio – Support Files - Application Programs for processing real time signals.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. Joseph Yiu, "The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors",3rd Edition, Newnes ,UK,2013 2. ARM Cortex-A Series Programmer's Guide for ARMv8-A Version: 1.0, ARM, United States,2015
REFERENCES:
1. Yifeng Zhu, Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C, E-Man Press LLC, United States, 2nd Edition 2015 2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.

17EEX31-EMBEDDED NETWORKING					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To understand the various proctocols in embedded system	**1.1**	The student will be able to know the concept of communication protocols	a,d,g,h,k	
2.0	To acquire knowledge on CANBUS and USB	**2.1**	The student will be able to learn the importance of USB and CAN Bus	a,d,e,f,g,h,k	
3.0	To learn the basic of ethernet controllers and elements of the network	**3.1**	The student will be able to apply advanced technical knowledge in multiple contexts	b,c,d,e,g,l	
4.0	To acquire the knowledge on embedded ethernet	**4.1**	The student will be able to design, execute and evaluate experiments on embedded platforms	a,d,g,k	
5.0	To understand the concept of wireless sensor network and its protocols.	**5.1**	The student will be able to learn the basics of wireless embedded networking	a,d,e,f,g,h,k	

UNIT I - EMBEDDED COMMUNICATION PROTOCOLS	**(9)**
Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 –Synchronous serial protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – Parallel communication protocols -ISA/PCI Bus protocols –Firewire.	
UNIT II - USB AND CAN BUS	**(9)**
USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames – Bit stuffing –Types of errors –Nominal bit timing – A simple application with CAN.	
UNIT III - ETHERNET BASICS	**(9)**
Elements of a network – Inside Ethernet – Building a network: Hardware options – Cables, connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet Protocol	
UNIT IV - EMBEDDED ETHERNET	**(9)**
Exchanging messages using UDP and TCP – Serving web pages with dynamic Data – Email for embedded Systems – Using FTP – Keeping devices and network secure.	
UNIT V - WIRELESS EMBEDDED NETWORKING	**(9)**
Wireless sensor networks – Introduction – Applications – Network topology – Localization –Time synchronization – Energy efficient MAC Protocols –SMAC – Energy efficient and robust routing – Data centric routing	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. Jan Axelson,Parallel Port Complete**,** Programming, Interfacing, and Using the PC's Parallel Printer Port ,Jan Axelson Series,2012 2. Dogan Ibrahim,Advanced PIC microcontroller projects in CII, Elsevier 2008.
REFERENCE:
1. Jan Axelson, Embedded Ethernet and Internet Complete: Designing and Programming Small Devices for Networking Jan Axelson Series,2007.

17EEX32-VLSI DESIGN TECHNIQUES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To impart basic knowledge about VLSI design methodology	**1.1**	The student will be able to explain the various VLSI design process	a,b,c,i,l	
2.0	To impart the knowledge on MOS device design and stick diagrams	**2.1**	The student will be able to describe the operation of nMOS and pMOS transistor and circuit model	a,b,c,i,l	
3.0	To make the students to understand the CMOS characteristics and its performance parameters	**3.1**	The student will be able to explain the various characteristics related to CMOS Inverter	a,b,c,e,j	
4.0	To make the students to understand the design of static and dynamic CMOS logic	**4.1**	The student will be able to design the static and dynamic CMOS logic	a,b,d,i,k	
5.0	To gain the knowledge about the design of arithmetic circuits and FIR filter design	**5.1**	The student will be able to design adders/subtractors, various multipliers and FIR filters	a,b,c,i,l	

UNIT I - VLSI DESIGN METHODOLOGY	**(9)**
VLSI design process: Architectural design, logical design, physical design- Layout styles: Full- custom, Semi-custom approaches	
UNIT II - MOS DEVICES	**(9)**
MOS Transistor Theory: nMOS, pMOS Enhancement Transistor-MOSFET as a Switch, Threshold voltage,MOS Device Design Equations, Second order effects-MOS Transistor Circuit Model, Stick Diagram, Layout Design Rules	
UNIT III - CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION	**(9)**
DC Characteristics of CMOS Inverter- Switching Characteristics of CMOS Inverter-Transistor Sizing, Analytical Delay model: Rise Time, Fall Time, Gate Delays,RC Delay Models, Logical Effort- Power Dissipation: Static, Dynamic, Short Circuit Power Dissipation .	
UNIT IV-COMBINATIONAL LOGIC CIRCUITS	**(9)**
Static CMOS Design-Complex Logic Gates-Ratioed Logic-Pass-Transistor Logic-Transmission gate Logic-Dynamic CMOS Logic Design: Considerations, Speed and Power Dissipation-Signal integrity issues	
UNIT V -DESIGN OF ARITHMETIC CIRCUITS	**(9)**
Adders & subtractors-Array based multipliers,Tree based multipliers-Speed and Area trade-off,Pipelined Multiplier - Accumulator,FIR filter design .	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. Neil H.E.Weste, David Money Harris, “CMOS VLSI DESIGN: a circuits and systems perspective”, 4th edition, Pearson 2015 . 2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated circuits: A design perspective”, Prentice Hall of India,2nd Edition 2016.
REFERENCES:
1. Samir Palnitkar, “Verilog HDL”, Prentice Hall, 2010 2. Sung-Ma Kong, Yusuf Leblebici and Chulwoo Kim, "CMOS digital integrated circuits: analysis and design", 4th edition, McGraw-Hill Education, 2015

17EEX33-EMBEDDED IOT					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To impart basic knowledge of IOT and its applications.	**1.1**	The student will be able to explain the various applications of IOT		a,b,c,d,e,f,l
2.0	To acquire knowledge in understanding the basic components in IOT	**2.1**	The student will be able to describe the operation of IOT Architecture		a,b,c,d,e,f,l
3.0	To make the students to understand the Communication principles	**3.1**	The student will be able to explain the Communication Principles		a,b,c,d,e,f,l
4.0	To make the students to understand communication interfaces in IOT	**4.1**	The student will be able to explain communication interface in IOT		a,b,c,d,e,f,l
5.0	To gain the knowledge about the Cloud security concepts .	**5.1**	The student will be able to explain security concepts in cloud.		a,b,c,d,e,f,l

UNIT I - FUNDAMENTALS AND APPLICATIONS OF IoT	**(9)**
Introduction to Internet of Things (IoT)- Functional Characteristics- Recent Trends in the Adoption of IoT - Societal Benefits of IoT- Health Care -Smart Transportation- Smart Living -Smart Cities- Smart Grid.	
UNIT II - IoT ARCHITECTURE	**(9)**
Functional Requirements-Components of IoT-Sensors- Actuator- Embedded Computation Units - Communication Interfaces - Software Development	
UNIT III - COMMUNICATION PRINCIPLES	**(9)**
RFID – ZigBEE - Bluetooth - Internet Communication- IP Addresses - MAC Addresses - TCP and UDP - IEEE 802 Family of Protocols- Cellular-Introduction to Ether CAT	
UNIT IV- COMMUNICATION INTERFACE IN IOT	**(9)**
IEEE 802.11 Wireless Networks Attacks: Basic Types, WEP Key Recovery Attacks, Keystream Recovery Attacks against WEP – RFID Security – Security Issues in ZigBEE: Eavesdropping Attacks, Encryption Attacks - Bluetooth Security: Threats to Bluetooth Devices and Networks.	
UNIT V - CLOUD SECURITY CONCEPTS	**(9)**
Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege,PAAS, IAAS and SAAS,Cryptographic Systems, Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management,X.509 certificates, Open SSL.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things‖, John Wiley and Sons Ltd, UK, 2014.
2. Olivier Hersent, David Boswarthick and Omar Elloumi, The Internet of Things: Key Applications and Protocols‖, John Wiley and Sons Ltd., UK 2012.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, ―Architecting the Internet of Things ‖, Springer, New York, 2011.

REFERENCES:

1. Johnny Cache, Joshua Wright and Vincent Liu, Hacking Exposed Wireless: Wireless Security Secrets and Solutions‖, Tata McGraw Hill, New Delhi, 2010
2. Himanshu Dwivedi, Chris Clark and David Thiel, ―Mobile Application Security‖, Tata McGraw Hill, New Delhi, 2010.
3. Vijay Madisetti, Arshdeep Bahga, ―Internet of Things (A Hands-on Approach), Universities Press, 2015.
4. Tim Mather, Subra Kumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009

17EEX34-FUNDAMENTALS OF ELECTRIC VEHICLES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To know the concepts, principles, operation and performance of the electric vehicle.	**1.1**	The students will be able to explain the overview of Electric Vehicle		a,b,c,g
2.0	To gain knowledge about the basics of the Hybrid electric vehicle.	**2.1**	The students will be able to describe the overview of Hybrid Electric Vehicle		a,b,c,d,g
3.0	To acquire knowledge on the fundamentals of the vehicles	**3.1**	The students will be able to illustrate the fundamental terminologies of Electric vehicle		a,b,c,d,g
4.0	To develop the modeling of an electric vehicle.	**4.1**	The students will be able to design electric vehicle model		a,b,c,d,g,h,j,l
5.0	To understand the Design Considerations for Electric Vehicle.	**5.1**	The students will be able to Design an electric vehicle based on the requirement		a,b,c,d,g,h,j,l

UNIT I - ELECTRIC VEHICLES	**(9)**
Introduction to EV- History- Components of Electric Vehicle- General Layout of EV-EV classification- Comparison with Internal combustion Engine: Technology, Advantages & Disadvantages of EV.	
UNIT II – HYBRID ELECTRIC VEHICLES	**(9)**
Introduction to HEV- History-Components of Hybrid Electric Vehicle -General Layout of Hybrid EV- Comparison with Electric Vehicles- Advantages & Disadvantages of Hybrid EV.	
UNIT III – VEHICLE FUNDAMENTALS	**(9)**
Vehicle resistance,-Types: Rolling Resistance, grading resistance, Aerodynamic drag vehicle performance- Calculating the Acceleration Force, maximum speed- Total Tractive Effort, Torque Required on the Drive Wheel, Transmission: Differential, clutch &gear box- Braking performance	
UNIT IV – ELECTRIC VEHICLE MODELLING	**(9)**
Tractive Effort-Modelling Vehicle Acceleration-Acceleration performance parameters-Modelling the acceleration of an electric scooter-Modelling the acceleration of a small car.	
UNIT V – DESIGN CONSIDERATION FOR ELECTRIC VEHICLE	**(9)**
Aerodynamic Considerations-Consideration of Rolling Resistance-Transmission Efficiency-Consideration of Vehicle Mass-Electric Vehicle Chassis and Body Design	
TOTAL (L=45) = 45 PERIODS	

TEXT BOOKS:

1. Iqbal Hussain., “Electric and Hybrid Vehicles: Design Fundamentals”, 3rd Edition, CRC press, Taylor & Francis Group, Florida,United States, 2021
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals,Theory and Design”, 3rd Edition, CRC Press, 2018

REFERENCES:

1. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, 2nd Edition, Wiley, 2012
2. L.Ashok Kumar, and S.Albert Alexander, Power Converters for Electric Vehicles. CRC Press, 2020..
3. Francois Beguin and Elzbieta Frackowiak ,“Super capacitors”, Wiley, 2013.
4. Tom Denton, “Advance Automotive Fault Diagnosis Automotive Vehicle Maintenance and Repair”, 4th Edition, Routledge Taylor & Francis Group, New York, 2017.

17EEX35-BATTERY PACK MODELING AND CHARGING OF ELECTRIC VEHICLE					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the different types of energy storage system.	**1.1**	The Students will be able to discuss about the different types of energy storage system.		a,b,c,d,e,f,l
2.0	To study about the battery characteristic & parameters.	**2.1**	The Students will be able to describe about the battery characteristic & parameters		a,b,c,d,e,f,l,l
3.0	To model the types of batteries	**3.1**	The Students will be able to model different types of batteries		a,b,c,d,e,l
4.0	To know the concepts of battery management system and design the battery pack	**4.1**	The Students will be able to apply the concepts of battery management system and design the battery pack		a,b,c,d,e,l
5.0	To enrich knowledge on various battery charging methods	**5.1**	The Students will be able to explain charging methods and its specifications		a,b,c,d,e,f,l

UNIT I - ENERGY STORAGE SYSTEM	**(9)**
Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery, Ultra capacitors,Flywheel Energy Storage System, Hydraulic Energy Storage System, Comparison of different Energy Storage System.	
UNIT II- BATTERY CHARACTERISTICS & PARAMETERS	**(9)**
Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics, Efficiency of batteries, Electrical parameters- Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries Meeting battery performance criteria- setting new targets for battery performance	
UNIT III - BATTERY MODELLING	**(9)**
General approach to modeling batteries- simulation model of a rechargeable Li-ion battery-simulation model of a rechargeable NiCd battery- Parameterization of the NiCd battery model- Simulation examples.	
UNIT IV-BATTERY PACK AND BATTERY MANAGEMENT SYSTEM	**(9)**
Selection of battery for EVs & HEVs- Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods-Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests.	
UNIT V -EV CHARGERS	**(9)**
Electric Vehicle Technology and Charging Equipment's- Basic charging -Block Diagram of Charger-Difference between Slow charger and fast charger-AC charging and DC charging- Inboard and off board charger specification	
TOTAL (L=45) = 45 PERIODS	

TEXT BOOKS:

1. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle Battery Systems", John Wiley& Sons Ltd., 2016.
2. Chris Mi, Abul Masrur& David Wenzhong Gao, "Hybrid electric Vehicle- Principles & Applications with Practical Properties", Wiley, 2011
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric Hybrid Electric and Fuel Cell Vehicles", Taylor& Francis Group, 2010.

REFERENCES:

1. G. Pistoia, J.P. Wiaux, S.P. Wolsky, "Used Battery Collection and Recycling", Elsevier, 2001. (ISBN: 0-444-50562-8)
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003

17EEX36-EV DESIGN AND DEVELOPMENT					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To learn about the basic concepts of electric vehicles.	**1.1**	The students should be able toDescribe about working principle of electric vehicles.		a,b,c,d,e,g,l
2.0	To learn about the motors & drives for electric vehicles.	**2.1**	The students should be able to know the construction and working principle of various motors used in electric vehicles.		a,b,c,d,e,l
3.0	To acquire knowledge on the battery characteristic & parameters	**3.1**	The students should be able to Describe about the battery characteristic & parameters.		a,b,c,d,e,l
4.0	To impart in-depth analysis of electronics and sensors in electric vehicles.	**4.1**	The students should be able to Understand about working principle of electronics and sensor less control in electric vehicles		a,b,c,d,e,l
5.0	To understand the concept of hybrid vehicles.	**5.1**	The students should be able to Describe the different types and working principle of hybrid vehicles		a,b,c,d,e,g,l

UNIT I - INTRODUCTION TO ELECTRIC VEHICLES	**(9)**
Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life, Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.	
UNIT II -ELECTRIC VEHICLE MOTORS	**(9)**
Motors (DC, BLDC,PMSM) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – SeriesHEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS),Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.	
UNIT III - BATTERY CHARACTERISTICS & PARAMETERS	**(9)**
Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics, Efficiency of batteries, Electrical parameters- Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries Meeting battery performance criteria- setting new targets for battery performance.	
UNIT IV - ELECTRONICS AND SENSOR-LESS CONTROL IN EV	**(9)**
Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, self-drive Cars, Hacking; Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.	
UNIT V -HYBRID VEHICLES	**(9)**
Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture- Series , Parallel and Series-Parallel Hybrid, Propulsion systems and components, Regenerative Braking, Economy, Vibration and Noise reduction, Hybrid Electric Vehicles System – Analysis and its types, Controls.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Amir Khajepour, Saber Fallah and AvestaGoodarzi, "Electric and Hybrid Vehicles Technologies, Modelling and Control: A Mechatronic Approach", John Wiley & Sons Ltd,2014.
2. Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.
3. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & SonsLtd, 2003.

REFERENCES:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
3. Krishnan R, "Permanent Magnet synchronous and Brushless DC Motor Drives", CRC Publishers,2010.
4. Antoni Szumanowski, "Hybrid Electric Power Train Engineering and Technology:Modelling, Control, and Simulation", IGI Global, 2013.

17EEX37- HYBRID ELECTRIC VEHICLES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the concept of electric vehicles.	**1.1**	The student will be able to describe about working principle of electric vehicles.		a,b,c,d,e,f,g,i,k,l
2.0	To study about the motors & drives for electric vehicles.	**2.1**	The student will be able to explain the construction and working principle of various motors used in electric vehicles.		a,b,c,d,e,f,g,i,k,l
3.0	To understand the electronics and sensors in electric vehicles.	**3.1**	The student will be able to Understand about working principle of electronics and sensor less control in electric vehicles.		a,b,c,d,e,f,g,i,k,l
4.0	To understand the concept of hybrid vehicles.	**4.1**	The student will be able to Describe the different types and working principle of hybrid vehicles.		a,b,c,d,e,f,g,i,k,l
5.0	To study about fuel cell for electric vehicles.	**5.1**	The student will be able to Illustrate the various types and working principle of fuel cells.		a,b,c,d,e,f,g,i,k,l

UNIT I - INTRODUCTION TO ELECTRIC VEHICLES	**(9)**
Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.	
UNIT II - ELECTRIC VEHICLE MOTORS	**(9)**
Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.	
UNIT III - ELECTRONICS AND SENSORLESS CONTROL IN ELECTRICAL VEHICLE	
Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self drive Cars, Hacking, Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.	**(9)**
UNIT IV - HYBRID VEHICLES	
Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls.	**(9)**
UNIT V -FUEL CELLS FOR ELECTRIC VEHICLES	
Fuel cell- Introduction, Technologies & Types, Obstacles,Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics -Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle -System, Components, maintenance.	**(9)**
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012.
2. Jack Erjavec and Jeff Arias, “Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cengage Learning Pvt. Ltd., New Delhi, 2007
3. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2009.

REFERENCES:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.

17EEX38-TESTING AND ELECTRIC VEHICLE POLICY					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To impart basic knowledge about classification of vehicles and its schemes	**1.1**	The student will be able to gain knowledge in the field of E-vehicle certification		a,b,c,g
2.0	To impart the knowledge on different types of static testing in E-vehicle	**2.1**	The student will be able to explain the concept of static testing of E-vehicle.		a,b,c,d,g
3.0	To make the students to understand the different types of dynamic testing in E-vehicle	**3.1**	The student will be able to explain the concept of dynamic testing of E-vehicle.		a,b,c,g
4.0	To make the students to understand the E-vehicle component testing	**4.1**	The student will be able to know about various E-vehicle component testing.		a,b,c,g
5.0	To gain the knowledge about the policies imposed by government on E-vehicles	**5.1**	The student will be able to know various E-vehicle policies offered by Government of India		a,b,c,d,g

UNIT I – INTRODUCTION	**(9)**
Specification & Classification of Vehicles (including M, N and O layout) -Homologation & its types-Regulations overview (EEC, ECE, FMVSS, AIS, CMVR)-Type approval Scheme-Homologation for export, Conformity of Production, various Parameters, Instruments and Types of test tracks-Hardware in The Loop (HIL) concepts for EV/HEVs	
UNIT II - STATIC TESTING OF VEHICLE	**(9)**
Photographs-CMVR physical verification-Tyre Tread Depth Test- Vehicle Weightment- Horn installation- Rear view mirror installation-Tell Tales-External Projection-Wheel Guard-Arrangement of Foot Controls for M1 Vehicle- Angle & Dimensions Measurement of Vehicle-The requirement of temporary cabin for drive- Chassis, electric vehicle -Safety norms, Energy consumption and power test.	
UNIT III - DYNAMICS TESTING OF VEHICLE	**(9)**
Hood Latch- Gradeability- Pass-by Noise- Interior Noise- Turning Circle Diameter & Turning Clearance Circle Diameter-Steering Effort-Constant Speed Fuel Consumption-Cooling Performance-Speedo-meter Calibration-Range Test- Maximum Speed- Acceleration Test-Coast-down test-Brakes Performance ABS Test, Broad band -Narrow band EMI Test-Electric vehicle - Range Test.	
UNIT IV - VEHICLE COMPONENT TESTING	**(9)**
Horn Testing- Safety Glasses Test: Windscreen laminated and toughened safety glass- Rear View Mirror Test- Hydraulic Brakes Hoses-Fuel Tank Test: Metallic & Plastic-Hinges and Latches Test-Tyre & Wheel Rim Test- Bumper Impact Test-Side Door Intrusion- Crash test with dummies- Demist test- Defrost Test-Interior Fittings-Steering Impact test (GVW<1500 kg)-Body block test- Head form test- Driver Field of vision- Safety belt assemblies-Safety belt anchorages-Seat anchorages & head restraints test- Airbag Test-Accelerator Control System-Motor power-Safety Requirements of Traction Batteries, EMI-EMC (CI, BCI, RE,RI and CTE).	
UNIT V -E-VEHICLE POLICIES	**(9)**
FAME II- PLI SCHEME- Battery Swapping Policy- Special Electric Mobility Zone- Tax Reduction on EVs.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. Michael Plint & Anthony Martyr, "Engine Testing & Practice", Butterworth Heinmenn, 3rd ed, 2007 2. Bosch Automotive Handbook, Robert Bosch, 7th Edition, 2007.
REFERENCES:
1. Vehicle Inspection Handbook", American Association of Motor Vehicle Administrators.Proceedings- Automotive Testing & Certification held on 20th to 24th July 2010

17EEX39-EV INTELLIGENT SYSTEM					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To design and drive the mathematical model of a BLDC motor and its characteristics	**1.1**	Students will be able to design the mathematical model of a BLDC motor and to discuss about its characteristics		a,b,c,d,h,j,l
2.0	To learn the different control schemes for BLDC motor	**2.1**	Students will be able to demonstrate the PID control, ant windup controller, Intelligent Controller and Vector Control. Control applied to BLDC motor.		a,b,c,d,h,j,l
3.0	To study the basics of fuzzy logic controller	**3.1**	Students will be able to illustrate the basics of fuzzy logic system		a,b,c,d,j,l
4.0	To study the FPGA & VHDL basics	**4.1**	Students will be able to describe the basics of VHDL & FPGA applied to control of EVs.		a,b,c,d,j,l
5.0	To implement fuzzy logic control of BLDC motor in real time	**5.1**	Students will be able to design and implement of fuzzy logic control scheme for BLDC motor using FPGA in real time.		a,b,c,d,e,h,j,l

UNIT I - MATHEMATICAL MODEL AND CHARACTERISTICS ANALYSIS OF BLDC MOTOR	**(9)**
Structure and Drive Modes - Basic Structure-General Design Method-Drive Modes. Mathematical Model-Differential Equations-Transfer Functions-State-Space Equations. Characteristics Analysis-Starting Characteristics-Steady-State Operation- Dynamic Characteristics- Load Matching Commutation Transients.	
UNIT II - SPEED CONTROL FOR ELECTRIC DRIVES	**(9)**
Introduction -PID Control Principle- Anti windup Controller-Intelligent Controller- Vector Control-Control applied to BLDC motor	
UNIT III - FUZZY LOGIC CONTROLLER	**(9)**
Membership functions: features, fuzzification, methods of membership value assignments, Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables- fuzzy propositions, formation of rules decomposition of rules- aggregation of fuzzy rules-fuzzy reasoning-fuzzy inference systems- overview of fuzzy expert system-fuzzy decision making.	
UNIT IV - FPGA AND VHDL BASICS	**(9)**
Introduction – FPGA Architecture-Advantages-Review of FPGA family processors- Spartan 3, Spartan 6 and Spartan 7. VHDL Basics- Fundamentals-Instruction set-data type-conditional statements- programs like arithmetic, sorting, PWM generation, Speed detection.	
UNIT V -REAL TIME IMPLEMENTATION	**(9)**
Inverter design- identifying rotor position via hall effect sensors-open loop and fuzzy logic control of 48 V BLDC motor using FPGA.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Electric Powertrain Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, John G. Hayes, G. Abas Goodarzi, Wiley 1st Edition 2018.
2. VHDL Primer, A (3rd Edition), Jayaram Bhasker, Prentice Hall, 1st Edition 2015.
3. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Third Edition" CRC Press, Taylor & Francis Group, 1st Edition,2021

REFERENCES:

1. Chang-liang, Permanent Magnet Brushless DC Motor Drives and Controls, Xia Wiley,1 st Edition,2012
2. M.N. Cirstea, A. Dinu, J.G. Khor,M. McCormick, Neural and Fuzzy Logic Control of Drives and Power Systems, Newnes publications, 1 st Edition, 2002.
3. Wei Liu, Hybrid Electric Vehicle System Modeling and Control, , 2nd Edition, Wiley 2017
4. Electric and Plug-in Hybrid Vehicle Networks Optimization and Control, Emanuele Crisostomi, Robert Shorten, Sonja Stüdli, Fabian Wirth, CRC Press, 1 st Edition. 2018.

17EEX40-ELECTRICAL VEHICLES IN SMART GRID					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To know the impact of charging strategies and smart charging technologies	**1.1**	The students will be able to describe vehicle electrification and impact of charging strategies.		a,b,c,d,e,f,g,h,i,j,k,l
2.0	To acquire knowledge on the influence of EV's on power system	**2.1**	The students will be able to interpret influence of EVs on power system		a,b,c,d,e,f,g,h,l
3.0	To gain knowledge on frequency control reserves & voltage support from EV's	**3.1**	The students will be able explain frequency control reserves & voltage support from EV's		a,b,c,d,e,f,g,h,l
4.0	To learn about smart grid and ICT solutions to support EV deployment	**4.1**	The students will be able to illustrate smart grid architecture and ICT solutions to support EV deployment		a,b,c,d,e,f,g,h,i,j,k,l
5.0	To understand the centralized charging, decentralized charging schemes and energy storage integration into microgrid	**5.1**	The students will be able to demonstrate centralized charging, decentralized charging schemes and energy storage integration into microgrid		a,b,c,d,e,f,g,h,i,j,k

UNIT I - INTRODUCTION	**(9)**
Introduction- Impact of charging strategies-EV charging options and infrastructure-Energy- Economic and environmental considerations-Impact of EV charging on power grid- effect of EV charging on generation and load profile-Smart charging technologies- Impact on investment.	
UNIT II - INFLUENCE OF ELECTRIC VEHICLES ON POWER SYSTEM	**(9)**
Introduction- identification of EV demand- EV penetration level for different scenarios- Classification based on penetration level-EV impacts on system demand: dumb charging, multiple tariff charging, smart charging-case study	
UNIT III - FREQUENCY CONTROL RESERVES	**(9)**
Introduction-power system ancillary services-Electric vehicles to support wind power integration-Electric vehicle as frequency control reserves and tertiary reserves- Voltage support and electric vehicle integration-properties of frequency regulation reserves-Control strategies for EV's to support frequency regulation.	
UNIT IV - ICT SOLUTIONS TO SUPPORT EV DEPLOYMENT	**(9)**
Introduction-Architecture and model for smart grid & EV- ICT players in smart grid-Smart metering, information & communication models- functional and logical models- technology and solution for smart grid: interoperability, communication technologies.	
UNIT V - EV CHARGING FACILITY PLANNING	**(9)**
Energy generation scheduling-Different power sources- Fluctuant electricity-Centralized Charging schemes- Decentralized charging schemes-Energy storage integration into Micro-grid-Design of V2G Aggregator.	
	TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:
1. Canbing Li, Yijia Cao, YonghongKuang and Bin Zhou, “Influences of Electric Vehicles on Power System and Key Technologies of Vehicle-to-Grid”, Springer-Verlag Berlin Heidelberg, 2016. 2. Qiuwei Wu, “Grid Integration of Electric Vehicles in Open Electricity Markets”, John Wiley & Sons, Ltd, 2013.
REFERENCE:
1. Harald Naunheimer , Bernd Bertsche , Joachim Ryborz , Wolfgang Novak "Automotive Transmission: Fundamentals, Selection, Design and Application", 2nd Edition, Springer, 2011.

17EEX41-DESIGN OF MOTOR AND POWER CONVERTERS FOR ELECTRIC VEHICLES					
				L	T	P	C
				3	0	0	3
PRE REQUISITE : NIL							
Course Objectives		**Course Outcomes**		**Related Program outcomes**			
1.0	To review the drive cycles and requirements of EVs	**1.1**	The Students will be able to analysis the Dynamics of Electric Vehicles	a,c,h,j,l			
2.0	To know the working of motors used in Electric Vehicle	**2.1**	The Students will be able to use appropriate electric machine for electric vehicle application	a,b,c,d,e,h,j,l			
3.0	To analyze and model the buck/boost converter operation and to design the same	**3.1**	The Students will be able to compute transfer function with factors such as constant, integral, differential, first order factor and second order factor (both numerators & denominators)	a,b,c,d,e,h,j,l			
4.0	To learn the simulation basics of control systems	**4.1**	The Students will be able to design buck, boost and buck-boost converter.	a,b,c,d,e,h,j,l			
5.0	To derive transfer functions for DC-DC converters	**5.1**	The Students will be able to compute a power stage transfer functions for DC-DC converters	a,b,c,d,e,h,j,l			

UNIT I - ELECTRIC VEHICLE DYNAMICS	**(9)**
Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed-Torque-Power-Energy requirements of EVs	
UNIT II – ADVANCED MOTORS FOR ELECTRIC VEHICLES	**(9)**
Introduction – Speed and Torque control of above and below rated speed - Speed control of EV in the constant power region of electric motors. Switched Reluctance Motors (SRMs). Synchronous Reluctance Machines-Choice of electric machines for EVs	
UNIT III - CONTROL SYSTEMS SIMULATION	**(9)**
Transfer Function- Poles & zeros- bode plot -Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions- state space modelling-Transfer function from state space Model	
UNIT IV - MODELING OF DC-DC CONVERTERS	**(9)**
Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling – Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter	
UNIT V -POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS	**(9)**
Power Stage Transfer Functions of buck-boost Converter in CCM Operation- Input-to-Output Transfer Function-Duty Ratio-to-Output Transfer Function- Load Current-to-Output Transfer Function.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Power Electronic Converters, Teuvo Suntio, Tuomas Messo, Joonas Puukko, First Edition 2017.
2. Fundamentals of Power Electronics with MATLAB, Randall Shaffer, 2nd Edition,Lakshmi publications,2013
3. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 1st Edition,2005
4. Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control, Md. Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, CRC Press 1st Edition,2021

REFERENCES:

1. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Third Edition 2021.
2. Feedback Control problems using MATLAB and the Control system tool box, Dean Frederick and Joe Cho, 1st Edition, Cengage learning,2000.
3. Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK, Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, Wiley,1st Edition,2021

17EEM01-ELECTRIC CIRCUITS					
			L	T	P	C
			2	1	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To impart basic knowledge about electric circuits and networks to the students	**1.1**	The student will be able to name the various circuit elements, explain the behavior of circuit elements and circuits and analyze the circuits using KVL, KCL, Mesh analysis and Nodal analysis techniques.	a,b,c,d,e,f,g,h,k.l	
2.0	To develop in students the ability to analyze various types of DC circuits using network theorems.	**2.1**	The student will be able to state the various network theorems, explain it and use it for solving the problems of electric circuits and networks	a,b,c,e,f,g,h,k.l	
3.0	To make the student s to understand circuit laws, waveform and network theorems in AC circuits	**3.1**	The student will be able to describe fundamental concepts used in single phase AC circuits, explain these concepts and solve problems pertaining to these circuits.	a,b,c,d,e,g,h,k.l	
4.0	To get an insight into analysis of resonance and coupled circuits	**4.1**	The student will be able to design resonance and coupled circuits	a,b,c,d,f,g,h,k,l	
5.0	To gain the knowledge about the three phase circuits	**5.1**	The student will be able to examine the 3-phase circuits for impedance, voltage, current, power, phase shift and power factor.	a,b,c,d,e,f,g,h,k,l	

UNIT I - DC CIRCUITS	**(6+3)**
Circuit Elements –Current and Voltage sources- Ohm's and Kirchhoff's laws – Resistive circuits- Series and parallel reduction –Current division rule and Voltage division rule - Mesh analysis for D.C circuits	
UNIT II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC CIRCUITS	**(6+3)**
Network reduction: Source transformation, Star delta transformation. **Network theorems**: Superposition theorem, Thevenin's theorem.	
UNIT III - AC CIRCUITS	**(6+3)**
Introduction to alternating quantities - Average and RMS values, Peak and Form Factors – Power and power factor of simple series RL circuits	
UNIT IV - RESONANCE AND COUPLED CIRCUITS	**(6+3)**
Resonance circuits: Resonant Frequency, Current and Voltage Variations, Bandwidth, Q factor for Series and Parallel Resonance Circuits. Coupled Circuits: Self and mutual inductance, Co-efficient of coupling.	
UNIT V -THREE PHASE CIRCUITS	**(6+3)**
Star and Delta systems – Line and Phase Quantities - Three Phase Power - Balanced and Unbalanced Circuit – Three wire and Four wire systems.	
TOTAL (L:30+T:15) = 45 PERIODS	

TEXT BOOKS:

1. Jr., William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M. “Engineering Circuits Analysis” ,9th edition., Tata McGraw Hill publishers, New Delhi, 2020.
2. Sudhakar A and Shyam Mohan S Pall, “Circuits and Network Analysis and Synthesis”, McGraw Hill Education India pvt.ltd New Delhi, 2015.

REFERENCES:

1. Van Valkenburg M.E., “Network Analysis”, Pearson Education India, Revised 3 rd Edition, 2019
2. S.R. Paranjothi, "Electric Circuits Analysis”, New Age International Ltd., New Delhi, 4th Edition, 2014
3. Charles K. Alexander and Mathew N.O. Sadiku, “Fundamentals of Electric Circuits", 2nd Edition Tata McGraw Hill publishers, 2013.

17EEM02-SOLID STATE DEVICES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To motivate the students to learn about the properties of semiconductor	**1.1**	The students will be able to understand the properties of semi conductor	a,b,c,e,f,g,k.l	
2.0	To educate about Carrier transport properties	**2.1**	The students will be able to gain adequate knowledge in carrier transport properties	a,b,c,e,f,g,k.l	
3.0	To learn about unidirectional diode	**3.1**	The students will be able to acquire knowledge of P-N junction diode	a,b,c,e,f,g,k.l	
4.0	To learn about Bipolar Junction Transistor	**4.1**	The students will be able to familiar with operation of Bipolar Junction Transistor	a,b,c,e,f,g,k.l	
5.0	To educate about Opto Electronic Devices	**5.1**	The students will be able to get dynamic understanding of Optical Devices	a,b,c,e,f,g,k.l	

UNIT I - PROPERTIES OF SEMICONDUCTOR	**(9)**
Intrinsic and Extrinsic Semiconductors –Majority and minority carrier concentration-Energy band diagrams for P and N type semiconductors – Allowed and forbidden energy bands – Electron effective mass – Concept of holes in semiconductor.	
UNIT II - CARRIER TRANSPORT PROPERTIES	**(9)**
Carrier drift – Drift current density – Mobility effects on carrier density – Conductivity in semiconductor – Carrier transport by diffusion – Diffusion current density – Total current density – Breakdown phenomena – Avalanche breakdown.	
UNIT III - PN JUNCTION DIODE	**(9)**
Qualitative description of charge flow in p-n junction – Boundary condition – Minority carrier distribution – Ideal p-n junction current – Temperature effects – Applications – The turn on transient and turn off transient.	
UNIT IV - BIPOLAR JUNCTION TRANSISTOR	**(9)**
Introduction to basic principle of operation – The modes of operation – Amplification – Minority carrier distribution in forward active mode – Non-ideal effects – Base with modulation– Breakdown voltage – Voltage in open emitter configuration and open base configuration.	
UNIT V - OPTO ELECTRONIC DEVICES	**(9)**
Optical absorption in a semiconductor-Photon absorption coefficient – Electron hole pair generation – Solar cell – Homo junction and hetero junction - Photo transistor –Laser diode.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Donald A Neamen , Dhrubes Biswas “Semiconductor Physics and Devices” McGraw Hill Education; 4th edition 2017.
2. Albert Malvino , David J. Bates “Electronic Principles” McGraw Hill Education; 7th edition 2017

REFERENCES:

1. M.S. Tyagi, Introduction to Semiconductor materials and devices, John Wiley and sons,2008
2. S.M. Sze & K.Ng. Kwok, Physics of semiconductor devices, John Wiley and sons, Third edition 2008

17EEM03-POWER SEMICONDUCTOR DEVICES					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To acquire the knowledge on various power semiconductor switches	**1.1**	The students will be able to know about the construction, physics of operation, safe operating areas and protection circuits for various semiconductor devices	a,b,h	
2.0	To gain the knowledge on structure and switching characteristics of power diode and BJT	**2.1**	The students will be able to know about the Construction, static characteristics, and switching characteristics of power diode and power BJT	a,b,d,e,f	
3.0	To acquire the knowledge on basic operation and characteristics of thyristor and GTO	**3.1**	The students will be able to know about the Construction, static characteristics, and switching characteristics of SCRS and GTOs	a,b,d,e,f	
4.0	To understand the operation of IGBT and Power JFET and MOSFET	**4.1**	The students will be able to know about the Construction, static characteristics, and switching characteristics of IGBT and power FETS	a,b,d,e,f	
5.0	To acquire the knowledge on application of various converters.	**5.1**	The students will be able to get the idea of how to use these devices for various converters	a,b,d,e,f,h,i	

UNIT I-POWER SEMICONDUCTOR SWITCHES	**(9)**
Introduction – Diodes-Thyristors- BJTs-JFETs-MOSFETs- GTOs IGBTs- Comparison of these as switching devices.	
UNIT II - POWER DIODE AND POWER BJT	**(9)**
Basic structure and I-V & Switching characteristics of Power diode- Structure and Switching characteristics of Power BJT - Safe operating area –Snubber design for Power diode.	
UNIT III - THYRISTORS AND GTOs	**(9)**
Basic structures - I-V characteristics -Switching characteristics of Thyristors and GTOs– Derive circuits - Snubber circuits for Thyristors and GTOs - Over current protection of GTO.	
UNIT IV - IGBT AND POWER JFET & MOSFETS	**(9)**
Basic structures - I-V characteristics- Switching characteristics – Safe operating area of IGBT and Power JFET & MOSFET - Derive circuits and Protection.	
UNIT V - APPLICATIONS	**(9)**
Single phase converters ,Three phase converters using Diodes and Thyristors-Inverters using GTOs.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:
1. Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Pearson, fourth edition, 2021.
REFERENCES:
1. MD Singh and K.B Khanchandani, “Power Electronics”, Tata McGraw Hill, 2010. 2. Mohan, Undcland and Robins, “Power Electronics – Concepts, applications and Design”, John Wiley and Sons, Singapore, 2000.

17EEM04-ELECTRICAL MEASUREMENTS AND INSTRUMENTS				
L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To educate the fundamental concepts and characteristics of measurement and errors	1.1	The students will be able to understand the fundamental art of measurement in engineering	a,b,c,d,e,f,l
2.0	To assimilate the operating principle of various measuring instruments	2.1	The students will be able to apply their knowledge to measure electrical quantities using analog instruments	a,b,c,d,e,l
3.0	To perceive knowledge on the fundamental working of potentiometer and instrument transformers	3.1	The students will be able to analyze and apply various transformers for measurement process	a,b,c,d,e,l
4.0	To impart the importance of various bridge circuits used with measuring instruments.	4.1	The students will be able to measure resistance, inductance and capacitance using various bridge circuits.	a,b,c,l,d,e,
5.0	To emphasize the need of digital instrumentation principles and display devices	5.1	The students will be able to understand the concept of digital instrumentation	a,b,c,d,e,l,l

UNIT I - MEASUREMENT OF VOLTAGE AND CURRENT	**(9)**
Galvanometers: Ballistic -D'Arsonval galvanometer -Calibration-Application -Principle of operation , Construction and working of moving coil, moving iron meters – Errors and compensation.	
UNIT II - MEASUREMENT OF POWER AND ENERGY	**(9)**
Electrodynamometer type wattmeter-LPF wattmeter-Phantom loading – Induction type KWH meter – Calibration of wattmeter, and energy meter.	
UNIT III – POTENTIOMETERS & INSTRUMENT TRANSFORMERS	**(9)**
DC potentiometer :Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer : Drysdale (polar type) Gall-Tinsley (coordinate) type – Limitations & applications- C.T and V.T construction and operation, characteristics, testing, and error elimination – Applications	
UNIT IV-BRIDGES	**(9)**
Wheatstone bridge-Maxwell Bridge – Wein's bridge – Hey's bridge – Schering bridge – Anderson bridge	
UNIT V -DIGITAL INSTRUMENTS & DISPLAY DEVICES	**(9)**
Digital voltmeters (DVM) - Ramp type DVM- Integrating type- DVM and Successive approximation DVM.- Cathode ray tubes-Light emitting diodes-Liquid crystal displays.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:
1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 29th Edition 2021. 2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
REFERENCES:
1. David A. Bell, Electronic Instrumentation and Measurements, Oxford University Press,2013 2. Jennings, Richard, and Fabiola De La Cueva. LabVIEW graphical programming, McGraw-Hill Education,2020 E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 6th Edition 2017.

17EEM05-BASICS OF ELECTRICAL MACHINES					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To know the construction, operation and characteristics of various types of DC Generators	**1.1**	The students will be able to illustrate the construction and principle of operation and characteristics of DC machines	a,b,c,d,e,l	
2.0	To know the construction, operation and characteristics of various types of DC Motors	**2.1**	The students will be able to illustrate the construction and principle of operation and characteristics of DC motors	a,b,c,d,e,l	
3.0	To impart knowledge on Construction, principle of operation and performance of single phase induction motors.	**3.1**	The students will be able to gain knowledge about the basic principles and working of Single phase induction motors.	a,b,c,d,e,l	
4.0	To impart knowledge on construction, principle of operation and performance of induction machines	**4.1**	The students will be able to understand the construction and working principle of Three Phase Induction Motor	a,b,c,d,e,l	
5.0	To impart knowledge on Special electrical machines	**5.1**	The students will be able to gain knowledge about the basic principles and working of Special electrical Machines.	a,b,c,d,e,l	

UNIT I - DC GENERATORS	**(9)**
Principle of operation-Constructional details- Emf equation- Methods of excitation- Self and separately excited generators- Characteristics of series, shunt and compound generators- Applications.	
UNIT II - DC MOTORS	**(9)**
Principle of operation- Back emf and torque equation- Characteristics of series, shunt and compound motor-Starter- Starting methods- Applications.	
UNIT III -SINGLE PHASE INDUCTION MOTOR	**(9)**
Single Phase Induction Motor: Constructional details– Double field revolving theory and operation – Equivalent circuit – Starting methods - Capacitor start ,capacitor start and run induction motor,Shaded pole induction motor.	
UNIT III-THREE PHASE INDUCTION MOTOR	**(9)**
Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests.	
UNIT V- SPECIAL MACHINES	**(9)**
Special Machines-:Repulsion motor - Servo motor – Switched Reluctance motor – Universal Motor – BLDC motor.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. P. S. Bimbhra, “Electric Machinery”, Khanna Publishers, 2nd Edition, 2021.
2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 5th Edition, 2017.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 6th Edition 2017

REFERENCES:

1 . B.R.Gupta, ’Fundamental of Electric Machines’ New age International Publishers, 3rd Edition, Reprint 2015.
2. Murugesh Kumar, ‘Electric Machines’, Vikas Publishing House Pvt. Ltd, First edition 2010.

17EEM06-ELECTRIC DRIVES					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To provide knowledge on the process of learning fundamental concept of electrical drive systems and drive motor characteristics.	**1.1**	The students will be able to know the fundamental concept electrical drive, the selection process involved in drives and drive motor characteristics	a,b,c,e,i,k	
2.0	To know the fundamental of DC motor drives	**2.1**	The students will be able to understand the operation of the converter, chopper fed dc drive and solve simple problems	a,b,c,f,i	
3.0	To give exposure to understand and analyze the various speed control of induction motor drives.	**3.1**	The students will be able to study and analyze the speed control of induction motor drive	a,b,c,f,i	
4.0	To acquire knowledge on digital control techniques used for speed control of dives	**4.1**	The students will be able to use recent microcontroller for motor control and PLC based control of drives.	b,c,e,f,i,k,l	
5.0	To learn about the design of different controllers for drives	**5.1**	The students will be able analyze and design various controllers for drives	a,b,c,e,i	

UNIT I – INTRODUCTION	**(9)**
Basic elements and types of drives – Factors influencing the choice of electrical drives –Multi quadrant operation-heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors –Drive motor characteristics - Braking of electrical motors	
UNIT II - DC DRIVES	**(9)**
Speed control of DC series and shunt motors - Armature and field control- Ward-Leonard control system – Steady state analysis of the single and three phase converter fed separately excited DC motor drive –4 quadrant operations of converter ,chopper fed drive.	
UNIT III - AC DRIVES	**(9)**
Speed control of three phase induction motor: Stator control: Voltage / frequency control – Constant airgap flux – Field weakening mode –AC voltage Regulator- Voltage / current fed inverter – Rotor control – Rotor resistance control and slip power recovery schemes- Principle of vector control.	
UNIT IV – STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR	**(9)**
Digital techniques in speed control - Advantages and limitations– Microprocessor based control of drives- Microcontroller based control of drives .	
UNIT V - DESIGN OF CONTROLLERS FOR DRIVES	**(9)**
Introduction-Transfer function for DC motor / load and converter – Closed loop control with Current and speed feedback– Armature voltage control and field weakening mode – Design of controllers: Current controller - Speed controller	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2015.
2. Bose, B.K., Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2010 .

REFERENCES:

1. Vedam Subramanyam, Electric Drives: Concepts and Applications II, Tata McGraw hill Pvt. Ltd, New Delhi, 2011.
2. Krishnan R, Electric Motor Drives: Modeling, Analysis and Control II, Prentice Hall of India, Pvt. Ltd, New Delhi,2010
3. S.K.Pillai, "A First Course on Electrical Drives", II Edition, New Age International Publishers, 2010.

17EEM07-POWER SYSTEMS					
			L	T	P	C
			3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To know the structure of electric power system and classifications of power generation.	**1.1**	The students will be able to understand the concepts of various power generation systems.	a,b,c,d,e,f,g,h,i,j,k,l	
2.0	To give exposure to transmission line insulators and grounding concepts.	**2.1**	The students will be able to design modern substation layout with grounding techniques	a,b,c,d,e,f,g,h,i,j,k,l	
3.0	To learn about overvoltages in power system	**3.1**	The students will be able to impart knowledge of over voltage phenomenon in electrical power systems	a,b,c,d,e,f,g,h,i,j,k,l	
4.0	To edify basic things about reactive power control techniques.	**4.1**	The students will be able to acquire knowledge about reactive power control techniques.	a,b,c,d,e,f,g,h,i,j,k,l	
5.0	To study various methods of power quality monitoring.	**5.1**	The students will be able to impart knowledge on various methods of power quality monitoring.	a,b,c,d,e,f,g,h,i,j,k,l	

UNIT I – INTRODUCTION TO POWER SYSTEMS	**(9)**
Structure of power system-Classification of power generation systems:Thermal, hydel, nuclear, wind and solar Power plant.	
UNIT II – DISTRIBUTION SYSTEM	**(9)**
Insulators – Cables: types of underground cables and its construction - Key diagram of 11 kV/415 V substation- Methods of Grounding	
UNIT III – OVERVOLTAGES IN POWER SYSTEM	**(9)**
Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages– Protection against over voltages	
UNIT IV – REACTIVE POWER CONTROL	**(9)**
Reactive power control in electrical power transmission lines -Uncompensated transmission line - Series compensation – Basic concepts of Static VAR Compensator (SVC) – Thyristor Controlled Series Capacitor (TCSC) – Unified Power Flow Controller (UPFC).	
UNIT V – POWER QUALITY MONITORING	**(9)**
Power line disturbance analyzer - Power quality measurement equipment - Harmonic / spectrum analyzer - Disturbance analyzer	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. D. P. Kothari, I. J. Nagrath, Power System Engineering, 3rd edition, McGraw Hill Education,2019
2. CL Wadhwa, Electrical Power Systems,7th Edition, New Age publication,2017
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.
4. S.Naidu and V. Kamaraju, ―High Voltage Engineering‖, Tata McGraw Hill, 5 th ed.,2013.
5. Narain G. Hingorani, ―Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems‖, Standard Publishers Distributors, 2011.

REFERENCES:

1. Arun Ingole, "power transmission and distribution" Pearson Education, 2017.
2. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
3. V.K.Mehta, Rohit Mehta, 'Principles of power system', S.Chand & Company Ltd, New Delhi, 2013.
4. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, ―Electrical Power Systems Quality‖ McGraw Hill,2012

17EEM08-RENEWABLE ENERGY SYSTEM				
L	T	P	C	
3	0	0	3	
PRE REQUISITE : NIL				

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To understand the importance of solar energy and its applications	**1.1**	Students will be able to understand the working and applications of solar energy systems	a,b,c,e,g
2.0	To acquire the knowledge principle of operation of wind energy and its applications	**2.1**	Students will be able to explain the working and applications of wind energy systems	a,b,c,e,g
3.0	To gain the knowledge on principle of operation of Bioenergy,ocean energy and chemical energy sources	**3.1**	Students will be able to express the principle of the bio-energy production techniques and operation of geothermal energy and ocean energy sources	a,b,c,g
4.0	To acquire the knowledge on chemical energy sources and additional energy sources.	**4.1**	Students will be able to explain the operation of additional alternate energy sources	a,b,c,e,g
5.0	To gain knowledge on energy conservation technologies.	**5.1**	Students will be able to describe the principle of energy conservation and its technologies	a,b,c,g

UNIT I - SOLAR ENERGY	**(9)**
Solar radiation at the earth‟s surface – Solar radiation measurements – Solar energy collectors: flat plate and concentrating collectors. Solar electric power generation: Solar Photo Voltaics – Applications of solar energy: solar pumping and solar cooking.	
UNIT II -WIND ENERGY	**(9)**
Basic components of a wind energy conversion system – Classification. Wing Energy Collectors: horizontal axis and vertical axis machines – Performance of wind machines – Generating system – Energy storage – Applications of wind Energy – Interconnected systems – Safety systems – Environmental aspects	
UNIT III- BIO ENERGY,OCEAN ENERGY AND GEOTHERMAL ENERGY	**(9)**
Bioenergy: Biomass conversion technologies – Biogas generation – Classification of biogas plants – Ethanol production. **Geothermal Energy:** Geothermal sources – Prime movers for geothermal energy conversion. **Ocean Energy:** Basic principle of tidal power – Components – Operation methods, Ocean waves **–** Energy and power from waves – wind energy conversion devices.	
UNIT IV- ADDITIONAL ALTERNATE ENERGY SOURCES AND CHEMICAL ENERGY SOURCES	**(9)**
MHD power generation – Thermoelectric power generation. Chemical energy sources: Hydrogen production – Storage – Transportation and utilization – Hydrogen as an alternative fuel for motor vehicles – Fuel cell – Principle – Types.	
UNIT V- ENERGY CONSERVATION	**(9)**
Principles of energy conservation – Energy conservation approach/ technologies – Co-generation – Waste heat utilization – Combined cycle power generation – Heat regenerators – Heat pipes – Heat pumps.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:
1. Rai G.D., "Non-Conventional Energy Sources", 6th Edition, Khanna Publishers, New Delhi, 2017.
REFERENCES:
1 Kothari D.P, Singal K.C & Rakesh Ranjan. "Renewable Energy Sources and Emerging Technologies", 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2011. 2 John Twidell & Tony Weir. "Renewable Energy Resources", 3rd Edition, Routledge, New York, 2015.

17EED01 – PROJECT WORK-I					
		L	T	P	C
		0	0	8	4
PREREQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To practice the fundamental electrical and electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	**1.1**	The students will be able to study problems in the field of Electrical and Electronics Engineering through literature survey and its reviews.	**a,b,e,f**	
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	**2.1**	The students will be able Undertake problem identification, formulation and solution.	**a,b,e,f**	
3.0	To Study various types of methodology based on the problem.	**3.1**	The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects	**a,c,d,f,i**	
4.0	To create platform to communicate and present the ideas in written and oral form	**4.1**	The students will be able to Communicate effectively and to present ideas clearly	**a,c,d,g,j**	
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	**5.1**	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	**c,d,f,h**	

Work Description
The students in a group of 4 works on a topic approved by a team of faculty project coordinators and the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
TOTAL (P: 120) = 120 PERIODS

17EED02 – PROJECT WORK II					
			L	T	P	C
			0	0	16	8
PREREQUISITE : 17EED01					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To practice the fundamental electrical and electronics engineering concepts and principles in addressing a real time situation autonomously or in a team.	**1.1**	The students will be able to study problems in the field of Electrical and Electronics Engineering through literature survey and its reviews.	**a,b,e,f**	
2.0	To develop an ability to solve problem by making a literature review and finding a solution for the same.	**2.1**	The students will be able Undertake problem identification, formulation and solution.	**a,b,e,f**	
3.0	To Study various types of methodology based on the problem.	**3.1**	The students will be able to Design engineering solutions to complex problems utilizing a systems approach and develop projects	**a,c,d,f,i**	
4.0	To create platform to communicate and present the ideas in written and oral form	**4.1**	The students will be able to Communicate effectively and to present ideas clearly	**a,c,d,g,j**	
5.0	To create a team work to exhibit the knowledge and skills to contribute to the society.	**5.1**	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal	**c,d,f,h**	

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work (same title as in project work-I if the same project is continued in project work-II or the title will be selected based on different project) is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P: 240) = 240 PERIODS

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B.E – Electrical and Electronics Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-23) onwards)

AUGUST 2022

22EEC03-ELECTRIC CIRCUIT THEORY *(For EEE Branch only)*				
	L	**T**	**P**	**C**
	2	**1**	**0**	**3**

PRE REQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To impart basic knowledge about electric circuits and networks to the students	**1.1**	The student will be able to name the various circuit elements, explain the behavior of circuit elements and circuits and analyze the circuits using KVL, KCL, Mesh analysis and Nodal analysis techniques.
2.0	To develop in students the ability to analyze various types of DC circuits using network theorems.	**2.1**	The student will be able to state the various network theorems, explain it and use it for solving the problems of electric circuits and networks
3.0	To make the student s to understand circuit laws, waveform and network theorems in AC circuits	**3.1**	The student will be able to describe fundamental concepts used in single phase AC circuits, explain these concepts and solve problems pertaining to these circuits.
4.0	To get an insight into analysis of resonance and coupled circuits	**4.1**	The student will be able to design resonance and coupled circuits
5.0	To gain the knowledge about the three phase circuits and power measurement	**5.1**	The student will be able to examine the 3-phase circuits for impedance, voltage, current, power, phase shift and power factor.

UNIT I - BASIC CIRCUITS ANALYSIS	**(6+3)**
Introduction-Circuit Elements –Current and Voltage sources- Circuit variables -Ohm's and Kirchhoff's laws – Resistive circuits- Series and parallel reduction –Current division rule and Voltage division rule - Mesh and Nodal analysis for D.C circuits	
UNIT II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC CIRCUITS	**(6+3)**
Network reduction: Source transformation, Star delta transformation. Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem	
UNIT III - AC CIRCUITS	**(6+3)**
Introduction to alternating quantities - Average and RMS values, Peak and Form Factors – Power, Power factor and energy – AC signals and RLC circuits-Network theorems: Thevenin's, Norton's theorem	
UNIT IV - RESONANCE AND COUPLED CIRCUITS	**(6+3)**
Resonance in Electric circuits-Series and parallel resonance- Variation of impedance with frequency-Bandwidth of RLC circuit- Quality factor - Impedance of RLC circuit near resonance-Selectivity- Coupled Circuits: Self and mutual inductance, Co-efficient of coupling.	

UNIT V -THREE PHASE CIRCUITS AND POWER MEASUREMENTS	(6+3)
Three phase voltages and currents-Phase sequence-Line and phase quantities- Phasor diagrams-Balanced and unbalanced loads- Analysis of three phase 3-wire, 4-wire circuits with star and delta connected loads– Power and power factor measurements using single and two wattmeter methods.	
TOTAL (L:30+T:15) = 45 PERIODS	

TEXT BOOKS:

1. Jr., William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M. "Engineering Circuits Analysis" ,9th edition., Tata McGraw Hill publishers, New Delhi, 2020
2. Sudhakar A and Shyam Mohan S Pall, "Circuits and Network Analysis and Synthesis", McGraw Hill Education India pvt.ltd New Delhi, 2015

REFERENCES:

1. Van Valkenburg M.E., "Network Analysis", Pearson Education India, Revised 3 rd Edition, 2019
2. S.R. Paranjothi, "Electric Circuits Analysis", New Age International Ltd., New Delhi, 4th Edition, 2014
3. Charles K. Alexander and Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 2nd Edition Tata McGraw Hill publishers, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	3	2	1	2	1	1	2	3	2
2	3	3	3	3	2	2	3	1	2	-	1	2	3	2
3	3	3	2	3	1	3	2	1	2	-	-	2	3	2
4	3	3	3	3	1	2	1	1	2	-	-	2	3	2
5	3	3	3	3	2	3	2	1	2	1	2	2	3	2
CO (W.A)	**3**	**3**	**2.8**	**3**	**1.6**	**2.6**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**2**

22EEP01- ELECTRIC CIRCUITS LABORATORY
(For EEE Branch only)

	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To provide fundamentals concepts of electric circuits.	**1.1**	The students will be able to analyze the electrical circuits using various circuit laws
2.0	To understand and analyze the basic theorems of Circuit theory.	**2.1**	The students will be able to examine the network theorems and operation of typical electrical circuits.
3.0	To understand the concept of network theorems using digital simulation.	**3.1**	The students will be able to simulate the resonance and network theorems using digital simulation software.
4.0	To understand the concept of resonance in series circuit.	**4.1**	The students will be able to design electric circuits under resonance to meet desired needs within realistic constraints.
5.0	To get an insight into solution of three phase power measurements.	**5.1**	The students will be able to find power and power factor in three phase circuits using two wattmeter method.

List of Experiments

1. Experimental verification of Ohm's law
2. Experimental verification of Kirchhoff's voltage and current laws
3. Experimental verification of Superposition theorem
4. Experimental verification of Thevenin's theorem
5. Experimental verification of Norton's theorem
6. Experimental verification of Reciprocity theorem
7. Verification of KVL and KCL by using digital simulation
8. Verification of Superposition theorem & Thevenin's theorem by using digital simulation
9. Verification of Reciprocity theorem & Maximum power transfer theorem by using digital simulation
10. RLC series resonance circuits by using digital simulation

ADDITIONAL EXPERIMENTS:

11. Study of DSO and measurement of sinusoidal voltage, frequency and power factor
12. Experimental determination of power in three phase circuits by two-watt meter method

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	3	-	3	-	1	3	1	2	2	2	3
2	3	3	3	3	-	2	2	1	2	1	2	2	2	3
3	3	3	2	-	3	2	2	1	2	1	2	3	2	3
4	3	3	3	-	3	2	1	1	2	1	2	3	2	3
5	3	2	3	2	-	2	2	1	2	1	2	2	2	3
CO (w.A)	**3**	**2.8**	**2.8**	**2.6**	**3**	**2.2**	**1.7**	**1**	**2.2**	**1**	**2**	**2.4**	**3**	**3**

22EEC05 - ELECTRONIC DEVICES AND CIRCUITS *(For EEE Branch only)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE :NIL

Course Objectives		**Course Outcomes**	
1.0	To motivate the students to learn about unipolar and bipolar devices	**1.1**	The students will be able to learn about the various types of diodes
2.0	To educate about current and voltage controlled devices	**2.1**	The students will be able to acquire knowledge about current and voltage controlled device
3.0	To learn about various BJT amplifiers	**3.1**	The students will be able to analyze various configurations of BJT Amplifiers
4.0	To learn about various FET amplifiers	**4.1**	The students will be able to analyze various configurations of FET Amplifiers
5.0	Develop a strong basis of oscillator	**5.1**	The students will be able to recognize about the Oscillator and its types

UNIT I - DIODE CIRCUITS	**(9)**
Diodes - Rectifier circuits - Zener diode circuits - Clipper and Clamper circuits –Schotty diode ,PIN diode,tunnel diode ,LED and Photodiode.	
UNIT II - JUNCTION TRANSISTOR	**(9)**
Operation of NPN and PNP Transistor, Characteristics of BJT in CB, CE and CC configurations- Bipolar transistor biasing-Construction, Operation, Characteristics of JFET and MOSFET-Applications of Junction Transistor	
UNIT III - BJT AMPLIFIERS	**(9)**
Analog signals and linear amplifiers - Basic transistor amplifier configurations-CE amplifiers - CC (Emitter Follower) amplifier - CB amplifier - Comparison of the three basic amplifiers.	
UNIT I V - FET AMPLIFIERS	**(9)**
Introduction to FET amplifier - Calculation of voltage Gain, Input Impedance and Output Impedance- Common source amplifier - Source follower amplifier - Common gate configuration - comparison of the three basic amplifiers.	
UNIT V - OSCILLATORS	**(9)**
Condition for oscillations- Hartley, Colpitts and Clapp Oscillators- Phase shift and Wien bridge Oscillator - Crystal oscillators	
	TOTAL = 45 PERIODS

TEXT BOOKS:

1. Donald A Neamen , Dhrubes Biswas "Semiconductor Physics and Devices" McGraw Hill Education; 4th edition 2017.
2. Albert Malvino , David J. Bates "Electronic Principles" McGraw Hill Education; 7th edition 2017
.

REFERENCES:

1. M.S. Tyagi, Introduction to Semiconductor materials and devices, John Wiley and sons,2008
2. S.M. Sze & K.Ng. Kwok, Physics of semiconductor devices, John Wiley and sons, Third edition 2008

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1	2	2	1	1	2	1	2	2	3	1
2	3	2	2	1	2	2	1	1	2	2	2	2	3	1
3	3	2	2	2	2	1	2	1	3	2	2	1	3	1
4	3	2	2	2	2	1	2	1	3	1	2	1	3	1
5	3	2	2	2	2	2	1	1	3	1	2	2	3	1
CO	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**1**

22EEC06 -ELECTRICAL MACHINES-I *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : 22EEC03					
Course Objectives		**Course Outcomes**			
1.0	To Understand the concepts of field energy, co energy, mechanical force and production of torque and EMF	1.1	The students will be able to understand the generation of EMF and Torque in rotating Machines		
2.0	To know the construction, operation and characteristics of various types of DC Generators	2.1	The students will be able to illustrate the construction and principle of operation and characteristics of DC machines		
3.0	To learn starting, starters and methods of speed control of DC motors.	3.1	The students will be able to select appropriate DC motor as well as to choose an appropriate method of Speed control for any industrial application		
4.0	To understand different types of Transformer construction, working principle and their performance	4.1	The students will be able to identify the transformer parameters from the equivalent circuit		
5.0	To analyze the various losses and efficiency taking place in DC Machines and transformers	5.1	The students will be able to evaluate the performance of DC machines and transformers		

UNIT I - BASIC CONCEPTS OF ROTATING MACHINES	**(9)**
Basics of magnetic circuit parameters -Principles of electro mechanical energy conversion- Single and multiple excited systems- Concepts of co-energy- Generated voltage- Torque in DC Machines.	
UNIT II - DC GENERATORS	**(9)**
Principle of operation-Constructional details- Emf equation- Methods of excitation- Self and separately excited generators- Characteristics of series, shunt and compound generators- Armature reaction and commutation- Parallel operation of DC shunt and compound generators – Applications.	
UNIT III - DC MOTORS	**(9)**
Principle of operation- Back emf and torque equation- Characteristics of series, shunt and compound motor- Starter- Starting methods- Speed control of DC shunt motors – Applications.	
UNIT IV -TRANSFORMERS	**(9)**
Constructional details of core and shell type transformers- Types of windings- Principle of operation- Emf equation- Transformer on no load- Parameters referred to HV/LV windings- Equivalent circuit- Transformer on load- Regulation- Parallel operation of single phase transformers-Construction and working of Auto transformer- Construction of three phase transformer.	
UNIT V -TESTING OF DC MACHINES AND TRANSFORMERS	**(9)**
Losses and efficiency in DC machines and transformers- Condition for maximum efficiency- Testing of DC machines- Brake test, Swinburne's test, Hopkinson's test- Testing of transformers- Polarity test, Load test, open circuit and short circuit tests- All day efficiency.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021.
2. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 6th Edition 2017.

REFERENCES:

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.
2. H .Cotton, "Advanced Electrical Technology", CBS Publishers and distributors, 1967.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	3	3	2	2	2	1	1	2	-	2	3	1
2	2	3	3	3	3	3	2	1	1	2	1	2	3	1
3	2	3	3	3	3	3	2	1	1	2	1	2	3	1
4	3	3	3	3	3	3	3	1	1	2	1	3	3	1
5	2	3	3	3	3	3	3	1	1	2	1	3	3	1
CO (w.A)	**2.2**	**3**	**3**	**3**	**2.8**	**2.8**	**2.4**	**1**	**1**	**2**	**0.8**	**2.4**	**3**	**1**

22EEC07 –ELECTROMAGNETIC FIELDS *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand basics of vector algebra and its applications.	1.1	The students will be able to Locate the position of a point in a given or its transformed coordinate system.		
2.0	To analyze fields a potential due to static charges.	2.1	The students will be able to Determine the electric field at a point due to a charge that is continuously distributed using Coulomb's law and Gauss's Law.		
3.0	To evaluate static magnetic fields.	3.1	The students will be able to Calculate energy associated with a magnetic field using the concepts of Biot-savart's law, Ampere's Circuit law and Magnetic flux density.		
4.0	To understand the relation between the fields under time varying situations.	4.1	The students will be able to emphasize the ideas about faradays laws, induced emf and their applications.		
5.0	To understand principles of propagation of uniform plane waves	5.1	The students will be able to Calculate the power associated with an Electromagnetic wave using the Poynting theorem and also summarize the sources of EMI and the control techniques to reduce EMI		

UNIT I -INTRODUCTION TO ELECTROMAGNETIC FIELDS	**(9)**
Sources and effects of electromagnetic fields – Introduction to vector algebra – Co-ordinate systems – Vector calculus: Gradient, divergence and curl – Divergence theorem – Stoke's theorem.	
UNIT II - ELECTROSTATICS	**(9)**
Coulombs law – Electric field intensity –Charge distribution – Electric Field due to straight conductor and circular disc – Electric flux density – Gauss's law and its applications –Electric Potential – Electric dipole – Boundary conditions at the interface of conductor and dielectric – Poisson's and laplace's equation – Capacitors.	
UNIT III - MAGNETOSTATICS	**(9)**
Biot-Savart's law – Ampere's circuital law –Magnetic flux and magnetic flux density – Scalar and vector magnetic potentials –Magnetic materials – Magnetic boundary conditions – Self and mutual inductance – Inductance of solenoid and toroid.	
UNIT IV - ELECTROMAGNETIC FIELDS	**(9)**
Time varying fields: Time Varying Fields – Transformer and Rotational EMF. Maxwell's equation: Maxwell's Equation in Point Form and Integral Form – Comparison of Circuit Theory with Field Theory. Electromagnetic Waves: Electromagnetic wave equation – Wave equation for free space – Poynting theorem – Standing wave ratio – Antenna and its types – Antenna measurements.	

UNIT V -ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY (Qualitative analysis only)	(9)
Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC) – Sources and Characteristics of EMI –Control Techniques of EMI – Grounding – Shielding – Filtering.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Sadiku Matthew N.O., "Principles of Electromagnetics", 6th Edition, Oxford University Press, New Delhi, 2015.
2. Hayt Jr W.H., Buck J.A., Jaleel Akhtar M.," Engineering Electromagnetics " 9th Edition McGraw Hill Education, India, 2020.

REFERENCES:

1. Gottapu Sasibhushana Rao., "Electromagnetic Field Theory and Transmission Lines", 1st Edition, John Wiley and Sons, India, 2013
2. David J Griffith, "Introduction to Electrodynamics", Pearson Education, 4th ed., 2012.
3. Ashutosh Pramanik, "Electromagnetism – Theory and Applications", Prentice-Hall of India Private Limited, New Delhi, 2006.
4. Fawwaz. T.Ulaby, "Electromagnetics for Engineers", Pearson Education, 2005.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	3	2	1	2	1	1	2	3	2
2	3	3	3	3	2	2	3	1	2	-	1	2	3	2
3	3	3	2	3	1	3	2	1	2	-	-	2	3	2
4	3	3	3	3	1	2	1	1	2	-	-	2	3	2
5	3	3	3	3	2	3	2	1	2	1	2	2	3	2
CO (w.A)	**3**	**3**	**2.8**	**3**	**1.6**	**2.6**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**2**

22EEC08 –DIGITAL LOGIC CIRCUITS *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To educate about the fundamentals of Boolean functions	**1.1**	The students will be able to study number systems and to simplify the mathematical expressions using Boolean functions		
2.0	To motivate the students to design combinational logic circuits	**2.1**	The students will be able to design combinational logic circuits		
3.0	To make the student to understand about the concepts of synchronous circuits	**3.1**	The students will be able to analyze and design various synchronous circuits		
4.0	To encourage the students to implement asynchronous circuits	**4.1**	The students will be able to implement the asynchronous circuits		
5.0	To motivate the students to know about logic families	**5.1**	The students will be able to expose the concept of memory devices and logic families		

UNIT I - BOOLEAN ALGEBRA AND LOGIC CIRCUITS	**(9)**
Number systems-Binary arithmetic– Logic gates- Binary codes–Boolean algebra and theorems-Boolean functions– Canonical and standard forms -Simplifications of boolean functions using Karnaugh map and Quine Mc-Clusky methods.	
UNIT II - COMBINATIONAL LOGIC CIRCUITS AND ITS APPLICATIONS	**(9)**
Introduction- Adder and subtractor circuits – Code converters(Binary to Gray, Gray to Binary, Binary to BCD,BCD to Binary and BCD to Excess 3) - Decoders and encoders -Multiplexers and demultiplexers.	
UNIT III - SEQUENTIAL LOGIC CIRCUITS	**(9)**
Synchronous sequential circuits – Flip flops – Shift registers – Counters - Analysis and design Procedures - State reduction and state assignment.	
UNIT IV - ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS	**(9)**
Introduction to asynchronous sequential circuits-Classification of Asynchronous Sequential circuit-Analysis and Design procedure-Reduction of state flow table-Hazards and Fault Detection -Race free statement.	
UNIT V -PROGRAMMABLE LOGIC DEVICES AND MEMORIES	**(9)**
Programmable logic devices: PLA, PAL, CPLD and FPGA –Memories: RAM organization, ROM organization, PROM, EPROM, EEPROM- Logic families: RTL, DTL and TTL logic.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Morris Mano M.,"Digital Design with an Introduction to Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, New Delhi,2018.

REFERENCES:

1. Charles H.Roth Jr , Larry L. Kinney, "Fundamentals of Logic Design" ,7th ed.,Thomson Learning, 2014.
2. Charles H. Roth, Jr.,Lizy Kurian John, "Digital System Design using VHDL", CL Engineering/Cengage Learning India ,2012.
3. Nripendra N Biswas, "Logic Design Theory", PHI Learning, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	3	2	3					1	2	1	3
2	3	2	3	3	2	2					1	2	1	3
3	2	3	2	3	1	3						2	2	3
4	3	3	3	3	1	2						2	1	2
5	3	3	3	3	2	3					2	2	1	3
CO (w.A)	**2.8**	**2.6**	**2.8**	**3**	**1.6**	**2.6**	**-**	**-**	**-**	**-**	**0.8**	**2**	**1.2**	**2.8**

22EEP02 - ELECTRONIC DEVICES AND CIRCUITS LABORATORY *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide fundamentals concepts of unipolar and bipolar devices.	**1.1**	The students will be able to build different characteristics of unipolar and bipolar devices		
2.0	To understand and analyze the basic concepts of diode.	**2.1**	The students will be able to know the applications of Diode		
3.0	To understand the concept of bipolar devices.	**3.1**	The students will be able to acquire knowledge about the various configuration of BJT		
4.0	To get an insig ht into solution of single phase rectifiers.	**4.1**	The students will be able to build different types of rectifiers and filter circuits.		
5.0	To understand the concept of unipolar devices and use of regulator.	**5.1**	The students will be able to attain information about regulators.		

List of Experiments

1. Characteristics of PN Junction Diode.
2. Characteristics of Zener Diode.
3. Verification of Clipper and Clamper Circuits With its Characteristics.
4. Verify a Single Phase Half Wave & Full Wave Rectifiers With and Without Filters.
5. Verify a Shunt Voltage Regulator.
6. Characteristics of Common Emitter Configuration of transistor.
7. Characteristics of Common Base Configuration of transistor.
8. Characteristics of Common Collector Configuration of transistor.
9. Characteristics of JFET.
10. Characteristics of MOSFET.

ADDITIONAL EXPERIMENTS

1. Characteristics of PN Junction Diode using VLABS.
2. Wien bridge oscillator using VLABS.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	2	1	1	1	1	1	1	1	2	1	3	1
2	3	2	2	1	1	1	1	1	1	1	2	1	3	1
3	3	2	2	2	1	1	1	1	1	1	2	1	3	1
4	3	2	2	2	1	1	1	1	1	1	2	1	3	1
5	3	2	2	2	1	1	1	1	1	1	2	1	3	1
CO **(w.A)**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**1**

22EEP03 -ELECTRICAL MACHINES-I LABORATORY

(For EEE Branch only)

	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To get a basic practical knowledge on DC generators and DC motors	**1.1**	The students will be able to acquire knowledge on load characteristics of DC Generators and DC motors
2.0	To understand and analyze the uniqueness of each kind of DC machine	**2.1**	The students will be able to know the characteristics of the DC machines independently
3.0	To understand the concept of loads and speed control techniques	**3.1**	The students will be able to familiar to control and test the speed of DC motor under various loads
4.0	To get an insight into working and operation of a transformer under load condition	**4.1**	The students will be able to analyze the performance of single phase transformer under load condition
5.0	To understand the concept of withstanding capacity and rating of transformer using tests	**5.1**	The students will be able to understand the various tests performed on transformer to acquire its efficiency

LIST OF EXPERIMENTS

1. Open circuit characteristics of DC separately excited generator.
2. Load characteristics of DC compound generators with cumulative and differential connections.
3. Load characteristics of DC shunt motors.
4. Load characteristics of DC series motors.
5. Speed control of DC shunt motors.
6. Swinburne's test.
7. Load test on single phase transformer.
8. Open circuit and short circuit test on single phase transformer.
9. Parallel operation of single phase transformer.
10. Study of Scott connection of transformer.

ADDITIONAL EXPERIMENTS

1. Polarity test on single phase transformer.
2. Separation of no load losses in a single phase transformer.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	2	3	2	1	2	1	-	3	3	-
2	2	3	3	3	2	3	2	1	2	1	-	2	3	-
3	2	3	3	3	2	3	2	1	2	1	-	2	3	-
4	2	3	3	3	2	3	2	1	2	2	-	2	3	-
5	3	3	2	3	2	2	2	2	2	1	-	3	3	-
CO (w.A)	**2.4**	**2.8**	**2.8**	**2.8**	**2**	**2.8**	**2**	**1.2**	**2**	**1.2**	**-**	**2.4**	**3**	**-**

G.8

22EEC09 -ELECTRICAL MACHINES-II *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : 22EEC06					
Course Objectives		**Course Outcomes**			
1.0	To impart knowledge on construction and performance of salient and non – salient type synchronous generators.	1.1	The students will be able to understand the construction and working principle of Synchronous generator.		
2.0	To impart knowledge on Principle of operation and performance of synchronous motor.	2.1	The students will be able to understand the construction and working principle of Synchronous Motor.		
3.0	To impart knowledge on construction, principle of operation and performance of induction machines	3.1	The students will be able to understand the construction and working principle of Three Phase Induction Motor.		
4.0	To impart knowledge on Starting and speed control of three-phase induction motors.	4.1	The students will be able to acquire knowledge about the starting and speed control of induction motors.		
5.0	To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines	5.1	The students will be able to gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.		

UNIT I – SYNCHRONOUS GENERATOR	**(9)**
Constructional details – Types of rotors – EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing torque - Capability curves– Salient pole Machine: Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test.	
UNIT II – SYNCHRONOUS MOTOR	**(9)**
Principle of operation – Procedure for starting - Starting methods – Different torques - Synchronization torque - Effect ofchange in torque - Effect of change in excitation - V and inverted V curves – Power input and power developed equations – Hunting – Applications.	
UNIT III – THREE PHASE INDUCTION MOTOR	**(9)**
Constructional details – Types of rotors –- Principle of operation – Slip – Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Applications.	
UNIT IV – STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR	**(9)**
Need for starting – Types of starters – DOL, Star delta, Autotransformer and Rotor resistance starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded Connection-V/f control – Slip power recovery Scheme.	

UNIT V – SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	(9)
Single Phase Induction Motor: Constructional details– Double field revolving theory and operation – Equivalent circuit – Starting methods - Capacitor start and capacitor start and run induction motor, Shaded pole induction motor. Special Machines- Repulsion motor - Servo motor – Switched Reluctance motor – Universal Motor – BLDC motor.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 6th Education 2017.
2. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017.

REFERENCES:

1. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3rd Edition, Reprint 2015.
2. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, First edition 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	1							1	3	2
2	3	3	1	1	1							1	3	2
3	3	3	1	1	1							1	3	2
4	3	3	1	1	1							1	3	1
5	3	3	1	1	1							1	3	-
CO (w.A)	3	3	1	1	1							**1**	**3**	**1**

22EEC10 –ANALOG INTEGRATED CIRCUITS *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : 22EEC05					
Course Objectives		**Course Outcomes**			
1.0	To provide in-depth instructions on the characteristics of operational amplifiers	1.1	The students will be able to impart knowledge on characteristics of OP-AMP		
2.0	To educate about basic operation using OP-AMP	2.1	The students will be able to acquire knowledge about basic operation using OP-AMP		
3.0	To learn about the application of OP-AMP	3.1	The students will be able to known about application OP-AMP		
4.0	To make the student to understand about unique IC	4.1	The students will be able to analyze and construct various application circuits using 555 timer.		
5.0	To learn about applications ICs	5.1	The students will be able to acquire knowledge about application ICs		

UNIT I – AMPLIFIER CHARACTERISTICS	**(9)**
Introduction-Advantages of negative feedback Amplifier – Voltage / current, series, Shunt feedback –Ideal OP -AMP characteristics -DC Performance - Bias currents, Offset currents, Offset voltage,AC characteristics - Frequency response, Slew rate.	
UNIT II – BASIC OPERATIONS USING OP-AMP	**(9)**
Differential amplifier–Inverting and Non-inverting Amplifiers - Voltage to current converter, current to voltage converter, differentiator and integrator, Summing, subtracting, averaging amplifier, Peak detector, Sample and hold circuit.	
UNIT III - APPLICATIONS OF OP-AMP	**(9)**
Instrumentation amplifier -Comparators – Multivibrators - Clippers – Clampers - D/A converter (R-2R ladder and weighted resistor types) - A/D converters using op amps.	
UNIT IV - SPECIAL ICS	**(9)**
Functional block, characteristics of Astable and Monostable multivibrators using 555 timers and its PWM application - IC566 voltage controlled oscillator- IC 565 phase locked loop IC.	
UNIT V - APPLICATION ICS	**(9)**
AD623 Instrumentation Amplifier and its application (load cell weight measurement)- IC voltage regulators – 78XX, 79XX, 317 Adjustable voltage regulators, 723 Precision voltage regulators.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits" , Fifth Edition New Age International,2018. 2. Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", IV edition, Pearson Education, PHI 2021.
REFERENCES:
1. David A. Bell, 'Op-amp & Linear ICs', Oxford, Third Edition, 2011 2. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	1	1	1	1	1	1	2	2	3	1
2	3	3	3	1	1	1	1	1	1	1	2	2	3	1
3	3	2	3	1	1	1	1	1	1	1	2	2	3	1
4	3	3	3	2	1	1	1	1	1	1	2	2	3	1
5	3	3	3	2	1	1	1	1	1	1	2	2	3	1
CO (w.A)	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**1**

22EEC11 - *POWER GENERATION, TRANSMISSION AND DISTRIBUTION* *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : 22EEC03					
Course Objectives		**Course Outcomes**			
1.0	To know the structure of electric power system and classifications of power generation.	1.1	The students will be able to understand the concepts of various conventional power generation systems.		
2.0	To impart knowledge on computation of transmission line parameters	2.1	The students will be able to estimate the line parameters for transmission line		
3.0	To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.	3.1	The students will be able to design electrical equivalent models and analyze the performance of transmission systems.		
4.0	To study the types, construction of cables and methods to improve the efficiency	4.1	The students will be able to calculate the sag of transmission line and predict voltage distribution in insulators		
5.0	To study about distribution systems, types of substations, methods of grounding.	5.1	The students will be able to explain about the importance of distribution of the electric power in power system.		

UNIT I – CLASSIFICATIONS OF POWER GENERATION	**(9)**
Structure of power system- Classification of power generation systems- Thermal, hydel, nuclear, wind and solar.	
UNIT II - TRANSMISSION LINE PARAMETERS	**(9)**
Parameters of single and three phase transmission lines with single circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - Application of self and mutual GMD- Skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines	
UNIT III – MODELLING AND PERFORMANCE OF TRANSMISSION LINES	**(9)**
Performance of Transmission lines - Short line, medium line and long line - Equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - Transmission efficiency and voltage regulation, real and reactive power flow in lines – Ferranti effect - Formation of Corona	
UNIT IV – DESIGN OF OVERHEAD TRANSMISSION LINES	**(9)**
Design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators- Types, voltage distribution in insulator string, improvement of string efficiency. Comparison between overhead line and underground cables, types of underground cables and its construction.	

UNIT V - DISTRIBUTION SYSTEMS AND SUBSTATIONS	(9)
Distribution Systems: General Aspects – Kelvin's Law – DC 2-wire distributor – Radial and ring main distribution. Substations: Types of Substations - Key diagram of 11 kV/415 V substation, Methods of Grounding.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. D. P. Kothari, I. J. Nagrath, Power System Engineering, 2019, 3rd edition, McGraw Hill Education
2. CL Wadhwa, Electrical Power Systems, 2017,7th Edition, New Age publication
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES:

1. Arun Ingole, "power transmission and distribution" Pearson Education, 2017.
2. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
3. V.K.Mehta, Rohit Mehta, 'Principles of power system', S.Chand & Company Ltd, New Delhi, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	3	2	1	2	2	1	3	3	2
2	3	3	3	3	2	3	2	1	2	1	1	3	3	2
3	3	3	3	3	2	3	2	1	2	1	1	3	3	2
4	3	3	3	3	2	3	2	1	2	1	1	3	3	2
5	3	3	3	3	2	3	2	3	2	2	2	3	3	2
CO (w.A)	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2**	**1.4**	**2**	**1.4**	**1.2**	**3.0**	**3.0**	**2.0**

22EEC12 – MEASUREMENTS AND INSTRUMENTATION *(For EEE Branch only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To educate the fundamental concepts and characteristics of measurement and errors	1.1	The students will be able to understand the fundamental art of measurement in engineering		
2.0	To assimilate the operating principle of various measuring instruments	2.1	The students will be able to apply their knowledge to measure electrical quantities using analog instruments		
3.0	To impart the importance of various bridge circuits used with measuring instruments.	3.1	The students will be able to measure resistance, inductance and capacitance using various bridge circuits.		
4.0	To perceive knowledge on the fundamental working of transducers and display devices	4.1	The students will be able to analyze and apply various transducers for measurement process		
5.0	To emphasize the need of digital instrumentation principles	5.1	The students will be able to understand the concept of digital instrumentation		

UNIT I – CHARACTERISTICS AND CONCEPTS OF MEASUREMENT	**(9)**
Instruments- Classification-applications -Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data- Standards and calibration.	
UNIT II - MEASURING INSTRUMENTS	**(9)**
Classification of measuring instruments-Essential requirements of an instrument-Construction, working principle of PMMC, MI type instruments -Electro-dynamometer type Wattmeter-Energy Meter-Determination of B–H curve and measurement of iron loss- Instrument transformers (CT & PT).	
UNIT III – DC AND AC BRIDGES	**(9)**
DC Bridges: Wheatstone bridge, Kelvin bridge, Kelvin double bridge and their merits and demerits. AC Bridges: Maxwell bridge, Anderson bridge, Schering Bridge and their Merits and Demerits.	
UNIT IV – TRANSDUCERS AND DISPLAY DEVICES	**(9)**
Classification of transducers- Selection of transducers- Resistive (Thermistor & Thermocouple) , capacitive and Linear Variable Differential Transducer, Piezoelectric and Hall effect Transducer-Working principle of Analog CRO, LED and LCD.	
UNIT V – DIGITAL INSTRUMENTS & INTRODUCTION TO VIRTUAL INSTRUMENTATION	**(9)**
Comparison of analog and digital techniques-Digital voltmeter- Multimeters- Smart meters- Measurement of frequency and phase- A/D converters: types and characteristics – D/A converters: types and characteristics-DSO- Introduction to Virtual Instrumentation	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 29th Edition 2021. 2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
REFERENCES:
1. David A. Bell, Electronic Instrumentation and Measurements, 2013, Oxford University Press 2. Jennings, Richard, and Fabiola De La Cueva. LabVIEW graphical programming, 2020, McGraw-Hill Education 3. E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 6th Edition 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1	3	1						3	3	2
2	3	2	3	2	2	1			2			2	3	2
3	3	2	3	2	3							2	3	3
4	3	3	3	2	2							1	3	2
5	3	3	3	2	3				2			3	3	3
CO (w.A)	**3**	**2**	**3**	**2**	**3**				**1**			**2**	**3**	**2**

22EEC13-MICROPROCESSOR & MICROCONTROLLER *(For EEE Branch only)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PRE REQUISITE : 22EEC08					
Course Objectives		**Course Outcomes**			
1.0	To impart knowledge on functional blocks and programming of 8085 Microprocessor	1.1	The students will be able to explain the architecture of 8085 Microprocessor		
2.0	To understand the concepts of 8051 architecture & instruction set of 8051.	2.1	The students will be able to develop skills in writing assembly language program		
3.0	To gain knowledge on microcontroller associated peripheral interface devices	3.1	The students will be able to recognize the knowledge on interfacing the external devices to the processor according to the user requirements		
4.0	To make the students understand ARM architecture	4.1	The students will be able to gain knowledge about architectures of RISC and ARM processor		
5.0	To convey the skills to know about PIC microcontroller	5.1	The students will be able to develop systems using PIC microcontroller		

UNIT I -8085 ARCHITECTURE INSTRUCTION SET AND PROGRAMMING	**(9)**
Functional block diagram-Interrupt Structure-Instruction format and addressing modes-Assembly language format-Data transfer, data manipulation and control instructions-Simple programming with 8085.	
UNIT II-8051 INSTRUCTION SET & PROGRAMMING	**(9)**
Functional block diagram-Instruction format and addressing modes-Interrupt structure-Timer-I/O Port-Serial Communication-Simple programming.	
UNIT III -APPLICATIONS OF 8051 MICROCONTROLLER	**(9)**
Interfacing LCD- Stepper motor control-Interfacing A/D converter- D/A Converter-DC Motor interfacing, sensor interfacing.	
UNIT IV-INTRODUCTION TO PIC MICROCONTROLLER	**(9)**
Introduction to PIC microcontrollers-Overview and features-PIC 16FXX architecture- Memory organization - Register File Structure-Timer module-CCP module – Addressing Modes-Classification of instructions.	
UNIT V - ARM ARCHITECTURE AND PROGRAMMING	**(9)**
Introduction to RISC processors-Comparison between CISC and RISC-Overview of 16XX ARM v7-Features-Pin Configuration-Architecture-Register configuration and instruction set.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996
3. Peatman,J.B., Design with PIC Micro Controllers PearsonEducation,3rdEdition, 2004
4. Jonathan W Valvano Introduction to Am(r) Cortex-M Microcontrollers Createspace Independent Publisher 2012

REFERENCES:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. Subrata Ghoshal, "8051 Microcontrollers, 2/e: Internals, Instructions, Programming &Interfacing", 2nd Edition,Pearson Education, 2014

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	3	1					1	1	3	3	2
2	2	1	2	3	2					1	1	2	3	2
3	2	1	2	3	2					2	2	2	3	3
4	2	2	2	3	1					1	1	1	3	2
5	2	1	2	3	2					1	1	3	3	3
CO (w.A)	**2**	**1**	**2**	**3**	**2**					**1**	**1**	**2**	**3**	**2**

22EEP04 -ELECTRICAL MACHINES-II LABORATORY

(For EEE Branch only)

L	T	P	C
0	0	4	2

PRE REQUISITE : 22EEP03

	Course Objectives		Course Outcomes
1.0	To expose the students to the operation of synchronous generator non-salient pole type and give them experimental skill.	**1.1**	Students will be able to understand and analyze EMF and MMF methods.
2.0	To expose the students to the operation of synchronous generator salient pole type and give them experimental skill.	**2.1**	Students will be able to acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods. to understand the importance of Synchronous machines.
3.0	To expose the students to the operation of synchronous motor and give them experimental skill.	**3.1**	Students will be able to analyze the characteristics of V and Inverted V curves
4.0	To expose the students to the operation of thee phase induction motors and gives them experimental skill.	**4.1**	Students will be able to acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods. to understand the importance of single and three phase Induction motors
5.0	To expose the students to the operation of single phase induction motors and gives them experimental skill.	**5.1**	Students will be able to acquire knowledge on separation of losses

LIST OF EXPERIMENTS

1. Regulation of Alternator by EMF and MMF Methods.
2. Regulation of Alternator by ZPF Method.
3. Regulation of Salient Pole Alternator.
4. Load Test on three phase alternator.
5. V and inverted V curve of three phase synchronous motor.
6. Load Test on three phase induction motor.
7. Performance evaluation of three phase induction motor from circle diagram.
8. Separation of no load losses of three phase induction motor.
9. Load Test on single phase induction motors.
10. No load and blocked rotor test on single-phase induction motor.

ADDITIONAL EXPERIMENTS

1. Synchronization of alternators by using dark and bright lamp method.
2. Study of Induction Motor Starters.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1					1			3	3	2
2	3	3	1	1					1			3	3	2
3	3	3	1	1					1			3	3	2
4	3	3	1	1					1			3	3	2
5	3	3	1	1					1			3	3	2
CO (w.A)	3	3	1	1					1			**3**	**3**	**2**

22EEP05- ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY
(For EEE Branch only)

	L	T	P	C
	0	0	4	2

PRE REQUISITE : 22EEP02

Course Objectives		Course Outcomes	
1.0	To implement the basic circuits using OP-AMP.	**1.1**	The students will be able to analyze about the characteristics of OP-AMP
2.0	To implement the timer IC application.	**2.1**	The students will be able to know the applications of OP-AMP and 555 IC
3.0	To verify the expressions using Boolean functions	**3.1**	The students will be able to acquire knowledge about the various types of logic gates
4.0	To verify the Combinational circuits	**4.1**	The students will be able to understand about the code converters
5.0	To understand the concept of conversions in various applications.	**5.1**	The students will be able to acquire knowledge about checker and generator

LIST OF EXPERIMENTS

1. Implementation of Inverting and Non-Inverting amplifier using OP-AMP.
2. Implementation of Differentiator and integrator using OP-AMP.
3. Implementation of Monostable multivibrator using 555 IC.
4. Implementation of Astable multivibrator using 555 IC.
5. Verification of logic gates.
6. Verification of Half subtractor and Half adder.
7. Verification of binary to gray code and gray to binary code converter.
8. Verification of Multiplexer and Demultiplexer.
9. Verification of encoder and decoder.
10. Verification of Parity checker and Parity generator.

ADDITIONAL EXPERIMENTS

1. Design and implementation of precision rectifier using op-amp
2. Design and implementation of triangular wave generator using op-amp

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	2	-	1	1	1	1	-	2	2	2	1
2	3	3	3	1	-	1	1	1	1	-	2	2	2	1
3	3	2	3	1	-	1	1	1	1	-	2	2	2	1
4	3	3	3	2	-	1	1	1	1	-	2	2	2	1
5	3	3	3	2	-	1	1	1	1	-	2	2	2	1
CO	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**1**	**-**	**2**	**2**	**2**	**1**

G.R

22EEP06- MICROPROCESSORS AND MICROCONTROLLERS LABORATORY
(For EEE Branch only)

	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the basic programming of Microprocessor and microcontroller.	1.1	The students will be able to apply fundamental of assembly language programming for microprocessor and microcontroller
2.0	To inscribe the interfacing of assembly language programs	2.1	The students will be able to apply computing platform for various engineering applications
3.0	To provide solid foundation on interfacing the external devices to the processor according to the user requirements	3.1	The students will be able to work with standard microcontroller real time interfaces including stepper motor, LED
4.0	To familiarize and develop programs for ARM and PIC	4.1	The students will be able to design circuits for various applications using microcontroller and microprocessor
5.0	To develop the quality of analyzing and assessing obtained data	5.1	The students will be able to demonstrate the basic instructions with processor and controller based on its architecture and instruction set

LIST OF EXPERIMENTS

1. Simple arithmetic operations: multiplication, division using 8085.
2. Traffic Light Controller using 8085.
3. Displaying a moving/rolling message in the trainer kit's output using 8085.
4. Simple arithmetic operations: multiplication, division using 8051.
5. Interfacing of Stepper Motor using 8051.
6. Flashing of LED using ARM.
7. Simple arithmetic operations: Addition/Subtraction using PIC and ARM
8. Analog to Digital conversion using PIC Microcontroller.

ADDITIONAL EXPERIMENTS

1. Interfacing of keypad and LCD using PIC 16FXX for Security System.
2. Implementing zigbee protocol using ARM.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	3								3	3	2
2	2	1	2	3								2	3	2
3	2	1	2	3								2	3	3
4	2	2	2	3								1	3	2
CO (w.A)	**2**	**1**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**2**

G.S

1.1.3 Number of courses focusing on employability/entrepreneurship/skill development offered by the institution during the academic year 2023-24

1.2.1 Details of courses introduced across all programmes offered during the year.

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
I	22MAN01	Induction Programme	MC	-	-	-	-	-	-
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra *	BSC	-	4	3	1	0	4
4	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
5	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
6	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
7	22GYA01	தமிழர் மரபு / Heritage of Tamils*	HSMC	-	1	1	0	0	1
PRACTICAL									
8	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
9	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
10	22PYP01	Physics Laboratory*	BSC	-	2	0	0	2	1
Mandatory Non Credit Courses									
11	22MAN02	Soft/Analytical Skills - I	MC	-	3	1	0	2	0
12	22MAN03	Yoga – I *	MC	-	1	0	0	1	0
				TOTAL	**32**	**16**	**1**	**15**	**22**

*Ratified by Eleventh Academic Council

SEMESTER: II									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
2	22MYB03	Statistics and Numerical Methods *	BSC	-	4	3	1	0	4
3	22ITC01	Data structures using C*	ESC	22CSC01	3	3	0	0	3
4	22ITC02	Python Programming *	ESC	-	3	3	0	0	3
5	22ITC03	Digital Principles and Computer Organization *	ESC	-	3	3	0	0	3
6	22GYA02	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology*	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22ITP01	Data Structures Laboratory	ESC	22CSP01	4	0	0	4	2
8	22ITP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN04	Soft Analytical Skills - II	MC	22MAN02	3	1	0	2	0
11	22MAN05	Yoga - II*	MC	-	1	0	0	1	0
				TOTAL	**34**	**16**	**1**	**17**	**23**

*Ratified by Eleventh Academic Council

SEMESTER: III									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
2	22ITC04	Algorithms	PCC	-	3	3	0	0	3
3	22ITC05	Operating Systems	PCC	-	3	3	0	0	3
4	22ITC06	Java programming	PCC	-	3	3	0	0	3
5	22ITC07	Computer Networks	PCC	-	3	3	0	0	3
6	22ITC08	Design Thinking	PCC	-	3	3	0	0	3
PRACTICAL									
7	22ITP03	Algorithms Laboratory	PCC	-	4	0	0	4	2
8	22ITP04	Java Programming Laboratory	PCC	-	4	0	0	4	2
9	22ITP05	Computer Networks Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN07# / 22MAN07R ##	Soft / Analytical Skills - III	MC	22MAN04	3	1	0	2	0
11	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**35**	**20**	**1**	**14**	**25**

Applicable for (2022-2026) Batch only

Applicable for (2023-2027) Batch only

SEMESTER: IV									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22ITC09	Theory of Computation	PCC	22MYB05	4	3	1	0	4
2	22ITC10	Fundamentals of Data Science	PCC	-	3	3	0	0	3
3	22ITC111	Database Management System	PCC	-	3	3	0	0	3
4	22ITC12	Agile Methodologies	PCC	-	3	3	0	0	3
5	22ITC13	Advanced Java Programming**	PCC	22ITC06	3	3	0	0	3
6	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3
PRACTICAL									
7	22ITP06	Database Management System Laboratory	PCC	-	4	0	0	4	2
8	22ITP07	Advanced Java Programming Laboratory**	PCC	22ITP04	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN08#/ 22MAN08R##	Soft / Analytical Skills - IV	MC	22MAN07	3	1	0	2	0
10	22GED01	Personality and Character Development	EEC	-	1	1	0	0	0
				TOTAL	**31**	**20**	**1**	**10**	**23**

Applicable for 2022-26 Batch only
Applicable for 2023-27 Batch only

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22CSC01 - PROBLEM SOLVING AND C PROGRAMMING

(Common to All Branches)

L	T	P	C
3	0	0	3

PRE-REQUISITE: NIL

Course Objective: To equip students with the essential skills and knowledge to solve computational problems using the C programming language.

	Course Outcomes The student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply basic syntax and semantics of C language to write clear and structured code.	Ap	20%
CO2	Make use of both conditional statements and iterative control structures for developing applications.	Ap	20%
CO3	Apply knowledge of arrays and strings to solve computational problems.	Ap	20%
CO4	Identify modular solutions that integrate problem-solving techniques to solve complex computational problems.	An	20%
CO5	Analyze the performance implications using pointers and to manage file operations efficiently.	An	20%

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming**: Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

1. Ashok N. Kamthane, “Programming in C”, 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, “Computer Fundamentals and C Programming”, 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., “Programming in C ”, 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3	3											3	3	
4		3										3	3	
5		3											3	2
CO (W.A)	3	3										3	3	2

22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY

(Common to All Branches)

	L	T	P	C
	0	0	4	2

PRE-REQUISITE: NIL

Course Objective: To develop programs to solve basic problems by understanding basic concepts in C language

Course Outcomes The student will be able to		**Cognitive Level**
CO1	Formulate the algorithms for simple problems	Ap
CO2	Apply the concept of pointers of different types	Ap
CO3	Apply and manipulate data with arrays, strings and structures	Ap
CO4	Apply the concept of functions and dynamic memory allocation	Ap
CO5	Analyse and correct logical errors encountered during execution	An

C-Programming:

1. Draw the flowchart for the following using Raptor tool.
   a) Simple interest calculation
   b) Greatest among three numbers
   c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												2	
3	3												2	
4	3												2	
5		3			2							2	3	
CO (W.A)	3	3			2							2	2.4	

22ITC01 –DATA STRUCTURES USING C *(Common to 22AIC01, 22CSC02, 22CCC01, 22CIC01)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: 22CSC01					
Course Objective:	● To develop skills to apply appropriate data structures in problem solving. ● To apply abstract data types (ADTs), recursion, algorithms for searching and sorting, and basic algorithm analysis.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply pointer and array concepts in functions.	Ap	20%
CO2	Solve problems using various implementations of linked list.	Ap	20%
CO3	Make use of ADTs like stack and queue for solving real world problems	Ap	20%
CO4	Analyze the tree traversal algorithms for various non-linear data structures.	An	20%
CO5	Analyze appropriate graph algorithms for computing problems	An	20%

UNIT I - POINTERS USING ARRAYS AND STRINGS	**(9)**
Pointers : Introduction – Pointers and arrays– passing an array to a function– returning an array from function – NULL pointers –Array of pointers – Pointer-to-pointer – Dangling Pointer. Function pointers: calling a function using function pointer- Using pointer as a function argument	
UNIT II - LIST	**(9)**
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT	
UNIT III - STACKS AND QUEUES	**(9)**
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressionsInfix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues	
UNIT IV - TREE	**(9)**
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.	

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UNIT V - GRAPHS	(9)
Definitions – Representation of Graphs – Types of Graph – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Sumitabha Das, "Computer Fundamentals &C Programming", McGraw Hill Education (India) Private Limited, 1st Edition, 2018.
2. Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.

REFERENCES:

1. Yashavant Kanetkar, "Pointers in C", BPP Publications, 4th Edition, 2017.
2. PradipDey, Manas Ghosh, "Programming in C", Oxford Higher Education, 2nd Edition, 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											3	3	
2	3											3	3	
3	3											3	3	
4		3										3	3	3
5		3										3	3	3
CO (W.A)	3	3										3	3	3

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22ITC02- PYTHON PROGRAMMING *(Common to 22AIC02, 22CSC03, 22CCC02, 22CIC02)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To develop the logical thinking abilities and to propose novel solutions for real world problems through programming language constructs.

Course Outcomes		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of syntax and semantics of the Python programming to develop different applications	Ap	20%
CO2	Apply control statements and operators to solve basic programming problems	Ap	20%
CO3	Make use of string,list, dictionaries, tuples, and sets data structures for developing applications	Ap	20%
CO4	Develop modular code using functions and manage file operations efficiently	C	20%
CO5	Perform data manipulation with NumPy arrays	C	20%

UNIT I - INTRODUCTION TO PYTHON	**(9)**
Introduction to python: Features - Execution of python program – Flavors of Python – Comments - Data Types: Built-in data types– Sequences – Set - Literals– Operators – Input and Output Statements - Control Statements if – if-else –if-else-if – while-For –Nested loops – the else suite - Break – Continue - pass - assert – return.	
UNIT II - STRINGS	**(9)**
Arrays: One Dimensional arrays - Multi Dimensional arrays - Strings and Characters: Creating - Length - Indexing - Slicing - Repeating - Concatenation - Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing - Splitting and Joining Strings - Changing Case - Checking Starting and Ending of a String – String Formatting - Working with Characters – Sorting - Searching Strings - Finding Number- Inserting sub string into a string.	

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UNIT III - LISTS , TUPLES AND DICTIONARIES	(9)
Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a tuples. Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.	
UNIT IV - FUNCTIONS AND FILES	**(9)**
Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators. Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories.	
UNIT V - MODULES AND FRAMEWORKS	**(9)**
Modules: Importing module –Features – Built in functions. - Python Environment and Frameworks: NumPy: NumPy Arrays – Computation on NumPy Arrays – Aggregation – Sorting Arrays – Structured Arrays.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 2021 Edition.
2. Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1st Edition O'Reilly Publishers, 2016.

REFERENCES:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2018.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2013.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	
2	3	3											3	
3	3	3	3										3	3
4			3		3								3	3
5			3		3								3	3
CO (W.A)	**3**	**3**	**3**		**3**		**3**						**3**	**3**

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22ITP01 –DATA STRUCTURES LABORATORY *(Common to 22AIC01, 22CSC02, 22CCC01, 22CIC01)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PRE-REQUISITE : 22CSP01				
Course Objective:	• To understand the fundamental concepts of data structures, including arrays, linked lists, stacks, queues, trees, and graphs.			

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Applying pointers and implement array operations	Ap
CO2	Analyze different steps on linked lists.	An
CO3	Capable of working with stack and queue principles.	An
CO4	Cable to creating and modifying a variety of tree operations.	C
CO5	Possible for executing numerous graph functions	Ap

LIST OF EXPERIMENTS:

1. Pointer using 1D, 2D array
2. Implementation of singly linked list and its operations
3. Implementation of doubly linked list and its operations
4. Implementation of circular linked list and its operations
5. Implementation of Infix to postfix conversion using stack ADT
6. Implement the application for evaluating postfix expressions using array of stack ADT
7. Implementation of reversing a queue using stack
8. Binary Search Tree
9. AVL Tree
10. Priority Queues (Heaps)
11. Implementation of Graph Traversals(BFS, DFS)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.

Software:

Compiler – C

TOTAL (P:60) : 60 PERIODS

*Ratified by Eleventh Academic Council

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3									3		3
2	3	3		3										3
3			3										3	
4		3		3			3					3		
5			3	3					3			3	3	
CO (W.A)	3	3	3	3			3		3			3	3	3

*Ratified by Eleventh Academic Council

22ITP02 - PYTHON PROGRAMMING LABORATORY *(Common to 22AIP02, 22CSP03, 22CCP02, 22CIP02, and 22ITP02)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	Gain proficiency in Python programming by applying fundamental concepts and techniques in practical exercises.

Course Outcomes		**Cognitive Level**
CO1	Apply the knowledge of python programming concepts to solve basic computational problems.	AP
CO2	Implement functions and file handling problems using python.	AP
CO3	Develop GUI applications using python framework.	C
CO4	Perform data manipulation using NumPy	AP
CO5	Design a python program for given requirement.	C

List of Exercises:

1. Programs for demonstrating the use of different types of operators.
2. Programs for demonstrating control statements.
3. Programs to implement various string operations.
4. Programs for demonstrating the following
   i. Lists
   ii. Tuples
   iii. Dictionaries
5. Programs to demonstrate concepts using functions
6. Programs to implement applications using File handling
7. Programs to demonstrate modules.
8. Programs to implement applications using regular expression.
9. Program to demonstrate GUI.
10. Perform data manipulation using NumPy.

TOTAL (P:60) = 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,

Software:

OS – Windows / UNIX Clone
Open Source Software – Python

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3		3									
4					3									
5			3											3
CO (W.A)	3	3	3		3									3

22ITC04 - **ALGORITHMS** ***(Common to 22AIC06, 22CCC04,22CIC04 and 22CSC05)***				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE: 22CSC02				
Course Objective:	To develop problem-solving skills through algorithms and prepare students to apply the skills in various domains such as software development, research, and engineering.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the time and space complexities of algorithms using asymptotic notations	An	20%
CO2	Apply algorithmic concepts and techniques to design and develop efficient solutions for real-world problems	Ap	40%
CO3	Apply the knowledge of complexity classes P, NP and NP-Completeness problem	An	20%
CO4	Design efficient algorithms to solve graph problems	Ap	20%
CO5	Optimized the existing algorithms by reducing the lines of code	An	Internal mode

UNIT I - INTRODUCTION	**(9)**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.	
UNIT II - BRUTE FORCE AND DIVIDE-AND-CONQUER	**(9)**
Brute Force – Computing an – String Matching - Selection Sort and Bubble Sort – Sequential Search - Closest-Pair and Convex-Hull Problems - Exhaustive Search: Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort –Closest-Pair and Convex - Hull Problems.	
UNIT III - DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	**(9)**
Dynamic Programming: Computing a Binomial coefficient – Warshall's and Floyd's Algorithm – Optimal Binary Search trees - 0/1 Knapsack Problem. Greedy Technique: Prim's algorithm and Kruskal's Algorithm - Huffman Trees.	

UNIT IV - ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER	(9)
Iterative Improvement - The Simplex Method - The Maximum-Flow Problem- Maximum Matching in Bipartite Graphs. Limitations of Algorithm Power: Lower bound arguments – Decision trees – P, NP and NP complete Problems.	
UNIT V - STATE SPACE SEARCH ALGORITHMS	**(9)**
Backtracking: N Queen's problem – Hamiltonian Circuit problem – Subset problem - Graph coloring problem. Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem – Travelling Salesman Problem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 3rd ed.., 2017.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
2. S. Sridhar, "Design and Analysis of Algorithms ", Oxford university press, 2014.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	3
2	3												3	
3		3											3	
4	3												3	
5			3	3					3				3	3
CO (W.A)	3	3	3	3					3				3	3

22ITC05- OPERATING SYSTEMS (Common to *22AIC08, 22CSC08, 22CIC07*)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE: NIL				
Course Objective:	• To provide understanding about the fundamental concepts, design principles, and functionalities of operating systems.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the different concepts and functionalities of operating system	Ap	20%
CO2	Analyze the efficient scheduling algorithms in process management	An	30%
CO3	Develop solutions using the paging and virtual memory management strategies	Ap	40%
CO4	Manage concurrent access to shared resources in operating systems	An	10%
CO5	Collaborate and compare the various file system structures	An	Internal Assessment

UNIT I - FUNDAMENTALS	**(9)**
Introduction - System Architecture - Operating System Structure - Operations - Process Management - Memory Management - Storage Management - System Structure - User Operating System Interface - System Calls - Types - System Programs - Operating System Design and Implementation - Virtual machines.	
UNIT II - PROCESS MANAGEMENT	**(9)**
Process Concept - Process Scheduling - Operations on Processes- Inter Process Communication - Shared Memory and Message Passing Systems - CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Threads Overview - Thread Scheduling.	
UNIT III - PROCESS SYNCHRONIZATION	**(9)**
Synchronization: The Critical-Section Problem - Peterson's solution - Hardware support for Synchronization - Mutex – Semaphores - Deadlocks: Deadlock Characterization - Methods for handling deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.	
UNIT IV - MEMORY MANAGEMENT	**(9)**
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Segmentation - Virtual Memory - Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing,	

UNIT V - SECONDARY STORAGE MANAGEMENT	(9)
Secondary Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap Space Management - File System - File Concepts: Access Methods - Directory Structure - File System Mounting - File System Implementation - Structure – Implementation - Directory Implementation - Allocation Methods - Free Space Management - I/O Systems - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

REFERENCES:

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall of India Pvt., 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			2										2	
4				3	2									3
5								2	2					
CO (W.A)	**3**	**3**	**2**	**3**	**2**			**2**	**2**				**2**	**3**

22ITC06 - JAVA PROGRAMMING *(Common to 22AIC04 ,22CSC07, 22CCC06 and 22CIC06)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: Nil

Course Objective:	• To understand object-oriented programming concepts, and apply them in solving problems. • To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of classes and objects to solve simple problems using Java	Ap	20%
CO2	Analyse how oops concepts like inheritance, polymorphism improves code organization and enhances flexibility.	An	20%
CO3	Build interactive applications using applets and swing	An	20%
CO4	Conduct practical experiments for demonstrating exception handling, multithreaded applications with synchronization.	An	40%
CO5	Build the Java Project for engineering applications and make an individual study being member of team.	An	Internal Assessment

UNIT I - INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	(9)
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Strings, Packages - JavaDoc comments.	
UNIT II - INHERITANCE AND INTERFACES	(9)
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods-Keywords: Static-final-this- final methods and classes – Method overloading-Method overriding-Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces	

UNIT III - EXCEPTION HANDLING AND I/O	(9)
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing File	
UNIT – IV –THREADS	(9)
Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads — Thread Priorities – Synchronization – Inter thread Communication – Suspending, Resuming, and Stopping Threads – Using Multithreading.	
UNIT – V EVENT DRIVEN PROGRAMMING	(9)
Graphics programming - Frame – Components Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019 for Units I, II, III, IV.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015 for Unit V.

REFERENCES:

1. Cay. S. Horstmann, Gary Cornell, "Core Java-JAVA Fundamentals", Prentice Hall, 10th ed., 2016.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.3. SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2		3												3
3			3		3								3	
4				3										
5					3				3		2	3		3
CO (W.A)	3	3	3		3				3		2	3	3	3

22ITC07 COMPUTER NETWORKS

(Common to 22AIC12, 22CSC06, 22CCC05 and 22CIC09)

L	T	P	C
3	0	0	3

PRE-REQUISITE: NIL

Course Objective: Develop expertise in networking fundamentals, protocols, security mechanisms, and network management for effective operational efficiency.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the fundamental concepts of communication in networking technologies.	Ap	30%
CO2	Analyze network performance metrics and optimize network configurations.	An	20%
CO3	Develop solutions for network routing algorithms and traffic management strategies.	Ap	30%
CO4	Manage network security protocols and evaluate their effectiveness in protecting network resources.	An	20%
CO5	Collaborate to design and deploy network infrastructures and services	C	Internal Assessment

UNIT I - INTERNET AND DATA COMMUNICATIONS	**(9)**
Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.	
UNIT II - DATA LINK LAYER	**(9)**
Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – Media Access Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.	
UNIT III - NETWORK LAYER	**(9)**
IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-State Routing, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.	
UNIT IV - TRANSPORT LAYER	**(9)**
Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.	
UNIT V - APPLICATION LAYER	**(9)**
Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022

REFERENCES:

1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3										3	
4		3	3							3				3
5					3			3				3		3
CO (W.A)	**3**	**3**	**3**		3			**3**		**3**		**3**		**3**

22ITC08 DESIGN THINKING *(Common to 22CIX41)*				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL				
Course Objective:	To expose the student with state-of-the-art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design thinking and its different phases for business process.	Ap	20%
CO2	Empathize with user situations and be able to define clear problem statement	An	20%
CO3	Create prototypes for clear understanding of the problem statement and Use the different ideation methods.	Ap	20%
CO4	Implement Plan through engage and evolve phase that will deliver/achieve the Big Idea/solution deduced from earlier phases	An	40%
CO5	Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches	C	Internal Assessment

UNIT I – Introduction to design thinking	(9)
Introduction – Need for design thinking – Design and Business – The Design Process — Phases in design thinking process – Five stage mode- Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.	
UNIT II - Empathize phase	(9)
Visualization – Mind Mapping – Empathize – Empathize with the users - Steps in empathize phase – Developing empathy towards people –Observations – Need Finding – User Personas.	
UNIT-III Ideate phase and Prototype phase	(9)
What is ideation – Need for ideation – Uses of ideation – Ideation Methods- Brainstorming-Rules for brainstorming -Ideation games - Six Thinking Hats –Doodling – Use of doodling in expressing creative ideas- Idea refinement. Prototyping- Guidelines for prototyping –Types of prototyping- Importance of prototyping in design thinking.	
UNIT IV – Engage phase	(9)
Assumption Testing-Rapid Prototyping – Engage – Story telling – Characteristics of good stories – Reaching users through stories-Storyboarding-Characteristics of good stories-Value proposition- Guidelines to write value proposition	
UNIT V – Evolve phase	(9)
Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems– Quick Wins Agile Methodology – Complementing agile with design thinking	
TOTAL= 45 PERIODS	

TEXT BOOKS:
1. Lee Chong Hwa "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 1st Edition, 2017 2. Eli Woolery, Design Thinking Handbook, Invision, 2019 3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires, 1stEdition, HarperCollins, 2009
REFERENCE:
1. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3											3	
3			3		3								3	
4				3										2
5					3	3					2	2		2
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**					**2**	**2**	**3**	**2**

22ITP03 ALGORITHMS LABORATORY

(Common to 22AIP05, 22CSP04, 22CCP03 and 22CIP03)

	L	T	P	C
	0	0	4	2

PRE-REQUISITE: NIL

Course Objective:	To learn and apply important algorithmic design paradigms and methods of analysis.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Implement basic algorithms such as brute force, string matching, sorting, and sequential search.	Ap
CO2	Apply algorithmic thinking to break down problems into manageable steps.	Ap
CO3	Apply dynamic programming techniques to solve complex computational problems.	Ap
CO4	Apply the greedy approach used in algorithm for finding minimum spanning trees in weighted undirected graphs.	Ap
CO5	Implement backtracking algorithms to solve a variety of combinatorial problems efficiently.	Ap

LIST OF EXPERIMENTS:

1. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
2. Sort a given set of elements using the Insertion sort, Selection sort and Bubble sort
3. Implementation of Linear Search.
4. Implementation of Recursive Binary Search
5. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
6. Develop a program to sort the numbers using Merge and Quick sort .
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
10. Implement N Queens problem using Backtracking.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,.

Software:

C/C++/JAVA/ Python

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3										3	
2	3		3											
3	3		3				3							
4	3		3			3	3							
5	3		3											
CO (W.A)	**3**		**3**			**3**	**3**						**3**	

22ITP04 JAVA PROGRAMMING LABORATORY *(Common to 22AIP03, 22CSP06, 22CCP05 and 22CIP05)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: Nil

Course Objective:	To learn Java Programming concepts and develop applications based on Java.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the concepts of Java to solve problems	Ap
CO2	Analyse the efficiency of using appropriate programming constructs.	An
CO3	Demonstrate the usage of different programming structures through example programs	Ap
CO4	Develop simple applications using swing.	C
CO5	Engage in independent study and learn to use Java for real time applications.	An

LIST OF EXPERIMENTS:

1. Write simple Java programs using operators, arrays and control statement
2. Programs using Static, final and this keywords.
3. Demonstrate the concepts of inheritance
4. Programs illustrating overloading and overriding methods in Java
5. Programs to use packages and Interfaces in Java.
6. Implement exception handling and creation of user defined exception.
7. Implement program to demonstrate multithreading and inter thread communication.
8. Write a program to perform file operations.
9. Develop applications using swing layouts

HARDWARE OR SOFTWARE REQUIREMENT:

HARDWARE:

1. LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
2. Printers – 3 Nos.

SOFTWARE:

1. Java / Equivalent Compiler

TOTAL L:60 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3											3	
3		3			2									3
4			3		3								3	
5									3			3		
CO (W.A)	**3**	**3**	**3**		**3**				**3**			**3**	**3**	**3**

22ITP05 - COMPUTER NETWORKS LABORATORY

(Common to 22CCP04, 22CIP06 and 22CSP05)

	L	T	P	C
	0	0	4	2

PRE-REQUISITE: NIL

Course Objective: Acquire expertise in network infrastructure through tasks such as cable crimping, LAN setup, TCP/IP configuration, socket communication, protocol simulations, and network topology design.

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Identify and implement RJ45 cable crimping for straight-through, standard, and crossover cables.	Ap
CO2	Develop and execute a program to transfer files between nodes using socket connections.	C
CO3	Implement the sliding window protocol with varying frame sizes to observe efficiency and throughput.	Ap
CO4	Apply the routing protocol for displaying the routing table.	Ap
CO5	Develop a client application that interacts with a DNS server to resolve domain names into IP addresses.	C

LIST OF EXPERIMENTS:

1. Study of Color coding Jack RJ45 and do the following Cabling works in a network
   a. Cable Crimping
   b. Standard Cabling
   c. Cross Cabling and
   d. Establish a LAN connection using three systems using any topology.
2. Configure IP Address in a system in LAN (TCP/IP Configuration) and Implement the client server communication using socket connection
3. Write a program for transferring a file between nodes in a network.
4. Perform CRC computation
5. By varying the number of frames, design the Sliding Window Protocol
6. Simulation of ARP/RARP
7. Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.
8. Write a program for downloading a file from HTTP server
9. Develop a client that contacts a given DNS server to resolve a given host name.
10. Configure a Network topology using Packet tracer software
11. Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.

TOTAL (P:60) : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 60 STUDENTS SOFTWARE :

HARDWARE:
Standalone desktops 60 Nos., Jack RJ45 connectors
SOFTWARE:
C / C++ / Java / Equivalent Compiler
Network simulator like Ethereal / NS2 / NS3 / Glomosim /OPNET/ 60 Equivalent.

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2			3											
3	3	3											3	
4	3												3	
5			3										3	
CO (W.A)	3	3	3										3	

22ITC09 - THEORY OF COMPUTATION

(Common to 22CSC10)

	L	T	P	C
	3	I	0	4

PRE-REQUISITE: 22MYB05

Course Objective:	To improve the performance and profitability of any system by identifying and eliminating the "constraints" that limits its output, throughput, and goal achievement.

Course Outcomes: The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of automata theory to model and solve computational problems.	AP	30%
CO2	Analyze efficiency and effectiveness of parsing algorithms in language processing.	An	30%
CO3	Develop solutions for language recognition and generation using formal language constructs.	Ap	30%
CO4	Evaluate and manage complexity in designing Turing machines for computational tasks.	An	10%
CO5	Utilize tools to explore and experiment with formal languages, automata, and abstract machines.	Ap	Internal Assessment

UNIT I - AUTOMATA **(9+3)**

. Introduction to finite automata(FA) – Central concepts of automata theory – Deterministic finite automata – Non deterministic finite automata – Finite automata with epsilon transitions – Equivalence between epsilon NFA and DFA - Minimization of automata.

UNIT II - REGULAR EXPRESSIONS **(9+3)**

Regular expressions(RE) - Manipulation of regular expressions - Equivalence between RE and FA - Inter conversion - Pumping lemma - Closure properties of regular sets – Decision properties of Regular Languages.

UNIT III - CONTEXT FREE GRAMMAR **(9+3)**

Context free Grammars (CFG) - Derivation trees - Ambiguity in Context-Free Grammars - Applications of Context Free Grammars - Normal Forms - Chomsky Normal Form (CNF) - Greibach Normal Form (GNF).

UNIT IV - PUSH DOWN AUTOMATA AND TURING MACHINE **(9+3)**

Push Down Automata (PDA) – Languages of PDA – Equivalence of PDA's and CFG's - Turing Machine, Programming techniques of Turing Machine – Types of Turing Machine.

UNIT V - CLASSES OF PROBLEMS	(9+3)
A language that is not Recursively Enumerable – Universal Turing Machine – Rice's Theorem and properties of the Recursively Enumerable Languages – Post's Correspondence Problem (PCP) – The Classes P and NP – An NP Complete Problem.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman," Introduction to Automata Theory, Languages, and Computation", 3rd ed., Pearson, 2013.
2. John C Martin, "Introduction to Languages and the Theory of Computation", 4th ed., Tata McGraw Hill Publishing Company, New Delhi, 2011

REFERENCES:

1. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009.
2. Lewis H.P. & Papadimitriou C.H.," Elements of Theory of Computation", Prentice Hall of India, 4th ed., 2007.
3. Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Prentice Hall of India, New Delhi, 3rd ed., 2006.
4. Harry R Lewis, Christos H Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India/ Pearson Education, New Delhi, 2nd ed., 2015.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3		3									3	
3	3		3										3	
4		3											3	
5	3				3								3	
CO (W.A)	3	3	3	3	3								3	

22ITC10 FUNDAMENTALS OF DATA SCIENCE *(Common to 22CIX42)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• To understand the data science fundamentals and process and learn to describe the data for the data science process.				
Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Apply the fundamental knowledge of data science to solve real time problem	Ap	20%		
CO2	Analyze and visualize data for knowledge representation.	An	20%		
CO3	Demonstrate proficiency in data analysis	Ap	30%		
CO4	Conduct experiments of data science concepts in python	An	30%		
CO5	Develop solutions for real world problems with standard datasets using data science tools	C	Internal Assessment		

UNIT I INTRODUCTION	**(9)**
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data	
UNIT II DESCRIBING DATA	**(9)**
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores	
UNIT III DESCRIBING RELATIONSHIPS	**(9)**
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean	
UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING	**(9)**
Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables	
UNIT V DATA VISUALIZATION	**(9)**
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III) 3
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3										3	
4			3	3	3									
5			3	3	3				2	2				3
CO (W.A)	3	3	3	3	3				2	2			3	3

22ITC11 DATABASE MANAGEMENT SYSTEM *(Common to 22CSC11, 22CIC10)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	To gain knowledge on introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.				
Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Design ER-models to represent simple database application scenarios	Ap	10%		
CO2	Apply the concepts of database management system for various applications.	Ap	30%		
CO3	Analyse database concepts for a given problem.	An	20%		
CO4	Design conceptual data model for database applications	Ap	20%		
CO5	Demonstrate SQL commands to create, manipulate and query data in a database	Ap	20%		

UNIT I - DATA BASE SYSTEM CONCEPT	**(9)**
Purpose of Database systems – Views of data – Database Languages - Database design – Database system architecture – Data models – Data Dictionary – Database Administration – Entity-Relationship model – EER Model.	
UNIT II - RELATIONAL DATABASE	**(9)**
Structure of Relational Database – Integrity Constraints – Relational Algebra – Relational Calculus – SQL – Views –Joins – Functions and Procedures – Triggers.	
UNIT III - DATABASE DESIGN	**(9)**
Functional Dependencies – Decomposition: Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	
UNIT IV - PHYSICAL DATABASE DESIGN AND QUERY PROCESSING	**(9)**
Storage and file structure: RAID – File Organization – Organization of Records in Files – Data dictionary Storage - Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices — Query Processing	
UNIT V -TRANSACTION PROCESSING	**(9)**
Transactions: Desirable properties of Transactions – Serializability – Concurrency Control: Lock-Based Protocols – Timestamp-Based Protocols – Validation-Based Protocols – Recovery systems.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 7th ed., McGraw Hill, 2020.

REFERENCES:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 7th ed., Pearson Education/Addison Wesley, 2017.
2. Date C.J., Kannan A. and Swamynathan S., "An Introduction to Database Systems", 8th Edition, Pearson Education, New Delhi, 2013.

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3											3	
4			3											
5			3		3								3	3
CO (W.A)	3	3	3		3								3	3

22ITC12 – AGILE METHODOLOGIES				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE: NIL

Course Objective:	Estimate in an incremental and iterative fashion using practical techniques Apply agile principles to a range of decision possibilities.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the ethical considerations and team dynamics	**An**	20%
CO2	Apply scrum practices in project management	**Ap**	30%
CO3	Interpret and utilize agile metrics for informed decision-making	**An**	30%
CO4	Conduct Effective Requirements Engineering in Agile	**An**	20%
CO5	Apply agile testing practices to ensure high product quality.	**Ap**	Internal Assessment

UNIT I AGILE METHODOLOGY	**(9)**
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values	
Unit – II AGILE PROCESSES	**(9)**
Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.	
Unit – III AGILITY AND KNOWLEDGE MANAGEMENT	**(9)**
Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).	
Unit – IV AGILITY AND REQUIREMENTS ENGINEERING	**(9)**
Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.	
Unit – V AGILITY AND QUALITY ASSURANCE	**(9)**
Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Sciencell, Springer, 2009.

REFERENCES:

1. Craig Larman, —Agile and Iterative Development: A Manager_s Guidell, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Managementll, Butterworth-Heinemann, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										2			3
2			3		3			2	2		2			
3	3										2		3	3
4	3							2		2				
5			3		3						2			3
CO (W.A)	3		3		3			2	2	2	2		3	3

22ITC13 ADVANCED JAVA PROGRAMMING *(Common to 22CSC12 and 22CCC14)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : 22ITC06

Course Objective:	Be able to put into use the advanced features of the Java language to build and compile robust enterprise grade applications

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of collections for high-performance implementations of data structures.	Ap	20%
CO2	Analyse how to use HTML and CSS in front end deign and JavaScript for responsive pages.	An	40%
CO3	Design web application based on client and server-side technologies and backend connectivity.	Ap	20%
CO4	Demonstrates the benefits of XML in data sharing.	An	20%
CO5	Implement mini project for any given web application using advanced web development concepts.	An	Internal Assessment

UNIT I WRAPPER CLASSES AND COLLECTIONS	(9)
Wrapper Classes: Autoboxing, Unboxing and Cloneable Interface **I/O Streams:** Introduction to I/O, I/O Operations, Object Serialization **Collection Framework:** Introduction to Collection, List, Array Lists, Linked Lists, Sorting Lists, Using Iterators, Generics, Set, Map, HashMap, Sorted Maps, Using Custom Objects, Map	
UNIT II HTML & CSS	(9)
HTML : Introduction to HTML and its elements, Basic Tags, Basic Elements, Formatting Tags, Layout tags and Semantic Tags, Tables, Forms and Frames, Style and div tags, Introduction to HTML5 **CSS:** Introduction to CSS, Styles and Style sheets, Formatting with CSS, Links and Lists, CSS Box Model, CSS3.	
UNIT III JAVASCRIPT	(9)
JAVASCRIPT: Introduction to JavaScript, variables, Data Types, JS Functions, JS Strings, JS Events, JS Objects, Arrays, Event Handling JS Validations, JS Regular Expressions.	

UNIT IV SERVLETS AND DATABASE CONNECTIVITY	(9)
SERVLETS: Introduction to Servlets, Servlet Lifecycle, Servlet-Get and Post Requests, Servlet Config and Servlet Context, Servlet-Cookies and Session Management. **RDBMS / SQL / JDBC:** Introduction to RDBMS, Oracle 11g Introduction, Select Statement, Restricting and Sorting Data, DML, DDL, Introduction to JDBC, Establishing Connection, Executing Query and Processing Results, Meta data & Prepared Statement, Using Callable Statement and Transactions.	
UNIT V JSP and XML	(9)
JSP : overview-Basic JSP Architecture-Lifecycle-JSP in Eclipse-JSP scripting elements-Directives-Actions-Implicit objects **XML:** Introduction to XML, Document Type Definition, XML Namespaces, XML Schema, XSLT.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill
2. "Web Technologies--A Computer Science Perspective", Jeffrey C.Jackson, Pearson Education, 2007

REFERENCES:

1. ThomasA. Powell,"TheComplete Reference HTML &CSS",New Riders, 5th ed., 2017.
2. SteveSuehring,"JavaScript– Step by Step", PHI, 2nd ed.,2011.
3. https://www.w3schools.com
4. https://www.tutorialspoint.com/jsp

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3			3										3	
4			2		3									3
5					2				2	2	2			
CO (W.A)	3	3	3		3				2	2	2		3	3

** Ratified by Twelfth Academic Council

22ITP06 DATABASEMANAGEMENT SYSTEM LABORATORY *(Common to 22CSP07, 22CIP07)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PRE-REQUISITE : NIL					
Course Objective:	To provide practical experience in designing, implementing, and managing databases using database management system concepts.				
Course Outcomes The students will be able to		**Cognitive Level**			
CO1	Analyse database concepts for a given problem.	An			
CO2	Demonstrate SQL commands to create, manipulate and query data in a database.	Ap			
CO3	Design SQL queries and conceptual data models for database applications.	Ap			
CO4	Construct front end tools to design forms, reports and menus	C			
CO5	Develop the solutions using database concepts for real time requirements	C			

LIST OF EXPERIMENTS
1. Structured Query Language : Creating Database • Creating a Table • Specifying Relational Data Types • Specifying Constraints • Creating Indexes
2. Table and Record Handling • INSERT statement • Using SELECT and INSERT together • DELETE, UPDATE, TRUNCATE statements • DROP, ALTER statements
3. Retrieving Data from a Database • The SELECT statement • Using the WHERE clause • Using Logical Operators in the WHERE clause • Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause • Using Aggregate Functions Combining Tables Using JOINS Sub queries
4. Database Management • Creating Views • Creating Column Aliases • Creating Database Users Using GRANT and REVOKE
High level language extension with Triggers
Database design using E-R model and Normalization
Design and implementation of Payroll processing system
Design and implementation of Banking system
Design and implementation of Library Information System
Design and implementation of Student Evaluation System
TOTAL (P: 60) = 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
HARDWARE: 33 nodes with LAN connection or Standalone PCs **SOFTWARE:** 1. MYSQL 8.0 2. Visual Basic 6.0

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											2	
2	3												3	2
3			3										3	
4					3								3	
5			3				3		3		3	3	3	
CO (W.A)	3	3	3		3		3		3		3	3	3	2

22ITP07 ADVANCED JAVA PROGRAMMING LABORATORY *(Common to 22CSP08 and 22CCP09)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE: 22ITP04				

Course Objective:	To use advanced client and server-side technologies to develop a web application.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply Advanced Java concepts to solve real-world problems.	Ap
CO2	Design and develop user-centric web applications focused on social and environmental issues.	C
CO3	Integrate front-end and back-end components effectively with databases and external services	Ap
CO4	Use web designing and scripting technologies to develop web applications.	An
CO5	Demonstrate teamwork and problem-solving skills in project development.	An

LIST OF EXPERIMENTS :

1. Practice programs on Java Collections Frameworks
2. Programs to convert primitive types to wrapper objects and vice versa
3. Programs with HTML and CSS
4. Programs with JavaScript.
5. Use JDBC connectivity and create Table, insert and update data.
6. Write a program in Java to create a Cookie and set the expiry time of the same.
7. Write a program in Java to create Servlet to count the number of visitors to a web page.
8. Write a program in Java to create a form and validate a password using Servlet.
9. Programs for creating web applications using JSP.
10. Programs on XML.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				3								3	
2		3			3	3	3						3	
3			3		3									3
4					3								3	
5								3	3	3	2			
CO (W.A)	**3**	**3**	**3**		**3**		**3**	**3**	**3**	**3**	**2**		**3**	**3**

** Ratified by Twelfth Academic Council

SEMESTER: V									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17ECC12	Digital Signal Processing	ES	-	4	2	2	0	3
2.	17ITC09	Internet and Web Programming	PC	17ITC01	4	2	0	2	3
3.	17ITC10	Object Oriented Analysis and Design	PC	17ITC07	3	3	0	0	3
4.	17ITC11	Computer Graphics and Multimedia	PC	-	3	3	0	0	3
5.	E1	Elective I (PSE)	PSE	-	3	3	0	0	3
6.	E2	Elective II (PSE)	PSE	-	3	3	0	0	3
PRACTICAL									
7.	17ITP04	Case Tools Laboratory	PC	-	4	0	0	4	2
8.	17ITP05	Computer Graphics and Multimedia Laboratory	PC	-	2	0	0	2	1
9.	17GED08	Essence of Indian Traditional Knowledge	EEC	-	2	2	0	0	0
				TOTAL	**28**	**18**	**2**	**8**	**21**

SEMESTER:VI									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17CSC09	Artificial Intelligence	PC	-	3	3	0	0	3
2.	17ITC13	Compiler Design	PC	-	3	3	0	0	3
3.	17ITC14	Cryptography and Network Security	PC	17ITC05	3	3	0	0	3
4.	E3	Elective III (PSE)	PSE	-	3	3	0	0	3
5.	E4	Elective IV (PSE)	PSE	-	3	3	0	0	3
6.	E5	Elective V (PSE/OE)	PSE/OE	-	3	3	0	0	3
PRACTICAL									
7.	17CSP09	Internet of Things Laboratory	ES	-	4	0	0	4	2
8.	17GED06	Comprehension	PC	-	2	0	0	2	0
9.	17GED07	Constitution of India	EEC	-	2	2	0	0	0
				TOTAL	**26**	**20**	**0**	**6**	**20**

SEMESTER: VII									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	17GEA01	Engineering Economics and Financial Accounting	HS	-	3	3	0	0	3
2.	17ITC15	Machine Learning Techniques	PC	17MYB01	3	3	0	0	3
3.	17CSC18	Full Stack Development	PC	-	3	3	0	0	3
4.	E6	Elective – VI (PSE/OE)	PSE/OE	-	3	3	0	0	3
5.	E7	Elective VII (OE)	OE	-	3	3	0	0	3
PRACTICAL									
6.	17ITP06	Machine Learning Techniques Laboratory	PC	-	4	0	0	4	2
7.	17ITD01	Project Work I	EEC	-	4	0	0	8	4
				TOTAL	**23**	**15**	**0**	**12**	**21**

SEMESTER: VIII									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1.	E8	Elective VIII (PSE)	PSE	-	3	3	0	0	3
2.	E9	Elective IX (OE)	OE	-	3	3	0	0	3
PRACTICAL									
3.	17ITD02	Project Work II	EEC	-	20	0	0	16	8
TOTAL					**26**	**6**	**0**	**16**	**14**

LIST OF PROGRAMME SPECIFIC ELECTIVES (PSE)									
AICTE NORMS : 10 –15%					ACTUAL : 12.96 %				
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRERQUISITE	CONTACT PERIODS	L	T	P	C
1.	17IT X04	Data mining and warehousing	PSE	17CSC07	3	3	0	0	3
2.	17IT X05	PHP Programming	PSE	17ITC09	3	3	0	0	3
3.	17IT X06	Programming with JAVA 2 Enterprise Edition	PSE	17ITC01	3	3	0	0	3
4.	17IT X07	Advanced Web Programming	PSE	17ITC09	3	3	0	0	3
5.	17IT X08	C# and .Net	PSE	17ITC01	3	3	0	0	3
6.	17IT X09	Ruby Programming	PSE	-	3	3	0	0	3
7.	17IT X11	Principles of Cloud Computing	PSE	-	3	3	0	0	3
8.	17IT X14	Software Testing	PSE	-	3	3	0	0	3
9.	17IT X19	Information Security Management	PSE	-	3	3	0	0	3
10.	17CSX19	Software Agents	PSE	-	3	3	0	0	3
11.	17CSX11	Human Computer Interaction	PSE	17ITC05	3	3	0	0	3
12.	17IT X17	Building Enterprise Applications	PSE	17ITX06	3	3	0	0	3
13.	17IT X20	Finite Automata	PSE	17ITC13	3	3	0	0	3
14.	17CSX20	Software Quality Assurance	PSE	-	3	3	0	0	3
15.	17IT X21	Knowledge Management Techniques	PSE	-	3	3	0	0	3
16.	17IT X22	Enterprise Resource Planning	PSE	-	3	3	0	0	3
17.	17CSX22	Natural Language Processing	PSE	-	3	3	0	0	3
18.	17IT X25	Video Processing And Analytics	PSE	-	3	3	0	0	3
19.	17MYB12	Basic Statistics and Numerical Analysis	PSE	-	3	3	0	0	3
20.	17IT X26	Problem Solving and Algorithmic Skills	PSE	-	3	3	0	0	3
21.	17CSX31	Problem Solving And Programming	PSE	-	3	3	0	0	3
22.	17CSX29	Internet of Things	PSE	17ITC05	3	3	0	0	3
23	17CSX30	Agile Methodologies	PSE	-	3	3	0	0	3
24.	17CSX05	Network Analysis and Management	PSE	17ITC05	3	3	0	0	3
25	17IT X28	Agile Software Development	PSE	-	3	3	0	0	3
26.	17IT X29	IT operations	PSE	-	3	3	0	0	3
27.	17IT X30	IT operations Advanced	PSE	17IT X29 17CSC09	3	3	0	0	3

28.	17ITX31	Professional Readiness for Innovation, Employability and Entrepreneurship	PSE	-	3	3	0	0	3
29.	17ITX32	Test Driven Programming	PSE	-	3	3	0	0	3
30.	17ITX33	Java-Full Stack Implementation	PSE	-	3	3	0	0	3
31.	17ITX37	Problem Solving using Java	PSE	-	3	3	0	0	3
32.	17ITX38	Product Lifecycle Management	PSE	-	3	3	0	0	3

17ITC09 - INTERNET AND WEB PROGRAMMING

(Common to CSE and IT Branches)

L	T	P	C
2	0	2	3

PRE REQUISITE : 17ITC01 | **QUESTION PATTERN: TYPE – I**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To discuss the concepts of XHTML and CSS.	**1.1**	The students will be able to design a web page using HTML and CSS	**a,c,d,e,f,g,i,k,l**
2.0	To infer the basics of JavaScript	**2.1**	The students will be able to make use of JavaScript client side coding	**a,b,c,d,e,f,g,i,k,l**
3.0	To know about basics Java Servlets	**3.1**	The students will be able to apply servlets for their web development	**a,b,c,d,e,f,g,i,k,l**
4.0	To know about basic concepts of JSP	**4.1**	The students will be able to make use of JSP	**a,b,c,d,e,f,g,i,k,l**
5.0	To know about XML and Web services	**5.1**	The students will be able to make use of XML and Web Services	**a,b,c,d,e,f,g,i,k,l**

UNIT I - HTML 5 and CSS **(6+6)**

HTML Elements –HTML Forms – Introduction to HTML5 new elements – Semantic elements- CSS-Features–Syntax– Box Model- Selectors – Display Positioning – CSS Floats – CSS Colors – CSS text fonts

UNIT II –JAVASCRIPT **(6+6)**

JavaScript Introduction - Basic Elements - Variable - Data Types - Operators and Literals – Functions -Objects- Arrays–Built-in- Object – Event Handling – Validation

UNIT III - SERVLETS **(6+6)**

Java Servlets: Architecture–Overview – Servlet Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies

UNIT IV – JSP **(6+6)**

JSP: Overview –Basic JSP: Architecture- Lifecycle– Directives – Actions- Implicit Objects– Java Beans Classes and JSP – MVC Paradigm

UNIT V - XML and WEB SERVICES **(6+6)**

XML: Namespaces- XML Processing- -XML Documents- XSL – XSLT; Webservices: WSDL-XMLSchema– Introduction to SOAP

List of Experiments:

1. Programs with HTML and CSS.
2. Programs with Java script.
3. Programs on basic JSP tags
4. Programs for creating web applications using JSP.
5. Programs on HTTP Servlet.
6. Programs for creating web application using Servlets.
7. Creation of 3 tier Application.
8. Programs on XML

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE:

1. System with 1 GB RAM minimum.

SOFTWARE:

1. OS – Windows 7 or higher
2. Notepad++
3. Net beans

TOTAL (L: 30+P:30) = 60 PERIODS

TEXT BOOKS:

1. Jeffrey C.Jackson,"WebTechnologies--A Computer Science Perspective", Pearson Education, 2006.
2. DeitelDeitelNieto, “Internet &World Wide Web HowTo Program”, Prentice Hall, 5thed., 2012.

REFERENCES:

1. ThomasA. Powell,“TheComplete Reference HTML &CSS”,New Riders, 5th ed., 2010.
2. SteveSuehring,“JavaScript– Step by Step”, PHI, 2nd ed.,2010.
3. https://www.w3schools.com
4. https://www.tutorialspoint.com/jsp

17ITC10-OBJECT ORIENTED ANALYSIS AND DESIGN					
		L	T	P	C
		3	0	0	3
PRE REQUISITE :17ITC07		**QUESTION PATTERN: TYPE - III**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To learn the basics of object and object oriented methodologies.	**1.1**	The students will be able to interpret the object basics and object oriented life cycle		**a, b, f, i**
2.0	To familiarize in unified modeling language.	**2.1**	The students will be able to identify the classes and their relationships and methodologies		**e, j**
3.0	To analyze the object oriented analysis	**3.1**	The students will be able to develop the UML diagrams for various projects.		**i, j, k**
4.0	To apply techniques of state machines and design patterns to your designs.	**4.1**	The students will be able to construct various UML models using the appropriate notation.		**c, d, e**
5.0	To test the software testing methodologies and software quality assurance.	**5.1**	The students will be able to recognize need of software quality and testing.		**c, j, l**

UNIT I – INTRODUCTION	**(9)**
An Overview of Object Oriented Systems Development -Object Basics –Object Oriented Systems Development Life Cycle - Unified Approach.	
UNIT II - OBJECT ORIENTED METHODOLOGY	**(9)**
Rumbaugh Methodology –Booch Methodology -Jacobson Methodology -Patterns –Frameworks —Unified Modeling Language –UML Diagrams - Use case Diagram - class diagram -Interaction Diagram –State chart Diagram - Activity Diagram – UML Meta Model.	
UNIT III - OBJECT ORIENTED ANALYSIS	**(9)**
Identifying use cases -Object Analysis -Classification – Identifying Object - relationships -Attributes and Methods.	
UNIT IV - OBJECT ORIENTED DESIGN	**(9)**
Design process and axioms -Designing Classes –Access Layer -Object Storage and Object Interoperability – View Layer – Designing Interface Objects- Prototyping the user interface.	
UNIT V - SOFTWARE QUALITY	**(9)**
Software Quality Assurance – Testing Strategies – Test cases – Test plan –System Usability and Measuring User Satisfaction – Usability testing – User satisfaction test.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Ali Bahrami, “Object Oriented Systems Development”, Tata McGraw-Hill, 2015.
2. Carol Britton and Jill Doake, ”Object Oriented Systems Development”, Elsevier Butterworth-Heinemann, 2005.

REFERENCES:

1. Martin Fowler, “UML Distilled”, Second Edition, PHI/Pearson Education, 2002.
2. Stephen R. Schach, “Introduction to Object Oriented Analysis and Design”, Tata McGraw- Hill, 2003.

17ITC11-COMPUTER GRAPHICS AND MULTIMEDIA					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		**QUESTION PATTERN: TYPE - I**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To study the basic 2D and 3D graphical structures	**1.1**	The students will be able to implement two and three dimensional graphical structures	a,b,j,k	
2.0	To analyse the 2D geometric transformations	**2.1**	The students will be able to enhance the perspective of modern computer system	a,c,j,k	
3.0	To illustrate the concept of Management and Transmission of Multimedia objects.	**3.1**	The students will be able to utilize 3Dimensional transformation, projections and various visible surface algorithms	a,b,c,j	
4.0	To outline the concept of multimedia system design	**4.1**	The students will be able to gain knowledge of different media streams	a,b,c,j,k	
5.0	To analyse different media and design issues related to multimedia systems	**5.1**	The students will be able to determine the design practice used in multimedia authoring tools	a,b,c,k	

UNIT I - 2D PRIMITIVES

Elements of pictures created in computer graphics – Graphics input primitives and devices Drawing primitives in open GL and Basic open GL programming - open GL basic Graphics primitives – Output primitives – Line, Circle and Ellipse drawing algorithms – Attributes of output primitives.

UNIT II - 2D and 3D GEOMETRIC TRANSFORMATIONS

Three-Dimensional object representations − Three-Dimensional geometric and modeling transformations − Three-Dimensional viewing − Hidden surface elimination − Color models – Virtual reality - Animation.2D Viewing – Window-Viewport Transformation - Two dimensional Geometric transformations– Line, Polygon, Curve and Text clipping algorithms.

UNIT III - 3D CONCEPTS

Projections - Three dimensional object representation – Parallel and Perspective Polygons, Splines, Quadric Surfaces - Visualization of data sets - 3D affine transformations 3D Rotations using Quaternions – Viewing – Visible surface identification – Color Models, 3D Transformations in open GL

UNIT IV - MULTIMEDIA BASICS

Introduction and definitions – applications – elements – Animations – Compression – Types of Compressions: Lossless – Lossy – Video compression – Image Compression – Audio compression– Data and file format standards.

UNIT V - MULTIMEDIA AUTHORING AND APPLICATIONS
Creating interactive multimedia – Multimedia Authoring Systems – Multimedia Authoring Software Applications – Virtual Reality – Content based retrieval in digital libraries.
TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, "Computer Graphics with OpenGL", Fourth Edition, Pearson Education, 2014.
2. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", First Edition, Pearson

REFERENCES:

1. F.S.Hill, "Computer Graphics using OPENGL", Second edition, Pearson Education, 2003.
2. Prabhat K Andleigh, Kiran Thakrar, "Multimedia systems design", First Edition, PHI, 2007.

17ITP04 - CASE TOOLS LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : Nil

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To learn the basics of OO analysis.	**1.1**	The students will be able to design and implement Object Oriented Concepts	**a,b,j**
2.0	To learn the basics of Object Oriented design skills.	**2.1**	The students will be able to use the UML and Design Diagrams	**a,j,k**
3.0	To apply the UML design diagrams.	**3.1**	The students will be able to design the UML Diagrams	**a,l,j,k**
4.0	To learn to map design to code.	**4.1**	The students will be able to create code from UML Diagrams	**b,c,k**
5.0	To familiar with the various testing techniques	**5.1**	The students will be able to compare and contrast various design techniques	**a,d,e,i**

LIST OF EXPERIMENTS:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System
14. Library Management System
15. Student Information System

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

1. Rational Suite 30 user License
2. Open Source Alternatives: ArgoUML, VisualParadigm
3. Eclipse IDE and JUnit
4. PCs 30

TOTAL (P:60) = 60 PERIODS

17ITP05 - COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY

L	T	P	C
0	0	2	1

PRE REQUISITE : Nil

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To interpret the algorithmic development of graphics primitives such as line, circle, ellipse, polygon etc.	**1.1**	The students will be able to create the basic shapes such as lines, circle and ellipse.	**b,c,d,l**
2.0	To demonstrate the concept of 3D Transformation and projection using openGL.	**2.1**	The students will be able to create the 3D graphical scenes using open graphics library suits	**b,c,d,e,l**
3.0	To illustrate the representation and transformation of graphical images and pictures.	**3.1**	The students will be able to apply the transformations to the basic shapes and various clipping algorithms.	**b,c,d,e,l**
4.0	To illustrate the 2D animations using Open source animation Software.	**4.1**	The students will be able to design animation sequences using Open source animation Software.	**b,c,d,e,k**
5.0	To illustrate the impact of videos using video editing Software.	**5.1**	The students will be able to create videos using video editing Software.	**b,c,d,e,f,k,l**

LIST OF EXPERIMENTS:

1. Implementation of Algorithms for drawing 2D Primitives– Line (DDA, Bresenham) – allslopes
   Circle (Midpoint)
2. Composite 2DTransformations
3. 2D Geometric transformations – Translation Rotation Scaling Reflection Shear Window-Viewport
4. Liang - Barsky LineClipping
5. 3D Transformations - Translation, Rotation,Scaling
6. 3D Projections – Parallel,Perspective
7. Creating 3DScenes
8. Compression Algorithms - To implement text and image compressionalgorithms.
9. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization
10. 2D Animation – To create Interactive animation using any authoring tool

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware

1. LAN System with 33 nodes (OR) Standalone PCs – 33 Nos,Printers – 3 Nos.

Software

1. Turbo C Software
2. OpenGL/Java

TOTAL (P:30) = 30 PERIODS

17CSC09 - ARTIFICIAL INTELLIGENCE *(Common to CSE and IT Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE REQUISITE : NIL	**QUESTION PATTERN: TYPE - I**			

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To illustrate the basic concepts of logic and knowledge-based agents.	**1.1**	The students will be able to understand the fundamentals of knowledge representation of agents.	**a,b,j,k**
2.0	To build the most basic concepts, representations and algorithms for planning, to explain the method of achieving goals.	**2.1**	The students will be able to an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	**a,b,j,k**
3.0	To introduce the most basic concepts, representations and algorithms for planning, to explain the method of achieving goals.	**3.1**	The students will be able to understand the representation of states, algorithm for planning and real world problems.	**a,b,d,i,j**
4.0	To understand the concept of uncertainty and to learn the syntax and semantics of probability theory.	**4.1**	The students will be able to analysis and compare the different learning process and apply to the probability theory.	**a,c,i,j**
5.0	To understand the basic concepts of several learning techniques.	**5.1**	The students will be able to understand the different limitations of current Artificial Intelligence techniques.	**a,b,j,k**

UNIT I - INTRODUCTION	**(9)**
Introduction–Definition - Future of Artificial Intelligence – Intelligent Agents – Structure of Agents - Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	
UNIT II - KNOWLEDGE AND LOGICAL REASONING	**(9)**
Knowledge Based Agents – Logical Agents – Propositional Logic – Inferences – First-order Logic – Inferences in First order Logic – Forward Chaining – Backward Chaining – Unification and Lifting – Resolution.	
UNIT III - PLANNING STRATAGIES	**(9)**
Introduction – Planning problem – Planning with State Space Search – Partial order Planning – Planning Graphs – Plan graph for Heuristic Estimation – Plan Graph Algorithm – Planning with proportional logic – Planning and Acting in the real world – Time, Schedules, and Resources.	
UNIT IV - UNCERTAIN KNOWLEDGE AND REASONING	**(9)**
Uncertainty – Review of Probability - Probabilistic Reasoning – Bayesian Networks – Inferences in Bayesian Networks – Inference by Enumeration – Variable Elimination Algorithm – Temporal Models – Hidden Markov Models.	
UNIT V - LEARNING TECHNIQUES	**(9)**
Learning from Observation – Forms of Learning – Ensemble Learning – Computational Learning Theory – Inductive Learning – Decision Trees – Decision Trees as Performance Elements – Expressiveness of Decision Tree – Explanation Based Learning – Statistical learning Methods –Reinforcement Learning.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", 3rd ed., Pearson Education, 2009.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logicalapproach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", 4th ed., Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.

17ITC13- COMPILER DESIGN					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		**QUESTION PATTERN: TYPE - III**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To learn the design principles of a Compiler	**1.1**	The students will be able to describe each phase of compilation process	**a,b,e**	
2.0	To learn the lexical analysis, NFA and DFA	**2.1**	The students will able to solve the NFA and DFA.	**c,g,j**	
3.0	To learn the different parsing techniques	**3.1**	The students will be able to implement the parsing techniques including Bottom-up and Top-down parsing for the given grammar	**b,c,i**	
4.0	To learn intermediate code generation schemes and run time environment	**4.1**	The students will be able to design experiments for Intermediate Code Generation in compiler	**a,d,g**	
5.0	To learn how to optimize and effectively generate machine codes.	**5.1**	The students will be able to learn how to optimize and effectively generate machine codes	**b,g,i**	

UNIT I - INTRODUCTION	**(9)**
Translators - Compilation and Interpretation - Language processors - Introduction to compiling – Analysis of the source program –The phases of a compiler – Cousins of a compiler – The grouping of phases – Compiler construction tools.	
UNIT II - LEXICAL ANALYSIS	**(9)**
The role of the lexical analyzer – Input buffering – Specification and Recognition of tokens – Finite Automata -Nondeterministic Finite Automata - Acceptance of Input Strings by Automata - Deterministic Finite Automata - Converting Regular Expression to DFA - Converting NFA to DFA - Minimization of DFA.	
UNIT III - SYNTAX ANALYSIS	**(9)**
Syntax Analysis – The role of a parser – Context free grammar – Top down parsing– Recursive descent parsing, Predictive parsing – Bottom up parsing – LR parsers – Construction of a simple SLR, CLR and LALR parsing table.	
UNIT IV - INTERMEDIATE CODE GENERATION AND RUN TIME ENVIROMENT	**(9)**
Intermediate languages – Declarations – Assignment statements – Boolean expressions – Case statements – Back patching – Procedure calls. Run - Time Environments – Source language issues – Storage-allocation strategies.	
UNIT V - CODE GENERATION AND CODE OPTIMIZATION	**(9)**
Issues in the design of a code generator – The Target machine – Run time storage management – Register allocation and assignment – The DAG representation of basic blocks – The Principle sources of Optimization – Peephole Optimization – Optimization of basic blocks.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, “Compilers – Principles, Techniques, and Tools”, Pearson Education Asia, 2013.

REFERENCES:

1. Steven S. Muchnick, “Advanced Compiler Design & Implementation”, Morgan Kaufmann Publishers, 2003.
2. C. N. Fisher and R. J. LeBlanc “Crafting a Compiler with C”, Pearson Education, 2011.
3. SudhaSadasivam G, “Compiler Design”, Scitech Publications (India) Private Limited, Chennai, 2010.
4. Dhamdhere D M, "Compiler Construction Principles & Practice", Macmillan India Limited, New Delhi, 1997.

17ITC14 - CRYPTOGRAPHY AND NETWORK SECURITY			
L	T	P	C
3	0	0	3

PRE REQUISITE : 17ITC05	QUESTION PATTERN: TYPE – I

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To be familiar with various cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel	1.1	The students will be able to understand the requirement and concepts of security system.	a,,c,d,e,h,i,j,l
2.0	To understand the various block cipher and Stream cipher models	2.1	The students will be able to analyze a given system with respect to security concepts.	a,c,e,h,k,l
3.0	Describe the principles of public key cryptosystems ,Hash Functions & Digital Signature.	3.1	The students will be able to create an understanding of public key cryptosystems and ability to solve Hash Functions & Digital Signature.	a,b,d,e,h,l
4.0	Gain the knowledge of Authentication Protocols and Firewall	4.1	The students will be able to apply the System Security concepts to overcome the attacks.	a,b,c,e,g,h,j,l
5.0	To impact knowledge on system security Intruders,Virus, and Evaluate the Security of Email, IP and Web	5.1	The students will be able to design Secure Authentication Protocols ,Email and IP Security.	a,b,c,e,g,h,l

UNIT I - COMPUTER SECURITY BASICS	(9)
Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Model for Network Security, Classical Encryption techniques- Substitution and Transposition methods, Block Cipher Principles.	
UNIT II - ENCRYPTION STANDARDS AND BLOCK CIPHER OPERATION	**(9)**
Data Encryption Standard- DES Encryption- Initial Permutation- Details of Single Round- Key Generation- DES Decryption, Advanced Encryption Standard (AES)- Triple DES- Double DES-Triple DES with Two Keys- Triple DES with Three Keys, Block Cipher Operation- Electronic Code Book- Cipher Block Chaining Mode- Cipher Feedback Mode-Output Feedback Mode- Counter Mode. RSA Algorithm- Diffie-Hellman Key Exchange Algorithm	
UNIT III - HASH FUNCTIONS AND DIGITAL SIGNATURES	**(9)**
Authentication Requirements - Authentication Functions - Message Authentication Code - hash Functions - Security of hash Functions and MAC-Hash and MAC Algorithms - -MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols	
UNIT IV - SECURITY PRACTICE	**(9)**
Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems	
UNIT V - SYSTEM & INFORMATION SECURITY	**(9)**
Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. William Stallings ,"Cryptography and Network Security - Principles and Practices" – PEARSON-Fourth Edition 2009.
2. Michael E Whitman and Herbert J Mattord, —Principles of Information Securityll, Vikas Publishing House, New Delhi, 2017.

17CSP09 - INTERNET OF THINGS LABORATORY
(Common to CSE and IT Branches)

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To learn the operations of 8051 microcontroller.	**1.1**	The students will able to gain programming knowledge in microcontroller.	**a,k,l**
2.0	To show how sensors and embedded systems work	**2.1**	The students will able to outline the basics of IoT applications.	**a,k,l**
3.0	To examine how to program on embedded and arduino platforms including ESP8266	**3.1**	The students will able to categorize and know to implement various sensors	**a,b,c,e,k,l**
4.0	To build a communication with other mobile devices using various communication platforms such as Bluetooth and Wi-Fi.	**4.1**	The students will able to assess their own IoT applications and deploy it.	**a,b,c,k,l**
5.0	To analyze collected data using cloud platform.	**5.1**	The students will able to compare the data and visualize the data received from sensors.	**a,b,c,d,e,g,j,k,l**

LIST OF EXPERIMENTS:

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

Hardware or Software Requirement:

Hardware:

1. 36 nodes with WiFi connection or standalone PCs
2. Temperature sensor, LDR, LCD, Servo motor , buzzer, LEDs,arduino board , IoT core board , ESP01 ESP8266

Software:

1. Arduino 1.8.5
2. Arduino library

TOTAL (P: 60) = 60 PERIODS

17GED06 - COMPREHENSION					
		L	T	P	C
		0	0	2	0
PRE REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise	**1.1**	The student will be able to understand and comprehend any given problem related to computer science & engineering field.	**a,b,c,e,k,l**	

METHOD OF EVALUATION

The student will be assessed for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be evaluated by a committee comprising of the faculty members of the department. The committee will conduct three written examinations of objective question type from the subjects as follows

- Test1- C Programming, Data Structures, Operating systems, Computer Networks.
- Test 2-Java Programming, Database Systems, Computer Architecture, Software Engineering.
- Test 3-Internet and Web programming, Object Oriented Analysis and Design, Internet of Things.

The end semester examination, which carries a total of 50 marks, will be an objective question type examination conducted by a committee of one internal examiner appointed by the COE of our college.

TOTAL: 30 PERIODS

17ITC15 - MACHINE LEARNING TECHNIQUES				
L	T	P	C	
3	0	0	3	

PRE REQUISITE : 17MYB01 | **QUESTION PATTERN: TYPE - III**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To introduce the basic concepts and techniques of Machine Learning	1.1	The students will be able to explain the concepts of supervised, unsupervised and semi-supervised learning	**a,b**
2.0	To have a thorough understanding of the Supervised and Unsupervised learning techniques.	2.1	The students will be able to apply the appropriate machine learning strategy for any given problem	**b,c,e,i,j,k,l**
3.0	To study the various probability based learning techniques	3.1	The students will be able to suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem	**b,c,e,i,j,k,l**
4.0	To study the evolutionary models and genetic algorithm for machine learning	4.1	The students will be able to design systems that uses the appropriate graph models of machine learning	**b,c,d,f,i,j,k,l**
5.0	To understand graphical models of machine learning algorithms	5.1	The students will be able to modify existing machine learning algorithms to improve classification efficiency	**b,c,d,f,i,j,k,l**

UNIT I – INTRODUCTION	**(9)**
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.	
UNIT II - LINEAR MODELS	**(9)**
Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.	
UNIT III - TREE AND PROBABILISTIC MODELS	**(9)**
Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.	
UNIT IV -DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS	**(9)**
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.	
UNIT V - GRAPHICAL MODELS	**(9)**
Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Stephen Marsland, "Machine Learning –An algorithmic perspective", 2nd ed., Chapman and Hall/CRC Machine learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, "Machine Learning", 1st ed., McGraw Hill Education India Ltd, 2013.

REFERENCES:

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st ed., Cambridge University Press, 2012.
2. Jason Bell, "Machine learning –Hands on for Developers and Technical Professionals", 1st ed., Wiley,

2014.

3. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", 3rd ed., MIT Press, 2014.

17CSC18 - FULL STACK DEVELOPMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE: NIL		**QUESTION PATTERN : III**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To build strong expertise in developing front end application using HTML5 and CSS3.	**1.1**	The students will be able to understand and develop web page using HTML and CSS	**a,c,j,k**	
2.0	To develop front end application using JavaScript.	**2.1**	The students will be able to design and develop front end application using JavaScript	**a,c,j,k**	
3.0	To become proficient in Bootstrap concepts and to develop web pages based on Bootstrap.	**3.1**	The students will be able to design and develop front end application using Bootstrap.	**a,b,c,k**	
4.0	To build strong expertise in developing front end application with jQuery.	**4.1**	The students will able to implement MVC and responsive design to scale well across PC, tablet and Mobile Phone using jQuery.	**a,b,c,j,k**	
5.0	To build strong expertise in developing front end application jQuery Mobile.	**5.1**	The students will able to implement MVC and responsive design to scale well across PC, tablet and Mobile Phone using jQuery Mobile.	**a,b,c,j,k**	

Unit I - HTML5 and CSS3	**(9)**
Introduction to HTML - HTML Basic Tags - HTML Formatting Tags - HTML Color Coding –HTML Grouping Using Div Span – Lists – Tables – Images – Hyperlink – Iframe – Headers – Classes – Responsive – Layout – HTML Javascript – Entities and URI code - Charset and Forms. Introduction to CSS3 – CSS3 Syntax - Selectors - Color Background Cursor -Text Fonts - Lists Tables - Box Model - Display Positioning - CSS Floats – Animations – Buttons – Pagination - User Interface – Filters – Responsive.	
Unit II - CLIENT SIDE PROGRAMMING	**(9)**
Introduction to JavaScript - Language Basics - JavaScript Objects - Scope – Events - Strings – Numbers – Math – Arrays – Boolean – Comparisons – Conditions – Switch - Loops - Type Conversion – RegExp – Errors - Debugging – Hoisting - Strict Mode - Functions – Objects – Forms - JavaScript HTML DOM - JavaScript BOM.	
Unit III – BOOTSTRAP	**(9)**
Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS – Node.js – MySQL - MongoDB	
Unit IV- jQUERY	**(9)**
Introduction to jQuery - jQuery Syntax - jQuery Selectors - jQuery Events - jQuery Effects - jQuery HTML - jQuery Traversing - jQuery AJAX & Misc.	
Unit V- jQUERY MOBILE	**(9)**
Introduction to jQuery Mobile - jQuery Mobile Pages - jQuery Mobile Transitions - jQuery Mobile Buttons - Mobile Icons - Mobile Popups - Mobile Toolbars - Mobile Navbars - Mobile Panels - Mobile Collapsibles - Mobile Tables - Mobile Grids - Mobile Lists - Mobile Forms - jQuery Mobile Themes - jQuery Mobile Events.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Kogent Learning Solutions Inc. “HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQUERY”, Wiley India Pvt. Limited, 2011.
2. Deitel and Deitel and Nieto, “Internet and World Wide Web – How to Program”, Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, “Bootstrap 4–Responsive Web Design” Packt Publishing (6 July 2017)
2. Adriaan de Jonge, Phil Dutson, “jQuery jQuery UI and jQuery Mobile - Recipes and Examples”, Pearson Education India.
3. Thomas Powell, “Web Design: The Complete Reference” ,Osborne / McGraw-Hill
4. https://www.w3schools.com/

17ITP06- MACHINE LEARNING TECHNIQUES LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : Nil

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To learn hands on coding of popular ML algorithms with Python	**1.1**	Get the knowledge to work in the Python packages.	**a,b,c,e**
2.0	To build Machine Learning applications with Python package Scikit-Learn.	**2.1**	Leverage the full power of the scikit-learn API.	**a,b,c,d,e**
3.0	To learn the knowledge of using specific regression, classification, and clustering models.	**3.1**	Use specific regression, classification, and clustering models skillfully to model their data and solve problems	**a,b,c,d,g**
4.0	To build a Neural Network with Tensor Flow.	**4.1**	Able to design a neural network with Tensor Flow.	**a,b,c,d,e,g**
5.0	To get the knowledge to complete Mini Projects..	**5.1**	Able to complete Mini Project for a classification problem.	**a,b,c,d,e,g**

LIST OF EXPERIMENTS:

1.Study the packages used in Python.
2. Implement the clustering mechanisms such as K-Means,Vector Quantization.
3.Implement the various dimensionality reduction models such as PCA, Feature Selection.
4.Implement the various graphical models.
5.Implement Logistic Regression Using Scikit-Learn.
6. Build a Neural Network with Tensor Flow.
7. Create a Mini Project for a Classification Problem using Tensor Flow.
8. Create a Mini Project on Machine Learning Application using Scikit-Learn.

Hardware or Software Requirement:

Hardware

1. LAN System with 33 nodes (OR) Standalone PCs – 33 Nos,
2. Printers – 3 Nos.

Software

1. Open Source Python Framework – Jupiter Notebook, Google Colab

TOTAL(P:60) =60 PERIODS

17ITD01 - PROJECT WORK I					
			L	T	P	C
			0	0	8	4
PRE REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To identify the problem in the specific domain or enhance the existing product to the next level.	**1.1**	The students will be able to demonstrate a sound technical knowledge of their selected project topic.	**a, b, l**	
2.0	To learn how to formulate solution for the problem.	**2.1**	The students will be able to undertake problem formulation and solution legally for the sustainable development.	**c,d,e,g,h**	
3.0	To be trained to function effectively as an individual and a member in diverse teams.	**3.1**	The students will be able to develop an attitude of team work and independent working on real time problems.	**h,i**	
4.0	To interpret and justify the experimental results	**4.1**	The students will be able to design engineering solutions to complex problems based on engineering and management principles.	**c, d, e, k**	
5.0	To develop an effective communication and be trained to write dissertation report	**5.1**	The students will be able to communicate with engineers and the community at large in written and oral forms.	**f,j**	

DESCRIPTION
Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.
TOTAL (P:120) = 120 PERIODS

17ITD02 - PROJECT WORK II				
L	T	P	C	
0	0	16	8	

PRE REQUISITE : 17ITD01

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To identify the problem in the specific domain or enhance the existing product to the next level.	**1.1**	The students will be able to demonstrate a sound technical knowledge of their selected project topic.	**a, b, l**
2.0	To learn how to formulate solution for the problem	**2.1**	The students will be able to undertake problem formulation and solution legally for the sustainable development.	**c,d,e,g,h**
3.0	To be trained to function effectively as an individual and a member in diverse teams.	**3.1**	The students will be able to develop an attitude of team work and independent working on real time problems.	**h,i**
4.0	To interpret and justify the experimental results	**4.1**	The students will be able to design engineering solutions to complex problems based on engineering and management principles.	**c, d, e, k**
5.0	To develop an effective communication and be trained to write dissertation report	**5.1**	The students will be able to communicate with engineers and the community at large in written and oral forms.	**f,j**

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P:240) = 240 PERIODS

17ITX14 - SOFTWARE TESTING

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL | **QUESTION PATTERN: TYPE - III**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To outline the fundamental concepts of Software Quality.	**1.1**	The students will be able to apply the concepts in software testing.	**c,f,k,g**
2.0	To illustrate knowledge about Software testing process flow and testing documents.	**2.1**	The students will be able to implement the concepts of manual testing.	**b,c,e,f**
3.0	To study the management concepts and testing techniques.	**3.1**	The students will be able to design the test cases and to getting familiarity over major testing team process.	**e,f,g,i,k**
4.0	To provide a complete coverage of functionality tools.	**4.1**	The students will be able to apply the testing tools exposure in real time applications.	**a,b,c,d,e,f,i,k,l**
5.0	To develop test cases using test management tool	**5.1**	The students will be able to use the testing tools to check the behavior of the real time application using management tools.	**a,b,c,d,e,g,k,l**

UNIT I - INTRODUCTION TO QUALITY AND SOFTWARE QUALITY **(9)**

Introduction- Software Development Life Cycle (SDLC)-Historical Perspective of Quality-Definition of Quality-Total Quality Management-Continuous Improvement Cycle-Constraints of Software Quality Assessment-Customer is a King-Software Quality Management-Why software has defects?-Important Aspects of Quality Management-Types of Products-Quality Management System Structure-Pillars of Quality Management System

UNIT II - FUNDAMENTALS OF SOFTWARE TESTING **(9)**

Definition of Testing-Approaches to Testing-Popular Definitions of Testing-Testing during Development Life Cycle-Requirements Traceability Matrix-Essentials of Software Testing-Workbench-Important Features of Testing Process-Test Planning-Test Team Approach-Testing Process- Black Box Testing-White Box Testing.

UNIT III - MANAGEMENT CONCEPTS AND TESTING TECHNIQUES **(9)**

Configuration Management-Configurable Items-Base lining-Configuration Management Planning-Types of Software Risks-Handling of Risks in Testing- Unit Testing- Integration Testing – System Testing – User Acceptance Testing - SRS – Use case Design-Test Case Design-Bug Report Preparation

UNIT IV - FUNCTIONALITY TOOL **(9)**

Introduction to Silk Test-Silk Test Architecture-Automated Testing Process-Quick start with Silk Test-Configuring the settings-Exposure to Silk Test IDE-Plug and Play test case.

UNIT V - TEST MANAGEMENT TOOL **(9)**

Introduction-Testing Process-Specifying Testing Requirements-Planning Tests-Calling Tests with Parameters-Creating and Viewing Requirements Coverage-Generating Automated Test Scripts-Running Tests-Defining Test Sets

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. M.G.Limaye , Software Testing, Tata McGraw-Hill, 2009.
2. URL: www.onestoptesting.com/SilkTest
3. URL: www.onestoptesting.com/testdirector

REFERENCE:

1. Dr. K.V.K.K Prasad , Software Testing Tools, Dreamtech 2004.

17ITX19 - INFORMATION SECURITY MANAGEMENT					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		**QUESTION PATTERN: TYPE - III**			

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To gain knowledge about the basics of information security	**1.1**	The students will be able to explain the Security Baselines	**a,c,j,k**
2.0	To impart the fundamental concepts of security investigation	**2.1**	The students will be able to explain the Roles of Computer Forensics and the Law in Information Security	**a,c,j,k**
3.0	To gain exposure about SDLC and its security	**3.1**	The students will be able to explainmanagement's role in information security	**a,b,c,j,k**
4.0	To get knowledge about various security model	**4.1**	The students will be able to design programs involving security and privacy issues	**a,b,c,k**
5.0	To learn about physical security in detail.	**5.1**	The students will be able to design without risk	**a,b,c,k**

UNIT I - INTRODUCTION	**(9)**
Introduction – What is Information Security?- Critical Characteristics of Information-ISM Security Policy– ISM Framework – Key Element in ISM Framework –Components of an Information System-Securing the Components.	
UNIT II - SECURITY INVESTIGATION	**(9)**
Need for Security-NSTISSC Security Model–Balancing Security and Access– Threats –Attacks-Legal-Ethical-Professional Issues.	
UNIT III - ISRM-INFORMATION SECURITY RISK MANAGEMENT	**(9)**
Stages of ISRM-Identification-Risk Assessment Process-Treatment-Communication-Rinse and Repeat – Controlling Risk- SDLC–The Security SDLC.	
UNIT IV - LOGICAL DESIGN	**(9)**
Blueprint for Security- Information Security Policy-Standards and Practices- ISO 17799/BS 7799-NIST Models-VISA International Security Model- Design of Security Architecture-Planning for Continuity.	
UNIT V - PHYSICAL DESIGN	**(9)**
Security Technology-IDS-Scanning and Analysis Tools-Cryptography-Access Control Devices- Physical Security-Security and Personnel.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2012

REFERENCE:

1. Micki Krause, Harold F. Tipton,"Handbook of Information SecurityManagement", AuerbachPublications ,Sixth Edition,2006.

17ITX32- TEST DRIVEN PROGRAMMING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : Nil					
COURSE OBJECTIVES AND OUTCOMES:					
Course objectives		**Course outcomes**		**Related program outcomes**	
1.0	To understand Object Oriented Programming concepts and basic characteristics of Java	**1.1**	The students will be able to implement fundamental concepts of Java.	**a,b,c,e,g,h,i, j,l**	
2.0	To gain exposure about Abstract classes and collection framework	**2.1**	The students will be able to develop applications using Abstract classes and collection framework	**a,b,c,i,j,k,l**	
3.0	To develop a java application with multiple threads and to access database through Java programs, using Java Data Base Connectivity (JDBC)	**3.1**	The students will be able to access database through Java programs, using Java Data Base Connectivity (JDBC)	**a,b,c,e,f,g,h, i,j,k,l**	
4.0	Design and develop Web applications	**4.1**	The students will be able to Design and develop Web applications	**a,b,c,d, g,h,i,j,k,l**	
5.0	To know about Servlet, XML and AJAX	**5.1**	The students will be able to apply servlets and AJAX for their web development	**a,b,c,d,e,f, h,j,k,l**	

UNIT I - JAVA FUNDAMENTALS	**(9)**
Java Architecture, Environment Setup, Variables, Data Types, Assignment, Operators. **Flow Control Statements**: If statement, If--Else Statement, Nested--If Statement, Switch Statement, While Statement, For Loop Statement, Enhanced For Loop Statement, Do while loop, Break and Continue Statement. **Arrays:** One dimensional and Two Dimensional Array. **OOPS / Inheritance:** Classes and Objects, Constructor, Return Statements. Encapsulation/Abstraction, Inheritance, Overriding/Polymorphism, Method Overloading, Garbage Collection, String, String Buffer. **Eclipse Overview:** Creating packages, classes, Adding Jar Files, Setting eclipse Preferences, Refactoring renaming classes or interfaces	
UNIT II - COLLECTION AND ABSTRACTION	**(9)**
Abstraction /Packages / Exception Handling: Abstract Classes, Final Keyword, Packages-import, Interfaces, Introduction to Exception Handling, Exception types, Try and Catch Block, Throws, Throw clause, Finally clause, Runtime exception. **Wrapper Classes:** Autoboxing, Unboxing and Cloneable Interface **I/O Streams:** Introduction to I/O, I/O Operations, Object Serialization **Collection Framework:** Introduction to Collection, List, Array Lists, Linked Lists, Sorting Lists, Using Iterators, Generics, Set, Map, HashMap, SortedMaps, Using Custom Objects, Map	
UNIT III - TEST CASES AND DATABASE CONNECTIVITY	**(9)**
Junit: Introduction to Junit, Junit Features, Junit with Eclipse, Assert Methods, Annotations, Test Suite, Introduction to Mockito **Multithreading I / II:** Introduction to Multithreading, Thread Creation-Thread class and Runnable Interface,Thread Control and Priorities, Thread Synchronization.	

RDBMS / SQL / JDBC: Introduction to RDBMS, Oracle 11g Introduction, Select Statement, Restricting and Sorting Data, DML, DDL, Introduction to JDBC, Establishing Connection, Executing Query and Processing Results, Meta data & Prepared Statement, Using Callable Statement and Transactions

UNIT IV- ANT,HTML & JAVASCRIPT	**(9)**

ANT: Introduction to ANT, Building sample java projects,

HTML : Introduction to HTML and its elemets, Basic Tags, Basic Elements, Formatting Tags, Layout tags and Semantic Tags, Tables, Forms and Frames, Style and div tags, Introduction to HTML5

JavaScript / CSS: Introduction to CSS, Styles and Style sheets, Formatting with CSS, Links and Lists, CSS Box Model, CSS3, Introduction to Javascripts, JS Functions, JS Strings, JS Events, JS Objects, JS Validations, JS Regular Expressions, Introduction to Bootstrap, Formatting and styling using Boostrap, Table, Bootstrap Grid System.

UNIT V - SERVLET, XML AND AJAX	**(9)**

Servlets and JSP: Introduction to Servlets, Servlet-Get and Post Requests, Servlet Config and Servlet Context, Servlet-Cookies and Session Management, Introduction to JSP, JavaBeans in JSP.

XML-I and XML-II: Introduction to XML, Document Type Definition, XML Namespaces, XML Schema, XSLT.

AJAX: Introduction to AJAX, AJAX working principle, AJAX Application, AJAX Database Application.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOKS:

1. Core Java Volume I- Fundamentals, Cay S. Horstmann, Gary Cornell, Pearson India Education Services Pvt. Ltd., 11th Edition,
2. Java: The Complete Reference, Eleventh Edition, 11th Edition by Herbert Schildt Released December 2018
3. HTML 5 Black Book, Kogent Learning Solutions Inc., ISBN:978-93-5004-095-9

REFERENCES

1. Head First EJB 3.0 by Kathy Sierra, Bert Bates, Publisher: O'Reilly Media
2. Head First Servlets and JSP by Bryan Basham, Kathy Sierra & Bert Bates, Publisher: O'Reilly Media

17ITX33 JAVA-FULL STACK IMPLEMENTATION				
L	T	P	C	
3	0	0	3	

PRE REQUISITE : Nil

COURSE OBJECTIVES AND OUTCOMES:

Course objectives		Course outcomes		Related program outcomes
1.0	Designing Enterprise based applications by encapsulating an application's business logic.	1.1	The students will be able to map Java classes and object associations to relational database tables with Hibernate mapping files	a,b,c,e,g,h,i, j,l
2.0	Learn Spring configuration using Java Configuration and Annotations	2.1	The students will be able to implement Spring configuration using Java Configuration and Annotations	a,b,c,i,j,k,l
3.0	Simplifying application development with Spring Boot	3.1	The students will be able to simplify application development using Spring Boot.	a,b,c,e,f,g,h, i,j,k,l
4.0	Consume REST services using observables	4.1	The students will be able to use REST web services	a,b,c,d, g,h,i,j,k,l
5.0	Utilizing AngularJS formats adequately	5.1	The students will be able to use various Angular features including directives, components, and services.	a,b,c,d,e,f, h,j,k,l

UNIT I - HIBERNATE	**(9)**
Hibernate Overview, Architecture, Configuration, Sessions, Annotations, Query Language, Native SQL, Batch Processing, Interceptors	
UNIT II -SPRING CORE	**(9)**
Spring Overview, Architecture, IoC Containers, Bean Definition and Scope, Bean Life cycle, Bean inheritance, Dependancy injection, Beans auto wiring, java based configuration, event handling, Custom events, AOP with spring framework, JDBC framework, transaction management.	
UNIT III - SPRING BOOT	**(9)**
Spring Boot-Introduction, Boostrapting, Tomcat deployment, Build systems, code structure, Spring beans and dependancy, Spring boot runners, Application properties, Logging, Building RESTful web services, Exception handling, Interceptor, Servlet filter, tomcat port number, File handling, Consuming RESTful web services, Internationalization, Spring boot scheduling	
UNIT IV - REST WEB SERVICE	**(9)**
RESTful-Introduction, Environment setup, Resources, Messages, Addressing, Methods, Statelessness, Caching, Security, JAX-RS.	
UNIT V - ANGULAR	**(9)**
Angular Introduction, Features, Apps Loading, Architecture, Directives, ngIf Directive, ngFor Directive, ngSwitch Directive, Data Binding, Property Binding, String Interpolation, Event Binding, Two way data binding, Forms.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. Soni, R. K. (2017). Full stack angularJS for java developers: Build a full-featured web application from scratch using angularJS with spring RESTful. Apress.
2. Duldulao, D. B., & Villafranca, S. R. (2022). Spring Boot and Angular: Hands-on full stack web development with Java, Spring, and Angular. Packt Publishing Ltd.
3. Fisher, P. T., & Murphy, B. D. (2010). Spring persistence with Hibernate. Apress.

REFERENCES

1. Just Hibernate, A Lightweight Introduction to the Hibernate Framework by Madhusudhan Konda, Publisher: O'Reilly Media

17ITX37 PROBLEM SOLVING USING JAVA

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program outcome
1.0	To understand the basics of Java Programming Language	**1.1**	The Students will be able to solve simple problems using Java.	**a,b,c,d,e, h,j,k,l**
2.0	To understand fundamentals of programming such as conditional and iterative execution	**2.1**	The students will be able to write programs using branching and looping statements	**a,b,c,d,e, h,i,j,k,l**
3.0	To understand the concepts of Java arrays and Strings.	**3.1**	The students will be able to Be able to develop confidently with Strings and implement arrays.	**a,b,c,d,e, h,i,j,k,l**
4.0	To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods.	**4.1**	The students will be able to understand basic oops concepts and develop applications using inheritance and interfaces.	**a,b,c,d,e, h,i,j,k,l**
5.0	To understand threads and collection concepts	**5.1**	The students will be able to build applications using threads and collection framework.	**a,b,c,d,e, h,i,j,k,l**

UNIT I - INTRODUCTION TO JAVA (9)

History of java-Features-Glimpse of java-Data types and Variables-Local variable-Instance variable-static variable-Keywords: this, super, final- Type conversion & casting- Importance of Scanner class-Getting started with Eclipse IDE and VSCode.

UNIT II-OPERATORS AND DECISION MAKING STATEMENTS (9)

Operators- Arithmetic Operator, Bitwise Operator, Conditional Operator, Unary Operator-Relational and Logical operators-Conditional statements: If else, If else if, Nested if -Looping Statements: For Loop, while Loop, do while loop-switch-break-continue- auto boxing and unboxing.

UNIT III-ARRAYS AND STRINGS (9)

Arrays: One Dimensional Array-Two Dimensional Array-Inbuilt functions in arrays. Strings-String array-Inbuilt functions in Strings-String Buffer class-String Builder class-String Tokenizer class

UNIT IV-OBJECT-ORIENTED PROGRAMMING PARADIGM (9)

Class-objects-Encapsulation-Inheritance and its types-Polymorphism: Static binding and dynamic binding-Methods –Constructors and its types-Abstract class-Interface.

UNIT V- MULTITHREADING AND COLLECTIONS (9)

Throwable classes-Exception types-Exception keywords-Collection classes: List, Set-Thread-Ways of thread creation-methods-thread priorities-Synchronization-multithreading-Lambda Expression.

TOTAL (L: 45) = 45 PERIODS

TEXT BOOK:

1. Herbert Schildt, “Java:The Complete Reference”,McGraw Hill Education, Twelfth edition,2021.

REFERENCE:

1. Cay.S.Horstmann,GaryCornell, “Core Java-JAVA Fundamentals”, Prentice Hall,Eleventh edition, 2020.

17MEC13 - DESIGN OF MACHINE ELEMENTS *(Use of Approved Design data book is permitted)*				
L	T	P	C
2	2	0	3
PREREQUISITE : 17MEC11	**QUESTION PATTERN : TYPE - 4**		

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the design methodology of machine elements	1.1	Estimate the stresses acting on various machine elements by considering the operating conditions	a, b, d, e, f, k, l
2.0	To acquire knowledge on analysis of forces acting on the machine elements and appropriate design methodology	2.1	Predict the variables stresses on the machine elements and/or design shafts for the given loading conditions.	a, c, e, f, k, l
3.0	To analyse the stresses acting on the temporary and permanent joints	3.1	Determine the maximum stresses acting on the temporary and/or permanent joints under static loads	a, c, e, f, k, l
4.0	To gain knowledge about the design of couplings and/or springs	4.1	Adapt the design procedures to select couplings and/or springs	a, c, e, f, k, l
5.0	To teach various standards, and selection procedures of couplings	5.1	Select a suitable type of bearing for the design requirements	a, b, c, d, e, f, k, l

UNIT I : STRESSES IN MACHINE ELEMENTS	**(6+6)**
Procedure in design process - factors influencing machine design - selection of materials based on mechanical properties preferred numbers ,fits and tolerance - direct, bending and torsional stress equation - Modes of failure- bending stress in curved beams - crane hook and 'C' frame - factor of safety - theories of failures	
UNIT II : VARIABLE STRESSES AND DESIGN OF SHAFTS	**(6+6)**
Variable stresses in machine parts - stress concentration factor - cyclic stresses - fatigue and endurance limit - Goodman and Soderberg methods - combined normal stress and variable stress - design of solid and hollow shafts based on strength and rigidity	
UNIT III : PERMANENT AND TEMPORARY JOINTS	**(6+6)**
Welded joints - types - basic weld symbols - strength of transverse and parallel fillet welded joints - eccentrically loaded welded joints - screwed joints - terms - forms - design of bolted joints under eccentric loading - introduction to riveted joints	
UNIT IV : DESIGN OF COUPLINGS AND SPRINGS	**(6+6)**
Couplings - types - design of muff coupling, unprotected type flange coupling, bushed pin flexible coupling - springs- types, helical springs, materials, end connections, terms used in compression springs - stresses and deflection in helical springs of circular wire - surge in springs - design of leaf springs - stress and deflection equation, nipping	
UNIT V : BEARINGS	**(6+6)**
Sliding contact bearings - theory of lubrication, hydrodynamic bearings, Sommerfield number - design of hydrodynamic bearings - rolling contact bearings, static and dynamic load capacity, cubic mean load, variable load, probability of survival, selection of deep groove ball bearing	
TOTAL (L:30 +T:30) = 60 PERIODS	

TEXTBOOKS:

1. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th ed., McGraw-Hill Education, 2015
2. Bhandari V.B, "Design of Machine Elements", 4th ed., McGraw Hill Education India Private Limited, 2017

REFERENCES:

1. Khurmi.R.S and Gupta.J.K, "A Textbook of Machine Design", S.Chand and Company Ltd., New Delhi, 2014
2. Jalaludeen S.Md, "Machine Design (Volume-1)", 4th ed., Anuradha Publications, Chennai, 2011
3. Sundararajamoorthy T. V. Shanmugam. N, "Machine Design", Anuradha Publications, Chennai, 2003
4. Robert C. Juvinall, Kurt M. Marshek, "Machine Component Design", Wiley India Pvt Ltd., 2016
5. Ganesh Babu.K, Srithar.K, "Design of Machine Elements", 2nd ed., McGraw Hill Education (India) Private Limited, 2009

17MEC14 - HEAT AND MASS TRANSFER *HMT data book and Steam tables*					
		L	T	P	C
		3	0	2	4
PREREQUISITE : 17MEC09		**QUESTION PATTERN : TYPE - 4**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the concept of heat conduction in various systems	**1.1**	Determine the amount of heat transferred in various systems under steady state	**a, b, d, e, i, k, l**
2.0	To analyze about the internal heat generation and transient heat conduction	**2.1**	Solve numerical problems on heat transfer with internal heat generation and/or transient heat transfer	**a, c, e, k, l**
3.0	To acquire knowledge on convection in various systems	**3.1**	Estimate the heat transfer coefficient and the amount of heat transferred under convection	**a, c, e, k, l**
4.0	To acquire knowledge on Boiling and Condensation, radiation heat transfer	**4.1**	Analyze the radiation heat transfer and/or heat transfer by boiling and condensation	**a, c, e, k, l**
5.0	To introduce the concept of heat transfer with phase change and heat exchangers	**5.1**	Examine heat transfer in heat exchangers and/or diffusion and convective mass transfer	**a, b, c, d, e, i, k, l**

UNIT I : STEADY STATE HEAT CONDUCTION	**(9+6)**
Mechanisms of heat transfer - General heat conduction equation in Cartesian coordinates - representation of heat equation in cylindrical coordinates - One dimensional steady state heat conduction in composite plane walls with constant thermal conductivity - critical radius of insulation - Rectangular plate fins and pin fins with uniform cross section - Efficiency and effectiveness - circumferential fins	
UNIT II : CONDUCTION WITH HEAT GENERATION	**(9+6)**
Solid cylinder with internal heat generation - Transient heat conduction - plane wall with negligible internal resistance - heat flow in an infinitely thick plate - chart solutions of transient heat conduction problems in plane wall	
UNIT III : CONVECTION	**(9+6)**
Representation of continuity, momentum and energy equations - thermal and velocity boundary layer in flow over flat plate and flow through circular pipe - Dimensional analysis - forced convection - correlations for flow over flat plate - flow across tube banks - correlations for flow through circular tubes - Natural convection in vertical and horizontal plates	
UNIT IV : RADIATION, BOILING AND CONDENSATION	**(9+6)**
Thermal radiation - emissive power - absorption, reflection and transmission - Plank's, Wien's displacement, Stefan-Boltzmann, Kirchhoff's laws - emissivity - grey body - shape factor theorems - Electrical analogy - Radiation shields - pool boiling curve for water - boiling correlations - condensation on vertical surfaces and horizontal tubes	
UNIT V : HEAT EXCHANGERS AND MASS TRANSFER	**(9+6)**
Types of heat exchangers - overall heat transfer coefficient - fouling factors - LMTD and Effectiveness - NTU methods - Diffusion mass transfer - Fick's law of diffusion - diffusion coefficient - equimolar counter diffusion - concentration boundary layer - governing equations - convective mass transfer correlations	

LIST OF THE EXPERIMENTS
1. Thermal conductivity measurement using guarded plate apparatus 2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus 3. Determination of heat transfer coefficient under natural convection from a vertical cylinder 4. Determination of heat transfer coefficient by forced convection inside tube 5. Efficiency calculation of a pin-fin apparatus (natural and forced convection modes) 6. Determination of Stefan - Boltzmann constant 7. Determination of emissivity of a given grey surface 8. Determine the effectiveness of parallel / counter flow heat exchanger 9. Determination of heat flux in boiling and condensation heat transfer
TOTAL (L:45 + P:30) = 75 PERIODS
TEXTBOOKS: 1. Yunus A Cengel, "Heat and Mass Transfer", 5th ed., McGraw Hill Education (India) Pvt Ltd, 2015 2. Sachdeva.R.C, "Fundamentals of Engineering Heat and Mass transfer", 5th ed., New age international publishers,
REFERENCES: 1. Kothandaraman.C.P, "Fundamentals of Heat and Mass transfer", 4th ed., New age international publishers, 2012 2. Nag.P.K, "Heat and Mass Transfer", 3rd ed., McGraw Hill Education, 2011 3. Holman.J.P, "Heat Transfer", McGraw Hill Education (India) Pvt Ltd, 2017 4. Incropera and Dewitt, "Fundamentals of Heat and Mass Transfer", 7th ed., Wiley India Pvt Ltd, 2013 5. Ghoshdastidar.P.S, "Heat Transfer", 2nd ed., Oxford University Press, 2012

17MEC15 - DYNAMICS OF MACHINERY					
		L	T	P	C
		2	2	0	3
PREREQUISITE : 17MEC08		**QUESTION PATTERN : TYPE - 4**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the concepts of turning moment diagrams, flywheel design and the dynamics of reciprocating engines	**1.1**	Analyze the static and dynamic forces in mechanisms and flywheel	**a, b, e, g, l**
2.0	To acquire knowledge on the balancing of rotating masses, reciprocating masses, rotors and engines.	**2.1**	Balance the rotary and reciprocating masses of mechanical systems	**a, b, c, e, l**
3.0	To introduce the fundamentals of longitudinal vibration vibrations	**3.1**	Analyze the longitudinal vibrations of systems with single degree of freedom	**a, b, c, e, k, l**
4.0	To impart knowledge on the concept of torsional vibratory systems and their analysis.	**4.1**	Determine the frequency of transverse and torsional systems	**a, b, c, e, k, l**
5.0	To introduce the mechanisms for controlling	**5.1**	Demonstrate the mechanism control systems like governors and gyroscopes	**a, b, c, f, k, l**

UNIT I : FORCE ANALYSIS AND FLYWHEELS	**(6+6)**
Static force analysis - static equilibrium conditions - free body diagrams - graphical force analysis without friction -four bar mechanism, slider crank mechanism - Dynamic force analysis in Reciprocating Engines –D'Alembert's principle - analytical method of engine force analysis without inertia - Turning moment diagrams - Flywheels of engines- fluctuation of energy	
UNIT II : BALANCING	**(6+6)**
Balancing of rotating masses - balancing of reciprocating masses - partial balancing of unbalanced primary force in a reciprocating engine - balancing of multi cylinder inline engines, V-engines - balancing machines	
UNIT III : LONGITUDINAL VIBRATION	**(6+6)**
Definitions - types of vibrations - basic features of vibratory systems - degrees of freedom - inertia effect of the mass of spring - damped vibrations - logarithmic decrement - Forced vibrations - forced damped vibrations - magnification factor - vibration isolation and transmissibility	
UNIT IV : TRANSVERSE, TORSIONAL VIBRATIONS AND VIBRATION MEASUREMENT	**(6+6)**
Transverse vibrations - Single concentrated load - uniformly loaded shaft - shaft carrying several loads - Dunkerley's method - whirling of shafts - Free torsional vibrations - single rotor system, two rotor and three rotor system, torsionally equivalent shaft – Vibration measuring instruments - accelerometers - frequency measurement - Fullarton, Frahm Tachometers, vibration absorbing materials	
UNIT V : MECHANISMS FOR CONTROL	**(6+6)**
Governors - Types - Watt, Porter, Proell, Hartnell Governors – Effect of friction, controlling force - sensitiveness, hunting, isochronisms, stability - Effort and power of governors - coefficient of Insentiveness - Gyroscope - angular velocity, acceleration - gyroscopic torque - gyroscopic effects in aeroplanes and naval ships	
TOTAL (L:30 +T:30) = 60 PERIODS	

TEXTBOOKS:

1. Joseph E. Shigley, Gordon R. Pennock, John J. Uicker. Jr, "Theory of machines and mechanisms", 4th ed., Oxford university press, New Delhi, 2014
2. Bansal.R.K and Brar.J.S, "Theory of Machines", 5th ed., Laxmi Publications, 5th ed., Revised 2016

REFERENCES:

1. Rattan.S.S, "Theory of Machines", 4th ed., Tata McGraw Hill Education Pvt. Ltd, 2017.
2. Kenneth J Waldron, Gary L Kinzel and Sunil Agarwal, "Kinematics, Dynamics and Design of Machinery", John-Wiley and Sons, 2016
3. Khurmi.R.S, Gupta.J.K, "Theory of Machines", 14th ed., S.Chand and Company Pvt. Ltd., Reprint 2015.
4. Singh.V.P, "Mechanical Vibrations", 4th ed., Dhanpat Rai and Co Pvt. Ltd., 2014
5. Thomas Bevan, "Theory of Machines", Pearson Education Publishers, 2010

17MEC16 - FLUID POWER SYSTEMS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17MEC05		**QUESTION PATTERN : TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the basics of hydraulics and pneumatics	**1.1**	The students will be able to list the importance of fluid power technology in industries	**a, b, c, e, j, l**
2.0	To acquire knowledge on hydraulic pumps and various power supply sources	**2.1**	The students will be able to explain the working principles of hydraulic and pneumatic components	**a, e, j, l**
3.0	To introduce the types of cylinders, accumulators, valves and various control components	**3.1**	The students will be able to select the control components as per requirements	**a, e, j, l**
4.0	To acquire knowledge on application circuits of fluid power system	**4.1**	The students will be able to illustrate the application circuits and their components in fluid power industry	**a, b, e, j, l**
5.0	To know about the troubleshooting and maintenance of fluid power systems	**5.1**	The students will be able to solve problems of fluid power systems in industries	**a, b, e, j, l**

UNIT I : BASICS OF FLUID POWER SYSTEMS	**(9)**
Introduction to fluid power, properties of hydraulic fluids- comparison between hydraulics and pneumatics - basic principle of hydraulics- Pascal's law-transmission and multiplication of force - application and advantages of fluid power - Types of fluid power systems - various hydraulic fluids- basic properties of air	
UNIT II : HYDRAULIC AND PNEUMATIC POWER SUPPLY	**(9)**
Hydraulic pump - graphic symbol - pump types - pump performance - air compressor - graphic symbols - compressor types, Piston compressors, vane compressor and screw compressors	
UNIT III : HYDRAULIC AND PNEUMATIC CONTROL COMPONENTS	**(9)**
Hydraulic cylinders - pressure control valves - directional control valves - flow control valves - types of accumulators – FRL - pneumatic valves check valve, flow control valve, shuttle valve, AND type valve, quick exhaust valve, time delay valve - pneumatic cylinders	
UNIT IV : CIRCUITS IN FLUID POWER SYSTEMS	**(9)**
DCV controlling single acting, double acting cylinder - intensifier press circuit - sequencing circuits, synchronizing circuits - regenerative circuit - counter balance circuit - fail safe circuit - meter in and meter out circuit for extended and retracted stroke - accumulator circuits - cascade circuit	
UNIT V : FLUID POWER SYSTEM MAINTENANCE	**(9)**
Hydraulic system installation - maintenance - Troubleshooting in hydraulics - possible causes and remedies for pumps, directional valves, flow control valves, hydraulic cylinder - Pneumatic system installation, maintenance, Troubleshooting - possible causes and remedies for compressor, FRL unit, air cylinder, air motor	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Antony Esposito, "Fluid Power with applications", 7th ed., Pearson India, 2014
2. Srinivasan.R, "Hydraulic and Pneumatic Controls", 2nd ed., Mcgraw Hill Education, 2008

REFERENCES:

1. Andrew Parr, "Hydraulics And Pneumatics", 1st ed., Jaico Publications, 1993
2. Majumdar S. R, "Oil Hydraulics : Principles and Maintenance", Mcgraw Hill Education, 2017
3. Majumdar S. R, "Pneumatic Systems : Principles And Maintenance", 1st ed., Mcgraw Hill Education, 1995
4. Shanmuga Sundaram.K, "Hydraulics And Pneumatics", 1st ed., S.Chand and Co, 2006
5. Soundararajan and Ilango, "Introduction to Hydraulics and Pneumatics", 2nd ed., PHI Learning Pvt. Ltd, New Delhi, 2011

17MEC17 - MECHATRONICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17MEC06		**QUESTION PATTERN : TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the integrated approach of Mechatronics systems	**1.1**	The students will be able to identify the elements of Mechatronics system and/or describe the working principles of controllers	**a, g, k, l**
2.0	To acquire knowledge on sensors and familiarize different types of actuators used in mechatronics system	**2.1**	The students will be able to recommend the suitable sensors and type of actuators to achieve the desired output motion	**a, b, c, e, l**
3.0	To impart knowledge on working of microprocessor in mechatronics systems	**3.1**	The students will be able to Discuss the architecture of microprocessor and microcontroller	**a, b, c, e, l**
4.0	To provide knowledge on Programmable Logic Controller (PLC) used in mechatronics systems	**4.1**	The students will be able to demonstrate the knowledge on architecture of PLC and contrast it from PC	**a, b, c, e, l**
5.0	To know the design stages of mechatronics system	**5.1**	The students will be able to design Mechatronics systems with the help of Microprocessor, PLC, other Electrical and Electronics components for an engineering application	**a, b, c, e, k, l**

UNIT I : MECHATRONICS AND CONTROL SYSTEMS	**(9)**
Introduction to Mechatronics - Need for Mechatronics - Emerging areas of Mechatronics - systems - measurement systems - control systems - open and closed loop systems - heating a room, automatic control of water level - analogue and digital control systems - control modes - two step, proportional, derivative, integral and PID controllers	
UNIT II : SENSORS AND ACTUATORS	**(9)**
Sensor terminologies - Static and Dynamic Characteristics of Sensor - Potentiometers - Strain Gauges - Capacitance Sensors - LVDT - Eddy Current Sensor - Hall Effect Sensor -Temperature Sensors - Electrical actuation systems - solenoids, AC and DC motors - construction, working principle - BLDC motor applications - types of stepper motors	
UNIT III : MICROPROCESSOR BASED CONTROLLERS	**(9)**
Microprocessor - architecture of 8085 microprocessor - Pin Configuration - Addressing Modes - Instruction set, Timing diagram of 8085 - architecture of 8051 microcontroller - typical architecture of a CAN based system	
UNIT IV : PROGRAMMABLE LOGIC CONTROLLER	**(9)**
Programmable logic controller - Architecture – Input / Output Processing – Ladder diagrams - Latching, Sequencing, Timers, Counters and Internal relays – Data Handling – Selection of PLC - Application of PLCs for control	
UNIT V : MECHATRONICS SYSTEM DESIGN	**(9)**
Stages of mechatronics design process - comparison of traditional and mechatronics design concepts - case studies of mechatronics systems - pick and place robot - car park barriers - digital camera - car engine management	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Bolton. W, "Mechatronics - A Multidisciplinary Approach", 4th ed., Pearson Education India, 2016
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publishing Private Limited, 6th ed., 2015

REFERENCES:

1. Necsulescu. D, "Mechatronics", 1st ed., Pearson Education India, 2002
2. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", 2nd ed., Cengage Learning India Pvt Ltd, New Delhi , 2012
3. Smaili.A and Mrad.F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, International Edition, 2008
4. Rajput. R. K, "A Text Book of Mechatronics", 3rd ed., S Chand and Company, 2007
5. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", 4th ed., McGraw Hill Education (India) Private Limited, 2014
6. Clarence W. de Silva, "Mechatronics - A Foundation Course", 1st ed., CRC Press, 2010

17MEC18 - DESIGN OF TRANSMISSION SYSTEMS *(Use of Approved Design data book is permitted)*				
L	T	P	C
2	2	0	3
PREREQUISITE : 17MEC13	**QUESTION PATTERN : TYPE - 4**		

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the design methodology of machine elements	**1.1**	Identify the design parameters of the Chain Drives and Belt Drives for power transmission	**a, b, d, f, l**
2.0	To acquire knowledge on analysis of forces acting on the machine elements and appropriate design methodology	**2.1**	Recommend the suitable Gear drive for an industrial application among spur and helical gears	**a, c, e, f, l**
3.0	To analyse the stresses acting on the temporary and permanent joints	**3.1**	Design Bevel and Worm Gears by considering various operating conditions	**a, c, e, f, l**
4.0	To gain knowledge about the design of couplings and/or springs	**4.1**	Select the Gear Box for variable operating speeds	**a, c, e, f, l**
5.0	To teach various standards, and selection procedures of couplings	**5.1**	Design Clutches and Brakes for the automobiles	**a, b, c, d, f, l**

UNIT I : DESIGN OF FLEXIBLE POWER TRANSMISSION SYSTEMS	**(6+6)**
Design flat belt and V belt drive based on manufacturer's catalogue - design of transmission chains and sprockets - introduction to timing belt and silent chain	
UNIT II : SPUR GEARS AND HELICAL GEARS	**(6+6)**
Gear materials - design of straight tooth spur gear and parallel axis helical gears based on speed ratio, number of teeth, fatigue strength, factor of safety, strength and wear considerations - forces on teeth - stresses on teeth - gear failures - helical gear - module - normal and transverse, equivalent number of teeth	
UNIT III : BEVEL AND WORM GEARS	**(6+6)**
Straight bevel gear - gear materials - tooth terminology - tooth forces and stresses - design of straight bevel gears by checking surface and bending stresses - worm gear - gear materials - tooth terminology, thermal capacity, forces and stresses, efficiency, design of worm gear drive by checking surface and bending stresses	
UNIT IV : DESIGN OF GEAR BOXES	**(6+6)**
Gear boxes - speed selection - geometric progression - standard step ratio - ray diagram, kinematic layout - design of multistage multi speed constant mesh gear boxes	
UNIT V : MOTION CONTROL: CLUTCHES AND BRAKES	**(6+6)**
Clutches - types - materials - design of single plate, multi plate and cone clutches - brakes - types - friction materials - design of single block brake, pivoted block brake, simple band brake, internal expanding brake	
TOTAL (L:30 +T:30) = 60 PERIODS	

TEXT BOOKS:

1. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th ed., Tata McGraw-Hill, 2015
2. Bhandari V.B, "Design of Machine Elements", 4th ed., Tata McGraw-Hill Book Co, 2017

REFERENCES:

1. Jalaludeen S.Md, "Machine Design (Volume-2)", 4th ed., Anuradha Publications, Chennai, 2012
2. Robert C. Juvinall, Kurt M. Marshek, "Machine Component Design", Wiley India Pvt Ltd., 2016
3. Sharma P. C, Aggarwal D. K., "A Textbook of Machine Design" S K Kataria and Sons-New Delhi, 2013
4. Spotts M. F, Shoup T. E , Hornberger L.E , David O. Kazmer, "Design of Machine Elements", 8th ed., Pearson India, 2006
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003

17MEC19 - METROLOGY AND MEASUREMENTS					
		L	T	P	C
		3	0	2	4
PREREQUISITE : 17MEC01, 17MEC13		QUESTION PATTERN : TYPE - 3			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes		Related Program Outcomes	
1.0	To introduce the principles of metrology and measurements	1.1	Describe the limits, fits, tolerance, errors, correction and calibration	a, b, j, k, l	
2.0	To acquire knowledge on measurement parameters and its applications	2.1	Explain the various methods of measuring mechanical parameters	a, c, k, l	
3.0	To acquire knowledge on the concept of various measurements like linear and angular measurements	3.1	Identify the types of linear and angular measurements for a component	a, c, k, l	
4.0	To impart knowledge on statistical measurements and surface finish	4.1	Select a type of form measurement methods for an application	a, c, k, l	
5.0	To gain knowledge on laser and advances in metrology system	5.1	Summarize various laser metrology and its advances	a, b, c, j, k, l	

UNIT I : MEASUREMENT SYSTEMS	(9+6)
General concept - units and standards - characteristics of measuring instruments - sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability, hysteresis - systematic and random errors - correction, calibration - interchangeability	
UNIT II : PARAMETER MEASUREMENTS	**(9+6)**
Measurement of force, torque, power using mechanical, pneumatic, hydraulic, electrical instruments - flow measurement - rotameter, pitot tube - Temperature measurement - bimetallic strip, thermocouple, electrical resistance thermometer	
UNIT III : LINEAR AND ANGULAR MEASUREMENTS	**(9+6)**
Linear measuring instruments - vernier, micrometer, slip gauges, tool maker's microscope - interferometry, optical flats, comparators - mechanical, pneumatic, electrical applications - angular measurements - sine bar, sine center, bevel protractor, autocollimator	
UNIT IV : METROLOGY OF SURFACES	**(9+6)**
Fundamentals of GD & T - measurement of straightness, flatness and roundness - measurement of surface finish - stylus based - Tomlinson surface meter and Taylor-Hobson Talysurf - optical measurement - light cross section method - Introduction to 3D surface metrology - contact, non-contact active, non-contact passive	
UNIT V : ADVANCED METROLOGY	**(9+6)**
Precision instruments based on laser principles - interferometer - application in linear, angular measurements - Coordinate Measuring Machine (CMM) - constructional features - types, applications - computer aided inspection - Introduction to machine vision system	

LIST OF THE EXPERIMENTS

1. Measurement of various dimensions using Vernier Caliper / Micrometer / Dial Gauge
2. Measurement of gauge block using Vernier Height Gauge and Vernier depth gauge
3. Measurement of Internal Bore diameter using Digital Bore Gauge
4. Measurement of Gear Tooth Dimensions using Gear Tooth vernier

5. Measurement of Taper Angle using Bevel Protractor / Sine bar / Slip Gauges
6. Measurement of thread parameters using Tool Makers Microscope / Floating Carriage Micrometer
7. Measurement of straightness and flatness of surface plate using Autocollimator
8. Measurement of various dimensions of the given component using Profile Projector
9. Measurement of the Surface Finish using Surface roughness tester
10. Measurement of Force and torque
11. Measurement of Temperature using thermo couples
12. Measurement of displacement using LVDT

TOTAL (L:45 + P:30) = 75 PERIODS

TEXT BOOKS:

1. Thomas G. Beckwith, Roy D, Marangoni, John H.Lienhard V., "Mechanical Measurements", 6th ed., Pearson Education India, 2014
2. Jain R.K., "Engineering Metrology", 20th ed, Khanna Publishers, 2009

REFERENCES:

1. Raghavendra N.V, Krishnamurthy L, "Engineering Metrology and Measurements", 1st ed., Oxford University Press, 2013
2. Gupta.I.C., "Engineering Metrology", 10th ed., Dhanpat Rai Publications, 2013
3. Anand K Bewoor, Vinay A Kulkarni, "Metrology and Measurement", McGraw Hill Education, 2009
4. Mahajan.M, "Engineering Metrology", Dhanapat Rai publications, 2014
5. Tayal A.K, "Instrumentation and Mechanical Measurements", 4th ed., Galgotia Publications, 2000

17MEC20 - CAD / CAM / CIM					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17MEC06		**QUESTION PATTERN : TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the concept of geometric modeling	**1.1**	Explain various CAD models, stages in geometric modeling	**a, c, d, f, l**
2.0	To introduce the concept of computer graphics	**2.1**	List the steps involved in 2D and 3D transformations in computer graphics	**a, b, c, d, f, k**
3.0	To understand the stages of Computer Aided Manufacturing	**3.1**	Summarize the steps involved in Computer Aided Manufacturing and process planning	**b, c, d, f**
4.0	To understand the basics of CNC machine tools	**4.1**	Distinguish the NC, CNC and DNC systems and explain their working principles	**a, c, d, f, g, k**
5.0	To acquire knowledge on the concept of Computer Integrated Manufacturing and production planning	**5.1**	Describe the importance of Computer Integrated Manufacturing and stages in production planning	**a, c, d, f, k**

UNIT I : GEOMETRIC MODELLING TECHNIQUES	**(9)**
CAD implementation - design Process - Shigley, Pahl and Beitz, Ohsuga, Earle model - benefits of CAD - hardware - input and output devices - display devices - LCD, LED - geometric modeling - basics of wire frame, surface, solid modeling	
UNIT II : PRINCIPLES OF COMPUTER GRAPHICS	**(9)**
Graphic primitives - transformation in graphics - coordinate system used in graphics and windowing - viewport - 2D Transformation - homogeneous transformation - combination transformation - clipping - 3D transformation - projections - scan conversion - rendering	
UNIT III : COMPUTED AIDED MANUFACTURING	**(9)**
Function of CAM - benefits of CAM - integrated CAD/CAM organization - computed aided process planning - retrieval type CAPP, generative CAPP - product development cycle - sequential engineering - concurrent engineering	
UNIT IV : CNC MACHINE TOOLS	**(9)**
Principle of numerical control - component of NC system - NC procedure - types of CNC machine tools - programming of CNC machine tools - preparatory functions - miscellaneous functions - part programming - types - turning and machining center	
UNIT V : COMPUTER INTEGRATED MANUFACTURING AND PRODUCTION PLANNING	**(9)**
Types of manufacturing - evolution of computer integrated manufacturing - CIM hardware and CIM software - nature and role of the elements of CIM system - development of CIM - material requirement planning - capacity requirement planning - manufacturing resource planning - just in time - shop floor control	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Ibrahim Zeid and Sivasubramanian, R, "CAD/CAM Theory and Practice", Tata McGraw Hill Publications, New Delhi, 2009
2. Radhakrishan.P, Subramanyan.S, Raju.V, "CAD/CAM/CIM", 4th ed., New Age International Publishers Ltd., 2018

REFERENCES:

1. Chris McMohon and Jimmie Browne, "CAD/CAM Principles, Practice and Manufacturing Management", 2nd ed., Pearson Education (Singapore) Pvt. Ltd., 2000
2. David F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", Tata McGraw Hill Publications, 2017
3. Donald Hearn and M. Pauline Baker, "Computer Graphics" Eastern Economy Edition, 2007
4. Groover, M. P. and Zimmers, E. W., "CAD/ CAM", Dorling Kingsley, 2008
5. Mikell P. Groover and Zimmers.W, "CAD/CAM - Computer Aided and Manufacturing", Pearson India, 2008

17MEC21 - FINITE ELEMENT ANALYSIS					
		L	T	P	C
		2	2	0	3
PREREQUISITE : 17MEC11		**QUESTION PATTERN : TYPE - 4**			
COURSE OBJECTIVES AND OUTCOMES:					

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To introduce the concepts of Mathematical Modeling and numerical solution of engineering problems	**1.1**	The students will be able to understand the use of the FEM to solve problems in Mechanical Engineering	**a, b, d, e, k**
2.0	To appreciate the use of Finite Element Method to a range of engineering problems	**2.1**	The students will be able to use the Finite Element Method to solve one dimensional Structural and Eigen value problems	**a, c, e, k**
3.0	To gain knowledge related to two dimensional scalar variable problems with heat transfer	**3.1**	The students will be able to use the FEM to solve two dimensional scalar variable structural and heat transfer problems	**a, c, e, k**
4.0	To introduce the vector variable of the axisymmetric problems and fluid mechanics	**4.1**	The students will be able to use the FEM to solve two dimensional axisymmetric problems and fluid mechanics problem	**a, c, e, k**
5.0	To teach Isoparametric formulation and advanced topics in FEM	**5.1**	The students will be able to solve the problems involving Isoparametric, numerical integration approach	**a, c, d, e, k, l**

UNIT I : BASIC CONCEPTS AND 1D ELEMENTS	**(6+6)**
Basic concepts - general procedure for FEA - discretization - weak form - weighted residual method - Ritz method- applications - finite element modeling - coordinates - shape functions - stiffness matrix and assembly - boundary conditions - solution of equations - mechanical loads, stresses and thermal effects - bar and beam elements	
UNIT II : 2D ELEMENTS	**(6+6)**
Finite element modeling - Poisson equation - Laplace equation - plane stress, plane strain - CST element - element equations, load vectors and boundary conditions - truss - deflection - stresses - Pascal's triangles - assembly - application in two dimensional heat transfer problems	
UNIT III : AXISYMMETRIC PROBLEMS	**(6+6)**
Vector variable problems - elasticity equations - axisymmetric problems - formulation - element matrices - assembly - boundary conditions and solutions	
UNIT IV : ISOPARAMETRIC ELEMENTS	**(6+6)**
Isoparametric elements - four node quadrilateral element - shape functions - Jacobian matrix - element stiffness matrix and force vector - numerical integration - stiffness integration - displacement and stress calculations	
UNIT V : DYNAMIC ANALYSIS	**(6+6)**
Types of dynamic analysis - general dynamic equation of motion, point and distributed mass - lumped and consistent mass - mass matrices formulation of bar and beam element - undamped - free vibration - eigen value and eigen vectors problems	
TOTAL (L:30 + T:30) = 60 PERIODS	

TEXTBOOKS:

1. Rao, S.S., "The Finite Element Method in Engineering", 3rd ed., Butter worth Heinemann, 2004
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., NewDelhi, 2007

REFERENCES:

1. J.N.Reddy, "An Introduction to the Finite Element Method", 3rd ed., Tata McGrawHill,2017
2. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2012
3. Robert D. Cook,David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th ed., Wiley Student Edition, 2007
4. Chandrupatla and Belagundu, "Introduction to Finite Elements in Engineering", 4th ed., Pearson Education India, 2015
5. David Hutton, "Fundamentals of Finite Element Analysis" McGrawHill, 2005
6. Dhanaraj. R and Prabhakaran Nair. K, "Finite Element Analysis", Oxford Publications, 2015

17MEC22 - POWER PLANT TECHNOLOGY					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17MEC04		**QUESTION PATTERN : TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**		**Related Program Outcomes**	
1.0	To acquire knowledge on working principle of steam power plant	**1.1**	Summarize the working principles of steam power plant and Boilers	**a, e, g, k, l**	
2.0	To understand the working principle of gas turbine power plant	**2.1**	Describe the working of Gas Turbine power plant and their functions	**a, e, g, k, l**	
3.0	To introduce the principles and operation of nuclear power plant and its economics	**3.1**	Explain the operating principle of Nuclear Power Plant and solve the Economics problems in power plant.	**a, e, g, k, l**	
4.0	To introduce the principles and operation of power plant and its economics.	**4.1**	Classify the type of energy sources and / or describe the working principle of hydroelectric power plant	**a, e, g, k, l**	
5.0	To introduce the principles and its economics.	**5.1**	Explain the operating principle of Power Plant and solve the Economics problems in power plant	**a, e, g, k, l**	

UNIT I : STEAM POWER PLANT	**(9)**
Essentials of steam power plant equipment - coal handling - fuel burning furnaces - methods of fuel firing - pulverizing mills - ball mill, ball and race mill, shaft mill - pulverized coal firing - steam condensers - surface condensers, jet condensers - ash disposal - handling equipment - smoke and dust removal - dust collectors - fluidized bed combustion - types - boiler - classification, working principles of Cochran boiler and La Mont boiler	
UNIT II : DIESEL POWER PLANT	**(9)**
Diesel engines - heavy oil engines - duel fuel engines - high compression gas engines - general layout of diesel power plant - performance of characteristics diesel engine - fuel system - common rail injection, individual pump injection, distributor system - diesel plant operation, efficiency - heat balance of a diesel engine power plant	
UNIT III : NUCLEAR POWER PLANT	**(9)**
Nuclear energy concepts and terms - energy from nuclear fission - radioactivity - nuclear reactor - parts, nuclear fuel, moderator, moderating ratio, reflector, reactor vessel, biological shielding, coolant, nuclear reactor, classification of nuclear reactors, Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR), CANDU Reactor	
UNIT IV : RENEWABLE ENERGY SOURCES	**(9)**
Classification of energy - construction and working principles of solar energy, flat plate collectors, focusing collector, solar pond technology, low temperature thermal power generation, medium temperature systems using focusing collectors, high temperature systems – solar farm and solar power plant - wind, ocean thermal and geothermal power plant	

UNIT V : HYDROELECTRIC POWER PLANT AND POWER PLANT ECONOMICS	(9)
Hydroelectric power plant - run-off - selection of site - essential features -pumped storage plants, economics - terms and factors - factors effecting power plant design - effect of power plant type - costs, rates, fixed elements, customer elements - plant selection, power generation - load curves - ideal and realized load curves	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. El.Wakil. M. M, "Power Plant Technology", McGraw-Hill Higher Education, 2017
2. Raja.A.K, Amit Prakash Srivastava, Manish Dwivedi, "Power Plant Engineering", New Age International (P) Limited, 1st ed., Reprint 2010

REFERENCES:

1. Rajput .R.K, "A Textbook of Power Plant Engineering", 5th ed., Laxmi Publications, New Delhi, 2016
2. Nag.P.K, "Power Plant Engineering", 4th ed., Tata McGraw Hill Publishing Company Ltd, 2014
3. Arora .S.C, Domkundwar, "Power Plant Engineering", 6th ed., DhanpatRai and Co, 2013
4. Manoj Kumar Gupta, "Power Plant Engineering", 1st ed., Prentice Hall India, 2010
5. Black, Veatch, "Power Plant Engineering", 1st ed., CBS Publishers, 2005

22MEC02 - ENGINEERING GRAPHICS AND DRAFTING

L	T	P	C
3	0	2	4

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To Create the projection of points, lines and planes	1.1	The students will be able to construct the projection of points, lines and planes
2.0	To Develop the projection of Solid	2.1	The students will be able to develop projection of solids
3.0	To Solve problems in sectioning of solids and developing the surfaces	3.1	The students will be able to solve problems in sections of solids and development of surfaces
4.0	To Apply the concepts of orthographic and isometric	4.1	The students will be able to apply the concepts of isometric in engineering practice
5.0	To Draw engineering drawing by Modeling software with dimensions	5.1	The students will be able to draw Engineering drawing by Modeling software with dimensions

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - use of drafting instruments - BIS conventions and specifications - size, layout and folding of drawing sheets - lettering and dimensioning – scales

UNIT I- PROJECTION OF POINTS AND LINES **(9)**

Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method.

UNIT II - FIRST ANGLE PROJECTION OF PLANE **(9)**

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III - PROJECTION OF SOLIDS **(9)**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and Parallel to another by rotating object method.

UNIT IV - DEVELOPMENT OF SURFACES **(9)**

Development of lateral surfaces of simple and sectioned solids - prisms, pyramids cylinder and cone.

UNIT V – ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS **(9)**

Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinder, cone – free hand sketching of orthographic views from isometric views of objects.

LIST OF THE EXPERIMENTS

1. Computer aided drafting of front and top views of the given isometric view.
2. Computer aided drafting of front and top views of cylinder and cone.
3. Computer aided drafting of sectional views of prism and pyramid.
4. Draw the isomeric projection from given front and top views of the solid model.
5. 3D modeling of prism and pyramid
6. 3D modeling of spur gear.

TOTAL (L:45+P30) : 75 PERIODS

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna., "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. Luzzader, Warren.J., and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	3	1	-	-	-	2	-	2	-	2
2	3	2	1	-	3	1	-	-	-	2	-	2	-	2
3	3	2	1	-	3	1	-	-	-	2	-	2	-	2
4	3	2	1	-	3	1	-	-	-	2	-	3	-	2
5	3	3	2	-	3	1	-	-	-	2	-	3	-	2
CO (W.A)	**3**	**2.2**	**1.2**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**-**	**2.4**	**-**	**2**

22MEC03 ENGINEERING MECHANICS
(Mechanical Engineering Branch only)

	L	T	P	C
	2	1	0	3

PRE REQUISITE :

Course Objectives		Course Outcomes	
1.0	To acquire knowledge on the behaviour of a particle under the action of forces	**1.1**	The students will be able to solve the engineering problems on resultant forces and particles under equilibrium conditions.
2.0	To analyze the behaviour of the rigid body under the action of forces	**2.1**	The students will be able to calculate the reaction forces of various supports and resultant forces on rigid bodies
3.0	To gain knowledge related to friction and simple contact friction	**3.1**	The students will be able to solve the problems involving dry friction of simple sliding systems and simple contact friction.
4.0	To introduce the geometric properties of the different surfaces.	**4.1**	The students will be able to determine the centroid, centre of gravity and moment of inertia of various surfaces.
5.0	To acquire knowledge work, energy and momentum related to dynamics of particles	**5.1**	The students will be able to solve the problems involving dynamics of particles.

UNIT I - STATICS OF PARTICLE	**(6+3)**
Units and dimensions - fundamental principles - laws of mechanics, lami's theorem, parallelogram and triangular law of forces, principle of transmissibility – system forces - statics of particles in two dimensions - resultant force - coplanar concurrent forces - Free body diagram - equilibrium of particles in two dimensions.	
UNIT II - STATICS OF RIGID BODY	**(6+3)**
Statics of rigid body in two dimensions - rigid body - moment of a force about a point - varignon's theorem - resultant force for coplanar parallel and nonconcurrent forces - moments and couples - equilibrium of rigid bodies in two dimensions - requirements of stable equilibrium - types of supports and their reactions.	
UNIT III - FRICTION	**(6+3)**
Frictional force – limiting friction - angle of repose - coulomb's law of dry friction - cone of friction - problems involving the equilibrium analysis of simple systems with sliding friction - simple contact friction - ladder friction - belt friction.	
UNIT IV - PROPERTIES OF SECTIONS	**(6+3)**
Centroid – centre of gravity- Theorems of Pappus and Guldinus – moment of inertia of plane areas - transfer theorems - parallel axis and perpendicular axis theorem- radius of gyration- product of inertia - polar moment of inertia - principal axes and principal moment of inertia of plane areas.	
UNIT V - DYNAMICS OF PARTICLES	**(6+3)**
Kinematics - Displacements, velocity and acceleration, their relationship -rectilinear motion - curvilinear motion - projectile motion. Kinetics - Newton's law – D'Alembert's principle - impact of elastic bodies.	
TOTAL (L:30+T:15): 45 PERIODS	

TEXT BOOK:

1. Ferdinand P. Beer and E. Russell Johnson, "Vector Mechanics for Engineers: Statics and Dynamics", 12th ed., Tata McGraw Hill International Edition, 2019

REFERENCES:

1. Irving H. Shames, "Engineering Mechanics : Statics and Dynamics", Prentice Hall of India Private limited, 2006
2. Russell C Hibbeler, "Engineering Mechanics: Statics and Dynamics", 14th ed., Prentice Hall, 2016
3. Anthony M. Bedford and Wallace Fowler, "Engineering Mechanics: Statics and Dynamics", 5th ed., Prentice Hall, 2008
4. Palanichamy, M.S and Nagan,S, "Engineering Mechanics - Statics and Dynamics", 3rd ed., Tata McGraw-Hill, New Delhi, 2005
5. Meriam.J.L , Kraige.L.G, and Boltan, J.N "Engineering Mechanics: Statics and Dynamics", 9th ed., Wiley Publishers, 2020
6. Rajasekaran.S and Sankarasubramanian.G, "Fundamentals of Engineering Mechanics", 3rd ed., vikas Publishing House Pvt.Ltd. New Delhi, 2005.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2	-	-	-	2	-	-	-	-	2	3	-
2	3	1	2	-	-	-	2	-	-	-	-	2	3	-
3	2	1	2	-	-	-	2	-	-	-	-	2	3	-
4	2	1	2	-	-	-	2	-	-	-	-	2	3	-
5	2	1	2	-	-	-	2	-	-	-	-	2	3	-
CO (W.A)	**2.4**	**1**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**3**	**0**

22MEC04 - ENGINEERING THERMODYNAMICS
(Use of Steam Tables and Psychrometric Chart permitted)

L	T	P	C
2	1	0	3

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To teach the basic concept of thermodynamics and applications of first law of thermodynamics	1.1	Describe the concepts of conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics
2.0	To introduce the concept of second law of thermodynamics and entropy	2.1	Apply the concept of second law to analyze the performance of thermal equipments
3.0	To teach steps involved in analysis of gas power cycles	3.1	Determine the performance characteristics of air standard cycles
4.0	To provide knowledge on the process of steam formation at various conditions	4.1	Explain the stages in steam formation and determine the properties of steam
5.0	To impart the knowledge in Psychrometry and Psychrometric processes	5.1	Analyze the Psychrometric processes and determine the properties of air

UNIT I : BASIC CONCEPT, ZEROTH AND FIRST LAW OF THERMODYNAMICS **(6+3)**

Definitions - Thermodynamic systems - thermodynamic equilibrium - properties, state, process and cycle - point and path function - Zeroth law - reversible and Irreversible processes - energy, work and heat - internal energy - First Law - energy as a property of a system - PMM 1 - application of first law to closed system and steady Flow processes - applications of steady flow energy equation - steam turbine, centrifugal compressor, nozzle - limitations of first law.

UNIT II : SECOND LAW OF THERMODYNAMICS AND ENTROPY **(6+3)**

Second Law - performance of heat engines and reversed heat engines - reversible processes - statements of Second Law - PMM 2 - Clausius inequality - Carnot cycle - Carnot's theorem and corollary - entropy as a property of a system - entropy and irreversibility - entropy changes for a closed system and open system - Third Law of Thermodynamics.

UNIT III : GAS POWER CYCLES **(6+3)**

Air standard efficiency - Otto cycle - Diesel cycle - dual combustion cycle - Brayton cycle - work ratio - pressure ratio for maximum work - calculation of air standard efficiency.

UNIT IV : PROPERTIES OF PURE SUBSTANCES AND THERMODYNAMIC RELATIONS **(6+3)**

Pure substances - definition - phase change - p-T diagram - P-V-T surface - phase change terminologies - formation of steam - thermodynamic properties of steam - external work done during evaporation - internal latent heat - internal energy of steam - Entropy of water, evaporation, wet steam, superheated steam - Mollier diagram – Thermodynamic relations – Maxwell equations – TDS equations- heat capacities relations – energy equation – joule Thomson coefficient.

UNIT V : PSYCHROMETRY **(6+3)**

Concept of psychrometry and psychrometrices - psychrometric Relations - pressure, specific humidity, degree of saturation, relative humidity, enthalpy of moist air - Sling psychrometer - psychrometric charts - Psychrometric processes

TOTAL (L: 30 + T: 15) = 45 PERIODS

TEXT BOOKS:	
1.	Rajput.R.K, "A Textbook of Engineering Thermodynamics", 5th ed., Laxmi Publications, 2017
2.	MichaelA.Boles,YunusA.Cengel,"Thermodynamics:AnEngineeringApproach",8th ed.,TataMcGraw-HillEducation,2017
REFERENCES:	
1.	Nag.P.K,"EngineeringThermodynamics",5th ed.,McGrawHillEducation,2013
2.	Arora.C.P,Thermodynamics,TataMcGraw-HillEducation,2003
3.	Moran,Shapiro,BoettnerandBailey"PrinciplesofEngineeringThermodynamics",8th ed.,WileyIndiaPvtLtd-2015
4.	Holman.J.P,"Thermodynamics",10th ed.,McGrawHillEducation,2011
5.	Rao.Y.V.C," An Introduction to Thermodynamics",RevisedEdition,OrientLongman,2009

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2		1				1	2	2	2	
2	3	3	2	2		1				1	2	2	2	
3	3	3	2	3		1				1	2	2	2	
4	3	3	2	2		1				1	2	2	2	
5	3	2	3	1		2				1	2	2	2	
CO (W.A)	**3**	**2.6**	**2.2**	**2**		**1.2**				**1**	**2**	**2**	**2**	

22MEC05 FLUID MECHANICS AND MACHINERY					
		L	T	P	C
		3	0	2	4
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To introduce the fundamentals of fluid mechanics and its properties	**1.1**	Demonstrate the fundamental concepts of fluid mechanics with different properties of fluids.		
2.0	To impart basic knowledge to determine major and minor losses in flow through pipes and boundary layer concept.	**2.1**	Calculate major and minor losses associated with pipe flow in piping networks.		
3.0	To give the fundamental knowledge on physical quantities and to predict the behavior of the prototype/model by applying model laws.	**3.1**	Predict the nature of physical quantities and to predict the behavior of the prototype/model by applying model laws.		
4.0	To introduce the types and working principles of hydraulic turbines and evaluate the performance of hydraulic turbines	**4.1**	Evaluate the performance of hydraulic turbines.		
5.0	To understand the functioning and characteristic curves of pumps	**5.1**	Demonstrate working principle and performance of centrifugal and recirocating pumps.		

UNIT I - FLUID PROPERTIES AND FLOW CHARACTERISTICS	**(9)+(3)**
Units and dimensions – Definition of fluids - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Flow characteristics -concept of control volume - application of continuity equation, energy equation and momentum equation. **Lab Experiments:** ➢ Verification of Bernoulli's equation ➢ Determination of the coefficient of discharge of given Orifice meter/ Venturimeter.	
UNIT II - FLOW THROUGH CIRCULAR CONDUITS	**(9)+(3)**
Laminar flow through circular conduits – Hagen Poiseuille equation - Boundary layer concepts -types of boundary layer thickness -Darcy Weisbach equation –friction factor - Moody diagram - minor losses - Flow through pipes in series and parallel - Hydraulic and energy gradient lines. **Lab Experiments:** ➢ Determination of friction factor for a given set of pipes ➢ Determination of minor losses in pipes	
UNIT III - DIMENSIONAL ANALYSIS AND SIMILITUDE	**(9)**
Fundamental dimensions - Dimensional homogeneity – dimensional analysis by using Buckingham's π theorem method - Similitude – types of similitude - Dimensionless parameters - application of dimensionless Parameters-Model analysis.	
UNIT IV - TURBINES	**(9)+(5)**
Classification of turbines -heads and efficiencies -velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines - working principles - work done by water on the runner - unit quantities - Specific speed. **Lab Experiments:** ➢ Performance studies on Pelton wheel ➢ Performance studies on Francis turbine ➢ Performance studies on of Kaplan turbine	

UNIT V - PUMPS	(9)+(4)
Classification of Pumps - Centrifugal pumps-working principle - work done by the impeller - various efficiencies-velocity components at entry and exit of the rotor - velocity triangles - Reciprocating pump - working principle - work done. **Lab Experiments:** ➢ Performance studies on centrifugal pump ➢ Performance studies on reciprocating pump	
TOTAL (L:45 + P:15) = 60 PERIODS	

TEXT BOOK:

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi. 2019. Reviced 9th Edition (Unit I, II, III, IV, V)

REFERENCES:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi 2019. 22nd Editon (Unit I, II, III, IV, V)
2. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", John Wiley & Sons; 9th Edition SI Version 2015. (UNIT - I, II, III, IV, V)
3. Kumar. K.L., Engineering Fluid Mechanics, S Chand., New Delhi, 2016. 8th Edison (Unit I, II, III)
4. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 2017. 9th Edition (Unit I, II, III)
5. Rajput. R. K, "A text book of Fluid Mechanics and Hydraulic Machines", S. Chand & Company Ltd., New Delhi, sixth edition, 2010 (Unit I, II, III, IV, V).

WEB RESOURCES

https://nptel.ac.in/courses/105101082/
https://nptel.ac.in/courses/112105183/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3							3	3		2	3	
2	3	3							3	3		2	3	
3	3	3	2						3	3		2	3	
4	3	3							3	3		2	3	
5	3	3							3	3		2	3	
CO (W.A)	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**3**	**-**

22MEC06 MANUFACTURING PROCESSES					
		L	T	P	C
		3	0	0	3
PREREQUISITE:					

Course Objectives		Course Outcomes	
1.0	To acquire knowledge on basic concepts of foundry and casting processes	1.1	Choose the suitable casting process to produce the simple casting components and prepare mould with core
2.0	To learn various metal joining processes and gain welding skills.	2.1	Categories and select appropriate metal joining process
3.0	To provide the knowledge on various bulk deformation processes and its applications.	3.1	Illustrate the different bulk deformation processes.
4.0	To expose knowledge on sheet metal forming processes and special forming processes and to make small sheet metal parts.	4.1	Explain the sheet metal forming processes and make simple sheet metal components.
5.0	To learn about the various plastics moulding and forming processes and to make simple plastic part.	5.1	Identify the suitable moulding and forming processes of plastics for produce simple plastic parts

UNIT I – METAL CASTING PROCESSES **(9)**

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – low pressure, gravity- Tilt pouring, high pressure die casting- Centrifugal Casting – CO_2 casting –- Defects in Sand casting process-remedies

UNIT II - METAL JOINING PROCESSES **(9)**

Fusion welding processes – Oxy fuel welding – Filler and Flux materials–Arc welding, Electrodes, Coating and specifications – Gas Tungsten arc welding –Gas metal arc welding - Submerged arc welding – Electro slag welding– Plasma arc welding — Resistance welding Processes -Electron beam welding –Laser beam Welding Friction welding – Friction stir welding – Diffusion welding – Thermit Welding, Weld defects – Inspection & remedies – Brazing - soldering – Adhesive bonding.

UNIT III – BULK DFORMATION PROCESSES **(9)**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – cold forging- Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire Drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Introduction to shaping operations.

UNIT IV – SHEET METAL FORMING AND SPECIAL FORMING PROCESSES **(9)**

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming – Incremental forming.

UNIT V –MANUFACTURE OF PLASTIC COMPONENTS **(9)**

Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers– working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics- duff moulding.

TOTAL (L:45) : 45 PERIODS

TEXT BOOK:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,4th Edition, 2013
2. P.N .Rao Manufacturing Technology Volume I McGrawhill Education 5th edition, 2018.

REFERENCES:

1. HajraChoudhury S.K, HajraChoundhury A.K and Nirjhar Roy, "Elements of Workshop Technology", Vol. I, 2017
2. HMT, "Production Technology", "McGraw Hill Education", 2017
3. Sharma.P.C, "A Textbook of Production Technology", S. Chand Publications, 2014
4. S. Gowri P. Hariharan, A.SureshBabu, Manufacturing Technology I, Pearson Education, 2008.
5. Ro y. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
6. Rajput.R.K, "A Textbook of Manufacturing Technology", 2nd ed., Laxmi Publications (P) Ltd, 2016

COs	POs												(PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	2	-		-	-	-	1	2		2	3	-
2	3	-	2	-		-	3	-	1	2		2	3	-
3	3	-	2			-	-	-	1	2		2	3	-
4	3	-	2		-	-	-	-	1	2		2	3	-
5	3	-	2	-		-	-	-	1	2		2	3	-
CO (W.A)	**3**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**1**	**2**		**2**	**3**	**-**

22MEC07 ENGINEERING MATERIALS AND METALLURGY

L	T	P	C
3	0	0	3

PRE REQUISITE :

Course Objectives		Course Outcomes	
1.0	To develop the knowledge on structure of materials including crystallography, microstructure, defect	1.1	Suggest suitable engineering materials for different application
2.0	To understand the importance of various ferrous materials and phase diagram.	2.1	Infer the composition and properties of ferrous metals and phase diagram
3.0	To apply the suitable heat treatment process to Enhance the property of a material.	3.1	Apply suitable heat treatment process based on material properties
4.0	To know mechanical properties of materials.	4.1	Evaluate the mechanical behavior of materials for different applications
5.0	To give insight in to advanced materials such as polymers, ceramics and composite and their applications.	5.1	Demonstrate the structure-property relationship and allied applications of polymers and ceramics

UNIT I - STRUCTURES OF MATERIALS	**(9)**
Materials Science - Simple Crystal Structures - BCC, FCC, HCP Structures - Unit Cell - Defects - Point, Line, Surface, Volume - Slip planes and slip systems - Schmid's rule - Polymorphism and allotropy.	
UNIT II - PHASE DIAGRAMS AND PHASE TRANSFORMATION	**(9)**
Gibbs's Phase rule - Solidification and Solid Solutions - Equilibrium Diagrams - Classification of Equilibrium Diagrams - Isomorphous System - Eutectic systems, Eutectoid, Peritectic and Peritectoid system - Iron-Iron carbide phase diagram - Phase, Time - Temperature - Transformation (TTT), Continuous Cooling Transformation (CCT) and Martensitic Transformation - Types and applications of Steels and Cast Irons.	
UNIT IV - HEAT TREATMENT PROCESS	**(9)**
Heat treatment – Overview – Objectives – Annealing and types, normalizing, quenching, austempering and martempering – microstructure changes – Surface hardening processes - Carburizing – nitriding – cyaniding and carbonitriding, induction and flame hardening, Laser and Electron beam hardening.	
UNIT IV - MECHANICAL PROPERTIES OF MATERIALS	**(9)**
Testing of Materials - Classification of tests, Tensile test, Impact test, Hardness test Tension and Torsion test - Stress-strain Curve - Fractures in metals - Ductile Fracture, Brittle Fracture - Methods of protection against fracture - Creep test - stages of creep - Prevention of Creep Fracture	
UNIT V –ADVANCED MATERIALS	**(9)**
Non Ferrous Metals - Aluminium, Copper, Nickel, Magnesium, Zinc, Lead, Non Ferrous Alloys - Copper alloys, Aluminium alloys - precipitation of hardening, Magnesium alloys and Nickel alloys. Non Metallic Materials - Polymers, Ceramics and Composites - Overview of Nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:
1. Balasubramaniam R. "Callister's Materials Science and Engineering". 2nd Edition, Wiley India Pvt. Ltd., 2017
REFERENCES:
3. Kenneth G.Budinski and Michael K.Budinski, Engineering Materials Prentice-Hall of India 4. Raghavan.V. Materials Science and Engineering, Prentice Hall of India 5. PremamoyGhosh., "Polymer Science and Technology: Plastics, Rubbers, Blends and Composites". 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011. 6. SinaEbnesajjad. "Handbook of Biopolymers and Biodegradable Plastics: Properties, Processing and Applications", 1st Edition, Elsevier, Amsterdam, Netherlands, 2012. 7. Bolton, W., Engineering materials technology: Butterworth-Heinemann.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	3	2	2	2	-
2	3	-	-	-	-	-	-	-	-	3	2	2	2	-
3	3	-	-	-	-	-	-	-	-	3	2	2	2	-
4	3	2	2	-	2	-	-	-	-	3	2	2	2	-
5	3	2	2	-	-	-	-	-	-	3	2	2	2	-
CO (W.A)	**3**	**2**	**2**	-	**2**	-	-	-	-	**3**	**2**	**2**	**2**	-

22MEP02 COMPUTER AIDED MACHINE DRAWING

	L	T	P	C
	0	0	4	2

PRE REQUISITE :

Course Objectives		Course Outcomes	
1.0	To instruct the basics of geometric dimensioning and tolerance which is incorporate with machine components.	**1.1**	Remember to permit dimensional variations in the manufacture of components
2.0	To inculcate the important of tolerances and fit in the assembly of the machine components.	2.1	Apply suitable tolerances to assemble parts and features, to ensure assembly of fit and functionality
3.0	To impart the knowledge of drawing practices for common machine components	**3.1**	Illustrate various machine components through drawings.
4.0	To familiarize in drawing assembly, orthographic and sectional views of various machine components.	**4.1**	Draw the various components/products elements using modeling software.
5.0	To Formulate the detailed drawing of the given component	**5.1**	Imagine and draw the assembled views of machine parts using modeling software.

PART I **DRAWING STANDARDS & FITS AND TOLERANCES** **12**

Code of practice for Engineering Drawing, Welding symbols, riveted joints, keys, and fasteners Limits, Fits– Tolerancing of individual dimensions - basic principles of Geometric Dimensioning &Tolerancing

PART II **MODELING AND ASSEMBLY** **48**

List of Experiment

Creation of 3D modeling, assembly and drafting of Plummer Block

Creation of 3D modeling, assembly and drafting of Connecting Rod

Creation of 3D modeling, assembly and drafting of Universal Coupling

Creation of 3D modeling, assembly and drafting of Knuckle Joint

Creation of 3D modeling, assembly and drafting of Screw Jack

TOTAL:60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	**10**	**11**	**12**	**1**	2
1	3	2	3		3					2		3	3	3
2	3	2	3		3					2		3	3	3
3	3	2	3		3					2		3	3	3
4	3	2	3		3					2		3	3	3
5	3	2	3		3					2		3	3	3
CO (W.A)	**3**	**2**	**3**		**3**					**2**		**3**	**3**	**3**

22MEC09 THERMAL ENGINEERING SYSTEM					
		L	T	P	C
		3	1	0	4
PRE REQUISITE :					

Course Objectives		Course Outcomes	
1.0	To enable the students to gain the basic knowledge on working of I.C Engines	**1.1**	Demonstrate the working principles of I.C Engines and its various components
2.0	To learn the performance calculations of I.C Engines and the working of auxiliary equipments	2.1	Calculate the performance of I.C Engines
3.0	To Understand the working of boilers and functions of nozzles	**3.1**	Design the steam nozzles for thermal power plants
4.0	To Comprehending the various components in thermal power plant and functions of steam turbine	**4.1**	Compute the efficiency of the Rankine cycle and steam turbine
5.0	To Impart knowledge in the performance of Refrigeration and air-conditioning	**5.1**	Examine the CoP of Refrigeration and describe the working of air conditioning components

UNIT I - INTERNAL COMBUSTION ENGINES – FUNDAMENTALS AND COMBUSTIONS	**(9+3)**
IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control	
UNIT II - INTERNAL COMBUSTION ENGINES - PERFORMANCES AND AUXILIARY SYSTEMS	**(9+3)**
Performance and Emission Testing, Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common rail direct injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbo charging – Emission Norms	
UNIT III - STEAM BOILERS AND NOZZLES	**(9+3)**
Classifications – comparison - Fire tube boiler and water tube boiler – simple vertical, Cochran boiler, Locomotive, Babcock and Wilcox boilers – High pressure boiler – Lamont boiler and Loeffler boiler – Steam nozzle – convergent and divergent nozzle - steam flow through nozzles – nozzle efficiency – Metastable expansion of steam in a nozzle	
UNIT IV - STEAM POWER CYCLES AND STEAM TURBINE	**(9+3)**
Steam Power Cycles - Carnot Cycle - Rankine Cycle - Modified Rankine Cycle - Regenerative Cycle - Steam Turbine - Classifications – working - Impulse and reaction turbine – Compounding – velocity diagram of impulse turbine	
UNIT V - REFRIGERATION AND AIR CONDITIONING	**(9+3)**
Fundamentals of refrigeration - COP - simple vapour compression system – Effect of super heating, Effect of sub cooling - working principle of vapour absorption system - refrigerants, classification, properties - air conditioning systems- summer, winter, year round air conditioning - central system	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOK:

1. Rajput.R.K, "Thermal Engineering", 11thEdition., Laxmi Publications Ltd, 2020
2. Ganesan V, Internal Combustion Engines, 4th Edition, McGraw-Hill companies, 2017

REFERENCES:

1. Ba Ilaney. P.L "Thermal Engineering", 25th Edition, Khanna Publishers, 2017.
2. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd ed., New Age International publications, 2021
3. Arora C P, "Refrigeration and Air Conditioning",4th Edition., Tata McGraw - Hill Education, 2021
4. Rudramoorthy.R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2017

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3		3		
2	3	3								3		3		
3	3	3	3							3		3	2	
4	3	3	3							3		3	2	
5	3	3	3							3		3	2	
CO (W.A)	**3**	**3**	**3**							**3**		**3**	**2**	

22MEC10 SUBTRACTIVE MANUFACTURING PROCESSES					
		L	T	P	C
		3	0	0	3
PRE REQUISITE :					

Course Objectives		Course Outcomes	
1.0	To study the concepts and basic mechanics of metal cutting and the factors affecting machinability	**1.1**	Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
2.0	To learn working of basic and advanced turning machines.	**2.1**	Describe the constructional and operational features of centre lathe and other special purpose lathes.
3.0	To apply the working of machine namely shaping, planing, slotting and different drilling machines	**3.1**	Understand the constructional and operational features of reciprocating machine tools.
4.0	To study the basic concepts of CNC of machine tools and constructional features of CNC.	**4.1**	Apply the constructional features and working principles of CNC machine tools.
5.0	To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre	**5.1**	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

UNIT I - THEORY OF METAL CUTTING	**(9)**
Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.	
UNIT II – TURNING MACHINES	**(9)**
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle	
UNIT III – RECIPROCATING MACHINE TOOLS	**(9)**
Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods .	
UNIT IV – CNC MACHINES	**(9)**
Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features.	
UNIT V – PROGRAMMING OF CNC MACHINE TOOLS	**(9)**
Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India, 7th Edition, 2018.
2. Richard R Kibbe, John E Neely, Roland O Meyer and Warren T White, "Machine Tool Practices", Prentice Hall of India, New Delhi, 10th Revised edition, 2014

REFERENCES:

1. HajraChoudhury S.K, HajraChoundhury A.K and Nirjhar Roy, "Elements of Workshop Technology", Vol. II, Media Promoters and Publishers Pvt Ltd., 2017
2. Jain R.K. and Gupta S.C., "Production Technology", Khanna Publishers, New Delhi, 2014
3. Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools", Vol. I & II Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2017
4. Sharma P.C., "A Textbook of Production Technology", S.Chand and Company Ltd., 2014
5. Peter Smid, CNC Programming Handbook, Industrial Press Inc.; Third edition, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	-	1	-	-	-	-	3	-	2	3	-
2	3	3	3	-	1	-	-	-	-	3	-	2	3	-
3	3	3	3	-	1	-	-	-	-	3	-	2	3	-
4	3	3	3	-	1	3	-	-	-	3	-	2	3	2
5	3	3	3	-	1	3	-	-	-	3	-	2	3	2
CO (W.A)	**3**	**3**	**3**	**-**	**1**	**3**	**-**	**-**	**-**	**3**	**-**	**2**	**3**	**2**

22MEC11 STRENGTH OF MATERIALS					
		L	T	P	C
		3	0	2	4
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide knowledge about stress distribution and strain in regular and composite structures subjected to axial loads	**1.1**	Determine stress and strain in regular and composite structures subjected to axial load and thermal load.		
2.0	To familiarize about bi-axial stress systems and stresses in thin cylinders	**2.1**	Evaluate the stresses in bi-axial stress systems and thin cylinders		
3.0	To give input on shear force, bending moment diagrams and evaluate the bending stress in different beams under transverse loading	**3.1**	Assess the shear force, bending moment and bending stresses in beams under transverse loading		
4.0	To impart knowledge on finding slope and deflection of beams and buckling of columns for different boundary conditions	**4.1**	Evaluate the slope and deflection of beams and buckling loads of columns under different boundary conditions		
5.0	To provide awareness on stresses on shafts and helical springs based on theory of torsion	**5.1**	Apply torsion equation in design of circular shafts and helical springs		

UNIT I: STRESSES AND STRAIN	**9**
Introduction to material properties, Stress-strain curve for ductile and brittle materials, Hooke's law, Stresses and strain due to axial force in Stepped and Composite bars, Stresses due to thermal effect in composite bars, Factor of safety, Poisson-ratio, Volumetric strain, Elastic constants and their relationship	
UNIT II: BI-AXIAL STRESS SYSTEM	**9**
State of stresses at a point, Normal and shear stresses on inclined planes, Principal planes and Principal stresses, Plane of maximum shear stress, Mohr's circle for bi-axial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical vessels, Maximum Shear stress, Changes in dimensions and volume.	
UNIT III: SHEAR FORCE, BENDING MOMENT AND STRESSES IN BEAMS	**9**
Types of beams, supports and Loads, Shear force and Bending Moment diagram of Cantilever, simply supported and overhanging beams, Point of contra flexure. Theory of Simple Bending, Bending stress.	
UNIT IV: DEFLECTION OF BEAMS AND COLUMNS	**9**
Slope and Deflection of cantilever and simply supported beams by Double integration method and Macaulay's method. Types of Columns, Equivalent length, Euler and Rankine's formulae, Slenderness ratio	
UNIT V: TORSION IN SHAFT AND HELICAL SPRING	**9**
Torsion equation - stresses and deformations in circular solid, circular hollow and stepped shafts - Closed coil helical spring-stresses and deflection under axial load.	

LIST OF EXPERIMENTS

1. Study of Stress / Strain curves for various materials
2. Tension test on steel rod
3. Double shear test in UTM
4. Rockwell Hardness test
5. Brinell Hardness Test
6. Izod impact test
7. Deflection test on Steel beam
8. Deflection test on Wooden beam
9. Compression test on Bricks
10. Compression test on helical spring

TOTAL (L:45 + P:30): 75 PERIODS

TEXT BOOK:

1. Bansal.R.K, "A textbook of Strength of Materials: (Mechanics of Solids) SI Units", 6th ed., Laxmi Publications, 2017
2. Ferdinand Beer Jr., E. Russell Johnston Jr., John T. DeWolf and David F. Mazurek, "Mechanics of Materials", 7th ed., McGraw Hill, 2011

REFERENCES:

1. S.S. Rattan, Strength of Materials, McGraw Hill Education (India) Private Limited, Chennai, Third Edition, 2017
2. S.S. Bhavikatti, Strength of Materials, Vikas Publishing House, New Delhi, Fourth edition, 2013
3. Egor P. Popov, Engineering Mechanics of Solids, Pearson India Education Services Pvt Ltd, New Delhi, 2015
4. Ramamrutham.S and Narayanan.R, "Strength of Materials", DhanpatRai Publications, 2017
5. Rajput R.K, "Strength of Materials", 6th ed., S.Chand and Company Ltd, 2015

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1						3	3		2	2	
2	3	3	2						3	3		2	2	
3	3	3	2						3	3		2	2	
4	3	3	2						3	3		2	2	
5	3	3	2						3	3		2	2	
CO (W.A)	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**2**	**-**

22MEC12 - THEORY OF MACHINES					
		L	T	P	C
		3	0	2	4
PRE REQUISITE : 22MEC03-Engineering Mechanics					
Course Objectives		**Course Outcomes**			
		At the end of the course, the students would be able to			
1.0	To know the basic components and velocity / acceleration analysis of mechanisms.	**1.1**	Demonstrate the working of various mechanisms and determine the velocity and acceleration of mechanisms.		
2.0	To understand the basic concepts of toothed gearing and kinematics of gear trains.	**2.1**	Describe the concepts and applications of kinematics of gears and gear trains.		
3.0	To acquire knowledge on cam mechanisms for specified output motions and the effects of friction in machine elements.	**3.1**	Explain the concepts of cam follower system and examine the friction concepts in various engineering applications.		
4.0	To introduce the concepts of static and dynamic force analysis in mechanisms and reciprocating engines.	**4.1**	Analyze the static and dynamic forces in mechanisms and reciprocating engines.		
5.0	To learn the balancing concepts of rotating and reciprocating masses and the various types of vibrations	**5.1**	Apply the balancing concepts in reciprocating and rotating masses to solve problems; and Compute the frequency of various types of vibrations.		

UNIT - I KINEMATICS OF MECHANISMS AND ANALYSIS	**(9)**
Mechanisms – Terminology and definitions – Degree freedom of simple mechanism – Grashof"s Law - Kinematic Inversions of Four bar chain, Single slider and Double slider crank chains –kinematics Analysis in slider crank mechanism - Velocity and Acceleration- Analytical method.	
UNIT – II GEARS AND GEAR TRAINS	**(9)**
Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains	
UNIT- III KINEMATICS OF CAMS AND FRICTION DRIVES	**(9)**
Classifications of Cams and Followers - Displacement diagrams for uniform velocity, simple harmonic motion, constant acceleration and deceleration, cycloidal motions - Graphical layout of radial cam profile with in-line knife edge follower- tangent cam and circular arc cam. Friction- Surface contacts – Sliding and Rolling friction- Friction drives – Plate clutches and belt drive.	
UNIT – IV FORCE ANALYSIS	**(9)**
Static force analysis - static equilibrium conditions - free body diagrams - static Equilibrium conditions – Two, Three and four members - graphical force analysis without friction for four bar mechanism and slider crank mechanism - Dynamic force analysis in Reciprocating Engines –D'Alembert's principle - analytical method of engine force analysis without inertia.	
UNIT – V BALANCING AND VIBRATION	**(9)**
Static and Dynamic balancing - Balancing of rotating masses – balancing of reciprocating masses - tractive force, swaying couple, hammer blow – vibration- Free longitudinal and transverse vibrations – natural Frequency – Damped Vibration – critical speed of simple shaft –torsional vibrations on single and two rotor systems.	

LIST OF EXPERIMENTS

1. Determination of transmission angle and toggle position of four bar mechanisms.
2. Determination of ratio of time of cutting stroke to return stroke and length of stroke of quick return mechanism.
3. Experimental study of Gears, Gear trains and Differential unit.
4. Determination of moment of inertia of an object by oscillation method.
5. Determination of jump speed of the cam.
6. Balancing of rotating mass of the shaft.
7. Deflection of fixed –free cantilever beam.
8. Determination of natural frequency of vibration of the spring mass system.
9. Determination of whirling speed of shaft.
10. Determination of natural frequency of the free torsional vibration of the single rotor system.

TOTAL (L:45 + P:30): 75 PERIODS

TEXT BOOK:

1. John J. Uicker, Jr., Gordon R. Pennock and Joseph E. Shigley, "Theory of Machines and Mechanisms - SI Edition", 4th ed., Oxford University Press, 2017
2. Khurmi.R.S and Gupta.J.K, "Theory of Machines", 15th ed., S.Chand & Company Pvt. Ltd., 2017

REFERENCES:

1. Rattan.S.S, "Theory of Machines", 5th ed., McGraw Hill Education India Private Limited, 2019
2. Ambekar A.G, "Mechanism and Machine Theory", 1st ed., Prentice Hall of India, 2013
3. Bansal.R.K and Brar.J.S, "Theory of Machines", 5th ed., Laxmi Publications, Revised 2016
4. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", East-West Publications, 2008
5. Kenneth J Waldron and Gary L Kinzel, "Kinematics, Dynamics, and Design of Machinery", 3rd ed., Wiley India Pvt Ltd, 2016

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	-	-	-	-	2	2	-	3	2	-
2	3	3	3	3	-	-	-	-	2	2	-	3	2	-
3	3	3	3	3	-	-	-	-	2	2	-	3	2	-
4	3	3	3	2	-	-	-	-	2	2	-	3	2	-
5	3	3	3	2	-	-	-	-	2	2	-	3	2	-
CO (WA)	**3**	**3**	**3**	**2.4**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**2**	**-**

22EDA02 CONCEPTS OF ENGINEERING DESIGN					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the fundamentals of design process for products	**1.1**	Apply the design concepts in various industrial products based on customer requirements.		
2.0	To impart the importance of design in today's context of global competition, environmental awareness and customer oriented market.	**2.1**	Utilize the statistical tools in monitoring the performance of products.		
3.0	To understand the various design methods of engineering design	**3.1**	Be familiar with the design concepts to improve the reliability and productivity.		
4.0	To understand the selection of proper materials	**4.1**	Apply the material selection process and design for manufacture.		
5.0	To impart the basic concepts and various aspects of design using simple examples and case studies.	**5.1**	Gain knowledge about the failure mode effect analysis and green design process.		

UNIT I : DESIGN FUNDAMENTALS	**(9)**
Importance of design - Design process - Considerations of good design - Morphology of design - Organization for design – Designing to codes and standards - Product and process cycles - Technological innovation.	
UNIT II : CUSTOMER ORIENTED DESIGN	**(9)**
Identification of customer needs - Customer requirements - Bench marking quality function deployment - Product design specifications - Human factors in design - Ergonomics and aesthetics - Contracts - Product liability - Protecting intellectual property - Legal and ethical domains -Codes of ethics -Ethical conflicts.	
UNIT III : DESIGN METHODS	**(9)**
Creativity and problem solving - Creative thinking methods - Theory of inventive problem solving (TRIZ) - Decision making - Embodiment design - Product architecture - Configuration design - Parametric design - Role of models in design - Rapid prototyping - Finite element analysis - Optimization.	
UNIT IV : MATERIAL SELECTION PROCESSING AND DESIGN	**(9)**
Material selection process - Economics -Weighted property index - Classification of manufacturing process - Design for manufacture - Design for assembly - Designing for castings, Forging, Metal Forming, Machining and Welding - Residual stresses.	
UNIT V : PROBABILITY CONCEPTS IN DESIGN & GREEN DESIGN PROCESS	**(9)**
Probability - Distributions - Test of hypothesis - Design of experiments - Reliability theory - Design for reliability - Robust design - Failure mode effect analysis. Design for environment - Green design process: Material life cycle, embodied energy, carbon footprint, green design in industry, sustainability.	
TOTAL : L: 45 = 45 PERIODS	

REFERENCES:

1. Dieter George E., "Engineering Design - A Materials and Processing Approach", 4th ed., Tata McGraw Hill, 2013.
2. Pahl, G, and Beitz, W., "Engineering Design", 3rd ed., Springer – Verlag, NY. 2007.
3. Robert C Juvinall, "Fundamentals of Machine Component Design", Wiley, 2011.
4. Suh, N.P., "The Principles of Design", Oxford University Press, NY.1990.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**
1	1	3	2	1	2	1	2	1
2	2	1	2	1	2	3	3	2
3	2	2	2	2	1	1	3	1
4	1	2	3	2	2	1	2	2
5	1	1	2	1	1	1	3	2
CO (W.A)	**1.4**	**1.8**	**2.2**	**1.4**	**1.6**	**1.4**	**2.6**	**1.6**

22EDB01 MECHANICAL VIBRATIONS AND ACOUSTICS			
L	T	P	C
3	0	0	3

PRE REQUISITE :

	Course Objectives		Course Outcomes
1.0	To understand the basic concepts of free and forced vibration with damped and undamped systems	1.1	able to analyze response of a SDOF system, damped or undamped, subjected to force excitations
2.0	To determine the natural frequencies and mounting of vibration absorbers in the two degree freedom systems	2.1	Identify the solutions for Machine vibration problems with two degree freedom systems using mathematical or numerical analysis.
3.0	To structure the stiffness matrix and calculate the natural frequencies of Multi Degree Freedom System and Continuous System.	3.1	Able to write the differential equations of motion for Multi Degree of Freedom and obtain the Eigen-values and mode shapes of natural vibrations
4.0	To recognize the control technique of vibration in machines.	4.1	Categorize the causes for vibrations in engineering systems using vibration control and analysis techniques
5.0	To know the terminologies in acoustics and acoustic wave transmission	5.1	Illustrate the basics of psychoacoustics, Equal loudness, scale, loudness, pitch loudness and noise.

UNIT I – FUNDAMENTALS AND SIGNLE DEGREE OF FREEDOM	**(9)**
Introduction -Sources Of Vibration – Methods of Vibration Analysis – Types of Vibration - Review Of Single Degree of Freedom Systems - Free vibrations, free damped vibrations, and forced vibrations with and without damping – Vibration Measuring Instruments vibrometers and accelerometer - Response To Arbitrary and non-harmonic Excitations – Transient Vibration – Impulse loads- Critical Speed Of Shaft-Rotor systems.	
UNIT II - TWO DEGREE FREEDOM SYSTEM	**(9)**
Introduction - Free Vibration of Undamped and Damped – Forced Harmonic Vibration – Semi definite System - Coordinate Couplings – Vibration absorber – Torsional vibration absorber – Centrifugal pendulum absorber – Untuned vibration dampers	
UNIT III - MULTI-DEGREE FREEDOM SYSTEM AND CONTINUOUS SYSTEM	**(9)**
Multi Degree Freedom System –Influence Coefficients and stiffness coefficients- Flexibility Matrix and Stiffness Matrix – Eigen Values and Eigen Vectors-Matrix Iteration Method – Approximate Methods: Dunkerley, Rayleigh's, and Holzer Method - Continuous System – Vibration of String, Shafts and Beams.	
UNIT IV – VIBRATION ANALYSIS AND CONTROL	**(9)**
Vibration Analysis Overview - Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings. -Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments - Specification of Vibration Limits – Vibration severity standards- Vibration as condition Monitoring Tool-Vibration Isolation methods - Dynamic Vibration Absorber - Static and Dynamic Balancing machines – Field balancing.	

UNIT V - ACOUSTICS	(9)
Psychoacoustics, Speech, mechanism of hearing, thresholds of the ear – sound intensity and frequency, loudness, equal loudness levels, loudness, pitch and timbre, beats, masking by pure tones, masking by noise.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. V.P. Singh, Raveesh Pratap, "Mechanical Vibrations", Dhanpat Rai Publications, New Delhi, 2015
2. Singiresu S Rao "Mechanical Vibrations", Prentice Hall, 2016.
3. Ramamurti.V,"MechanicalVibrationPracticewithBasicTheory",NarosaPublishingHouse, 2010
4. Lawrence E. Kinsler and Austin R.Frey, "Fundamentals of acoustics", Wiley Eastern Ltd., 1987.
5. Michael Rettinger, "Acoustic Design and Noise Control", Vol. I & II. , Chemical Publishing Co., New York, 1977.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) /Programme SpecificOutcomes (PSOs)

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	1	3	3	2	2	1	3	3
2	2	3	2	3	2	2	3	3
3	3	3	2	3	2	2	3	3
4	1	2	1	2	1	2	2	2
5	1	1	1	2	3	1	2	2
CO (W.A)	**1.6**	**2.4**	**1.8**	**2.4**	**2**	**1.6**	**2.6**	**2.6**

22EDB02 FAILURE ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

PRE REQUISITE :

Course Objectives		Course Outcomes	
1.0	To impart knowledge about various modes of failure this leads to materials and design.	**1.1**	Demonstrate the various modes of failure and material behavior in fracture loading.
2.0	To learn about large variety of fracture mechanisms and fracture modes associated with failure.	**2.1**	Examine the fracture mechanisms and fracture, creep, fatigue, corrosion and wear failures.
3.0	To provide an exposure to the students on statistical nature of fatigue and fatigue tests	**3.1**	Implement of fatigue analysis principles in innovative applications.
4.0	To provide fundamental knowledge of corrosion and environmentally-assisted cracking.	**4.1**	Demonstrate the corrosion and wear failure analysis.
5.0	To study about industrial application of failure analysis tools.	**5.1**	Demonstrate the failure analysis tools.

UNIT I : MATERIALS AND DESIGN PROCESS (9)

Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, material selection process, introduction to stress, two dimensional and three-dimensional state of stress, Mohr's circle two and three dimensions, hydrostatic stress, von-Mises, maximum shear stress (Tresca), octahedral shear stress.

UNIT II : FRACTURE MECHANICS (9)

Ductile fracture, brittle fracture, cleavage-fractography, ductile to brittle transition, factors affecting ductile to brittle transition, fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage - Linear Elastic Fracture Mechanics: Griffiththeory, energy release rate, Instability and R-curve, stress analysis of cracks-stress intensity factor, Crack growth instability analysis.

UNIT III :FATIGUE (9)

Statistical nature of fatigue, signal-noise curve, low cycle fatigue, strain life equations, structural feature of fatigue, fatigue crack propagation, effect of stress concentration, size, surface properties, metallurgical variables on fatigue, case studies, designing against fatigue, detail design, improvements after failure and service, fatigue of bolts, welded and adhesive joints. Fatigue Tests-Purpose, specimen, fatigue test procedures, evaluation of fatigue test results, crack growth measurement. Creep, stress rupture, elevated temperature fatigue, super plasticity.

UNIT IV : CORROSION AND WEAR FAILURES (9)

Types of corrosion, Factors influencing corrosion failures, analysis of corrosion failures, stress corrosion cracking - sources, characteristics of stress corrosion cracking, procedure of analyzing stress corrosion cracking, various types of hydrogen damage failures, corrective and preventive action. Types of wear, lubricated and non – lubricated wear, wear on different materials, different methods of wear measurement. Role of friction on wear, analysis of wear failures, wear tests -ferrography

UNIT V : FAILURE ANALYSIS TOOLS (9)

Reliability concept and hazard function, application of Poisson, exponential and Weibull distribution for reliability, bathtub curve, parallel and series system, failure mode effect analysis - definition-Design, types, process, industrial case studies / Projects.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Yiannis Papadopoulos, Engineering failure analysis and design optimization with HiPHOPS" Engineering Failure Analysis, Volume 18, Issue 2, pp 590–608, March 2011.
2. F. Rui, Martins, Failure analysis of bilge keels and its design improvement, Engineering Failure Analysis, Volume 27, pp 232–249, January 2013.
3. T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, CRC Press, 2005.
4. F.Michael and Ashby, Material Selection in Mechanical Design, Butterworth Heinemann, 2004.
5. ASM Metals Handbook, Failure Analysis and Prevention, ASM Metals Park, Ohio, USA, Vol.10, 2002.
6. J.E. Shigley and Mische, Mechanical Engineering Design, McGraw Hill, 2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1			1			1		
2	2	2	3	3	1	2		2
3	2	2	3	3	1	2		2
4	2	2	3	3	1	2		2
5			1	1		1		
CO (W.A)	**2**	**2**	**2.2**	**2.5**	**1**	**1.6**		**2**

22EDB03 COMPUTER APPLICATIONS IN DESIGN

L	T	P	C
3	0	0	3

PREREQUISITE :

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes	
1.0	To develop the modeling skills using computer graphic techniques.	1.1	Demonstrate computer graphic techniques
2.0	To impart knowledge on CAD software and data exchange standards.	2.1	Using CAD software to exchange standards data
3.0	To study the applications of NURBS and solid modeling.	3.1	Use of CAD software transfer of product data in various software.
4.0	To gain knowledge on visual realism and computer animation.	4.1	Describe the types NURBS and solid modeling
5.0	To provide knowledge on assembly modeling and tolerance analysis.	5.1	Demonstrate the knowledge of assembly modeling and tolerance analysis

UNIT I : INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS **(9)**

Output primitives (points, lines, curves etc.) 2D & 3D transformation (Translation, scaling, rotations) windowing - view ports - clipping transformation Open GL Data Exchange standards- IGES, STEP etc. - Communication standards.

UNIT II : CURVES AND SURFACE MODELING **(9)**

Representation of curves - Bezier curves- cubic spline curve - B-Spline curves - Rational curves - Curve manipulations Representation of surface modeling techniques - Analytical surfaces : Plane surface, ruled surface, surface of revolution and tabulated cylinder - synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface - surface manipulation.

UNIT III : NURBS AND SOLID MODELING **(9)**

NURBS - Basics - curves, lines, arcs, circle and bi linear surface Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations constructive solid geometry comparison of representations - user inter face for solid modeling.

UNIT IV : VISUAL REALISM **(9)**

Hidden Line - Surface-solid removal algorithms shading - coloring. Introduction to parametric and variational geometry based software sand the in principles creation of prismatic and lofted parts using the sepackages.

UNIT V : ASSEMBLY OF PARTS **(9)**

Assembly modeling - interferences of positions and orientation - tolerances analysis - mass property calculations- mechanism simulation

TOTAL : L: 45 = 45 PERIODS

REFERENCES:

1. Ibrahim Zeid, "Mastering CAD/CAM", 2nd ed., McGraw Hill, International Edition, 2006.
2. Donald Hearn, M. Pauline Baker, "Computer Graphics", 4th ed., Prentice Hall, Inc., 2010.
3. William M Neumann, Robert F. Sproul, "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
4. P.Radhakrishnan, C.P.Kothandaraman, "Computer Graphics and Design", Dhanpat Rai and Sons,1999.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	**1**	2
1	3	**1**	**1**	3	**-**	3	3	**1**
2	3	**1**	**1**	3	**-**	3	3	**1**
3	3	**1**	**1**	3	**-**	3	3	**1**
4	3	**1**	**1**	3	**-**	3	3	**1**
5	3	**1**	**1**	3	**-**	3	3	**1**
CO (W.A)	**3**	**1**	**1**	**3**	**-**	**3**	**3**	**1**

22EDB05 ADVANCED FINITE ELEMENT ANALYSIS

L	T	P	C
3	0	0	3

PREREQUISITE :22EDA01

	Course Objectives		Course Outcomes
1.0	To understand the basic principles of the finite element analysis techniques and enhancing the ability to apply the tools of the analysis for solving practical problems arising in Engineering design.	1.1	Apply finite elements technique in engineering problem solving for various applications.
2.0	To create expertise in basic elements, one and two dimensional problems.	2.1	Derive finite element equation and to solve the real time 1D and 2D structural and thermal problems.
3.0	To create expertise in basic elements of Isoperimetric elements problems.	3.1	Solve and analysis the engineering problems using isoparametric and parametric elements.
4.0	To provide knowledge on structural dynamic analysis of bar and beam element	4.1	Estimate the solve structural dynamic analysis
5.0	To study the non-linear problems and error estimates of FEM	5.1	Create nonlinear problems and error method

UNIT I : ONE-DIMENSIONAL APPLICATIONS	**(9)**
Basic concept of FEM - Weighted residual methods - Variational formulation of B.V.P - Ritz method - Finite element modeling - Element equations - Linear and quadratic shape functions - Bar and beam elements - Bars and beams of arbitrary orientation - Applications to structural heat transfer problems.	
UNIT II : TWO-DIMENSIONAL APPLICATIONS	**(9)**
Poisson equation - Laplace equation - Weak form - Element matrices for triangular and rectangular elements - Evaluation of integrals - Applications – Conduction- and convection heat transfer - Theory of elasticity - Plane strain - Plane stress - Axi-symmetric problems - Principle of virtual displacement.	
UNIT III : ISOPARAMETRIC ELEMENTS	**(9)**
Natural Co-ordinate Systems - Lagrangian Interpolation Polynomials - Isoparametric elements - Quadrilateral elements formulation - Jacobian matrix -Triangular elements - Rectangular elements - Serendipity elements – Numerical Integration - Gauss quadrature - Illustrative Examples.	
UNIT IV : STRUCTURAL DYNAMIC ANALYSIS	**(9)**
Dynamic equations - Consistent and lumped mass matrices - 1D bar element - Formulation of element stiffness, mass and force matrices - Example problems. Natural frequencies - 1D beam element - Formulation of element stiffness, mass matrices.	
UNIT V : NON-LINEAR PROBLEMS AND ERROR ESTIMATES	**(9)**
Introduction - Material non-linearity - Elasto Plasticity - Plasticity - Visco plasticity - Geometric non-linearity - Large displacement - Error norms and convergence rates - H-refinement with adaptivity - adaptive refinement.	
TOTAL (L : 45) :45 PERIODS	

TEXT BOOK:

1. Reddy J.N., "An Introduction to the Finite Element Method", 4rd ed., McGraw Hill, International Edition, 2018.
2. Logan D.L, "A First Course in the Finite Element Method", 6th ed.,Thomson Learning, 2018.

REFERENCES:

1. Cook, Robert Davis et al, "Concepts and Applications of Finite Element Analysis", 4th ed., Wiley, John & Sons, 2007.
2. Chandrupatla, T. R and Belegundu, A.D., "Introduction to Finite Elements in Engineering", 4th ed., Pearson Education, New Delhi, 2018.
3. Rao Singiresu S. "The Finite Element Method in Engineering". 6th Edition, Butterworth-Heinemann, USA, 2017.
4. Bhavikatti SS, "Finite Element Analysis", New Age International Publishers, 2015.
5. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", 7th ed., McGraw Hill International Edition, Physics Services, 2013.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	-	1	3	-	-	3	-
2	3	-	1	3	-	-	3	-
3	3	-	1	3	-	-	3	-
4	3	-	1	3	-	-	3	-
5	3	-	1	3	-	-	3	-
CO (W.A)	3	-	-	3	-	-	3	-

22EDB06 MECHANISMS DESIGN AND SIMULATION

L	T	P	C
3	0	0	3

PRE REQUISITE : Nil

Course Objectives		Course Outcomes	
1.0	To learn the fundamentals of kinematics and various mechanisms.	1.1	Familiarize with the fundamentals of kinematics and mechanisms.
2.0	To study the complex mechanisms to determine velocity and acceleration of output links.	2.1	Determine velocity and acceleration of complex mechanisms.
3.0	To study the path curvature and coupler curves of mechanisms.	3.1	Create the path curvature and coupler curves of mechanisms.
4.0	To study the synthesis of mechanisms.	4.1	Synthesize the planar mechanisms.
5.0	To learn the design of six bar coupler driven mechanisms and cam mechanisms and to study Simulation Software packages.	5.1	Design the six bar coupler driven mechanisms and cam mechanisms.

UNIT I - INTRODUCTION **(9)**

Review of fundamentals of kinematics - classifications of mechanisms-components of mechanisms - mobility analysis - formation of one D.O.F., Compliant mechanisms - Equivalent mechanisms - Basic kinematic structures of serial and parallel robot manipulators

UNIT II - KINEMATIC ANALYSIS **(9)**

Analytical methods for velocity and acceleration Analysis - four bar linkage jerk analysis. Velocity analysis of Plane complex mechanisms using graphical method - Spatial RSSR mechanism - Denavit-Hartenberg Parameters.

UNIT III - PATH CURVATURE THEORY AND COUPLER CURVE **(9)**

Fixed and moving centrodes, inflection points and inflection circle. Hartmann's construction - Euler Savary equation, graphical constructions - Bobbilier constructions - Cubic of stationary curvature. Four bar coupler curve - cusp - crunode - coupler driven six - bar mechanisms - straight line generators.

UNIT IV - SYNTHESIS OF FOUR BAR MECHANISMS **(9)**

Type synthesis - Number synthesis - Dimensional synthesis - function generation, path generation, motion generation. Associated Linkage Concept. Graphical methods- Inversion technique - point position reduction - two, three and four position synthesis of four-bar mechanisms. Analytical methods - Bloch method and Freudenstein's Equation, Mechanism defects.

UNIT V -SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS **(9)**

Cognate Linkgages - parallel motion Linkages. Design of six bar mechanisms-single dwell-double dwell - double stroke. Geared five bar mechanism-multi-dwell. Cam mechanisms- determination of optimum size of cams. Unbalance, Spring surge and Wind up - Study and use of Mechanism using Simulation Software packages.

**** Term Project must be submitted at end of the Semester**

TOTAL (L:45) : 45 PERIODS

TEXT BOOK:
1. Uicker, J.J., Pennock, G. R. and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press. 2017
REFERENCES:
1. Robert L.Norton, "Design of Machinery", Tata McGraw Hill, 2012 2. Sandor G.N. and Erdman A.G., "Advanced Mechanism Design Analysis and Synthesis", Volume II Prentice Hall, 1984. 3. Amitabh A Ghosh and Asok Kumar Mallik, "Theory of Mechanism and Machines", EWLP, Delhi, 2008. 4. Kenneth J, Waldron, Gary L. Kinzel, "Kinematics, Dynamics and Design of Machinery", John Wiley-sons, 2016. 5. Jingshan Zhao Associate Pr, Zhijing Feng, "Advanced Theory of Constraint and Motion Analysis for Robot Mechanisms", Academic Press, 2013.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	1	-	1	1	1	-	1	1
2	1	-	2	3	1	-	2	1
3	1	-	2	3	1	-	2	1
4	1	-	2	3	1	-	2	1
5	1	-	2	3	1	-	2	1
CO (W.A)	1	-	1.8	2.6	1	-	1.8	1

22EDB07 INTEGRATED MECHANICAL DESIGN *(Use of Approved Data Book is Permitted)*					
			L	T	P	C
			3	0	0	3
PRE REQUISITE :					
Course Objectives		**Course Outcomes**			
1.0	To know the integrated design procedure of different machine elements for mechanical applications.	**1.1**	Apply concepts of design of shafts to obtain solutions to real time engineering problems		
2.0	To ensure that the student has thorough conceptual understanding of gear and gear boxes	**2.1**	Identify the gear tooth failure modes and design of gears		
3.0	To study design concepts of dynamics and thermal aspects of brakes and clutches	**3.1**	Integrated design of brakes and clutches for machine tools		
4.0	To study the design of systems consisting of machine elements	**4.1**	Categorize the engineering applications of Integrated design of machine elements		
5.0	To study the design of systems consisting of transmission systems	**5.1**	Apply the concepts of integrated design in transmission systems		

UNIT I : FUNDAMENTALS AND DESIGN OF SHAFTS	**(9)**
Phases of design - Standardization and interchange ability of machine elements - Process and Function Tolerances - Individual and group tolerances - Selection of fits for different design situations - Design for assembly and modular constructions - Concepts of integration - BIS, ISO,DIN, BS, ASTM Standards. Oblique stresses - Transformation Matrix - Principal stresses - Maximum shear stress - Theories of Failure - Ductile vs. brittle component design - Analysis and Design of shafts for different applications - integrated design of shaft, bearing and casing - Design for rigidity	
UNIT II : DESIGN OF GEARS AND GEAR BOXES	**(9)**
Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads - Component design of spur, helical, bevel and worm gears - Design for sub assembly - Integrated design of speed reducers and multi-speed gear boxes - application of software packages.	
UNIT III : BRAKES & CLUTCHES	**(9)**
Dynamics and thermal aspects of brakes and clutches - Integrated design of brakes and clutches for machine tools, automobiles and mechanical handling equipments.	
UNIT IV: INTEGRATED DESIGN OF MACHINE ELEMENTS	**(9)**
Integrated Design of systems consisting of shaft, bearings, springs - Design of Elevators, Escalators	
UNIT V: INTEGRATED DESIGN OF TRANSMISSION SYSTEMS	**(9)**
Integrated Design of systems consisting of belt, rope, chain, pulleys, gears, gear boxes, valve gear mechanisms	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:
1. Norton L. R., "Machine Design - An Integrated Approach" Pearson Education, 2019
REFERENCES:
1. Rajamani, Rajesh. Vehicle dynamics and control. Springer Science & Business Media, 2011. 2. Newcomb, T.P. and Spur, R.T., "Automobile Brakes and Braking Systems", Chapman and Hall, 2nd ed., 1975. 3. Maitra G.M., "Hand Book of Gear Design", Tata McGraw Hill, 1985. 4. Shigley, J.E., "Mechanical Engineering Design", McGraw Hill, 1986. 5. Prasad. L. V., "Machine Design", Tata McGraw Hill, New Delhi, 1992. 6. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	-	-	3	-	1	1	1
2	3	-	-	3	-	1	1	1
3	3	-	-	3	-	1	1	1
4	3	-	-	3	-	1	1	1
5	3	-	-	3	-	1	1	1
CO (W.A)	3	-	-	3		1	1	1

22EDP02 ANALYSIS AND SIMULATION LABORATORY				
	L	T	P	C
	0	0	4	2

PRE REQUISITE :

Course Objectives		Course Outcomes	
1.0	To impart hands-on training with ANSYS software for solving practical problems arising in engineering design	1.1	Compute the engineering problem using a simulation model and find out the solutions
2.0	To simulate the real time problems by using these software and also to understand the application of analysis packages	2.1	Get familiarized with the computer aided finite element analysis packages which are necessary to solve the engineering problems numerically
3.0	To develop finite element formulations of engineering problems from a variety of application areas including stress, heat transfer, and vibration analysis	3.1	Create the mechanical systems to meet thermal and fluid flow requirements for various applications
4.0	Be aware of the limitations of the FEM. Learn to use ANSYS (Commercial finite element programs)	4.1	Usage of commercial FE softwares to solve complex engineering problems with an understanding of their limitations
5.0	To develop the students to perform Design optimization, Buckling, Modal, Fatigue and Harmonic analysis	5.1	Demonstrate the mechanical components to meet optimization, Buckling, Modal, Fatigue and Harmonic analysis for various applications

Analysis of Mechanical Components – Use of FEA Packages.

1. Analysis of machine elements under Static loads
2. Analysis of an Axi-symmetric problem
3. Modal and Harmonic Analysis
4. Thermal Analysis of mechanical systems
5. Non-linear Structural Contact Analysis
6. Eigen value Buckling Analysis
7. Fatigue Analysis of a component
8. Modeling a component using Pro/E, Importing to ANSYS and Meshing

• Use of kinematics and dynamics simulation software. Analysis of velocity and acceleration for mechanical linkages of different mechanisms

TOTAL : P: 45 = 45 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs								
COs	**POs**						**PSOs**	
	1	2	3	4	5	6	1	2
1	2	1	3	3	1	2	3	1
2	2	1	2	2	1	2	3	1
3	3	2	3	3	2	3	3	2
4	2	2	3	3	2	2	2	2
5	2	2	3	2	2	2	2	2
CO (W.A)	**2.2**	**1.6**	**2.8**	**2.6**	**1.6**	**2.2**	**2.6**	**1.6**

NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabus

for

MBA – MASTER OF BUSINESS ADMINISTRATION [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-2023) onwards)

AUGUST 2022

INSTITUTE VISION AND MISSION	
VISION	❖ To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	❖ To provide quality education to produce ethical and competent professionals with social Responsibility ❖ To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. ❖ To create a learner centric environment and improve continually to meet the changing global needs.

MBA - MASTER OF BUSINESS ADMINISTRATION	
VISION	❖ To be recognized as a centre of excellence in Management to produce competent business professionals to meet the changing needs of the society.
MISSION	❖ To provide quality management education through managerial activities to meet the global needs. ❖ To impart business knowledge to enhance Employability, Entrepreneurship and Research with ethical and social responsibility. ❖ To be a learner centric environment to cater the changing business needs of the society.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	The graduates after three to five years will be able **PEO 1: Core Competency:** To work with multidisciplinary teams for problem solving and understand the group dynamics and team work. **PEO 2: Employability, Entrepreneurship and Research** To demonstrate business skills as employee, Entrepreneur, researcher and excel in providing socially acceptable solutions to real world problems by applying emerging management techniques. **PEO 3: Ethical and Committed Professional:** To develop life long learning attitude, ethics and values for a successful profession.
PROGRAMME OUTCOMES (POs)	The students of post graduates in Business Administration will be able to **PO 1.** Apply knowledge of management theories and practices to solve business problems. **PO 2.** Foster analytical and critical thinking abilities for data-based decision making. **PO 3.** Develop Value based Leadership ability. **PO 4.** Understand, analyze and communicate global, economic, legal, and ethical aspects of business. **PO5.** Lead themselves and others in the achievement of organizational goals, contributing effectively to a team.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES				
	1	**2**	**3**	**4**	**5**
1	3	3	2	3	2
2	3	3	3	3	3
3	3	3	3	3	3

Contribution **1: Reasonable** **2: Significant** **3: Strong**

SEMESTER: I									
SI. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22BAB01	Statistics for Management	PC	Nil	3	2	1	0	3
2	22BAB02	Management Concepts and Organizational Behavior	PC	Nil	3	3	0	0	3
3	22BAB03	Economic Analysis for Business	PC	Nil	3	3	0	0	3
4	22BAB04	Information Management	PC	Nil	3	3	0	0	3
5	22BAB05	Accounting for Decision Making	PC	Nil	3	2	1	0	3
6	22BAB06	Legal Aspects of Business	PC	Nil	3	3	0	0	3
7	22BAB07	Entrepreneurship Development	PC	Nil	3	3	0	0	3
PRACTICAL									
8	22BAP01	Business Communication	EEC	Nil	4	0	0	4	2
9	22BAP02	Indian ethos (Seminar)	EEC	Nil	4	0	0	4	2
				TOTAL	**29**	**19**	**2**	**8**	**25**

SEMESTER: II									
SI. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22BAB08	Quantitative Techniques for Decision Making	PC	Nil	3	2	1	0	3
2	22BAB09	Operations Management	PC	Nil	3	3	0	0	3
3	22BAB10	Financial Management	PC	Nil	3	3	0	0	3
4	22BAB11	Marketing Management	PC	Nil	3	3	0	0	3
5	22BAB12	Human Resource Management	PC	Nil	3	3	0	0	3
6	22BAB13	Business Research Methods	PC	Nil	3	3	0	0	3
7	22BAB14	International Business Management	PC	Nil	3	3	0	0	3
PRACTICAL									
8	22BAP03	Data Analysis and Business Modeling (Laboratory)	EEC	Nil	4	0	0	4	2
9	22BAP04	Community Engagement Project and Entrepreneur Interface Project	EEC	Nil	2	0	0	2	1
10	22BAP05	Share Trading	EEC	Nil	2	0	0	2	1
				TOTAL	**29**	**20**	**1**	**8**	**25**

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22BAB15	Total Quality Management	PC	Nil	3	3	0	0	3
2	22BAB16	Strategic Management	PC	Nil	3	3	0	0	3
3	EI	Elective I	PE	Nil	3	3	0	0	3
4	EII	Elective II	PE	Nil	3	3	0	0	3
5	EIII	Elective III	PE	Nil	3	3	0	0	3
6	EIV	Elective IV	PE	Nil	3	3	0	0	3
7	EV	Elective V	PE	Nil	3	3	0	0	3
8	EVI	Elective VI	PE	Nil	3	3	0	0	3
PRACTICAL									
9	22BAP06	Managerial Skill Development	EEC	Nil	4	0	0	4	2
10	22BAP07	Corporate Internship	FW	Nil	4	0	0	4	2
				TOTAL	**32**	**24**	**0**	**8**	**28**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22BAB17	Business Ethics, Corporate Social Responsibility and Governance	PC	Nil	3	3	0	0	3
2	EVII	Elective VII	PE	Nil	3	3	0	0	3
3	EVIII	Elective VIII	PE	Nil	3	3	0	0	3

4	EIX	Elective IX	PE	Nil	3	3	0	0	3
5	EX	Elective X	PE	Nil	3	3	0	0	3
PRACTICAL									
1	22BAP08	Project Work	FW	22BAP07	16	0	0	16	8
2	22BAP09	Transactional Analysis	EEC	-	2	0	0	2	1
				TOTAL	**25**	**15**	**0**	**18**	**24**

PROFESSIONAL ELECTIVES (PE)

Students can choose three electives course from two functional specializations

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
Marketing Management									
1	22BAX01	Brand Management	PE	Nil	3	3	0	0	3
2	22BAX02	Retail Management	PE	Nil	3	3	0	0	3
3	22BAX03	Services Marketing	PE	Nil	3	3	0	0	3
4	22BAX04	Integrated Marketing Communication	PE	Nil	3	3	0	0	3
5	22BAX05	Marketing Analytics	PE	Nil	3	3	0	0	3
Financial Management									
6	22BAX06	Security Analysis and Portfolio Management	PE	Nil	3	3	0	0	3
7	22BAX07	Merchant Banking and Financial Services	PE	Nil	3	3	0	0	3
8	22BAX08	International Trade Finance	PE	Nil	3	3	0	0	3
9	22BAX09	Financial Modelling	PE	Nil	3	3	0	0	3
10	22BAX10	Financial Derivatives	PE	Nil	3	3	0	0	3
Human Resource Management									
11	22BAX11	Industrial Relations & Labour Legislations	PE	Nil	3	3	0	0	3
12	22BAX12	Training and Development	PE	Nil	3	3	0	0	3
13	22BAX13	Organizational Design, Change and Development	PE	Nil	3	3	0	0	3

14	22BAX14	HR Metrics and Analytics	PE	Nil	3	3	0	0	3
15	22BAX15	Strategic Human Resource Management	PE	Nil	3	3	0	0	3
Business Analytics									
16	22BAX16	Deep learning and Artificial Intelligence	PE	Nil	3	3	0	0	3
17	22BAX17	e-Business Management	PE	Nil	3	3	0	0	3
18	22BAX18	Enterprise Resource Planning	PE	Nil	3	3	0	0	3
19	22BAX19	Data Mining for Business Intelligence	PE	Nil	3	3	0	0	3
20	22BAX20	Social Media Web Analytics	PE	Nil	3	3	0	0	3
Operations Management									
21	22BAX21	Logistics and Supply Chain Management	PE	Nil	3	3	0	0	3
22	22BAX22	Services Operations Management	PE	Nil	3	3	0	0	3
23	22BAX23	Project Management	PE	Nil	3	3	0	0	3
24	22BAX24	Supply Chain Analytics	PE	Nil	3	3	0	0	3
25	22BAX25	Warehouse Management	PE	Nil	3	3	0	0	3
Entrepreneurship									
26	22BAX26	Business Plan	PE	Nil	3	3	0	0	3
27	22BAX27	Social Entrepreneurship	PE	Nil	3	3	0	0	3
28	22BAX28	Indian Models in Entrepreneurship	PE	Nil	3	3	0	0	3
29	22BAX29	Entrepreneurial Marketing	PE	Nil	3	3	0	0	3
30	22BAX30	Soft Skills for Entrepreneurs	PE	Nil	3	3	0	0	3
Open Elective Courses									
31	22BAZ01	Research Methodology and IPR	OEC	Nil	3	3	0	0	3
Value Added Courses									
32	22BAV01	Artificial Intelligence For Managers	VAC	NIL	2	0	0	2	1
33	22BAV02	Introduction to Google Apps	VAC	NIL	2	0	0	2	1

(A) PC, PE, EEC Courses, Field Wok, Value Added Courses, Open Elective Courses									
(a) Professional Core (PC)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22BAB01	Statistics for Management	PC	NIL	3	2	1	0	3
2.	22BAB02	Management Concepts and Organizational Behavior	PC	NIL	3	3	0	0	3
3.	22BAB03	Economic Analysis for Business	PC	NIL	3	3	0	0	3
4.	22BAB04	Information Management	PC	NIL	3	3	0	0	3
5.	22BAB05	Accounting for Decision Making	PC	NIL	3	2	1	0	3
6.	22BAB06	Legal Aspects of Business	PC	NIL	3	3	0	0	3
7.	22BAB07	Entrepreneurship Development	PC	NIL	3	3	0	0	3
8.	22BAB08	Quantitative Techniques for Decision Making	PC	NIL	3	2	1	0	3
9.	22BAB09	Operations Management	PC	NIL	3	3	0	0	3
10.	22BAB10	Financial Management	PC	NIL	3	3	0	0	3
11.	22BAB11	Marketing Management	PC	NIL	3	3	0	0	3
12.	22BAB12	Human Resource Management	PC	NIL	3	3	0	0	3
13.	22BAB13	Business Research Methods	PC	NIL	3	3	0	0	3
14.	22BAB14	International Business Management	PC	NIL	3	3	0	0	3
15.	22BAB15	Total Quality Management	PC	NIL	3	3	0	0	3
16.	22BAB16	Strategic Management	PC	NIL	3	3	0	0	3
17.	22BAB17	Business Ethics, Corporate Social Responsibility and Governance	PC	NIL	3	3	0	0	3

(b) Professional Electives (PE)									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22BAX01	Brand Management	PE	NIL	3	3	0	0	3
2	22BAX02	Retail Management	PE	NIL	3	3	0	0	3
3	22BAX03	Services Marketing	PE	NIL	3	3	0	0	3
4	22BAX04	Integrated Marketing Communication	PE	NIL	3	3	0	0	3
5	22BAX05	Marketing Analytics	PE	NIL	3	3	0	0	3
6	22BAX06	Security Analysis and Portfolio Management	PE	NIL	3	3	0	0	3
7	22BAX07	Merchant Banking and Financial Services	PE	NIL	3	3	0	0	3
8	22BAX08	International Trade Finance	PE	NIL	3	3	0	0	3
9	22BAX09	Financial Modelling	PE	NIL	3	3	0	0	3
10	22BAX10	Financial Derivatives	PE	NIL	3	3	0	0	3
11	22BAX11	Industrial Relations & Labour Legislations	PE	NIL	3	3	0	0	3
12	22BAX12	Training and Development	PE	NIL	3	3	0	0	3
13	22BAX13	Organizational Design, Change and Development	PE	NIL	3	3	0	0	3
14	22BAX14	HR Metrics and Analytics	PE	NIL	3	3	0	0	3
15	22BAX15	Strategic Human Resource Management	PE	NIL	3	3	0	0	3
16	22BAX16	Deep learning and Artificial Intelligence	PE	NIL	3	3	0	0	3
17	22BAX17	e-Business Management	PE	NIL	3	3	0	0	3
18	22BAX18	Enterprise Resource Planning	PE	NIL	3	3	0	0	3
19	22BAX19	Data Mining for Business Intelligence	PE	NIL	3	3	0	0	3
20	22BAX20	Social Media Web Analytics	PE	NIL	3	3	0	0	3
21	22BAX21	Logistics and Supply Chain Management	PE	NIL	3	3	0	0	3
22	22BAX22	Services Operations Management	PE	NIL	3	3	0	0	3

23	22BAX23	Project Management	PE	NIL	3	3	0	0	3
24	22BAX24	Supply Chain Analytics	PE	NIL	3	3	0	0	3
25	22BAX25	Warehouse Management	PE	NIL	3	3	0	0	3
26	22BAX26	Business Plan	PE	NIL	3	3	0	0	3
27	22BAX27	Social Entrepreneurship	PE	NIL	3	3	0	0	3
28	22BAX28	Indian Models in Entrepreneurship	PE	NIL	3	3	0	0	3
29	22BAX29	Entrepreneurial Marketing	PE	NIL	3	3	0	0	3
30	22BAX30	Soft Skills for Entrepreneurs	PE	NIL	3	3	0	0	3

(c) Employability Enhancement Courses (EEC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22BAP01	Business Communication	EEC	Nil	4	0	0	4	2
2	22BAP02	Indian ethos (Seminar)	EEC	Nil	4	0	0	4	2
3	22BAP03	Data Analysis and Business Modeling (Laboratory)	EEC	Nil	4	0	0	4	2
4	22BAP04	Community Engagement Project and Entrepreneur Interface Project	EEC	Nil	2	0	0	2	1
5	22BAP05	Share Trading	EEC	Nil	2	0	0	2	1
6	22BAP06	Managerial Skill Development	EEC	Nil	4	0	0	4	2
7	22BAP09	Transactional Analysis	EEC	Nil	2	0	0	2	1
(d)Field Wok									
7	22BAP07	Corporate Internship	FW	Nil	4	0	0	4	2
8	22BAP08	Project Work	FW	22BAP07	16	0	0	16	8
(e)Value Added Courses									
9	22BAV01	Artificial Intelligence For Managers	VAC	Nil	2	0	0	2	1
10	22BAV02	Introduction to Google Apps	VAC	Nil	2	0	0	2	1
(e) Open Elective Courses									
1	22BAZ01	Research Methodology and IPR	OEC	Nil	3	3	0	0	3

Minor Degree Courses									
1.Entrepreneurship Development									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22BAM01	Entrepreneurship Development	OE	Nil	3	3	0	0	3
2	22BAM02	Business Plan	OE	Nil	3	3	0	0	3
3	22BAM03	Social Entrepreneurship	OE	Nil	3	3	0	0	3
4	22BAM04	Indian Models in Entrepreneurship	OE	Nil	3	3	0	0	3
5	22BAM05	Entrepreneurial Marketing	OE	Nil	3	3	0	0	3
6	22BAM06	Soft Skills for Entrepreneurs	OE	Nil	3	3	0	0	3
7	22BAM07	Entrepreneurial Finance	OE	Nil	3	3	0	0	3
8	22BAM08	Family Business Management	OE	Nil	3	3	0	0	3

2. Financial Management									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22BAM09	Financial Management	OE	Nil	3	3	0	0	3
2	22BAM10	International Trade Finance	OE	Nil	3	3	0	0	3
3	22BAM11	Financial Services, Products and Markets	OE	Nil	3	3	0	0	3
4	22BAM12	Merchant Banking and Financial Services	OE	Nil	3	3	0	0	3
5	22BAM13	Banking Laws and Operations	OE	Nil	3	3	0	0	3
6	22BAM14	Digital transformation	OE	Nil	3	3	0	0	3
7	22BAM15	Investment Management	OE	Nil	3	3	0	0	3
8	22BAM16	Financial Derivatives	OE	Nil	3	3	0	0	3

SUMMARY						
S.NO	SUBJECT AREA	CREDITS AS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	PC (Professional Core)	21	21	6	3	51
2	PE (Professional Elective)	-	-	18	12	30
3	EEC (Employability Enhancement Course)	4	4	2	1	11
4	FW(Field Work)	-	-	2	8	10
CREDITS TOTAL		25	25	28	24	102

22BAB01 - STATISTICS FOR MANAGEMENT				
	L	T	P	C
	2	1	0	3

PREREQUISITE : NIL

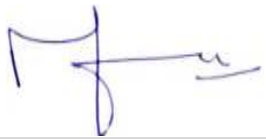
	Course Objectives		Course Outcomes
1.0	To enable the students to have an insight into basic statistical techniques.	1.1	The students will be able to analyze the collected information using descriptive statistics to interpret the collected data.
2.0	To determine the outcomes and probabilities for experiments.	2.1	The students will be able to apply the probability distributions in business decision making.
3.0	To estimate the relationships among variables.	3.1	The students will be able to examine the collected data using univariate and bivariate statistical tools.
4.0	To identify the population parameter and test statistic of given scenario.	4.1	The students will be able to perform test of Hypothesis as well as calculate confidence interval.
5.0	To enable the students to draw conclusions from the analysis for better decision making.	5.1	The students will be able to apply non-parametric test to draw meaningful conclusions.

UNIT I - INTRODUCTION TO STATISTICS	**(6+3)**
Statistics – Definition, Types. Types of variables – Organising data – Descriptive Measures: Mean, Median, Mode, Standard Deviation, Mean Deviation.	
UNIT II -PROBABILITY	**(6+3)**
Basic Definitions and Rules for Probability – Conditional Probability – Independence of Events – Baye's Theorem. Probability distributions: Binomial, Poisson and Normal distributions.	
UNIT III -CORRELATION AND REGRESSION ANALYSIS	**(6+3)**
Linear Correlation, Measures of Correlation, Rank Correlation – Simple Linear Regression – Coefficient of Correlation	
UNIT IV TESTING OF HYPOTHESIS	**(6+3)**
Hypothesis testing, One Sample and Two Samples test for means of large samples(Z – Test) - One Sample and Two Sample test for means of small samples (t – Test)and ANOVA One and two way.	
UNIT V – NON PARAMETRIC TEST	**(6+3)**
Chi-Square Test – Goodness of fit and Independence of Attributes, Rank sum test- Mann-Whitney U test and Kruskal-Wallis Test. One sample run test.	
TOTAL (L:30 , T:15) = 45 PERIODS	

REFERENCES:

1. Richard I. Levin, David S. Rubin, Masood H.Siddiqui, Sanjay Rastogi, "Statistics for Management", Pearson Education, 8th Edition, 2017.
2. Prem. S. Mann, "Introductory Statistics", Wiley Publications, 10th Edition, 2020.
3. T N Srivastava and ShailajaRego, "Statistics for Management", Tata McGraw Hill, 3rd Edition 2017.
4. Ken Black, "Applied Business Statistics", 7th Edition, Wiley India Edition, 2012.
5. David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran, "Statistics for business and economics", 13th Edition, Thomson (South – Western) Asia, Singapore, 2016.
6. N. D. Vohra, "Business Statistics", Tata McGraw Hill, 2017.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	3	2	-	1	-
CO 2	3	2	-	2	-
CO 3	3	2	2	1	1
CO 4	3	3	2	2	2
CO 5	3	2	1	3	1
CO(W.A)	**3**	**2**	**2**	**2**	**2**



22BAB02 - MANAGEMENT CONCEPTS AND ORGANIZATIONAL BEHAVIOR			
L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	Provide insights on the fundamental concepts and theories of management.	1.1	The students will be able to apply the management concepts in taking better managerial decisions.
2.0	To understand the complexity and wide variety of issues managers face in today's business firms.	2.1	The students will be able to gain knowledge of various functions of management in a real time management context.
3.0	To acquaint the students with the fundamentals of managing business and to understand individual behavior.	3.1	The students will be able to understand the complexities associated with management of individual behavior in the organizations.
4.0	Give inputs on how individual's behavior is influenced by group.	4.1	The students will be able to develop the skill set to manage group behavior in Organizations.
5.0	To understand the emerging aspects of organizational behavior.	5.1	The students will be able to know the current trends in managing organizational behavior.

UNIT I – INTRODCUTION TO MANAGEMENT	**(9)**
Evolution of management Thought-Classical, Behavioral and Management Science Approaches. Management-meaning, levels, Management as an Art or Science, Managerial functions and Roles, - Contribution of F.W.Taylor, Henri Fayol.	
UNIT II – MANAGEMENT FUNCTIONS	**(9)**
Planning - Steps in Planning Process - Scope and Limitations - Forecasting and types of Planning - Management by Objectives (MBO) - Policies and Strategies - Decision Making – Types and Processes. Formal and Informal Organization - Organization Structure and Design - Authority and Responsibility - Decentralization. Control - Process and types.	
UNIT III - INDIVIDUAL BEHAVIOUR	**(9)**
Meaning of Organizational behavior - Contributing disciplines - Importance of organizational behavior, Perception – Factors influencing perception , Learning-Types of learners –The learning process – Personality-Types- Factors influencing Personality – Motivation- theories – Maslow's Hierarchy – Herzberg Theory – Attitudes – Formation and Components.	
UNIT IV – GROUP BEHAVIOUR, LEADERSHIP AND DYNAMICS OF OB	**(9)**
Groups in organizations - Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics - Organizational Climate and Culture, Conflict - Sources - Stages of conflict.	
UNIT V -EMERGING ASPECTS OF ORGANIZATIONAL BEHAVIOUR	**(9)**
Comparative Management Styles and approaches - Japanese Management Practices - Organizational Creativity and Innovation - Organizational behavior across cultures - Managing International Workforce, Productivity and cultural contingencies, Cross cultural communication, Management of Diversity.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

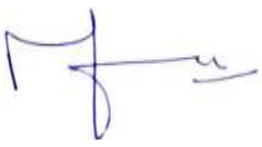
1. Harold Koontz and Heinz Weihrich, "Essentials of Management: An International, Innovation, And Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2020.
2. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, "Organizational Behaviour", 18 th Edition, Pearson, 2018.

REFERENCES:

1. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 10th Edition, 2016.
2. Samuel C. Certo and S.TrevisCerto, "Modern Management: Concepts and Skills", Pearson Education, 15th Edition, 2018.
3. P.Stephen Robbins, "Organizational Behaviour", New Delhi: Prentice Hall India, 2016.
4. Charles W.L Hill and Steven L McShane, "Principles of Management", McGraw Hill Education, Special Indian Edition, 2017.
5. Uma Sekaran, "Organizational Behaviour", New Delhi: Tata McGraw Hill, 2016.
6. Samuel C. Certo, S. Trevis Certo, "Modern Management: Concepts and Skills" from Pearson Education.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	1	2	2	2
CO 2	-	1	2	1	3
CO 3	2	2	2	1	2
CO 4	1	-	3	1	2
CO 5	2	1	1	-	1
CO(W.A)	**2**	**1.25**	**2**	**1.25**	**2**



22BAB03 - ECONOMIC ANALYSIS FOR BUSINESS

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL | **QUESTION PATTERN : TYPE - I**

	Course Objectives		Course Outcomes
1.0	To manage an Organization to describe principles of macroeconomics to have the understanding of economic environment of Business	1.1	The students will be able to understand the basic concepts of economics.
2.0	To understand the Market demand and supply analysis and the ways in which changes in these determinants affect equilibrium price and output	2.1	The students will be able to know the principles of microeconomics relevant to managing an organization.
3.0	To determine the changes in price of the product, the effect of a price control in different market structure	3.1	The students will be able to fix the price level in different market structure.
4.0	To know the principles of macroeconomics to have the understanding of economic environment of business.	4.1	The students will be able to understand the economic environment of business.
5.0	To acquire a reasonable knowledge in Economic indicators.	5.1	The students will be able to know the policies that regulate economic variables.

UNIT I: INTRODUCTION — (9)

Basic concepts and principles definition and scope of economic, managerial economics– three fundamental economic problems. Theory of firms: Introduction, forms of ownership-profit maximization theory.

UNIT II: DEMAND AND SUPPLY — (9)

Demand and Supply – Determinants – Market equilibrium – elasticity of demand and supply. Production – Short run and long-run Production Function – Returns to scale – economies Vs diseconomies of scale – Analysis of cost – Short-run and long-run cost function – Relation between Production and cost function.

UNIT III: MARKET STRUCTURE — (9)

Market Structure; Perfect Competition, Monopoly, Economic Inefficiency of Monopoly, Monopolistic Competition, Oligopoly.

UNIT IV: PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS — (9)

Macro-economic concepts –macro variables, circular flow of income – National income determination – Fiscaland monetary policies.

UNIT V: ECONOMIC INDICATORS — (9)

Price Indices, Inflation, Deflation, Business Cycle and Stabilization Policies – Unemployment and its impact – Inflation and the impact – reasons for inflation –Inflation Vs Unemployment tradeoff.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. McGuigan, Moyer and Harris, "Managerial Economics; Applications, Strategy and Tactics", Thomson South Western, 10 th Edition., 2005.
2. James R. Mc Guigan, R. Charles Moyer, Frederick H.deB. Harris, "Managerial Economics: Applications, Strategies and Tactics", Cengage Learning 14th Edition 2016.

REFERENCES:

1. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, "Economics", 19th Edition, Tata McGraw Hill, New Delhi, 2011.
2. William Boyes and Michael Melvin, "Textbook of Economics", Biztantra, 7th Edition 2008.
3. N. Gregory Mankiw, "Principles of Economics", 8 th Edition, Thomson learning, New Delhi, 2017.
4. Richard Lipsey and Alec Chrystal, "Economics", 13th Edition, Oxford,University Press, New Delhi, 2015.
5. Karl E. Case and Ray C. Fair, "Principles of Economics", 12th Edition, Pearson, Education Asia, New Delhi, 2017.
6. Panneerselvam. R, "Engineering Economics", 2 nd Edition, PHI Learning, 2014.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	1	2	2	2
CO3	3	-	1	3	1
CO4	3	2	2	2	2
CO5	2	2	1	2	1
CO(W.A)	**2.6**	**1.75**	**1.6**	**2.4**	**1.8**

22BAB04 - INFORMATION MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE: NIL

Course Objectives		Course Outcomes	
1.0	To understand the importance of information system in business.	1.1	The students will be able to learn the fundamentals of information system.
2.0	To understand system analysis and design tools and techniques.	2.1	The students will be able to acquire knowledge on tools and techniques used to analyze different types of IS.
3.0	To understand the applications of information system.	3.1	The students will be able to Identify the range and importance of information systems applications in modern organizations.
4.0	To furnish knowledge on security threats and control systems.	4.1	The students will be able to know the various security threats and networks system.
5.0	To acquire knowledge about IT initiatives.	5.1	The students will be able to procure knowledge on latest information technology concepts and practices.

UNIT I – INTRODUCTION TO INFORMATION SYSTEM	**(9)**
Data, Information, Need for Information Systems, evolution of IS, Components of information system, Types of Information Systems based on functions and hierarchy, Basics of Management Information system, System Analyst- Role, Functions.	
UNIT II – SYSTEM ANALYSIS AND DESIGN	**(9)**
System analysis and design Concepts, Types of Systems, System development methodologies, Prototyping, Data Flow Diagram, Entity Relationship, Object Oriented Analysis and Design (OOAD).	
UNIT III - MANAGEMENT INFORMATION SYSTEM IN FUNCTIONAL AREAS	**(9)**
Financial, Marketing, Personnel, Production, Materials Information System, DSS, EIS, KMS, GIS-International Information System.	
UNIT IV - SECURITY, CONTROL AND REPORTING	**(9)**
System Security, Testing, Error Detection and Controls, IS Vulnerability, Computer Crimes and Cyber security, Intranets, Extranets, Wireless Networks, Ethics in IT.	
UNIT V - NEW IT INITIATIVES	**(9)**
DBMS overview, Data warehousing and Data Mining, various IT applications in business: ERP, Advancement in AI, IoT, and Block chain Technology.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Kenneth C. Laudon and Jane P Laudon, "Management Information Systems – Managing the Digital Firm", 17th Edition, Pearson, April 2022.
2. Ramesh Behl , James A. O'Brien, "Management Information Systems", 11th Edition, Tata McGraw Hill 2019.

REFERENCES:

1. Panneerselvam. R, "Database Management Systems", 3rd Edition, PHI Learning, 2018.
2. O'Brien, "Management Information System" Tata McGraw Hill 2009.
3. Robert Schultheis and Mary Summer, "Management Information Systems" –The Managers View, Tata McGraw Hill, 2008.
4. Bidgoli, Chattopadhyay, MIS – "Management Information Systems", Cengage learning, 2016.
5. Kenneth C. Laudon and Jane Price Laudon, "Management Information Systems" – Managing the digital firm, PHI Learning / Pearson Education, PHI, Asia, 2002.
6. NirmalyaBagchi, BagchiNirmalya, "Management Information Systems",Vikas Publishing House Pvt Limited 2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	1	2	2	1	2
CO2	2	1	2	2	2
CO3	2	1	2	2	2
CO4	1	2	2	1	2
CO5	2	2	2	2	2
C O (W.A)	**1.6**	**1.6**	**2**	**1.6**	**2**

22BAB05 - ACCOUNTING FOR DECISION MAKING					
		L	T	P	C
		2	1	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To familiarize the students with the fundamental principles of accounting.	**1.1**	The students will be able to generate the financial statements by applying accounting principles.		
2.0	To facilitate the students to read and understand financial statements.	**2.1**	The students will be able to analyze and interpret the financial statements for effective decision making.		
3.0	To enhance the knowledge of students in cost Accounting.	**3.1**	The students will be able to understand the cost accounting techniques.		
4.0	To develop the knowledge of students in marginal costing	**4.1**	The students will be able to gain insights about Break Even Analysis and applications of marginal costing		
5.0	To enrich the knowledge of students in budgeting.	**5.1**	The students will be able to Construct budgetary control and analyze the various types of budget.		

UNIT I - FINANCIAL ACCOUNTING	**(6+3)**
Introduction to Financial, Cost and Management Accounting – Generally Accepted Accounting Principles– Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet.	
UNIT II -FINANCIAL STATEMENT ANALYSIS	**(6+3)**
Techniques of financial statement analysis - Comparative statement - Common size - Ratio Analysis- Liquidity Ratio, Solvency Ratio, Activity Ratio and Profitability Ratio - cash flow statement as per Accounting Standard 3.	
UNIT III - COST ACCOUNTING	**(6+3)**
Cost Accounting – Objectives - Elements of Cost - Preparation of Cost Sheet – Job order costing – Process costing –Activity Based Costing, Target Costing, EOQ.	
UNIT IV - MARGINAL COSTING	**(6+3)**
Marginal Costing and profit planning – Cost, Volume, Profit Analysis – Break Even Analysis – Make or Buy decisions.	
UNIT V -BUDGET AND BUDGETARY CONTROL	**(6+3)**
Budget and Budgetary Control, Cash Budget, Functional Budget, Flexible Budget, Zero based budget.	
TOTAL (L:30 , T:15) = 45 PERIODS	

TEXT BOOKS:

1.Maheswari S.N., CA Sharad K. Maheswari, Suneel K. Maheswari, "A Textbook of Accounting for Management", 5th Edition, Vikas Publishing, New Delhi, 2022.

2.M.Y. Khan & P.K. Jain, "Management Accounting", Tata McGraw Hill, 8th Edition ,2018.

3.Godwin, Alderman, Sanyal (2016), "Financial ACCT - Financial Accounting" (2016), Cengage Learning.

REFERENCES:

1. Jan Williams, Susan Haka, Mark S bettner, Joseph V Carcello, "Financial and Managerial Accounting" - The basis for business Decisions, 18th Edition, Tata McGraw Hill Publishers, 2017.

2. Shashi K. Gupta, Sharma R.K., "Management Accounting Principles Practice", 13th Edition, Kalyani Publishers, New Delhi, 2017.

3. R. Narayanaswamy, "Financial Accounting - A Managerial Perspective", New Delhi: Prentice Hall India, 2016.

4. N. Ramachandran Ram Kumar Kakani,"Financial Accounting for Management", New Delhi: Tata McGraw Hill, 2015.

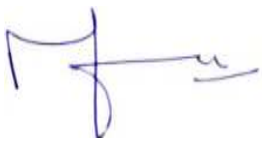
5. Sawyers, Jackson, Jenkins, Arora Jenkins, Arora (2016), "Managerial ACCT - Managerial Accounting", Cengage Learning.

6. Jain S.P., Narang K.L. Simi Agrawal, "Financial Accounting", 1st Edition, Kalyani Publishers, New Delhi 2016.

7. AsishK. Bhattacharyya, "Principles and Practice of Cost Accounting", 10th Printing (3rd Edition), PHI Publication, New Delhi 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	2	2	1	2	2
CO2	2	2	1	2	2
CO3	2	1	2	2	1
CO4	2	2	2	1	2
CO5	-	2	1	-	1
CO(W.A)	**2**	**1.8**	**1.4**	**1.75**	**1.6**



22BAB06 - LEGAL ASPECTS OF BUSINESS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	The Students will learn the concept of contract and its formation and discharge procedure in the business.	**1.1**	The students will be able to acquire basic knowledge and understanding of the legal framework of contracts.
2.0	The Students will learn the components of sales and procedure of selling the products and legal framework for the protection of consumers.	**2.1**	The students will be able to obtain knowledge and understanding of the legal framework of sales of goods.
3.0	It helps them to learn the mode of payment in the business.	**3.1**	The students will be able to understand the legal aspects of payment in the business.
4.0	The Students will learn the legal aspects like welfare measures, wages provided, bonus offered and conflicts solutions in the industry.	**4.1**	The students will be able to know the basic concepts of industrial laws and its implications in industry.
5.0	The Students will learn the management of the company, cyber-crimes and its precautions.	**5.1**	The students will be able to understand the Key areas of business law relating to forms of business and cyber security.

UNIT I - THE INDIAN CONTRACT ACT 1872	**(9)**
Definition of contract, Essentials of a valid contract, Performance of contracts, breach of contract and its remedies.	
UNIT II - THE SALE OF GOODS ACT 1930 & THE CONSUMER PROTECTION ACT 1986	**(9)**
Definition and essentials of a contract of sale, Transfer of title and risk of loss, Guarantees and Warranties in sales contract, conditional sales and rights of an unpaid seller, Overview of Consumer protection Act.	
UNIT III - NEGOTIABLE INSTRUMENTS ACT 1881	**(9)**
Nature and requisites of negotiable instruments. Transfer of negotiable instruments and liability of parties, Types of negotiable instruments, discharge of negotiable instruments.	
UNIT IV - INDUSTRIAL LAW AND GOODS AND SERVICES TAX (amendment on 01.01.2022)	**(9)**
An Overview of Factories Act - Payment of Wages Act - Payment of Bonus Act - Industrial Disputes Act.- Goods and Services tax	
UNIT V - COMPANY LAW AND CYBER LAW	**(9)**
Nature and types of companies, Formation, Memorandum and Articles of Association, Power, duties and liabilities of Directors, winding up of companies, Introduction to IT Act-Cyber Law-Cyber Crime.	
TOTAL (L: 45) : 45PERIODS	

TEXT BOOKS:

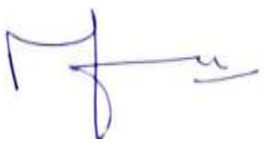
1. Kapoor, N. D., "Elements of Mercantile Law", 30th Edition, Sultan Chand & Sons, NewDelhi,2015.
2. Parul Gupta , "Legal Aspects of Business: Concepts and Applications", 1st Edition, Vikas Publishing House, Reprinted 2018.

REFERENCES:

1. N.D. Kapoor, Dr.RajniAbbi, Bharat Bhushan, Rajiv Kapoor, "Business Law", Sultan Chand & Sons (P) Ltd, 2019.
2. K.R. Bulchandani, "Business Law For Management", Himalaya Publishing House, India, 2017.
3. V.S.Datey, "GST Ready Reckoner", Taxmann Publishing, July 2017.
4. P. P. S. Gogna, "Mercantile Law", S. Chand & Co. Ltd., India, 11 th Edition, 2015
5. Maheshwari, S.N. and S.K. Maheshwari; "A Manual of Business Law", 6th Edition, Himalaya Publishing House,2015.
6. "Legal Aspects of Business", Pathak Akhileshwar, 6th Edition, McGraw Hill Education India.
7. https://books.google.co.in/books/about/Legal_Aspects_of_Business.html?id=JxJ_AgAAQBAJ&redir_esc=y

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	2	-	3	3
CO2	3	2	2	3	3
CO3	-	-	1	3	-
CO4	3	3	2	3	3
CO5	3	3	1	3	3
CO(W.A)	**3**	**2.5**	**1.5**	**3**	**3**



22BAB07 - ENTREPRENEURSHIP DEVELOPMENT			
L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the skills and characteristics of successful Entrepreneurs.	**1.1**	The students will be able to gain entrepreneurial competence to run the business efficiently.
2.0	To understand Entrepreneurial environment.	**2.1**	The students will be able to understand the entrepreneurial environment and make decisions.
3.0	To familiarize students to prepare feasible Business plan.	**3.1**	The students will be able to capable of preparing business plans and undertake feasible projects.
4.0	To impart knowledge on mobilizing resource and launching a new business.	**4.1**	The students will be able to efficient in launching and develop their business ventures successfully.
5.0	To impart knowledge to students in monitoring and evaluation of small business	**5.1**	The students will be able to monitor the business effectively towards growth and development.

UNIT I – ENTREPRENEURAL COMPETENCE	**(9)**
Entrepreneurship – Types of entrepreneur – Entrepreneurship as a Career – Characteristics of Entrepreneur – Key Qualities of Good Entrepreneur – Intrapreneur Vs Entrepreneur.	
UNIT II – ENTREPRENEURAL ENVIRONMENT	**(9)**
Business Environment – Entrepreneurship Development Training and Other Support Organizational Services – Central and State Government Industrial Policies and Regulations.	
UNIT III – BUSINESS PLAN PREPARATION	**(9)**
Definition – Purposes of Business Plan – Benefits – Elements of Business plan – Developing an Effective Business Plan – Prefeasibility Study – Project Profile Preparation.	
UNIT IV – LAUNCHING OF SMALL BUSINESS	**(9)**
Finance and Human Resource Mobilization – Operations Planning – Market and Channel Selection – Product Launching – Incubation, Venture Capital, Start-ups.	
UNIT V - MANAGEMENTOF SMALL BUSINESS	**(9)**
Monitoring and Evaluation of Business – Business Sickness – Prevention and Rehabilitation of Business Units – Effective Management of Small Business.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016.
2. Robert D.Hisrich, Michael P. Peters, Dean A. Shepherd, "Entrepreneurship", Tata McGraw Hill; 11th Edition, 2020.

REFERENCES:

1. Rajeev Roy," Entrepreneurship", Oxford University Press, 2rd Edition, 2011.
2. Donald F Kuratko, T.V Rao. "Entrepreneurship: A South Asian perspective" Cengage Learning, 2012.
3. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH, 2006.
4. Arya Kumar. Entrepreneurship, Pearson, 2012.
5. Charantimath Poornima M, "Entrepreneurship Development and Small Business Enterprises", Pearson Education; 3 rd Edition (2018).
6. Rashmi Bansal, "Stay Hungry Stay Foolish", IIM – Ahmadabad, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	1	3	-	3
CO2	3	2	2	3	1
CO3	3	1	2	-	1
CO4	3	2	3	1	2
CO5	3	2	2	1	2
CO(W.A)	**3**	**1.6**	**2.4**	**1.6**	**1.8**

22BAP01 - BUSINESS COMMUNICATION (LABORATORY)			
L	T	P	C
0	0	4	2

PRE REQUISITE: NIL

	Course Objectives		Course Outcomes
1.0	To familiarize learners with the mechanics of communication.	1.0	The students will be able to develop good managerial communication skills.
2.0	To enable learners to Communicate precisely and effectively.	2.0	The students will be able to excel in different forms of written communication required in a business context.
3.0	To help the students to acquire some of the necessary skills to handle day-to-day managerial responsibilities.	3.0	The students will be able to develop good presentation skills.
4.0	To Make controlling one-to-one communication,	4.0	The students will be able to In-depth understanding of interview skills.
5.0	To Enriching group activities and processes	5.0	The students will be able to Ability to prepare Business reports.

UNIT I INTRODUCTION AND TYPES OF BUSINESS COMMUNICATION	(12)
Introduction to Business Communication: Principles of effective communication, Target group profile, Barriers of Communication, Reading Skills, Listening, and Feedback. - Principles of Nonverbal Communication: Professional dressing and body language. Role Playing, Debates and Quiz. Types of managerial speeches - Presentations and Extempore - speech of introduction, speech of thanks, occasional speech, theme speech. - Group communication: Meetings, group discussions.	
UNIT II BUSINESS COMMUNICATION WRITING MODELS AND TOOLS	**(12)**
Business letters, Routine letters, Bad news and persuasion letters, sales letters, collection letters, Maintaining a Diary, Resume/CV, job application letters, proposals. Internal communication through - notices, circulars, memos, agenda and minutes, reports. Case Studies.	
UNIT III BUSINESS COMMUNICATION WRITING MODELS AND TOOLS	**(12)**
Principles of Effective Presentations, Principles governing the use of audio visual media.	
UNIT IV INTERVIEW SKILLS	**(12)**
Mastering the art of giving interviews in - selection or placement interviews, discipline interviews, appraisal interviews, exit interviews, web /video conferencing, tele-meeting.	

UNIT V -REPORT WRITING	(12)
Objectives of report, types of report, Report Planning, Types of Reports, Developing an outline, Nature of Headings, Ordering of Points, Logical Sequencing, Graphs, Charts, Executive Summary, List of Illustration, Report Writing.	
TOTAL (L:60) : 60 PERIODS	

TEXT BOOKS:

1. Rajendra Pal, J.S. Korlahalli, "Essentials of Business Communication" Sultan Chand & Sons, 13th Edition, 2011.
2. Meenakshi Raman, Prakash Singh, "Business Communication" Oxford, 2nd Edition, 2012.
3. Raymond V. Lesikar, Flatley, "Basic Business Communication Skills for Empowering the Internet Generation", M.E., TMGH , New Delhi , 10th Edition, 2004.

REFERENCES:

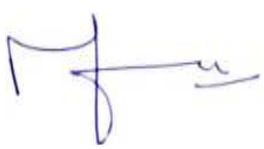
1. Ludlow R , Panton , "The Essence of Effective Communications", Prentice Hall of India Pvt. Ltd. 2, 1995.
2. C. S. Rayadu , "Communication" HPH, 2015.
3. R. C. Sharma , Krishna Mohan, "Business Correspondence & Report Writing", Tata McGraw Hill, 5th Edition, 2017.
4. Malcolm Goodale, "Developing Communication Skills" 2nd Edition Professional Presentations, Cambridge University Press.
5. "Supplementary Reading Material Business Communication" - Harvard Business Essentials Series, HBS Press.
6. Adair, J , "Effective Communication", Pan Macmillan Excellence in Business Communication by Thill, J. V. & Bovee, G. L, McGraw Hill, New York. "Business Communications: From Process to Product" Bowman, J.P. & Branchaw, P.P., Dryden Press, Chicago.

WEBSITES :

1. www.businesscommunicationskills.com
2. www.kcitraining.com
3. www.mindtools.com
4. www.businesscommunication.org

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	2	1	2	3	3
CO2	3	-	1	3	2
CO3	-	2	1	2	2
CO4	3	3	2	3	3
CO5	3	2	-	3	3
CO(W.A)	**2.2**	**1.8**	**1.2**	**3**	**2.6**



22BAP02 - INDIAN ETHOS (SEMINAR)				
	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To enable the learners in understanding of the basic concepts of Indian Ethos and familiarize about ethical behavior and value systems at work.	1.1	The students will be able to apply the basic concepts of Indian ethos and value systems at work.
2.0	To enable the learners to handle issues related to ethics.	2.1	The students will be able to handle issues of business ethics and offer solutions in ethical perspectives.
3.0	To understand the value systems and culture professionally.	3.1	The students will be able to professionally efficient and skillful in value systems and culture.
4.0	To enable the learners for managing the business ethically.	4.1	The students will be able to capable in ethically manage business towards well being of the society.
5.0	To inculcate the learners to be socially effective and to undertake business responsibilities.	5.1	The students will be able to socially effective in undertaking business responsibilities.

NOTE: The following is the list of topics suggested for preparation and presentation by students twice during the semester.

1) Indian Ethos and Personality Development.
2) Work ethos and ethics for Professional Managers.
3) Indian Values, Value Systems and Wisdom for modern managers.
4) Ethos in leadership development.
5) Indian system of learning – Gurukul system of learning, Law of humility, Law of growth, Law of responsibility.

TOTAL: 60 Hours

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	1	1	2	2	1
CO2	2	2	2	3	2
CO3	1	2	3	2	3
CO4	1	1	2	3	2
CO5	2	2	3	2	3
CO(W.A)	1.4	1.6	2.4	2.4	2.2

22BAB08 - QUANTITATIVE TECHNIQUES FOR DECISION MAKING

L	T	P	C
2	1	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand, develop and solve mathematical model of linear programming problems.	1.0	The Students will be able to construct and solve linear programming models to answer business optimization problems.
2.0	To comprehend and solve mathematical model of transportation and assignment problems.	2.0	The Students will be able to use transportation and assignment problems to find the best routes and allocation of resources in matching supply and demand.
3.0	To provide knowledge on Game Theory and Decision theory in real time applications.	3.0	The Students will be able to apply various techniques of Game Theory and Decision Theory for enhancing operational efficiency.
4.0	To understand basic concepts, strategies and replacement model techniques to analyze the problems.	4.0	The Students will be able to evaluate various techniques of inventory and replacement models in manufacturing context.
5.0	To provide necessary mathematical support and confidence to tackle real time problems.	5.0	The Students will be able to implement the applications of queuing and simulation in real time optimization.

UNIT I LINEAR PROGRAMMING PROBLEMS (6+3)

Introduction to applications of operations Research in functional areas of management Linear Programming- Formulation, Solution by Graphical and Simplex Methods.

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEMS (6+3)

Transportation Models (Minimizing and Maximizing Cases) – Balanced and unbalanced cases – Initial basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation method. Check for Optimality. Solution by MODI/ Stepping stone method. Assignment Models (Minimizing and Maximizing problems) - Balanced and unbalanced problems. Solution by Hungarian method. Travelling Salesman problems.

UNIT III DECISION AND GAME THEORIES (6+3)

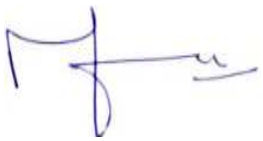
Decision making under risk, Expected Monetary value approach, Decision trees- Decision making under uncertainty. Game Theory- Two person zero sum games- Saddle point, Dominance Rule, graphical Method for 2 x n or m x 2 Games

UNIT IV INVENTORY AND REPLACEMENT MODELS	(6+3)
Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models(one price break and two price breaks only) Replacement models – Individuals replacement models (With and without time value of money) – Group Replacement Models.	
UNIT V – QUEUING THEORY AND SIMMULATION	**(6+3)**
Queuing Theory – single and Multi-channel models – infinite number of customers and infinite calling source. Monte-Carlo simulation- use of random Numbers.	
TOTAL (L:30+T:15) : 45 PERIODS	

REFERENCES:

1. Vohra N.D., "Quantitative Techniques in Management", 5th Edition, McGraw Hill Education, New Delhi, 2017.
2. G. Srinivasan, "Operations Research – Principles and Applications", 2nd Edition, PHI, 2011.
3. Paneer Selvam R., "Operations Research", 2nd Edition, PHI Learning, New Delhi, 2014.
4. Hamdy A Taha, "Introduction to Operations Research", Prentice Hall India, 10th Edition, Third Indian Reprint 2019.
5. Gupta M.P., "Quantitative Techniques for Decision Making", 4th Edition, PHI Learning, New Delhi, 2013.
6. Sharma J.K., "Operations Research - Theory and Application", 6th Edition, Laxmi Publications, New Delhi, 2017.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	3	2	1	2	1
CO2	3	2		2	
CO3	3	2	1	1	1
CO4	3	3	2	2	
CO5	3	2		1	1
CO(W.A)	**3**	**2**	**1**	**2**	**1**



22BAB09 - OPERATIONS MANAGEMENT			
L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the basic concepts in Production and operation activities.	**1.1**	The students will be able to gain knowledge of Production and operation activities.
2.0	To enable the students to learn capacity plans and demand forecasting.	**2.1**	The students will be able to forecast demand and overcome bottlenecks.
3.0	To enable students to identify factors influencing Plant location, Plant layout and Design process.	**3.1**	The students will be able to understanding on product development and design process.
4.0	To educate students to manage the materials effectively by using appropriate Inventory.	**4.1**	The students will be able to apply the Materials management and inventory management techniques.
5.0	To understand how to improve productivity by using effective Project management.	**5.1**	The students will be able to solve various conditions in Project Management.

UNIT I: OPERATIONS MANAGEMENT	**(9)**
Operations Management – Nature, Importance, historical development, functions, challenges, recent trends; differences between services and goods, Productivity – Methods to improve productivity.	
UNIT II: FORECASTING AND CAPACITY PLANNING	**(9)**
Demand forecasting – Need, Types, Objectives and Steps. Capacity Planning – Types. Overview of MRP, MRP II and ERP.	
UNIT III: FACILITY DESIGN AND DESIGN OF PRODUCT	**(9)**
Facility Location – Factors affecting facility location, Steps in Selection, Location Models. Facility Layout–Principles, Types. Product Design and Development – Process; Elements, New product development phases and Techniques.	
UNIT IV: MATERIALS MANAGEMENT	**(9)**
Materials Management – Objectives, Planning. Purchasing – Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management – Nature, Layout, Classification. Inventory –Objectives, Costs and control techniques. Overview of JIT.	
UNIT V: PROJECT MANAGEMENT AND WORK SYSTEM	**(9)**
Project Management – Nature, Constraints in Projects, Project Life Cycle. Work Study – Objectives, Procedure. Method Study and Motion study. Work Measurement.	
TOTAL (L:45) :45PERIODS	

TEXT BOOKS:

1. Jay Heizer, Barry Render, Chuck Munson, AmitSachan, "Operations Management", 12th Edition, Pearson Education 2017.
2. William J Stevenson, "Operations Management", 12th Edition, McGraw Hill, New Delhi, 2018.
3. Mahadevan B, "Operations Management Theory and practice", Pearson Education, 3rd Edition, 2015.

REFERENCES:

1. Russel and Taylor, "Operations Management", Wiley, 8th Edition, 2015.
2. S N Chary, "Production and Operations Management", 6 th Edition, McGraw-Hill Education, 2019.
3. Panneerselvam R, "Production and Operations Management", 3rd Edition, PHI, New Delhi, 2013.
4. KanishkaBedi, "Production and Operations Management", Oxford University, 3rd Edition, 2013.
5. Norman Gaither & Gregory Frazier, "Operations Management", Cengage Learning, 9 th Edition, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	-	1	1	1
CO2	2	2	2	2	2
CO3	2	1	1	-	2
CO4	3	-	1	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.4**	**1.7**	**1.4**	**1.8**	**1.8**

22BAB10 - FINANCIAL MANAGEMENT					
		L	T	P	C
		3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To enable the students to understand the concept of financial management	**1.1**	The students will be able to understanding of financial management concepts & principles.
2.0	To help the students to learn the investment decisions taken by the financial manager.	**2.1**	The students will be able to apply the techniques involved in the investment decision.
3.0	To make the students to understand the theories & determinants influencing financing & divided decisions taken in the firm.	**3.1**	The students will be able to understanding on financing & dividend decisions to raise the funds & increasing the market value of the firm.
4.0	To acquire knowledge on working capital requirement.	**4.1**	The students will be able to calculate the working capital requirement and also management of cash & receivables.
5.0	To educate the students to understand the long term sources of finance for raising the funds.	**5.1**	The students will be able to understanding on the various sources of finance.

UNIT I -FOUNDATIONS OF FINANCE	**(9)**
Financial management – Objectives, Scope, financial decisions - Time value of money- Introduction to the concept of risk and return of a single asset and of a portfolio- Valuation of bonds and shares.	
UNIT II - INVESTMENT DECISIONS	**(9)**
Capital Budgeting: Principles - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques - Project selection under capital rationing - Concept and measurement of cost of capital - Specific cost and overall cost of capital (Simple problems).	
UNIT III - FINANCING AND DIVIDEND DECISION	**(9)**
Financial and operating leverage - capital structure – Theories of capital structure – determinants of capitalstructure. Dividend policy - Aspects of dividend policy – relevance and irrelevance theories - forms of dividend policy - forms of dividends - share splits.	

UNIT IV – LIQUIDITY DECISIONS	(9)
Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital requirements (Simple problems). Accounts Receivables Management and factoring – Inventory management - Cash management - Working capital finance: Trade credit, Bank finance and Commercial paper.	
UNIT V - LONG TERM SOURCES OF FINANCE	**(9)**
Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.	
TOTAL (L:45) :45 PERIODS	

TEXT BOOK:

1. M.Y. Khan and P.K.Jain, "Financial management", Text, Problems and cases, Tata Mc GrawHill, 8th Edition, 2018

REFERENCES:

1. I.M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 11th Edition, 2015.
2. Prasanna Chandra, "Financial Management", 10th Edition, Tata McGraw Hill, 2019.
3. Stephen Ross, Randolph Westerfield, Bradfordfordan, "Corporate Finance" Tata Mc grow Hill, 11th Edition, 2016.
4. R.P.Rustagi, "Financial Management Theory Concepts and Problems", Taxmann, 6th Edition | Reprint 2022.
5. http://nptel.ac.in/courses/110106043/3, "Basics of Financial Management", Prof. A. ThillaiRajan, Department of Management Studies Indian Institute of Technology, Madras.
6. http://nptel.ac.in/courses/110105057/, "International Financial Environment", Prof. A.K. Misra, Department of Management Indian Institute of Technology, Kharagpur.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	2	1	2	3
CO2	3	3	1	3	3
CO3	3	3	3	1	1
CO4	3	3	1	2	2
CO5	2	2	-	2	2
C O (W.A)	2.8	2.6	1.5	2.0	2.2

22BAB11 - MARKETING MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE: NIL

Course Objectives		Course Outcomes	
1.0	To understand the changing business environment.	**1.0**	The students will be able to know the various Marketing concepts, Marketing philosophies and Marketing Environment factors.
2.0	To identify the indicators of management thoughts and practices.	**2.0**	The students will be able to build Effective Branding Strategies.
3.0	To understand fundamental premise underlying market driven strategies	**3.0**	The students will be able to choose the right Marketing Mix with appropriate use of the Marketing mix Elements.
4.0	To provide insight on the basic concepts of Marketing and the various marketing environment factors that impact formulation of marketing strategies	**4.0**	The students will be able to respond to Marketing challenges by understanding Contemporary Marketing Practices.
5.0	To facilitate understanding about the Dynamics of consumer behavior and the utility of Marketing Research	**5.0**	The students will be able to understand the comprehensive industry assessment, strategy formulation and Implementation details.

UNIT I - INTRODUCTION	**(9)**
Marketing – Definitions - Conceptual frame work – Marketing environment: Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.	
UNIT II -MARKETING STRATEGY AND RURAL MARKETING	**(9)**
Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components. A comparative Analysis of Rural Vs Urban Marketing- Size &Structure of Rural Marketing – Emerging challenges & Opportunities in Rural Marketing.	
UNIT III: MARKETING MIX DECISIONS	**(9)**
Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.	

UNIT IV - BUYER BEHAVIOUR	(9)
Understanding industrial and individual buyer behavior - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.	
UNIT V -MARKETING RESEARCH & TRENDS IN MARKETING	**(9)**
Marketing Information System – Research Process – Concepts and applications : Product – Advertising – Promotion – Consumer Behaviour – Retail research– Customer driven organizations - Cause related marketing - Ethics in marketing –Online marketing trends.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

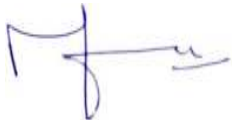
1. Philip Kotler and Kevin Lane Keller, "Marketing Management", Pearson Education Limited 15th Edition, 2021.
2. KS Chandrasekar, —"Marketing management-Text and Cases", Tata McGrawHill-Vijaynicole, 1st Edition,2010.
3. Paul Baines, Chris Fill and Kelly Page, "Marketing", Oxford University Press, 2nd Edition, 2011.

REFERENCES:

1. Lamb, hair, Sharma, Mc Daniel– "Marketing – An Innovative approach to learning and teaching"- A south Asian perspective, Cengage Learning – 2012.
2. MichealR.Czinkota& Masaaki Kotabe, "Marketing Management", Vikas Thomson Learning, 2000.
3. Duglas,J.Darymple, "Marketing Management", John Wiley & Sons, 2008.
4. NAG, "Marketing successfully- A Professional Perspective", Macmillan 2008.
5. Boyd Walker, "Marketing Management", McGraw Hill, 2002.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	1	2	2	1	2
CO2	2	1	2	2	2
CO3	2	1	2	2	2
CO4	1	2	2	1	2
CO5	2	2	2	2	2
CO(W.A)	1.6	1.6	2	1.6	2



22BAB12 - HUMAN RESOURCE MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To enable the students to understand the various HR functions in-depth.	**1.1**	The students will be able to gain knowledge on the various aspects of HRM.
2.0	To familiarize students with contemporary practices in Human Resource Management	**2.1**	The students will be able to gain knowledge needed for success as a human resources professional.
3.0	To provide knowledge about management issues related training and development.	**3.1**	The students will be able to develop the skills needed for a successful HR manager.
4.0	To practice ethical values in achieving stakeholders compensation and welfare	**4.1**	The students will be able to implement the concepts learned in the workplace.
5.0	To learn about the Assessesment the performance of workforce in organization	**5.1**	The students will be able to aware of the emerging concepts in the field of HRM.

UNIT I: PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT	**(5)**
Evolution of human resource management – The importance of the human factor – Challenges – Inclusive growth and affirmative action -Role of human resource manager – Human resource policies – Computer applications in human resource management – Human resource accounting and audit.	
UNIT II: THE CONCEPT OF BEST FIT EMPLOYEE	**(8)**
Importance of Human Resource Planning – Forecasting human resource requirement –Matching supply and demand - Internal and External sources. Recruitment- Selection – Induction – Socialization benefits.	
UNIT III: TRAINING AND EXECUTIVE DEVELOPMENT	**(10)**
Types of training methods –purpose- benefits- resistance. Executive development programmes – Common practices - Benefits – Self development – Knowledge management	
UNIT IV: SUSTAINING EMPLOYEE INTEREST	**(12)**
Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Development of mentor – Protégé relationships.	
UNIT V: PERFORMANCE EVALUATION AND CONTROL PROCESS	**(10)**
Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes –mplications – Redressal methods.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Gary Dessler, BijuVarkkey, (2018), "Human Resource Management", 15th Edition, Pearson Education.
2. Denisi, Griffin, Sarkar (2016), HR –" Human Resource Management", Cengage Learning.
3. George W. Bchlander, Scott A. Snell, (2014), "Principles of Human Resource Management", 16th Edition, Cengage Learning.

REFERENCES:

1. K.Aswathappa,"Human Resource and Personnel Management- Text and Cases", New Delhi: Tata McGraw Hill, 8th Edition 2019.
2. BiswajeetPattanayak,"Human Resource Management", New Delhi: Prentice Hall of India, 2015.
3. Dessler,"Human Resource Management", Pearson Education Limited, 14th Edition, 2015.
4. Bernardin H John, "Human Resource Management-An experiential Approach", New Delhi: Tata McGraw Hill, 2015.
5. Denisi, Griffin, Sarkar," Human Resource Management", 2nd Edition Cengage Learning, 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	2	-	2	3
CO2	3	2	1	2	3
CO3	-	-	1	-	-
CO4	3	3	2	2	3
CO5	3	3	-	2	3
CO(W.A)	**3**	**2.5**	**1.33**	**2**	**3**

22BAB13 - BUSINESS RESEARCH METHODS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To introduce the concept of scientific research and the methods of conducting scientific enquiry.	1.1	The students will be able to understand the basic concepts of business research.
2.0	To introduce the measurement tools and test for its validity and reliability.	2.1	The students will be able to execute research on a scientific basis and select appropriate research design.
3.0	To develop the skills for scientific data collection methods and sampling technique.	3.1	The students will be able to use appropriate data collection method and sampling technique.
4.0	To familiarize the students with the application of basic analytical tools with SPSS software.	4.1	The students will be able to analyze data and find out the solutions to the problems.
5.0	To develop the skills for scientific communications.	5.1	The students will be able to generate the research report adopting the right tools for enhancing the quality of presentation.

UNIT I INTRODUCTION	(9)

Business Research – Definition and Significance – The Research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time – Series Research – Research questions / Problems – Research objectives – Research hypotheses – Characteristics – Research in an evolutionary perspective – The role of theory in research.

UNIT II - RESEARCH DESIGN AND MEASUREMENT	(9)

Research design – Definition – Types of research design – Exploratory and causal research design – Descriptive and experimental design – Different types of experimental design – Validity of findings – Internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

UNIT III - DATA COLLECTION	(9)

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Types of Validity – Sampling plan – Sample size – Determinants optimal sample size – Sampling techniques – Sampling methods.

UNIT IV - DATA PREPARATION AND ANALYSIS	(9)

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling – Conjoint Analysis – Application of statistical software for data analysis.

UNIT V - REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH	(9)
Research report –Types – Contents of report – need for executive summary – Chapterization – Contents of chapter – Report writing – The role of audience – Readability – Comprehension – Tone – Final proof – Report format – Title of the report – Ethics in research – Subjectivity and Objectivity in research.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma," Business Research methods", 12 th Edition, Tata McGraw Hill, New Delhi, 2014.
2. Panneerselvam. R, "Research Methodology", 2nd Edition, PHI Learning, 2014.

REFERENCES:

1. Naresh K. Malhotra, "Marketing Research - An Applied Orientation", Noida: Pearson Education, 2015.
2. Alan Bryman and Emma Bell," Business Research methods", 4th Edition, Oxford University Press, New Delhi, 2015.
3. William G. Zikmund, "Business Research Methods", New Delhi: Thomson Learning, 2015.
4. Uma Sekaran and Roger Bougie, "Research methods for Business", 5th Edition, Wiley India, New Delhi, 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	2	2	2	1	2
CO2	2	2	1	2	3
CO3	2	1	2	3	2
CO4	2	2	2	1	3
CO5	3	2	1	2	3
CO(W.A)	2.2	1.8	1.6	1.8	2.6

22BAB14 - INTERNATIONAL BUSINESS MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To introduce the driving factors of international Business.	**1.1**	The students will be able to gain knowledge on driving factors of international Business.
2.0	To introduce the theories of trade and investment practice.	**2.1**	The students will be able to Understand the theories of trade and investment practices in the global world.
3.0	To develop the skills of various market entry strategies.	**3.1**	The students will be able to deep Insights in to various market entry strategies followed by Global Organizations.
4.0	To familiarize the students with the various global productions and supply chain issues.	**4.1**	The students will be able to identify the various global production methods and supply chain issues.
5.0	To understand the multinational dimensions in management of a MNC company and the business operations in more than one country.	**5.1**	The students will be able to enhance the cognitive knowledge of managing business across the cultures.

UNIT I - AN OVERVIEW OF INTERNATIONAL BUSINESS	**(9)**
Definition and drivers of International Business - Changing Environment of International Business - Country attractiveness - Trends in Globalization - Effect and Benefit of Globalization.	
UNIT II - INTERNATIONAL TRADE AND INVESTMENT	**(9)**
Promotion of global business – the role of GATT/WTO – multilateral trade negotiation and agreements – VIII & IX, round discussions and agreements – Challenges for global business – global trade and investment – theories of international trade and theories of international investment – Need for global competitiveness – Regional trade block – Types – Advantages and disadvantages – RTBs across the globe .	
UNIT III - GLOBAL ENTRY	**(9)**
Strategic compulsions-– Strategic options – Global portfolio management- Global entry strategy, different forms of International business, Advantages - Organizational issues of international business – Organizational structures – Controlling of international business, approaches to control – Performance of global business, performance evaluation system.	

UNIT IV – PRODUCTION, MARKETING, FINANCIALS OF GLOBAL BUSINESS	(9)
Global production: Location, scale of operations- cost of production- Standardization Vs Differentiation- Make or Buy decisions- global supply chain issues- Quality considerations. Globalization of markets: Marketing strategy- Challenges in product development - Pricing - Production and channel management. Foreign Exchange Determination Systems: Basic Concepts-types of Exchange Rate Regimes- Factors Affecting Exchange Rates.	
UNIT V -HUMAN RESOURCE MANAGEMENT IN INTERNATIONAL BUSINESS	**(9)**
Selection of expatriate managers- Managing across cultures -Training and development- Compensation- Disadvantages of international business – Conflict in international business- Sources and types of conflict – Conflict resolutions – Negotiation –Ethical issues in international business – Ethical decision-making.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Charles W.I. Hill and Arun Kumar Jain, "International Business", 6th Edition, Tata McGraw Hill, New Delhi, 2010.
2. K. Aswathappa, "International Business", 5th Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1.Michael R. Czinkota, Ilkka A. Ronkainen and Michael H. Moffet, "International Business", 7 th Edition, Cengage Learning, New Delhi, 2010.

2. John D. Daniels and Lee H. Radebaugh, "International Business", Pearson Education Asia, New Delhi,12th Edition,2015.

3.Vyuptakesh Sharan, "International Business", 3rd Edition, Pearson Education in South Asia, New Delhi, 2011

4. Rakesh Mohan Joshi, "International Business", Oxford University Press, New Delhi, 2009.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	1	2	2	1	2
CO2	2	1	2	2	2
CO3	2	1	2	2	2
CO4	1	2	2	1	2
CO5	2	2	2	2	2
CO(W.A)	1.6	1.6	2	1.6	2

22BAP03 - DATA ANALYSIS AND BUSINESS MODELING			
L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	Students will be able to systematically apply qualitative and quantitative techniques to solve problems.	**1.1**	The students will be able to understand the forecasting in real time business world using analytical tools.
2.0	To help students to learn about the tools used for research analysis.	**2.1**	The students will be able to conduct Risk and sensitivity analysis and portfolio selection based on business data.
3.0	To disseminate the students about networking, inventory models and queuing theory using data analytical tools	**3.1**	The students will be able to know the networking, inventory models and queuing theory using data analytical tools.

S.NO	EXP.NO	DETAILS OF EXPRIMENTS	PERIODS
1	1	Descriptive Statistics	4
2	2	Parametric Tests	4
3	3	Non-parametric Tests	4
4	4	Correlation & Regression	4
5	5	Forecasting	4
6	6	Extended experiment – 1	4
7	7	Portfolio Selection	4
8	8	Risk Analysis & Sensitivity Analysis	4
9	9	Revenue Management	4
10	10	Extended experiment – 2	4
11	11	Transportation & Assignment	4
12	12	Networking Models	4
13	13	Queuing Theory	4
14	14	Inventory Models	4
15	15	Extended experiments – 3	4
		TOTAL PERIODS	**60**

REFERENCES:

1. Hansa Lysander Manohar, "Data Analysis and Business Modeling using Microsoft Excel" PHI, 2017.

2. Wallace Wang, "Microsoft Office 2019 For Dummies", 1st Edition, Wiley, New Delhi, 2018.

3. David M. Levine et al, "Statistics for Managers using MS Excel",6th Edition, Pearson, 2010.

4. Ellan F. Monk, Joseph A. Brady, Gerard S. Cook, "Problem – Solving Cases in Microsoft Access and Excel", 12 th Edition, Cengage Learning, New Delhi, 2015.

Software Required:

- MS Office.
- TORA.
- SPSS.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	3	2	3	3
CO2	2	2	1	2	2
CO3	3	3	2	2	3
CO4	2	2	2	2	2
CO5	3	2	2	1	2
CO(W.A)	**2.6**	**2.4**	**1.8**	**2**	**2.4**

22BAP04 - COMMUNITY IMMERSION AND ENTREPRENEUR IMMERSION PROJECT				
	L	T	P	C
	0	0	2	1

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	The objective of the visit was to inculcate social entrepreneurship training.	1.1	The students will be able to experience the Entrepreneurship training stimulates powers of observation, develops creative and critical thinking.
2.0	Community immersion projects provide students with multiple opportunities for growth and learning beyond the classroom environment.	2.1	The students will be able to understand and find sustainable solutions for pressing community needs.

Community Immersion:

- Assist you in applying these leadership skills within school and community settings, including taking on roles of social change within the community.
- Hands-on experience working with various community issues such as hunger, homelessness, violence prevention, environmental issues, education, health, and youth issues, social justice, etc. Provide opportunities for you to work together toward creative solutions for community problems of 15 hours.

Contents of Report

- Select the service required communities and plan for service strategy.
- Implement the service strategy.
- Write a brief report and attach the live photographs with all its benefits and scopes.

Employing Entrepreneurship venture Criteria

- Must be a business that is entrepreneurial in nature.
- Provide significant work that will enhance the intern‘s professional and educational development.
- Provide the intern the opportunity to work a minimum of 15 hours.
- Must be approved by the Faculty supervisor.

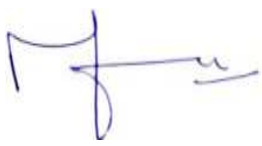
Contents of Report

- ❖ Company Profile & Literature-Promotional/information brochures, etc. from the employing entrepreneur Industry profile – a study on the industry within which the entrepreneur operates.
- ❖ Entrepreneur Interview—Interview with the entrepreneur on the business plan and strategies.
- ❖ Daily Journal—Daily journal entries of internship activities and hours worked.
- ❖ Journal entries can be used to compose the reflective Paper.
- ❖ Reflective Paper—written as a retrospective of the internship experience.

TOTAL (P : 30) = 30 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	3	1	2	2
CO2	3	3	1	2	2
CO3	3	3	2	2	3
CO4	2	3	2	1	2
CO5	3	2	2	1	2
CO(W.A)	2.8	2.8	1.6	1.6	2.2



22BAP05 - SHARE TRADING

L	T	P	C
0	0	2	1

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To enable the students in understanding the Functions of Stock Market.	**1.1**	The students will be able to Know the basics of the securities market and the respective roles they play in the Indian securities market
2.0	To know about market participants and process in share market operations..	**2.1**	The students will be able to Recognize the regulatory framework, various market participants and the role of the Securities Exchange Board of India.
3.0	To know about security broking operations and depositaries.	**3.1**	The students will be able to Identify with the trade cycle, clearing and settlement process and various depositary participants.
4.0	To learn about analysis of share trading.	**4.1**	The students will be able to Know the various tools available used for Investing and trading in shares and learn how to trade through online platform.
5.0	To learn about basics of Derivatives Market.	**5.1**	The students will be able to Realize various derivatives products and its trading strategies.

1. Introduction to Stock Market.
2. Regulatory Environment - SEBI
3. Primary and Secondary Market
4. Major stock exchanges in India
5. Bull and Bear Market.
6. Depositary services
7. Analysis of NIFTY 50 and SENSEX 30 Companies
8. Trading with Chart Patterns
9. Share Trading on Virtual Platform
10. Future and Options

TOTAL (P) :30 PERIODS

REFERENCES:

1. Willian J O'Neil, "How to make money in Stocks?" McGraw Hill, 2019.
2. Ashwani Gujral, "How to Make Money Trading with Charts", Vision Books Publication, 3rd Edition 2018.
3. Raghu Palat, "Fundamental Analysis for Investors", Vision Books Publication, 4th Edition 2015.
4. Ashwani Gujral, "How to Make Money Trading Derivatives – An Insider's Guide", Vision Books Publication, 3rd Edition 2012.
5. PunithavathyPandian, "Security Analysis and Portfolio Management", Vikas Publication, 2nd Edition 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO 2	PO 3	PO4	PO5
CO1	3	3	1	2	3
CO2	3	3	1	2	2
CO3	2	3	2	2	3
CO4	3	3	2	1	2
CO5	3	2	2	1	2
CO(W.A)	**2.8**	**2.8**	**1.6**	**1.6**	**2.4**

22BAZ01 - RESEARCH METHODOLOGY AND IPR

L	T	P	C
3	0	0	3

PRE REQUISITE :NIL	QUESTION PATTERN : TYPE - 1

	Course Objectives		Course Outcomes
1.0	To understand the basic concepts of research and its methodologies, investigation of solutions for research problem, data collection, analysis and interpretation	1.1	Demonstrate the concepts of research and its methodologies, Approaches of information investigation of solutions for research problem, data collection, analysis and interpretation
2.0	To identify the various procedures to collect literature studies approaches, analysis, plagiarism, and research ethics.	2.1	Formulate effective literature studies approaches, analysis, plagiarism, and research ethics.
3.0	To inculcate knowledge on Effective technical writing and method to write report	3.1	Identify the design for Effective technical writing and how to write report
4.0	To provide knowledge process like drawing and drafting tools and reviewing research papers	4.1	Choose the process like drawing and drafting tools and reviewing research papers
5.0	To summarize the design for Intellectual property rights and code of ethics	5.1	Formulate the design for Intellectual property rights and code of ethics

UNIT I RESEARCH PROBLEM FORMULATION	**(9)**
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations	
UNIT II LITERATURE REVIEW	**(9)**
Effective literature studies approaches, analysis, plagiarism, and research ethics	
UNIT III TECHNICALWRITING /PRESENTATION	**(9)**
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.	
UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)	**(9)**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	
UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR)	**(9)**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1.Cooper, D. R. and Schindler, P. S., (2009), Business Research Methods, Tata McGraw Hill, 9th Edition.
2. Krishnaswamy, K.N., Sivakumar, A.I., and Mathirajan, M., Management Research Methodology, Pearson Education 2006.
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

REFERENCES:

1. Jackson, S.L., Research Methods and Statistics, Cengage Learning India Private Limited, New Delhi, 2009
2. Lebrun, J-L., Scientific Writing: A Reader and Writer's Guide, World Scientific Publishing Co. Pte. Ltd., Singapore, 2007.
3. MLA, MLA Handbook for Writers of Research papers, Seventh Edition, Affiliated East West Press Pvt Ltd, New Delhi, 2009.
4. Thiel, D. V., Research Methods for Engineers, Cambridge University Press, 2014.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010.

Mapping of COs with POs / PSOs

COs	(POs)						(PSOs)	
	1	2	3	4	5	6	1	2
1	3	2	1	1	2	1	3	-
2	2	3	2	1	-	-	2	1
3	2	3	2	2	1	1	2	1
4	1	3	2	2	2	1	1	2
5	1	1	2	3	2	2	1	2
CO (weighted average)	**1.8**	**2.4**	**1.8**	**1.8**	**1.75**	**1.25**	**1.8**	**1.5**

22BAB15 - TOTAL QUALITY MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE :NIL

Course Objectives		Course Outcomes	
1.0	To learn the concept of quality and customer perspective of quality, cost quality and quality control.	1.1	The students will be able to Know the principles of total quality management and peculiarities of their implementation.
2.0	To understand the philosopher's contribution and the quality methodologies.	2.1	The students will be able to Apply quality philosophies and tools to Facilitate continuous improvement and ensure customer delight.
3.0	To impart the control techniques and various methodologies like six sigma, TPM to improve the operational efficiency and control.	3.1	The students will be able to acquire knowledge on quality management process for analyzing and solving problems of an organization.
4.0	To learn the product planning and development models through QFD, HOQ, FMEA and the ways to benchmark the product quality.	4.1	The students will be able to analyze appropriate statistical tools and techniques for improving quality processes.
5.0	To understand the ISO standards and quality certifications and quality audit.	5.1	The students will be able to acquire knowledge on ISO standards and various quality certifications to implement in the organization.

UNIT I - INTRODUCTION TO QUALITY	**(9)**
Quality – vision, mission, and policy statements. Customer perception of quality - customer retention. Dimensions of product and service quality-Cost of quality-Quality Control – TQM System.	
UNIT II - PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT	**(9)**
Overview of the contributions of Deming, Juran Crosby, Ishikawa, Taguchi techniques – Introduction, loss function. Concepts of Quality circle, Japanese 5S principles and 8D methodology.	
UNIT III - STATISTICAL PROCESS CONTROL	**(9)**
Meaning and significance of statistical process control (SPC) –control charts. Six sigma-JIT - Kaizen - Total Productive Maintenance (TPM), Terotechnology. Business Process Improvement (BPI), BPR-benefits and limitations.	
UNIT IV - TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT	**(9)**
Quality functions development (QFD) – House of quality (HOQ), QFD process. Failure mode effect analysis (FMEA) – FMEA stages, design, Seven Tools (old & new). Bench marking and POKA YOKE.	
UNIT V - QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION	**(9)**
ISO 9001:2015 Quality Management System-ISO/IEC 27001:2013 Information Technology-ISO 14001:2015 Environmental Management Systems– CGMP (Current Good Manufacturing Practices) – Quality council and quality Audit.	
TOTAL (L: 45): 45 PERIODS	

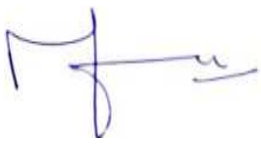
TEXT BOOKS:

1. Poornima M. Charantimath, Total Quality Management, Pearson Education, Fourth edition 2022.
2. DaleH.Besterfield, Carol Bester field–Michna, Glen H.Bester field,Mary Besterfield–Sacre,Hermant-Urdhwareshe,RashmiUrdhwareshe,TotalQualityManagement,RevisedThirdedition, Pearson Education,2018.
3. Shridhara Bhat K, Total Quality Management–Text and Cases, Himalaya Publishing House, FirstEdition2002.

REFERENCES:

1. Sunil Luthra, Dixit Garg, Ashish Agarwal, Sachin K. Mangla,Total Quality Management (TQM)Principles, Methods, and Applications, CRC Press,2020
2. Sunil Sharma,Total Quality Management Concepts, Strategy and Implementation for Operational Excellence,SAGE Publications,2018.
3. Indian standard – quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi
4. D.R. Kiran, Total Quality Management Key Concepts and Case Studies, Elsevier Science,2016
5. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2012

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	3
CO2	3	3	3	2	2
CO3	2	3	3	3	3
CO4	3	2	2	2	3
CO5	2	2	2	2	2
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.6**



22BAB16 - STRATEGIC MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the Strategic management process and social responsibility of business organizations.	1.1	The students will be able to understand the Strategic management process and social responsibility of business organizations.
2.0	To identify the need for developing competitive advantage for organizations.	2.1	The students will be able to gain in-depth understanding about the need for developing competitive advantage for organizations.
3.0	To develop the various corporate and business level strategies.	3.1	The students will get insights into various corporate and business level strategies
4.0	To familiarize the students with organizational strategy implementation process.	4.1	The students will be able to identify the various control systems required for organizational strategy implementation process.
5.0	To understand the cognitive knowledge about various strategic issues and development of new business models.	5.1	The students will be able to enhance the cognitive knowledge about various strategic issues and development of new business models.

UNIT I - STRATEGY AND PROCESS	(9)
Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business – Vision, Mission and Purpose – Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.	
UNIT II - COMPETITIVE ADVANTAGE	**(9)**
External Environment - Porter's Five Forces Model - Capabilities and competencies– Core competencies - Low cost and differentiation Generic Building Blocks of Competitive Advantage - Distinctive Competencies - Avoiding failures and sustaining competitive advantage - Case study.	
UNIT III - STRATEGIES	**(9)**
The generic strategic alternatives – Business level strategy- Corporate Strategy- Vertical Integration Diversification and Strategic Alliances- Environmental Threat and Opportunity Profile (ETOP) - SWOT Analysis - GAP Analysis - Mc Kinsey's 7s Framework - GE 9 Cell Model	
UNIT IV – STRATEGY IMPLEMENTATION & EVALUATION	**(9)**
The implementation process, Resource allocation, Designing organizational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic change- Politics-Power and Conflict-Techniques of strategic evaluation & control.	

UNIT V -OTHER STRATEGIC ISSUES	(9)
Managing Technology and Innovation - Strategic issues for Non Profit organizations. New Business Models and strategies for Internet Economy. Recent Trends in Strategic Management - Strategic Thinking - Strategic management in a new globalised economy.	
TOTAL (L:45) : 45PERIODS	

TEXT BOOKS:

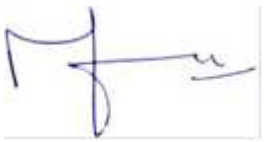
1. Anthony Henry, "Understanding Strategic Management", 4th Edition, Oxford University Press, New Delhi, 2021.
2. Charles W. L. Hill, Melissa A. Schilling, Gareth R. Jones, Strategic Management: Theory & Cases: An Integrated Approach 12th Edition, Cengage Learning 2016.
3. Lawerence G. Hrebiniak, Making strategy work, Pearson, 2 nd edition, 2013.

REFERENCES:

1. John A. Pearce II, Richard B. Robinson, AmitaMital, "Strategic Management Formulation, Implementation and Control", 14th Edition, McGraw Hill Education, New Delhi, 2018.
2. Fred R, David, Forest R,"David. Strategic Management: Concepts: a Competitive Advantage Approach", Global Edition, Pearson Education, Noida, 2017.
3. Michael A. Hitt, Duane Ireland R, Robert E. Hoskisson, "Strategic Management: Concepts and Cases", 12th Edition, Cengage Learning, New Delhi, 2017.
4. Hill. Strategic Management: An Integrated approach, 2009 Edition Wiley (2012).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	2	3
CO2	3	2	3	2	3
CO3	2	2	2	3	2
CO4	2	2	2	2	3
CO5	3	2	2	2	2
CO(W.A)	**2.6**	**2**	**2.4**	**2.2**	**2.6**



22BAP06-MANAGERIAL SKILL DEVELOPMENT				
	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To be effective in oral communication of a managerial decision and is also convincing.	1.1	The students will be able to demonstrate interpersonal skills to allow effective functioning in diverse groups.
2.0	To Comprehend effective use written communication for expressing views	2.1	The students will be able to identify strengths and interests and match these to a chosen career path.
3.0	To establish a favorable team climate and ensure enthusiastic decision making	3.1	The students will be able to examine the effective techniques which promote learning for all students regardless of race, culture, gender, age, creed or ability.
4.0	To elicit constructive feedback in conflicting situations.	4.1	The students will be able to ddescribe the professionalism and ownership of professional growth and learning.
5.0	To facilitate enthusiastic stakeholder/team participation and contribution in decision making.	5.1	The students will be able to generalize the collaboration of colleagues and the community.

UNIT 1 PERSONAL COMMUNICATION	**12**
Day-to-Day Conversation - Context Specific – Agreeing/Disagreeing, Wishing, Counseling, Advising, Persuading, Expressing Opinions, Arguing – Self Introduction.	
UNIT 2 SOCIAL COMMUNICATION	**12**
Values and Etiquettes -Telephone Calls - Discussing Issues (social, political, cultural) - Clubs (any social gathering) - Talking about Books - News Items, - T.V Programmes - Sharing Jokes.	
UNIT 3 GROUP/MASS COMMUNICATION	**12**
Group Discussion – Debate - Anchoring/Master of Ceremony - Welcome Address - Vote of Thanks - Introducing Speakers - Conducting Meetings - Making Announcements - Just-a Minute (JAM) - Block and Tackle - Ship Wreck – Spoof - Conducting Quiz.	
UNIT 4 INTEGRATED SPEAKING AND PRESENTATION SKILLS	**12**
Lecturing - PowerPoint Presentation - Interviews of Different Kinds (One to One, Many to One - Stress Interview - Telephonic Interview - Suggestions and Reviews.	
UNIT 5 EMPLOYABILITY AND CORPORATE SKILLS	**12**
Mock Interview - Leadership and Co-Ordination - Time Management and Effective Planning – Simple Physical Exercises - Simple Yoga and Meditation Techniques - Relaxation Techniques - Decision making - Teamwork.	
TOTAL (P:60) : 60 PERIODS	

TEXT BOOKS:
1. Clampitt P.G, Understanding Communication, Communicating for Managerial Effectiveness: Problems, Strategies and Solutions ,Sixth Edition, Sage Publications Inc.2017. 2. Lehman, Dufrene, Sinha, Business Communication – A South Asian Perspectives, 2nd edition, South-Western Cengage Learning India (P) Ltd,(2016).

REFERENCES:
1. Rajendra Pal, Korlahalli J.S., "Essentials of Business Communication", 13th Edition, S. Chand Publishing, New Delhi, 2017. 2. Herta Murphy, "Effective Business Communication", 7th Edition, McGraw Hill Education, New Delhi, 2017. 3. Asha Kaul, "Effective Business Communication", 2nd Edition, PHI Learning, New Delhi, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	2	2	2	2	2
CO3	3	2	2	3	3
CO4	3	3	2	2	2
CO5	2	2	3	3	3
CO(W.A)	**2.6**	**2.4**	**2.2**	**2.6**	**2.6**

22BAP07 - CORPORATE INTERNSHIP

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	Provide an extensive exposure to the student and hands-on experience of the functional areas of management in a corporate environment.	**1.1**	The students will be able to understand the functional areas of management in a corporate environment.
2.0	To gain employment knowledge and contacts leading to job.	**2.1**	The students will be able to acquire employment opportunities leading directly to a full-time job after graduation from college.
3.0	Provide skill based platform for the students to improve quality and performance of the student.	**3.1**	The students will be able to develop work habits, communication, interpersonal and other critical skills and attitudes necessary for job success.
4.0	To enhance interest and abilities for the students.	**4.1**	The students will be able to assess interests and abilities in their field of study.
5.0	Helps the students to meet professional role models and potential mentors who can provide guidance, feedback, and support.	**5.1**	The students will be able to Identify people who can provide guidance, feedback, and support.

Content

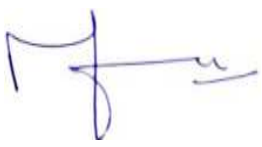
Marketing	Finance
➢ Marketing manager's roles and responsibilities ➢ Products and product policies ➢ Pricing policies ➢ Distribution structure ➢ Advertising policies & procedures ➢ Sales promotion activities ➢ Marketing research activities	➢ Sources of capital ➢ Role of Finance manager ➢ Cost of capital ➢ Allocation of funds to various departments ➢ Credit policy ➢ Payment & collection procedure ➢ Budgeting method ➢ Cash management ➢ Control process
Human Resource	**Production**
➢ Role of HR Manager ➢ Human Resource planning ➢ Recruitment & selection ➢ Training & development ➢ Payroll preparation ➢ ESI-PF calculation ➢ Performance appraisal ➢ Career planning & development ➢ Compensation plan ➢ Financial/ Non-financial incentives ➢ Welfare benefits ➢ Discipline Administration	➢ Production process ➢ Receiving and processing orders ➢ Types of production systems ➢ Production planning procedures ➢ Inventory management ➢ Record keeping ➢ Wastage management ➢ Quality control techniques ➢ Efficiency analysis ➢ Logistics

TOTAL: 4 Weeks

Summer internship – Minimum of 4 weeks of internship

The report along with the company certificate should be submitted within the three weeks of the reopening date of 3rdsemester.The report should be sent to the Controller of Examinations by the HOD through the Principal, before the last working day of the 3rdsemester.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	2
CO2	2	2	2	2	3
CO3	3	3	2	3	3
CO4	2	2	3	2	2
CO5	3	3	3	3	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.6**



22BAB17- BUSINESS ETHICS, CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE

L	T	P	C
3	0	0	3

PREREQUISITE:NIL

	Course Objectives		Course Outcomes
1.0	To Provide an understanding of ethics and Identify the ethical issues.	**1.1**	The student is able to recognize ethical issues that affect multiple stakeholders.
2.0	To have grounding on ethical theory through the understanding of real life situation and cases.	**2.1**	The student can gain knowledge on ethical theories and the understanding of real life situations.
3.0	To inculcate knowledge on legal aspects of ethics.	**3.1**	The Students will be able to apply multiple ethical Concepts in analyzing consequences of decision making.
4.0	To understand the philosophy of environmental ethics.	**4.1**	The student is able to evaluate the most Appropriate perspective in achieving stakeholder welfare.
5.0	To induce the role of corporate social Responsibility.	**5.1**	The Students will be able to Identify the Requirement of Corporate social responsibility.

UNIT I: INTRODUCTION	**(9)**
Definition & nature Business ethics ,Characteristics ,Ethical theories; Causes of unethical behavior ;Ethical abuses, Work ethics; Code of conduct; Public good.	
UNIT II: ETHICS THEORY AND BEYOND	**(9)**
Management of Ethics–Ethics analysis [Hosmer model]; Ethical dilemma ;Ethics in practice –ethics for managers; Role and function of ethical managers-Comparative ethical behavior of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics. Business and ecological / environmental issues in the Indian context and case studies.	
UNIT III:LEGAL ASPECTS OF ETHICS	**(9)**
Political–legal environment; Provisions of the Indian constitution pertaining to Business; Political setup–major Characteristics and their implications for business; Prominent features of MRTP& FERA. Social– cultural environment and their impact on business operations, Salient features of Indian culture and values.	
UNIT IV:ENVIRONMENTAL ETHICS	**(9)**
Economic Environment; Philosophy of economic grow and its implications for business, Main features of Economic Planning with respect to business; Industrial policy and framework of government contract over Business; Role of chamber of commerce and confederation of Indian Industries.	

UNIT V:CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE	(9)
Definition-Evolution-Need for CSR; Theoretical perspectives; Corporate citizenship; Business practices; Strategiesfor CSR; Challenges and implementation; Evolution of corporate governance; Governance practices and regulation; Structure and development of boards; Role of capital market and government; Governance ratings; Future of governance-innovative practices; Case studies with lessons learnt.	
TOTAL(L:45):45PERIODS	

TEXTBOOKS:

1. C.S.V. Murthy, "Business Ethics Text & Cases", Himalaya Publishing House,2018
2. Tushar Agarwal, Nidhi Chandorkar, "Indian Ethos in Management", First Edition, Himalaya publishing House, 2017.
3. Ferrell,O.C.,JohnFraedrich,andLindaFerrell,"BusinessEthics-Ethical Decision Making And Cases", Ninth Edition,CengageLearning,Delhi,2016.

REFERENCES:

1. Andrew Crane," Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalization",Oxford University Press, 2020.
2. Mitra, Nayan, Schmidpeter, Rene, "Corporate Social Responsibility in India: Cases and Developments after the Legal Mandate", Pearson Publications, New Delhi, 2017.
3. Francis R & Mishra M (2012)., Business Ethics; An Indian Perspective, Tata Mc- Graw- Hill Publishing Company Ltd.,New Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	2
CO2	3	3	2	3	3
CO3	3	3	2	3	2
CO4	2	2	2	3	3
CO5	2	3	2	2	2
CO(W.A)	**2.4**	**2.8**	**2**	**2.8**	**2.4**

22BAP08–PROJECT WORK

L	T	P	C
3	0	0	3

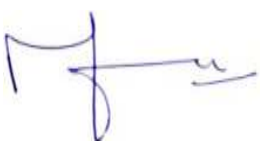
PREREQUISITE:22BAP07

	Course Objectives		Course Outcomes
1.0	The students has to gain knowledge in exercise his managerial skills for decision making in the organization.	**1.1**	The Students will be able to know the managerial skills for decision making to solve the business problems.
2.0	To explain the business ideas using the skills and knowledge they have gained.	**2.1**	The students will be able to undertake research using appropriate recognized Methodology and framework.
3.0	To gain hands on experience in creating a business plant his will be an in dispensable tool for future development and growth.	**3.1**	Assess meaningful entrepreneurial Opportunities from a business and personal perspective.
4.0	To solve business problems through Organizational research, in the contemporary work place environments.	**4.1**	The students will be able to solve business problems through Organizational research, in the contemporary work place environments.
5.0	To conduct an independent research project, resulting in research outputs in the form of journalpublication,or conference or seminar presentations confidently.	**5.1**	The students will be able to an independent research project, resulting in research outputs in the form of journal publication or conference or seminar presentations confidently.

	Corporate Project
Process	❖ Study the organization and its environment. ❖ Identify a specific issue/ problem/ challenge /developmental area of study /research ❖ Build the research design or framework and conduct the study. ❖ Report the findings. ❖ Give specific implementable suggestions to the organization ❖ Report of the study ❖ Write a working paper of the study.
	Entrepreneurship Project
Process	❖ Description of the business idea. ❖ Customer problem to be solved and the Entrepreneurial Team ❖ Industry Analysis ❖ Market Analysis ❖ Financial Analysis ❖ Business Model canvas ❖ Final Draft Submission ❖ Mock Business plan presentation ❖ Final Business plan pitch.

Total : 8 Weeks

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	2
CO2	3	3	3	3	3
CO3	3	3	3	3	2
CO4	3	2	3	3	3
CO5	2	3	2	2	2
CO(W.A)	**2.6**	**2.8**	**2.6**	**2.8**	**2.4**



22BAP09–Transactional Analysis

L	T	P	C
0	0	2	1

PREREQUISITE:Nil

	Course Objectives		Course Outcomes
1.0	To provide a realistic and useful method for analyzing and understanding the behavior of others	**1.1**	The students will be able to demonstrate the theoretical framework for understanding human behaviour.
2.0	To provide a role in describing fundamental patterns of thinking, feeling and behavior using TA model.	**2.1**	The students will be exploring one's own feelings and behavior using the TA model.
3.0	To describe the application of TA in several areas of people management organizations.	**3.1**	The students will be able to appraise the application of TA in several areas of people management organizations.
4.0	To provide TA Applications in Motivation, Leadership and Teamwork.	**4.1**	The students will be able to analyze TA Applications in Motivation, Leadership and Teamwork.
5.0	To gain knowledge on Transactional Analysis in Short-term counselling and longer-term therapy.	**5.1**	The students will be able to apply Transactional Analysis in Short-term counselling and longer-term therapy.

List of Exercises / Experiments :

1.Play the game of dispute with the partner to understand TA and Self-Awareness.

2.An exploration of the past is useful to the degree that it continues to influence our emotional and behavioral difficulties. Experience sharing and lessons learned.

3.Conduct activities to make the students to realize the mental state of Winners and Losers.

4.Exercise to build a therapeutic relationship through Structural Analysis

5.Life Positions and Transactions support in understanding our working relationship.

6.Games and Strokes to provide the foundations for a trusting and meaningful alliance between people.

7.Life Scripts to apprehend each person is a unique individual.

8.TA Applications in Motivation, Leadership and Teamwork.

9.Transactional Analysis in Short-term counselling and longer-term therapy.

10.Contracting for Change to work together as well as the goals individual wish to achieve.

REFERENCES:

1.Eric Berne,Games, "People Play: The Psychology of Human Relationships", 1st Edition, Penguin, UK, 2016.

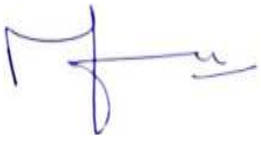
2. Vann Joines,Ian Stewart, "TA Today: A New Introduction to Transactional Analysis", 2nd Revised Edition, Lifespace Publishing,US, 2012.

3. Richard G Erskine, "Transactional Analysis in Contemporary Psychotherapy" 1st Edition, Routledge, USA, 2019.

4. Richard L. Daft, Nishant Uppal, "Understanding the Theory and Design of Organizations", 11th Edition, Cengage Learning,New Delhi, 2020.

5. Robbins, Coulter, "Management", 17th Edition, PHI Learning, New Delhi, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	2	3
CO2	3	2	2	3	3
CO3	3	3	2	2	2
CO4	3	2	3	3	3
CO5	2	3	2	2	2
CO(W.A)	**2.8**	**2.6**	**2.4**	**2.4**	**2.6**



22BAX01-BRAND MANAGEMENT				
	L	T	P	C
	3	0	0	3

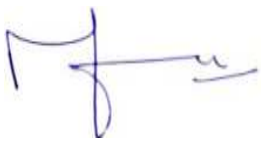
PRE REQUISITE: 22BAB11

Course Objectives		Course Outcomes	
1.0	To understand the methods of managing brands and co-branding in brand management	1.0	The students will be able to learn the fundamentals of branding and co-branding.
2.0	To co-create unique ideas, products and positioning.	2.0	The students will be able to understand brand strategies in the global environment.
3.0	To comprehend branding techniques through various methods.	3.0	The students will be able to understand the ways that use of branding tools and techniques to interact with their customers.
4.0	To create brand adoption practices for brand re- creation or re-branding.	4.0	The students will be able to create new ideas and combine multiple perspectives to develop new brand.
5.0	To comprehend global branding strategies influencing the business environment.	5.0	The students will be able to learn the aspects of brand performance.

UNIT I -INTRODUCTION	**(9)**
Basics Understanding of Brands – Definitions - Branding Concepts – Functions of Brand - Significance of Brands – Different Types of Brands – Co branding – Store brands.	
UNIT II -BRAND STRATEGIES	**(9)**
Strategic Brand Management process – Building a strong brand – Brand positioning – Establishing Brand values – Brand vision – Brand Elements – Branding for Global Markets – Competing with foreign brands.	
UNIT III - BRAND COMMUNICATIONS	**(9)**
Brand image Building – Brand Loyalty programmes – Brand Promotion Methods – Role of Brand ambassadors, celebrities – On line Brand Promotions.	
UNIT IV - BRAND EXTENSION	**(9)**
Brand Adoption Practices – Different type of brand extension – Factors influencing Decision for extension – Re- branding and re-launching.	
UNIT V -BRAND PERFORMANCE	**(9)**
Measuring Brand Performance – Brand Equity Management - Global Branding strategies - Brand Audit – Brand Equity Measurement – Brand Leverage - Branding challenges & opportunities.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
1.Emmanuel Mogaji, Brand Management, An Introduction Through Storytelling, Springer International Publishing, 1st Edition,2021. 2.Kevin Lane Keller, Ambi M. G. Parameswaran, Isaac Jacob,Strategic Brand Management Building, Measuring, and Managing Brand Equity,Pearson, 5th Edition, 2019.
REFERENCES:
1. Kevin Lane Keller, Strategic Brand Management: Building, Measuring and Managing, Prentice Hall, 5thEdition 2019. 2. Tapan K Panda," Product and Brand Management", 1st Edition, Oxford University Press, Noida, 2016. 3. Moorthi YLR, Brand Management – I edition, Vikas Publishing House 2012. 4. Kevin Lane Keller, Ambi M. G. Parameswaran and Isaac Jacob, "Strategic Brand Management: Building, Measuring, and Managing Brand Equity", 9th Edition, Pearson Education, New Delhi, 2015. 5.Mahim Sagar, Deepali Singh, D.P.Agarwal, Achintya Gupta.–Brand Management Ane Books Pvt.Ltd – (2009).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	3
CO2	3	2	2	2	2
CO3	2	2	2	2	2
CO4	3	2	2	3	3
CO5	3	3	2	2	2
CO(W.A)	**2.8**	**2.2**	**2**	**2.2**	**2.4**



22BAX02 - RETAIL MANAGEMENT					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: : 22BAB11					

Course Objectives		Course Outcomes	
1.0	To understand the concepts of effective retail business.	**1.0**	The Students will be able to manage the retail chains and understand the retail customer's behavior.
2.0	To understand effective retail formats and strategies required for retail management.	**2.0**	The Students will be able to gain knowledge on recent trends in retail formats.
3.0	To understand how to utilize resources and techniques used in retail management.	**3.0**	The Students will be able to establish retail and the ways to manage retailing.
4.0	To understand analysis of store location, merchandising, products and pricing.	**4.0**	The Students will be able to provide insights on retail operation.
5.0	To provide insights on retail management behaviour.	**5.0**	The Students will be able to understand the behaviour involved and its implementation in retail shop.

UNIT I –INTRODUCTION	**(9)**
An overview of Global Retailing – Challenges and opportunities – Retail trends in India – Socio economic and technological Influences on retail management.	
UNIT II -RETAIL FORMATS	**(9)**
Organized and unorganized formats – Different organized retail formats – Characteristics of each format – Emerging trends in retail formats – MNC's role in organized retail formats.	
UNIT III - RETAILING DECISIONS	**(9)**
Choice of retail locations - internal and external atmospherics – Positioning of retail shops – Building retail store Image - Retail service quality management – Retail Supply Chain Management – Retail Pricing Decisions.	
UNIT IV - RETAIL SHOP MANAGEMENT	**(9)**
Visual Merchandise Management – Space Management – Retail Inventory Management – Retail accounting and audits - Retail store brands – Retail advertising and promotions –Online retail – Emerging trends.	
UNIT V -RETAIL SHOPPER BEHAVIOUR	**(9)**
Understanding of Retail shopper behavior – Shopper Profile Analysis – Shopping Decision Process - Factors influencing retail shopper behavior – Complaints Management - Retail sales force Management	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:
1. Giri, Arunangshu, Paul, Pradip, Chatterjee, Satakshi, Retail management text & cases, PHI Learning Pvt. Ltd.1st Edition,2021. 2. Prabhu TL, Retail Management, An Effective Management Strategy for Retail Store Managers, Nestfame Creations Pvt. Ltd., 1st Edition, 2019.
REFERENCES:
1. Barry Berman, Joel R. Evans, Patrali Chatterjee, Ritu Srivastava Retail Management: A Strategic Approach, 13th Edition, Pearson Education, Noida, 2017 2. Michael Levy, Barton Weitz, Dhruv Grewal "Retailing Management",10th Edition, McGraw Hill Education, New Delhi, 2018. 3. Gibson G. Vedamani, "Retail Management", 5th Edition, Pearson Education, Noida, 2018. 4. Swapna Pradhan, "Retailing Management: Text and Cases", 4th Edition, McGraw Hill Education, New Delhi, 2017 5. Chetan Bajaj, Rajnish Tow and Nidhi V. Srivatsava, Retail Management, Oxford University Press, 2007. 6. Swapna Pradhan, Retail Management -Text and Cases, Tata McGraw Hill.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

Mapping of COs with POs					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	2	3
CO2	3	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	3	2	2	2	3
CO(W.A)	**2.6**	**2.0**	**2.2**	**2.0**	**2.4**

20BAX03- SERVICES MARKETING			
L	T	P	C
3	0	0	3

PRE-REQUISITE: : 22BAB11

Course Objectives		Course Outcomes	
1.0	To understand the meaning of services and the significance of services marketing.	1.1	The students will be able to apply the concepts of services marketing in promoting services.
2.0	To appreciate the challenges involved in managing the services and analyse the strategies to deal with these challenges.	2.1	The students will be able to review and give a general understanding of advertising, personal selling, sales promotion and indirect promotion.
3.0	To co-create unique ideas, products and solutions	3.1	The students will be able to understand the concepts and techniques for the development and designing an effective Service Marketing Communication programme.
4.0	To give insights about the foundations of services marketing, customer expectations of services and gap existing in the service delivery processes and service Quality.	4.1	The students will be able to develop awareness about marketing communications tools, and how each can be used effectively-individually or in an integrated mix.
5.0	To formulate competitive strategies for the digital market places.	5.1	The students will be able toexamine the process, by which integrated marketing communications programs are planned, developed, executed and measured.

UNIT I INTRODUCTION	**(9)**
Definition – Service Economy – Evolution and growth of service sector – Nature and Scope of Services – Unique characteristics of services - Challenges and issues in Services Marketing.	
UNIT II - SERVICE MARKETING OPPORTUNITIES	**(9)**
Assessing service market potential - Classification of services – Expanded marketing mix – Service marketing – Environment and trends – Service market segmentation, targeting and positioning.	
UNIT III -SERVICE DESIGN AND DEVELOPMENT	**(9)**
Service Life Cycle – New service development – Service Blue Printing – GAP model of service quality – Measuring service quality – SERVQUAL – Service Quality function development.	
UNIT IV - SERVICE DELIVERY AND PROMOTION	**(9)**
Positioning of services – Designing service delivery System, Service Channel –Pricing of services, methods – Service marketing triangle - Integrated Service marketing communication.	
UNIT V -SERVICE STRATEGIES	**(9)**
Service Marketing Strategies for health – Hospitality – Tourism – Financial – Logistics – Educational – Entertainment & public utility Information technique Services.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1.R. Srinivasan, Services Marketing, The Indian context, PHI learning,3rd Edition, 2012.

2. Alan Wilson, Valarie Zeithaml, Mary Jo Bitner, Dwayne Gremler, Services Marketing: Integrating Customer Service Across the Firm, 7th Edition, Mc-Graw-Hill Education, 2020.

REFERENCES :

1. Valarie A Zeithaml, Mary Jo Bitner, Dwayne D Gremler and Ajay Pandit, Service Marketing Integrating Customer Focus Across the Firm, 7th Edition, McGraw Hill Education, New Delhi, 2018.

2. Jochen Wirtz, Christopher Lovelock, "Essentials of Services Marketing", 3rd Edition, Pearson Education, Noida, 2019

3. Christopher Lovelock, Jochen Wirtz, Jayanta Chatterjee, Services Marketing: People, Technology, Strateg, 8th Edition, Pearson Education, Noida, 2017

4. William Chitty, Steven D'Alessandro, Andrew Hughes, Services Marketing, 2nd Edition, Oxford University Press, New Delhi, 2019.

5.Muhammad Sabbir Rahman, Mahmud Habib Zaman, MdAfnan Hossain, Service Marketing Strategies for Small and Medium Enterprises: Emerging Research and Opportunities, 1st Edition, IGI Global, 2019.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	2	3	2	3
CO3	3	2	3	2	3
CO4	2	2	3	3	2
CO5	3	3	2	2	2
CO(W.A)	**2.8**	**2.4**	**2.6**	**2.4**	**2.6**

22BAX04-INTEGRATED MARKETING COMMUNICATION			
L	T	P	C
3	0	0	3

PRE REQUISITE : 22BAB11

Course Objectives		Course Outcomes	
1.0	To introduce the basic concepts of Advertising.	1.1	The students will have an understanding on advertising concepts and principles.
2.0	To have an understanding on Advertising media and message development.	2.1	The Students will be able to make effective choice for advertisements.
3.0	To Understand the concept of Sales promotion techniques.	3.1	The Students will be able to plan Sales promotion campaigns.
4.0	To develop the knowledge of students in personal selling and public relations.	4.1	The Students will be able to involve in Personal selling and handle issues ethically.
5.0	To enrich the knowledge of students in publicity.	5.1	The Students will be able to understand the importance of Publicity.

UNIT I – PRINCIPLES OF ADVERTISEMENT	**(9)**
Definition – Objectives – Importance – Functions – Principles of Effective Advertising – Advertising Challenges – Advertisement Agencies – Advertisement campaigns.	
UNIT II – ADVERTISEMENT MEDIA	**(9)**
Media Plan – Type and Choice Criteria – Reach and Frequency of Advertisements – Media Strategy and Scheduling. Design and Execution of Advertisements – Message development – Different Types of Advertisements – Measuring Impact of Advertisements.	
UNIT III – SALES PROMOTION	**(9)**
Definition – Role and Importance of Sales Promotion – Objectives – Steps – Sales Promotion techniques – Consumer and Trade Promotions – Online Sales Promotions.	
UNIT IV – PERSONAL SELLING & PUBLIC RELATIONS	**(9)**
Personal selling: Meaning – Objectives – Types - Process of Personal Selling. Public Relations: Definition – Importance – Functions – Steps in Public Relation – PR Agencies – Emerging Trends in Integrated Marketing Communication.	
UNIT V -PUBLICITY	**(9)**
Introduction – Meaning – Objectives – Types – Importance of Publicity – Difference between Public Relations and Publicity.	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

1. George E Belch and Michel A Belch, Advertising and Promotion, Tata McGraw Hill, 12th Edition, 2022.
2. Kenneth Clow, Donald Baack, Integrated Advertisements, Promotion and Marketing Communication, 8th Edition, Prentice Hall of India, New Delhi, 2017.

REFERENCES:

1. J Craig Andrews, Terence A. Shimp "Advertising, Promotion, and Other Aspects of Integrated Marketing Communications", 10th Edition, Cengage Learning, New Delhi, 2017.

2. philippe Malaval, Marie Helene Abbo, Muneesh Kumar, Jean Marc Decaudin, "Integrated Marketing Communication: Pent", 4th Edition, Pearson India, Chennai, 2017.

3.Terence A. Shimp and J. Craig Andrews, Advertising Promotion and other aspects of Integrated Marketing Communications, CENGAGE Learning, 10th Edition, 2017.

4. PR Smith, ZeZook, "Marketing Communications: Integrating Online and Offline, Customer Engagement and Digital Technologies", 7th Edition, Kogan Page, London, United Kingdom, 2017.

5. Kruti Shah, "Advertising And Integrated Marketing Communications", 1st Edition, McGraw Hill Education, New Delhi, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	3
CO2	2	2	2	2	2
CO3	2	2	2	2	3
CO4	3	2	2	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.4**	**2.0**	**2.0**	**2.2**	**2.4**

22BAX05-MARKETING ANALYTICS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB11

Course Objectives		Course Outcomes	
1.0	To introduce the basic concepts of Marketing Segmentation & Customer Value Analysis	1.1	The students will have an understanding on Marketing Segmentation & Customer Value Analysis concepts and principles.
2.0	To have an understanding on Product Analytics& analysis concepts.	2.1	The Students will be able to understanding on Product Analytics& analysis concepts.
3.0	To Understand the concept of Pricing Analytics.	3.1	The students will be able to summarize suitable analytic tools to target and retain profitable customers and avoid high-risk customers
4.0	To develop the knowledge of students in Distribution Strategy.	4.1	The Students will be able to involve in Distribution Channel strategy.
5.0	To enrich the knowledge of students in Promotion Analytics	5.1	The Students will be able to understand the importance of Estimating Promotion Budgets and to understand the Metrics for Social Media

UNIT I – MARKETING SEGMENTATION & CUSTOMER VALUE ANALYSIS	(9)
Marketing Segmentation: Segmentation - Targeting - Positioning. Customer Value Analysis: Life Time Customer Value Calculation - Simulation Technique - Model for Customer Retention and Acquisition Spending EXPERIMENTS: Generate a model for customer retention and acquisition spending using given data.	
UNIT II – PRODUCT ANALYTICS	(9)
Product Analytics: Identifying New Product Features using Conjoint Analysis - Forecasting New Product Sales using S Curves - Copernican Principle to Predict Duration of Future Sales - Attribute Preference Testing. EXPERIMENTS: Estimates demand curves.	
UNIT III – PRICING ANALYTICS	(9)
Pricing Analytics: Pricing Techniques-EstimatingDemandCurveandOptimizingPrice-PrinceBundling-NonlinearPricing. EXPERIMENTS: Price bundling.	
UNIT IV – DISTRIBUTION STRATEGY	(9)
Distribution Strategy: Distribution Channel Characteristics - Retail Location Selection - Channel Evaluation and Selection – Multi Channel Distribution- Distribution Channel Metrics. EXPERIMENTS: Market result analysis.	

UNIT V – PROMOTION ANALYTICS	(9)
Promotion Analytics: Estimating Promotion Budgets-Promotion Budget Allocation-Metrics for Traditional Media-Metrics for Social Media. EXPERIMENTS: Market result analysis.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Wayne L. Winston, "Marketing Analytics: Data-Driven Techniques with Microsoft Excel", 1st Edition, Wiley, New Delhi, 2018.
2. Stephen Sorger, "Marketing Analytics: Strategic Models and Metrics", 1st Edition, Admiral Press, UK, 2016.

REFERENCES:

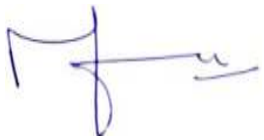
1.Tommy Blanchard, "Data Science for Marketing Analytics", 1st Edition, Packt Publishing, UK, 2019.

2. Mike Grigsby, "Marketing Analytics", 2nd Edition, Kogan Page, UK, 2018.

3. David A. Aaker, V. Kumar, Robert P. Leone, George S. Day., "Marketing Research", 1st Edition, Wiley, New Delhi, 2019.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	3
CO2	2	2	2	2	2
CO3	2	2	2	2	3
CO4	3	2	2	2	2
CO5	3	2	2	2	2
CO(W.A)	**2.4**	**2.0**	**2.0**	**2.2**	**2.4**



22BAX06- SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE: 22BAB10

Course Objectives		Course Outcomes	
1.0	To make the students to identify the various investment avenues.	**1.1**	The Students will be able to understand the risk and return association n various investment alternatives.
2.0	To familiarize with Capital Market & Risk and Return.	**2.1**	The Students will be aware of the Capital Market & Risk and Return.
3.0	To make students learn about fundamental analysis.	**3.1**	The Students will be able to do economic, industry & company analysis.
4.0	To make students learn about technical analysis.	**4.1**	The Students will be able to apply technical analysis.
5.0	To make students understand the strategies in developing portfolio investment and analysis.	**5.1**	The Students will be able to construct and manage portfolio investment and analysis.

UNIT I - INVESTMENT SETTING& SECURITIES	**(9)**
Financial and economic meaning of Investment – Characteristics and objectives of Investment – Types of Investment – Investment alternatives – Choice and Evaluation – Risk and return concepts - Securities-Securities Markets in India	
UNIT II -CAPITAL MARKET& RISK AND RETURN	**(9)**
Capital Market: Primary Market – Participants- Listing Formalities and Procedure- Secondary Market - Buying and Selling Mechanisms- Margin and Settlement of Shares- Regulating Framework, SEBI – Functions, Guidelines and Regulations- Stock Exchanges In India – Indices- Depositories in India.	
UNIT III -FUNDAMENTAL ANALYSIS	**(9)**
Economic Analysis – Economic forecasting and stock Investment Decisions – Forecasting techniques. Industry Analysis - Industry classification, Industry life cycle – Company Analysis - Measuring Earnings – Forecasting Earnings	
UNIT IV -TECHNICAL ANALYSIS	**(9)**
Technical Analysis: Need and Importance-Fundamental Vs Technical-Tools of Technical Analysis – Charts Indicators and Oscillators-Dow Theory-Efficient Market Theory.	
UNIT V -PORTFOLIO ANALYSIS	**(9)**
Portfolio Analysis: Approaches in Portfolio Construction-Portfolio Theory-Markowitz Model-Portfolio Performance Evaluation – Sharpe, Treynor's and Jensen's Measure-Portfolio Revision.	
	TOTAL (L: 45) : 45 PERIODS

TEXT BOOKS:

1. Prasanna Chandra, Investment Analysis and Portfolio Management, 6th Edition, McGraw Hill Education, New Delhi, 2021.
2. Bhalla V.K., Investment Management: Security Analysis and Portfolio Management, 19thEdition,S. Chand Publishing, New Delhi,2018.
3. Punithavathy Pandian, Securities Analysis and Portfolio Management, 2nd Edition, Vikas publishing House Pvt Ltd, New Delhi,2015.

REFERENCES:

1. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage Learning, 9th edition, United States, 2014.

2. Sasidharank, Alex k. Mathews, "Security Analysis and Portfolio Management" 2nd Edition, McGraw Hill Education, New Delhi, 2015.

3.Shalini Talwar, "Security Analysis &Portfolio Management, Cengage Learning,2016.

4.http://nptel.ac.in/courses/ 110101005/downloads/Lecture%2003.pdf, Prof. Trupti Mishra, Shailesh J. Mehta School of Management, IIT, Bombay, "Basic Tools of Economic Analysis".

5.http://nptel.ac.in/courses/110101005/, Dr. Jitendra Mahakud, Department of Humanities and Social Sciences, Indian Institute of Technology, Kharagpur, "Introduction to Investment".

6.Kevin, Securities Analysis and Portfolio Management, 2nd Edition, PHI Learning, New Delhi,2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	2
CO2	3	3	2	3	3
CO3	2	3	2	3	2
CO4	3	2	2	2	2
CO5	2	3	3	2	3
CO(W.A)	**2.6**	**2.6**	**2.2**	**2.4**	**2.4**

22BAX07-MERCHANT BANKING AND FINANCIAL SERVICES				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB10

Course Objectives		Course Outcomes	
1.0	To make Students learn about the functions & regulatory framework of merchant Banking.	**1.1**	The Students will be able to gain knowledge on merchant banking services.
2.0	To learn the methods of issuing securities.	**2.1**	The Students will be familiarized with the methods and challenges in issuing securities.
3.0	To make Students understand the role of merchant banker in issuing of securities.	**3.1**	The Students will be able to acquire knowledge on role of merchant banker in issuing of securities.
4.0	To make students learn the fee based services of merchant banks.	**4.1**	The Students will be able to gain knowledge about fee based financial services.
5.0	To make students understand the novel fund based financial services.	**5.1**	The Students will be familiarized with novel fund based financial services.

UNIT I - MERCHANT BANKING	**(9)**
Introduction – An Over view of Indian Financial System – Merchant Banking in India – Functions of Merchant Bank - SEBI guidelines.	
UNIT II - ISSUE MANAGEMENT	**(9)**
Public Issue Management – Mechanism - Categories of Securities Issue - Role of Issue Manager - Marketing of New Issues - Post Issue Activities – Pricing - Laws Relating to Issue Management.	
UNIT III –ROLE OF MERCHANT BANKER	**(9)**
Role of Merchant Banker: Prospectus Preparation – Underwriting of Securities - Capital Structure Decisions - Dealing with Registrar - Brokers and Advertising Consultant.	
UNIT IV - FEE BASED SERVICES	**(9)**
Mergers and Acquisitions – Portfolio Management Services – Credit Syndication – Credit Rating – Mutual Funds.	
UNIT V - FUND BASED FINANCIAL SERVICES	**(9)**
Leasing and Hire Purchasing – Basics of Leasing and Hire purchasing – Financial Evaluation.	
TOTAL (L: 45) : 45 PERIODS	

TEXT BOOKS:

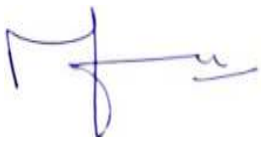
1. Machiraju H.R., "Merchant Banking", 4th Edition, New Age International, New Delhi, 2019.
2. Madhu Vij, Swati Dhawan, "Merchant Banking and Financial Services", 2nd Edition, McGraw Hill Education, New Delhi,2017.
3. Khan M.Y., "Financial Services", 10th Edition, McGraw Hill Education. New Delhi, 2019.
4. NISM, "Merchant Banking", 1st Edition, Taxmann, New Delhi, 2019.
5. Dr. Ravichandran K., "Merchant Banking and Financial Services", 2nd Edition, Himalaya Publishing, Mumbai, 2019.

REFERENCES:

1. Nalini Prava Tripathy, Financial Services, 4th Edition, PHI Learning, New Delhi 2012.
2. J.C.Verma,A Manual of Merchant Banking, Bharath Publishing House, NewDelhi.
3. Varshney P.N. & Mittal D.K., Indian Financial System, Sultan Chand & Sons, NewDelhi.
4. http://nptel.ac.in/courses/109104076/, Dr. Surajit Sinha, Department of Humanities and Social Sciences, Indian Institute of Technology, Kanpur, "Money and Banking".
5. http://nptel.ac.in/courses/110106040/module1/1_1-Structure%20of%20Banking%20Industry.pdf "Structure of Banking".

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	2	2	2	3
CO3	3	2	2	2	2
CO4	3	3	2	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.8**	**2.2**	**2.0**	**2.2**	**2.2**



22BAX08-INTERNATIONAL TRADE FINANCE					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 22BAB10					

Course Objectives		Course Outcomes	
1.0	To understand the International Trade finance concepts and basics.	**1.1**	The students will be able to understand the impact of international competitive forces on balance of payments and trade.
2.0	To Know export import finance and FOREX management	**2.1**	The students will be able to know the major models of export import finance in international trade.
3.0	To learn about FOREX Market.	**3.1**	The students will be able to determine the basic concepts in Forex Management.
4.0	To Understand the documentation involved in international trade	**4.1**	The students will be able to construct documentation involved in international trade finance.
5.0	To create awareness about the various schemes provided by government.	**5.1**	The students will be able to evaluate the export promotion schemes.

UNIT I -INTERNATIONAL TRADE	**(9)**
International Trade - Meaning and Benefits - Basis of International Trade - Barriers to International Trade - Balance of Trade - Balance of Payment - WTO - Indian EXIM Policy.	
UNIT II -EXPORT AND IMPORT FINANCE	**(9)**
Special need for Finance in International Trade - Pre shipment finance - Post shipment Finance - Financial institutions - Forfeiting.	
UNIT III - FOREX MANAGEMENT	**(9)**
Foreign Exchange Markets – Spot Prices and Forward Prices – Factors Influencing Exchange Rates – The Effects of Exchange Rates in Foreign Trade – Tools for Hedging against Exchange Rate Variability – Forward, Futures and Currency Options – FEMA.	
UNIT IV - DOCUMENTATION IN INTERNATIONAL TRADE	**(9)**
Export Trade Documents: Financial Documents – Bill of Exchange- Type- Commercial Documents -Transport Documents - Risk Covering Document- Official Document - GSPS – UPDC Norms.	
UNIT V - EXPORT PROMOTION SCHEMES	**(9)**
Government Organizations Promoting Exports – Export Incentives: Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License.	
	TOTAL (L:45) : 45 PERIODS

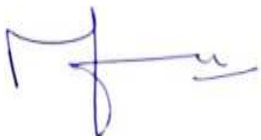
TEXT BOOKS:

1. Franchis Cherunilam, "International Marketing (Text and cases)", 16th Edition, Himalaya Publishing, Mumbai, 2019.
2. Franchis Cherunilam, "International Trade and Export Management", 21st Edition, Himalaya Publishing, Mumbai, 2019.

REFERENCES:

1. Philip R Cateora, Bruce Money, Mary C.Gilly, John Graham, "International Marketing", 18thEdition, McGraw Hill Education, New Delhi, 2019.
2. Anders Grath, "The Handbook of International Trade and Finance", 2nd Edition, Nordia Publishing Ltd, United Kingdom, 2012.
3. Eun and Resnik, "International Financial Management", 5th Edition, McGraw Hill, New Delhi, 2011.
4. Apt P.G., "International Financial Management", 3rd Edition, McGraw Hill, New Delhi, 2011.
5. Jeff Madura, "International Corporate Finance", 9th Edition, Cengage Learning, New Delhi, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	2
CO2	2	2	2	2	2
CO3	3	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.4**	**2.0**	**2.0**	**2.2**	**2.0**



22BAX09-FINANCIAL MODELLING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB10

Course Objectives		Course Outcomes	
1.0	To know about the functions of Indian capital markets & reforms.	**1.1**	The Students can be able to understand the basics & reforms in Indian capital market.
2.0	To make the students understand the differences in working capital financing.	**2.1**	The Students will able to determine & use various sources of short term finance for business.
3.0	To inculcate the knowledge on techniques involved in project Selection.	**3.1**	The Students can able to analyze the feasibility of projects based on sensitivity analysis.
4.0	To understand the flow of cash in the business.	**4.1**	The Students can able to take decisions related to financing & divided distribution in the business.
5.0	To familiarize the students with good governance practices to make them ethical budding professionals.	**5.1**	The Students will be able to apply ethical procedures in the business.

UNIT I - INTRODUCTION TO FINANCIAL MODELLING & BUILT IN FUNCTIONS USING SPREAD SHEETS	**(9)**
Introduction to Financial Modelling- Need for Financial Modelling- Steps for effective financial modelling- Time value of Money Models: EMI with Single & Two Interest rates –Loan amortisation modeling -Debenture redemption modelling	
UNIT II - BOND & EQUITY SHARE VALUATION MODELLING	**(9)**
Bond valuation – Yield to Maturity(YTM): Rate method Vs IRR method-Flexi Bond and Strip Bond YTM Modelling-Bond redemption modelling -Equity share valuation : Multiple growth rate valuation modelling with and without growth rates	
UNIT III - CORPORATE FINANCIAL MODELLING	**(9)**
Alt Man Z score Bankruptcy Modelling-Indifference point modelling – Financial Break even modelling - Corporate valuation modelling (Two stage growth)- Business Modelling for capital budgeting evaluation: Payback period ,NPV ,IRR and MIRR	
UNIT IV - PORTFOLIO MODELLING	**(9)**
Risk ,Beta and Annualised Return –Security Market Line Modelling –Portfolio risk calculation (Equal Proportions)-Portfolio risk optimisation (varying proportions)-Portfolio construction modelling	

UNIT V -DERIVATIVE MODELLING	(9)
Option pay off modelling: Long and Short Call & Put options -Option pricing modeling (B-S Model)-Optimal Hedge Contract modelling.	
TOTAL (L: 45) :45PERIODS	

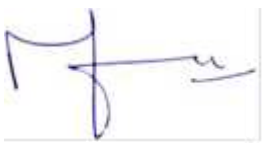
TEXT BOOKS:

1. Wayne L Winston," Microsoft Excel 2016-Data Analysis and Business Modelling ",PHI publications, (Microsoft Press),New Delhi, 2017.
2. Chandan Sen Gupta, "Financial analysis and Modelling –Using Excel and VBA" , Wiley Publishing House. 2014'

REFERENCES:

1. Craig W Holden,"Excel Modelling in Investments" Pearson Prentice Hall, Pearson Inc,New Jersey,5th Edition 2015
2. Ruzhbeh J Bodanwala , "Financial management using excel spread sheet ", Taxman Allied services Pvt Ltd, New Delhi,3rd Edition 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAX10-FINANCIAL DERIVATIVES				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB10

Course Objectives		Course Outcomes	
1.0	To Understand the basics involved in derivatives	1.1	The students can able to understand the fundamental concepts of derivatives.
2.0	To Understand the basic operational mechanisms in derivatives	2.1	The students will be able to analyze the applications of future contracts.
3.0	To Utilize options contracts for portfolio management purpose	3.1	The students can able to Illustrate the concepts of options in financial market.
4.0	To discuss the uses of SWAP in stock market.	4.1	The students will be able to demonstrate the uses and application of SWAP in stock market.
5.0	To learn about history of derivatives in India.	5.1	The students able to describe the history of derivatives in India.

UNIT I -DERIVATIVES	(9)
Derivatives – Definition – Types – Forward Contracts – Futures Contracts – Options – Swaps – Differences between Cash and Future Markets – Types of Traders – OTC and Exchange Traded Securities – Types of Settlement – Uses and Advantages of Derivatives – Risks in Derivatives.	
UNIT II - FUTURES CONTRACT	**(9)**
Specifications of Futures Contract - Margin Requirements – Marking to Market – Hedging uses Futures – Types of Futures Contracts – Securities, Stock Index Futures, Currencies and Commodities – Delivery Options.	
UNIT III - OPTIONS	**(9)**
Definition – Exchange Traded Options, OTC Options – Specifications of Options – Call and Put Options – American and European Options – Intrinsic Value and Time Value of Options – Option payoff, options on Securities, Stock Indices, Currencies and Futures – Options pricing models – Differences between future and Option contracts.	
UNIT IV -SWAPS	**(9)**
Definition of SWAP – Interest Rate SWAP – Currency SWAP – Role of Financial Intermediary – Warehousing – Valuation of Interest rate SWAPs and Currency SWAPs Bonds and FRNs – Credit Risk.	
UNIT V -DERIVATIVES IN INDIA	**(9)**
Evolution of Derivatives Market in India – Regulations - Framework – Exchange Trading in Derivatives – Commodity Futures – Contract Terminology and Specifications for Stock Options and Index Options in NSE – Contract Terminology and specifications for Stock Futures, Index Futures in NSE and Interest Rate Derivatives.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Jiří Witzany, Derivatives, Theory and Practice of Trading, Valuation, and Risk Managementm,Springer International Publishing · 2020.
2. John C. Hull, Sankarshan Basu (2016), Options, Futures and other Derivatives, 9thEdition, Pearson education.

REFERENCES:

1. Prakash Yaragol, "Financial Derivatives: Text and Cases", 1stEdition, Vikas Publishing, New Delhi, 2018.
2. Gupta S.L., "Financial Derivatives Theory, Concept and Problems", 2ndEdition, PHI Learning, New Delhi, 2017.
3. John C. Hull, SankarshanBasu, "Options Futures & Other Derivatives", 10thEdition, Pearson Education, Noida, 2018.
4. Parasuraman N.R., "Fundamentals of Financial Derivatives",3rdEdition, Wiley, New Delhi,2014.
5. Rajiv Srivastava, "Derivatives and Risk Management", 2ndEdition, Oxford University Press, New Delhi, 2014.
6. Keith Redhead, "Financial Derivatives – An Introduction to Futures, Forwards, Options and SWAPs", PHI Learning, New Delhi, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**

22BAX11 - INDUSTRIAL RELATIONS AND LABOUR LEGISLATIONS

L	T	P	C
3	0	0	3

PRE REQUISITE : 22BAB12

	Course Objectives		Course Outcomes
1.0	To explore contemporary knowledge and understanding of industrial relations.	1.1	The students will be able to know the basic concept of industrial relations and trade unions concept.
2.0	To understand appropriate conflict resolution strategy to resolve conflicts and reap the best results of group effort	2.1	The students will be able to understand the appropriate conflict resolution strategy to resolve conflicts.
3.0	To enhance knowledge on legal provisions for factory workers, wages and Bonus	3.1	The students will be able to gain knowledge on the legal provisions in industry.
4.0	To impart knowledge on management of human resources, labor legislation, employee benefits.	4.1	The students will be able to Identify the need and importance of human resources, labor legislation, and employee benefits.
5.0	To acquire knowledge on provisions of gratuity and child labor acts in industries.	5.1	The students will be able to apply the provisions of gratuity and child labor acts in industries.

UNIT I - INDUSTRIAL RELATIONS (9)

Concept - Importance - Approaches to IR- Industrial relations system in India. Trade Unions Act,1926 - Procedure for registration oftrade union- Rights and responsibilities- problems- Employee relations in IT sector.

UNIT II - INDUSTRIAL CONFLICTS AND LABOUR WELFARE (9)

The Industrial Disputes Act, 1947-Disputes – Strikes – Prevention – Industrial Peace – Government Machinery – Conciliation – Arbitration – Adjudication. Labour Welfare- Statutory Voluntary- Welfare Funds.

UNIT III - LABOUR LEGISLATIONS-I (9)

Origin and growth of labour legislation in India- Principles of labour legislations-Factories Act 1948-Minimum Wages Act, 1948- Payment of Wages Act, 1936- Payment of Bonus Act, 1965

UNIT IV - LABOUR LEGISLATIONS-II (9)

The Industrial employment (standing orders) Act, 1946- The Equal Remuneration act, Employees Provident Fund and Miscellaneous Provision act 1952, 1976- Payment of Gratuity act 1972- Employee compensation act in 2013

UNIT V - LABOUR LEGISLATIONS-III (9)

Employees' Provident fund and Miscellaneous provisions act, 1952- Employees' state insurance (ESI)Act, 1948- Maternity Benefit Act, 1961- Contract Labour Regulations and Abolition Act, 1970 -The ChildLabour Prevention and Regulation Act, 1986.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. P. Subba Rao, "Essentials of Human Resource Management and Industrial Relations" – 1 January 2021
2. N. D. Kapoor, "Elements of Mercantile Law" – 8 July 2022
3. Gupta Parul, "Industrial Relations and Labour Laws for Managers", 1st Edition, Sage Publications, New Delhi, 2019.
4. PiyaliGhosh, ShefaliNandan, "Industrial Relations and Labour Laws ", 1st Edition, McGraw Hill Education, New Delhi, 2017.
5. Mamoria C.B. and Sathish Mamoria, Dynamics of Industrial Relations, Himalaya Publishing House, New Delhi, 2016.

REFERENCES:

1. Sivarethinamohan R., "Industrial Relations and Labour Welfare" 3rd revised Edition, PHI Learning, New Delhi, 2018.
2. Venkataratnam C.S., Manoranjan Dhal, "Industrial Relations", 2nd Edition, Oxford University Press, New Delhi, 2019.
3. Dwivedi R.S., "Human Relations and Organizational Behaviour", 5th Edition, Macmillan Publishers, New Delhi, 2016.
4. ArunMonappa, RanjeetNambudiri, PatturajaSelvaraj. Industrial relations &Labour Laws. TataMcGraw Hill. 2012
5. P.R.N Sinha, InduBalaSinha, SeemaPriyardarshiniShekhar. Industrial Relations, Trade Unionsand Labour Legislation. Pearson. 2017
6. Tax Mann, Labour Laws, 2018.
7. Srivastava, Industrial Relations and Labour laws, Vikas, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	2	2
CO2	3	2	2	2	3
CO3	3	3	2	3	2
CO4	3	3	3	3	3
CO5	2	2	3	2	2
CO(W.A)	**2.6**	**2.4**	**2.6**	**2.4**	**2.4**

22BAX12 - TRAINING AND DEVELOPMENT

L	T	P	C
3	0	0	3

PRE REQUISITE :22BAB12

	Course Objectives		Course Outcomes
1.0	To provide knowledge about Training and Development to employees and its implications.	**1.1**	The students will be able to understand the knowledge about Training and Development andits implications.
2.0	To enhance the training, organizational and operation analysis and the methods and techniques used for assessment.	**2.1**	The students will be able to know the training need analysis concepts and assessment methods.
3.0	To enrich the training design and the factors affecting training design, budgeting and learning concepts.	**3.1**	The students will be able to identify the training design and the factors affecting training design, budgeting and learning concepts.
4.0	To familiarize with the training needs, identification of training needs, training processes, training methods, and evaluation of training	**4.1**	The students will be able to identify the training needs, process, methods of training and the evaluation.
5.0	To understand the process of management development and the managers learn and improve their skills & knowledge.	**5.1**	The students will be able to furnish the concepts and approaches of management development and to and improve their skills & knowledge.

UNIT I-Concepts of Training **(9)**

Training Objective and concepts of Training- Scope of Training- Training and HRD- How Training Benefits the Organization- Current and Future Trends in Training.

UNIT II-Training needs Analysis **(9)**

Analysis of Training Needs- Organizational Analysis: Task, Person Requirement Analysis- Methods and Techniques of Training Need Assessment- Training need Analysis and Process- Operational Analysis/ Job analysis.

UNIT III- Training Design **(9)**

Training Design- Prime Considerations while designing a Training Programme- Factors affecting Training Design- Budgeting for Training- Identification of Evaluation objectives & Needs- Establishing and identifying Training Objectives.

UNIT IV Effective Implementation Evaluation **(9)**

Training Process and Methods- Designing the Training Programme- Training Implementation Training Policy and Plan- Types of Evaluation Instruments- Evaluation Design& Techniques- Training Audit Suggestions for Making Training Effective.

UNIT V Management Development **(9)**

Management Development- The need & importance of management development- Approach to management development- Sources of knowledge and skills- Special needs of Technical Managers- Strategies to develop Technical Managers.

TOTAL (L:45) :45 PERIODS

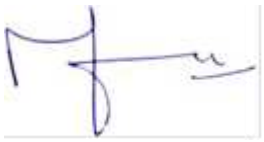
TEXT BOOKS:

1. Raymond A. Noe,Amitabh Deo Kodwani**,** "Employee Training and Development (SIE)" – 21 July 2018, 7th edition, McGraw Hill.
2. Alan M. Saks, Robert R. Haccoun, (2022), Managing Performance through Training and development, 8th edition, Cengage Learning

REFERENCES:

1. Armstrong Michael, (2020), Human Resource Management Practice,16th edition, Kogen page.
2. Morgan King, Weisz Schopler, (2022), Introduction to Psychology, Tata McGraw Hill.
3. Antonette Asumptha J, A Guru murugan, M collin joseph xavier (2020), Notion Press
4. Lynton Rolf, Pareek Udai, (2011), Training for Development, 3rd edition, Sage Publications, New Delhi
5. Dr.B.Janakiram, Training & Development, Biztantra, 2008.
6. R.K.Sahull, Training for Development, Excel books, 2005.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	2
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	2	3	3	3	3
CO5	3	2	3	2	2
CO(W.A)	**2.8**	**2.8**	**2.4**	**2.6**	**2.6**



22BAX13 – ORGANISATIONAL DESIGN, CHANGE AND DEVELOPMENT

L	T	P	C
3	0	0	3

PRE-REQUISITE: 22BAB12

	Course Objectives		Course Outcomes
1.0	To help the students to gain knowledge about the concepts, challenges, impact of organizational design.	**1.1**	The students will be able to Know about the fundamentals of organizational design, challenges and the impact on design.
2.0	To familiarize the students about Organizational change, types, techniques and change resistant concepts and the job redesign.	**2.1**	The Students will be able to understand the Organizational Change, process, types, and models of change in organizations
3.0	To understand the concept and techniques of OD and to enable the skills for the application of OD in organizations.	**3.1**	The Students will be able to know about the foundations, process and techniques for Organizational Development.
4.0	To inculcate OD interventions to manage and solve various organizational issues, to build efficient team and encourage Inter group development.	**4.1**	The Students will be able to manage and analyze various organizational issues, to build efficient team and encourage Inter group development.
5.0	To make students understand the Organizational learning and decision making.	**5.1**	The Students will be able to understand Organization evolution, sustenance and HR implications.

UNIT I ORGANIZATIONAL DESIGN (9)

Organizational Design – Determinants – Components –Differentiation, Integration, Centralization, Decentralization, Standardization, Mutual adjustment - Technological and Environmental Impacts on Design- Importance of Design –Success and Failures in design.

UNIT II ORGANIZATIONAL CHANGE (9)

Meaning, Nature, Forces for change- Resistance to Change -Types and forms of change Models of change- Strategy for Organizing Change-Organizational Culture and Change. Resistance to change – individual factors – organizational factors – techniques to overcome change- job redesign.

UNIT III ORGANIZATIONAL DEVELOPMENT (9)

Introduction- evolution- basic values and assumptions- foundations of OD- Process of OD- Organizational Diagnosis-Process-stages- Techniques-Questionnaire, interview, workshop, task-force- collecting, analyzing- feedback of diagnostic information.

UNIT IV OD INTERVENTION (9)

Human process interventions-Individual, group and inter-group human relations- structure and technological interventions- strategy interventions – sensitivity training – survey feedback, process consultation – team building – inter-group development.

UNIT V ORGANIZATIONAL EVOLUTION AND SUSTENANCE (9)

Organizational life cycle – Models of transformation – Models of Organizational Decision making – Organizational Learning – Innovation, Intrapreneurship and Creativity-HR implications.

TOTAL (L:45):45 PERIODS

TEXT BOOKS:

1. Thomas G. Cummings, Christopher G. Woreley, "Theory of Organizational Development and Change", 10th Edition, Generic, New Delhi, 2021.
2. Ratan Raina, "Change Management and Organizational Development", 1st Edition, Sage Publications, New Delhi, 2019.
3. Wendell L. French, Cecil H. Bell, "Organization Development: Behavioral Science Interventions for Organizational Improvement", 6th Edition, Pearson Education, Noida, 2017.

REFERENCES:

1. Ian Palmer, Richard Dunford, Gib Akin, "Managing Organizational Change: A Multiple Perspective Approach", 3rd Edition, McGraw Hill Education, New Delhi, 2016.
2. Susan Bridges, William Bridges, "Managing Transitions", 4th Edition, Da Capo Lifelong Books, Lebanon, 2017.
3. French & Bell: Organisational Development, McGraw-Hill, 2005
4. Rajiv Shaw: Surviving Tomorrow: Turnaround Strategies In Organisational Design And Development, Vikas Publishing House.
5. Thomas G. Cummings, Christopher G. Worley: Organisation Development And Change, Thomson Learning.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	3
CO2	2	2	2	2	3
CO3	3	3	3	3	3
CO4	2	2	3	3	2
CO5	3	3	2	2	2
CO(W.A)	**2.4**	**2.4**	**2.4**	**2.4**	**2.6**

22BAX14 - HR METRICS AND ANALYTICS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB12

Course Objectives		Course Outcomes	
1.0	To understand the fundamental analytical approaches used by HR Professionals to solve real business problems.	**1.1**	The students will be able to Facilitate the different analytical approaches of the organization to solve problems.
2.0	To enhance the knowledge in talent acquisition, Onboard metrics, Measures, Metrics, KPIs, Performance Management and Basics of Enterprise Reporting	**2.1**	The students will be able to understand the process of talent acquisition, Recruitment KPI, on boarding metrics, Cultural fit and Stages.
3.0	To learn about the tools available for HR analytics, operational issues, and the organizational strategies.	**3.1**	The students will be able to know the toolkits for HR analytics, operations issues in organization and predictive analysis.
4.0	To impart knowledge on human value chain, BSC, ROI and prediction in HR activities.	**4.1**	The students will be able to know about human value chain, BSC, ROI and prediction in HR activities
5.0	To enhance better decision-making ability for hiring, firing employees, resource utilization, big Data, and people analysis.	**5.1**	The students will be able to gain knowledge on people analysis, data privacy and big data.

UNIT I: INTRODUCTION TO HR ANALYTICS AND PERSPECTIVE	**(9)**
Understanding HR Analytics characteristics, the strategic focus and problems facing of HR analytics -HR analytics process and application of analytical techniques to evaluate Human capital impact on business.	
UNIT II: TALENT ACQUISITION AND DATA CHALLENGES	**(9)**
Talent Acquisition: Pre-interview Assessment Criteria – On boarding and Cultural fit - Stages, OPEN Analytical Framework for Effective on boarding. Data and Metrics – to identify and obtain quality HR data - the purpose & efficiency of metrics – creating HR metrics and link to KPIs- transform strategic goals to HR metrics.	
UNIT III: TOOL KITS FOR RESOLVING OPERATIONAL ISSUES	**(9)**
Tool kits available in market - Identify and resolve operational issues in order to develop and align HR metrics with organizational strategy.	
UNIT IV: ANALYTICS AND THE ORGANISATION AS A SYSTEM	**(9)**
Analytics – Human Capital in the Value Chain- Balance Score card – ROI – Predictive Analytics.	

UNIT V: LEVERAGING PEOPLE ANALYTICS & BIG DATA AND PEOPLE ANALYTICS EFFECTIVENESS	(9)

Leveraging People Analytics: Future of People Analytics - Rise of Employee Behavioral Data - People Analytics as a Specialized Department - Employee Data Privacy Backlash. Big Data and People Analytics: Big Data and People Analytics.

TEXT BOOKS:

1. Rama Shankar Yadav, Sunil Maheshwari "HR Analytics", Wiley,2020.
2. Martin R. Edwards, Kirsten Edwards, "Predictive HR Analytics: Mastering the HR Metric", 2nd Edition, Kogan Page, UK, 2018.
3. Dipak Kumar Bhattacharyya, "HR Analytics-Understanding Theories and Applications" 2nd Edition, Sage Publications, New Delhi, 2017.
4. Jean Paul Isson, Jesse S. Harriott , "People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop, and Retain Talent", 1st Edition, Wiley, New Delhi, 2016.

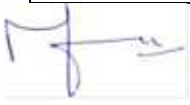
REFERENCES:

1. John Boudreau, Wayne Cascio, "Investing in People: Financial Impact of Human Resource Initiatives", 3rd Edition, Pearson Education, Noida, 2019.
2. Bernard Marr, "Data-Driven HR: How to Use Analytics and Metrics to Drive Performance", 1st Edition, Kogan Page, UK, 2018.
3. Edwards, M. R., & Edwards, K. (2016). Predictive HR Analytics: Mastering the HR Metric. London: Kogan Page.
4. Sesil, J. C. (2014). Applying advanced analytics to HR management decisions: Methods for selection, developing incentives, and improving collaboration. Upper Saddle River, New Jersey: Pearson Education .

TOTAL (L: 45) : 45 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	2	2	3
CO3	2	3	3	3	3
CO4	3	2	3	3	3
CO5	2	2	3	3	2
CO(W.A)	**2.4**	**2.4**	**2.6**	**2.6**	**2.6**



22BAX15 - STRATEGIC HUMAN RESOURCE MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITE: 22BAB12

Course Objectives		Course Outcomes	
1.0	To learn the basic concepts, process, challenges, and organizational capability of strategic HRM.	1.1	The students will be able to know the fundamental concepts, HR practices, challenges, and organizational capability of strategic HRM.
2.0	To familiarize in dealing all areas of Human Resources Management in a strategic way like Human Resources Planning, design, redesigns and strategy implementation.	2.1	The students will be able to know the **HR planning** strategies, labor **markets,**work systems and organizational culture.
3.0	To know about the SHRM Measurements, planning, acquisition, staffing and Motivation of human resources.	3.1	The students will be able to comprehend the need for different HRM practices in alignment with different business strategies while implementation.
4.0	To know about the employee career development, Strategic Pay and Employee Relations.	4.1	The students will be able to know the career management concepts and the employee enrichments.
5.0	To make the students to differentiate the General Strategic HRM from global strategic HRM.	5.1	The students will be able to assess ethical, environmental and sustainability ,considerations in SHRM for effective decision-making and practice.

UNIT I: Introduction to Strategic HRM **(9)**

Strategic HRM and Corporate strategies- Integrating HR strategies with business strategies –Challenges in HRM- Analyzing HR Practices followed by different firms -Human Resource System.

UNIT II: Human Resource Planning and Strategy **(9)**

Human Resource Planning - Design and redesign of work systems - Organizational culture.

HR Strategies- Performance management strategies-reward and compensation- retrenchment

UNIT III: Implementation of SHRM **(9)**

SHRM Measurement – Challenges -HR as a Strategic Partner. Process based approach. Strategic HR Planning Acquisition and Development. HRM Motivation of human resources – Staffing - Performance management and feedback.

UNIT IV: CAREER & COMPETENCY DEVELOPMENT **(9)**

Career Concepts – Roles – Career stages – Career planning and Process – Career development Models– Career Motivation and Enrichment –Designing Effective Career Development Systems – Competencies and Career Management – Competency Mapping Models.

UNIT V: Strategies in Global Environment **(9)**

Global Human Resources Management- Recruitment - Retention strategies - Training and Development strategies. Corporate Strategy and Career Systems. Corporate Ethics and Values- Evaluating the Effectiveness of SHRM.

TOTAL (L: 45) : 45 PERIODS

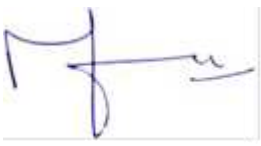
TEXT BOOKS:

1. Jeffrey A. Mello , "Strategic Management Of Human Resources " , Cengage Learning, 4th Edition, 2021.
2. Ekta Sharma, "Strategic Human Resource Management and Development", 1st Edition, Pearson Education, Noida, 2019.

REFERENCES:

1. Feza Tabassum Azmi, "Strategic Human Resource Management", 1st Edition, Cambridge University Press, New York, 2019.
2. Mathur, SP, "Strategic Human Resource Management", New Age International (P) Ltd Publishers,1stEdition, 2015.
3. Luis R. Gomez-Mejia, David B. Balkin, Robert L. Cardy, "Managing Human Resources", 8th Edition, PHI Learning, New Delhi, 2015.
4. Paul Boselie, "Strategic Human Resource Management", 1st Edition, McGraw Hill Education, New Delhi, 2011.
5. Nirmalya Bagchi, Bagchi Nirmalya, Management Information Systems,Vikas Publishing House Pvt Limited,2010
6. O'Brien Management Information System Tata McGraw Hill 2009.
7. K.Prasad , "Strategic Human Resource Management Text and Cases", Macmillan India Ltd., 2008.
8. Robert Schultheis and Mary Summer, Management Information Systems –TheManagers View, Tata McGraw Hill, 2008.
9. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Managing thedigital firm, PHI Learning / Pearson Education, PHI, Asia, 2002.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	2
CO2	3	2	3	2	3
CO3	2	3	2	3	3
CO4	2	3	3	3	3
CO5	3	2	2	3	2
CO(W.A)	**2.6**	**2.6**	**2.4**	**2.6**	**2.6**



22BAX16-DEEP LEARNING AND ARTIFICIAL INTELLIGANCE

L	T	P	C
3	0	0	3

PRE-REQUISITE: 22BAB04

	Course Objectives		Course Outcomes
1.0	To understand the Deep Networks, Modern Practices and Deep forward networks.	**1.0**	Students will able to understand the Deep Networks, Modern Practices and Deep forward networks.
2.0	To understand the importance of Training Deep Models and How Learning Differs from Pure Optimization.	**2.0**	Students will able to apply suitable algorithm for the specified applications understand different Basic Algorithms, Optimization Strategies and Meta- Algorithms.
3.0	To understand Artificial Intelligence and Problem Solving techniques.	**3.0**	Students will able to Learn the basics of Artificial Intelligence and Problem Solving techniques.
4.0	To be aware of Advanced Problem-Solving Paradigm and Knowledge Representation.	**4.0**	Students will able to understand Advanced Problem-Solving Paradigm and Knowledge Representation.
5.0	To know about the Expert Systems and Applications	**5.0**	Students will able to understand the Expert Systems and Applications

UNIT I –DEEP NETWORKS	**(9)**
Deep Networks: Modern Practices: Deep Forward Networks: Example: Learning XOR - Gradient-Based Learning - Hidden Units - Architecture Design - Regularization for Deep Learning.	
UNIT II -MODELS	**(9)**
Optimization for Training Deep Models: How Learning Differs from Pure Optimization - Challenges in Neural Network Optimization - Basic Algorithms - Parameter Initialization Strategies - Algorithms with Adaptive Learning Rates - Approximate Second-Order Methods - Optimization Strategies and Meta-Algorithms	
UNIT III -INTELLIGENT SYSTEMS	**(9)**
Introduction to Artificial Intelligence: Intelligent Systems - Foundations of AI - Applications - Tic-Tac-Toe Game Playing - Problem Solving: State-Space Search and Control Strategies: Introduction - General Problem Solving - Exhaustive Searches - Heuristic Search Techniques.	
UNIT IV - KNOWLEDGE REPRESENTATION	**(9)**
Advanced Problem-Solving Paradigm: Planning: Introduction - Types of Planning Systems - Knowledge Representation: Introduction - Approaches to Knowledge Representation - Knowledge Representation using Semantic Network - Knowledge Representation using Frames	
UNIT V - APPLICATIONS	**(9)**
Expert Systems and Applications: Blackboard Systems - Truth Maintenance Systems - Applications of Expert Systems - Machine-Learning Paradigms: Machine-Learning Systems - Supervised and Unsupervised Learnings.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

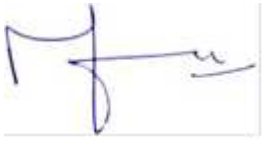
1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Li Deng and Dong Yu, "Deep Learning Methods and Applications", Foundations and Trends in Signal Processing.

REFERENCES:

1. YoshuaBengio, "Learning Deep Architectures for AI", Foundations and Trends in Machine Learning.
2. SarojKaushik, "Artificial Intelligence", Cengage Learning India Pvt. Ltd.
3. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education(India) Private Limited, NewDelhi.
4. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence" Third Edition, McGraw Hill, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	2	2	2	2	3
CO3	2	2	2	3	2
CO4	2	2	2	2	2
CO5	3	2	2	2	3
CO(W.A)	2.4	2	2.2	2.2	2.6



22BAX17-e-BUSINESS MANAGEMENT					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: 22BAB04					
Course Objectives		**Course Outcomes**			
1.0	To understand the practices and technology to start an online business	**1.0**	Students will be able to build and manage an e-business.		
2.0	To refer aspects of online customer acquisition, conversation or experience and Retention	**2.0**	Students will be able to Knowledge about Technology Infrastructure		
3.0	To develop key business strategy and industry issues and goals	**3.0**	Students will be able to of customer-oriented business applications		
4.0	To Link through to objectives and strategies to achieve them through high level goals	**4.0**	Students will be able to Knowledge of e business payment protocols and security		
5.0	To communicate the goals and significance of an e-business initiate to employees and partners.	**5.0**	Students will be able to understanding of ethical, legal, privacy issues and encryption policies		

UNIT I –INTRODUCTION	**(9)**
E Business, e-business vs e-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce, S-commerce	
UNIT II - TECHNOLOGY INFRASTRUCTURE	**(9)**
Internet and World Wide Web, internet protocols - FTP, intranet and extranet, information publishing technology- basics of web server hardware and software.	
UNIT III - BUSINESS APPLICATIONS	**(9)**
Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, e- governance, EDI on the internet, Delivery management system– social media marketing.	
UNIT IV - e-BUSINESS PAYMENTS AND SECURITY	**(9)**
E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – cryptography – security protocols – network security.	
UNIT V -LEGAL AND PRIVACY ISSUES	**(9)**
Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1.Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers,Pearson, 2011.

2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, Electronic Commerce – A managerial perspective, Pearson Education Asia, 2010.

3. Parag Kulkarni, Sunita Jahirabadkao, Pradeep Chande, e business, Oxford University Press, 2012.

4. Hentry Chan & el , E-Commerce – fundamentals and Applications, Wiley India Pvt Ltd, 2007.

REFERENCES:

1.Gary P. Schneider, Electronic commerce, Thomson course technology, Fourth annual edition, 2007

2. Bharat Bhasker, Electronic Commerce – Frame work technologies and Applications, 3rdEdition. Tata McGrawHill Publications, 2009

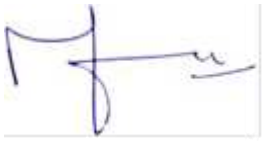
3.Kamlesh K.Bajaj and Debjani Nag, Ecommerce- the cutting edge of Business,Tata McGrawHill Publications, 7th reprint, 2009.

4. Kalakota et al, Frontiers of Electronic Commerce, Addison Wesley, 2004

5.Micheal Papaloelon and Peter Robert, e-business, Wiley India, 2006.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	2	3
CO2	2	2	2	2	2
CO3	2	2	3	2	2
CO4	3	2	2	3	3
CO5	3	2	2	2	3
CO(W.A)	2.2	2	2.4	2.2	2.6



22BAX18-ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

PRE REQUISITE : 22BAB04

	Course Objectives		Course Outcomes
1.0	To exhibit the theoretical aspects of Enterprise Resource Planning.	1.1	Students will be able to understand the ERP practices in the business.
2.0	To learn about the ERP softwares and its applications.	2.1	Students will be able to get Knowledge, ERP solutions and functional modules
3.0	To provide practical implication on ERP Suite implementation	3.1	Students will be able get Exposure to the implementation environment.
4.0	To learn the post impact of ERP Implementation.	4.1	Students will be able to understanding of post implementational impact and maintenance of ERP
5.0	To learn the emerging trends on ERP	5.1	Students will be able to know emerging trends on ERP

UNIT I – INTRODUCTION	**(8)**
Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology -warehouse management– case studies.	
UNIT II – ERP SOLUTIONS AND FUNCTIONAL MODULES	**(10)**
Overview of ERP software solutions, BPR, Project management, Functional modules-Organizationaldata, master data and document flow– case studies.	
UNIT III - ERP IMPLEMENTATION	**(10)**
Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation,Methodology and Frame work- Training – Data Migration. People Organization in implementation, Consultants, Vendors and Employees– case studies.	
UNIT IV - POST IMPLEMENTATION	**(8)**
Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation– case studies.	
UNIT V - EMERGING TRENDS ON ERP	**(9)**
Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics- Future trends in ERPsystems-web enabled, Wireless technologies, cloud computing and Augmented reality– case studies.	
TOTAL (L: 45) : 45 PERIODS	

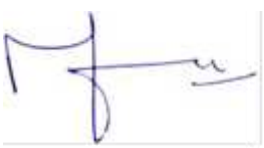
TEXT BOOKS:

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.
2. Alexis Leon, Enterprise Resource Planning, third edition, Tata McGraw-Hill, 2014.
3. Vinod Kumar Garg and NK Venkita Krishnan. (2011), Text Book of Enterprise Resource Planning – Concepts and Practice, PHI., New Delhi.
4. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012

REFERENCES:

1. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
2. Mahadeo Jaiswal and Ganesh Vanapalli, first edition,ERP Macmillan India, 2013
3. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, second edition Prentice Hall of India, 2009.
4. Summer, ERP, Pearson Education, 2016
5. K Ganesh and Sanjay Mohapatra, etl. (2014), Text Book of Enterprise Resource Planning – Fundamentals of Design and Implementation, Springer., London

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	2
CO2	3	3	2	3	3
CO3	2	2	3	2	2
CO4	2	2	2	2	3
CO5	3	2	3	2	2
CO(W.A)	**2.6**	**2.2**	**2.4**	**2.2**	**2.4**



22BAX19 - DATA MINING FOR BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITE: 22BAB04

	Course Objectives		Course Outcomes
1.0	To learn the basics of data mining.	**1.1**	Students will be able understand the concept of data mining in the business
2.0	To learn the methods of storing huge amount of data	**2.1**	Students will be able to design data warehouse.
3.0	To study the tools and techniques involved in data mining.	**3.1**	Students will be able to apply the knowledge on data mining in the business.
4.0	To learn the new technology and its opportunities in the business.	**4.1**	Students will be able to understand the recent trends in IT and its opportunities.
5.0	To learn the application part of Business intelligence.	**5.1**	Students will be able to apply BI in their field.

UNIT I - INTRODUCTION	**(5)**
Data mining, Text mining, Web mining, Spatial mining, Process mining, BI process- Private and Public intelligence, Strategic assessment of implementing BI	
UNIT II –DATA WAREHOUSE	**(12)**
Data ware house – characteristics and view - OLTP and OLAP - Design and development of data warehouse, Meta data models, Extract/ Transform / Load (ETL) design	
UNIT III - DATA MINING TOOLS, METHODS AND TECHNIQUES	**(9)**
Regression and correlation; Classification- Decision trees; clustering –Neural networks; Market basket analysis, Association Rules-Genetic algorithms and link analysis, Support Vector Machine, Ant Colony Optimization	
UNIT IV -MODERN INFORMATION TECHNOLOGY AND ITS BUSINESS OPPORTUNITIES	**(9)**
Business intelligence software, BI on web, Ethical and legal limits, Industrial espionage, modern techniques of crypto analysis, managing and organizing for an effective BI Team.	
UNIT V - BI AND DATA MINING APPLICATIONS	**(9)**
Applications in various sectors – Retailing, CRM, Banking, Stock Pricing, Production, Crime, Genetics, Medical, Pharmaceutical.	
TOTAL (L: 45) : 45 PERIODS	

TEXT BOOKS:

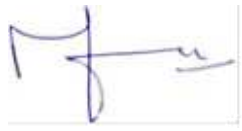
1. G. K. Gupta, Ïntroduction to Data mining with Case Studies, Prentice hall of India, 2011.
2. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011.
3. Elizabeth Vitt, Michael LuckevichStaciaMisner, Business Intelligence, Microsoft, 2011

REFERENCES:

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3. Galit Shmueli, Peter C Bruce, Inbal Yahav, Nitin R Patel, Kanneth C Lichtendahl Jr., "Data Mining for Business Analytics: Concepts, Techniques, and Applications in R", 1st Edition, Wiley India, New Delhi, 2017.
4. Daniel T. Larose and Chantal D. Larose, "Data Mining and Predictive Analytics", 2nd Edition, Wiley, 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	2	3	2
CO4	3	3	2	2	2
CO5	2	2	3	3	3
CO(W.A)	**2.4**	**2.4**	**2.4**	**2.6**	**2.4**



22BAX20 – SOCIAL MEDIA WEB ANALYTICS				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE: 22BAB04

Course Objectives		Course Outcomes	
1.0	To showcase the opportunities that exist today to leverage the power of the web and social media	**1.0**	The Students will be able to understand opportunities that exist today to leverage the power of the web and social media
2.0	To make them understand science of Social Media for community building and management.	**2.0**	The Students will be able to identify and understand for community building and management.
3.0	To get an idea of social media policies.	**3.0**	The Students will be able to Learn and get an idea of social media policies and Tracking Social Media
4.0	To understand the fundamentals and concepts of web analytics.	**4.0**	The Students will be able to understand the fundamentals and concepts of web analytics.
5.0	To know about How to effectively use the resulting insights to support website design decisions, campaign optimisation, search analytics, etc.	**5.0**	The Students will be able to understand How to effectively use the resulting insights to support website design decisions, campaign optimisation, search analytics, etc.

UNIT I –INTRODUCTION	**(9)**
Evolution of online communities - Social Media Audience and Goals for using Social Media - Understanding Social Media: Strong and weak ties – Influencers - How ideas travel – Viralness - technological determinism in popular discourse on social media technologies.	
UNIT II -COMMUNITY BUILDING AND MANAGEMENT	**(9)**
Science of Social Media - Promoting Social Media Pages- Linking Social Media Accounts-Digital PR- Identity in social media: formation of identities, communities, activist movements, and consumer markets - Social Media as business	
UNIT III -SOCIAL MEDIA POLICIES AND MEASUREMENTS	**(9)**
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The road ahead in social media- The Basics of Tracking Social Media - social media analytics- Insights Gained From Social Media- Customized Campaign Performance Reports - Observations of social media use.	
UNIT IV - WEB ANALYTICS	**(9)**
Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.	

UNIT V - SEARCH ANALYTICS	(9)
Search engine optimization (SEO), non-linear media consumption, user engagement, user generated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1.K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013

2.Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014

3.TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

REFERENCES:

1. Bittu Kumar, Social Networking, V & S Publishers, 2013

2. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007

3. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and Café Press, 2004

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	2	3
CO2	2	3	2	2	2
CO3	2	3	2	3	2
CO4	2	2	3	2	3
CO5	3	2	3	2	3
CO(W.A)	**2.4**	**2.4**	**2.6**	**2.2**	**2.6**

22BAX21-LOGISTICS AND SUPPLY CHAIN MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB09

Course Objectives		Course Outcomes	
1.0	To impart the supply chain and logistics fundamentals.	**1.1**	The Students will be able to understand the supply chain and logistics fundamentals.
2.0	To determine the supply chain networks and performance.	**2.1**	The Students will be able to design supply chain networks to enhance supply chain performance.
3.0	To inculcate demand based on inventory and warehousing.	**3.1**	The Students will be able to plan demand based on inventory and warehousing.
4.0	To identify both domestic, International transportation and Packaging methods and problems	**4.1**	The Students will be able to evaluate the both domestic and international transportation problems and effectively develop and present actionable Solutions.
5.0	To gain knowledge and develop skills in logistics and supply chain management control and its environment .	**5.1**	The Students will be able to understand the logistics and supply chain management, organizational structure knowledge, and control techniques.

UNIT-I Introduction to Logistics and SC management	**(9)**
Business logistics and supply chain – importance, objectives and drivers. Strategy – planning, selecting proper channel, performance measurement. Outsourcing- Make vs buy approach.	
UNIT-II MANAGING FLOWS	**(9)**
Planning Networks – Decision making under risk – Decision trees – Decision making under uncertainty. Distribution Network Design – Role - Factors Influencing Options, Value Addition. Logistics information system - Role of IT – Framework for IT adoption.	
UNIT-III INVENTORY AND WAREHOUSING	**(9)**
Demand Forecasting in a Supply Chain, Aggregate Planning in a Supply Chain-Sales and Operations Planning: Planning Supply and Demand in a Supply Chain- Coordination in a Supply Chain.	
UNIT-IV TRANSPORTATION AND PACKAGING	**(9)**
Transportation – Drivers, Modes, Measures - Strategies for Transportation, 3PL and 4PL, Vehicle Routing and scheduling. Packaging- Design considerations, Material and Cost. Packaging as Unitisation. Consumer and Industrial Packaging.	
UNIT-V ORGANISATION AND CONTROL	**(9)**
Organisation Structure – need and development. Organizational – Choices, Orientation and positioning. Interfunctional and interorganisational management – alliances and partnerships. Control– Process framework, system details, information, measurement and interpretation.	
TOTAL (L: 45) : 45 PERIODS	

TEXT BOOKS:

1. Rajat K. Baisya, "Integrated Supply Chain and Logistics Management", 1st Edition, Sage Publications, New Delhi, 2019.
2. Sunil Chopra and Peter Meindl, "Supply Chain Management – Strategy, Planning and Operation", 6 th Edition, Pearson Education, New Delhi, 2015.

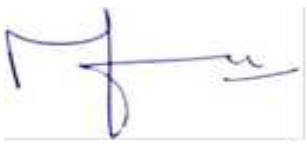
3.Janat Shah, "Supply Chain Management – Text and Cases", 9th Edition, Pearson Education, New Delhi, 2009.

REFERENCES:

1. Janat Shah, "Supply Chain Management: Text and Cases", 2nd Edition, Pearson Education, Noida, 2016.
2. Sunil Chopra, "Supply Chain Management – Strategy, Planning and Operation", 7th Edition, Pearson Education, Noida, 2018.
3. John J. Coyle, "Supply Chain Management: A Logistics Perspective", 10th Edition, Cengage Learning, New Delhi, 2019.
4. Donald W. Dobler, "Supply Chain Logistics Management", 4th Edition, McGraw Hill Education, New Delhi, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	2	2	2
CO3	3	2	2	2	2
CO4	2	3	2	2	2
CO5	3	2	2	2	2
CO(W.A)	2.8	2.4	2.0	2.0	2.0



22BAX22-SERVICES OPERATIONS MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITE :22BAB09

	Course Objectives		Course Outcomes
1.0	To understand how service performance can be improved by studying services operations management.	**1.1**	The students will be able to Understand how service performance can be improved by studying services operations management.
2.0	To understand techniques of location and facility planning; line balancing; job designing; and capacity plan in operations management.	**2.1**	The students will be able to Identify the elements of services operations management and various transformation processes to enhance productivity and competitiveness.
3.0	To understand the concept of Service quality.	**3.1**	The students will be able to gain knowledge on Service quality.
4.0	To learn about Service facility design and facility location and to know about facility location techniques.	**4.1**	The students will be able to Acquire knowledge on tools and techniques for various facility alternatives and decisions for business performance.
5.0	To understand the Materials Management function starting from Demand Management through Inventory Management.	**5.1**	The students will be able to Identify the Demand management in service and to formulate inventories.

UNIT I: INTRODUCTION **(9)**

Services – Importance, role in economy, service sector – growth; Nature of services -Service classification, Service Package, distinctive characteristics, open-systems view; Service Strategy – Strategic service vision, competitive environment, generic strategies, winning customers.

UNIT II: SERVICE DESIGN **(9)**

New Service Development – Design elements – Service Blue-printing - process structure - Service Encounter – triad, creating service orientation, service profit chain; Front-office Back-office Interface– service decoupling. Technology in services – self-service, automation, e-commerce, e-business, technology innovations.

UNIT III: SERVICE QUALITY **(9)**

Service Quality- Dimensions, Service Quality Gap Model; Measuring Service Quality –SERVQUAL, Walk-through Audit, Quality service by design , Service Recovery, Service Guarantees. Process Improvement – productivity improvement - DEA, quality tools, benchmarking.

UNIT IV: SERVICE FACILITY **(9)**

Supporting facility -Service scapes, Facility design – nature, objectives, process analysis, Service facility layout. Service Facility Location – considerations, facility location techniques – metropolitan metric, Euclidean, centre of gravity, retail outlet location, location set covering problem. Vehicle routing and Scheduling.

UNIT V: MANAGING CAPACITY AND DEMAND **(9)**

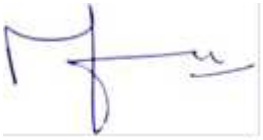
Managing Demand – strategies; Managing capacity – basic strategies, supply management tactics, operations planning and control; Yield management; Inventory Management in Services– Retail Discounting Model, Newsvendor Model, Managing for growth- expansion strategies, franchising, globalization.

TOTAL (L: 45): 45 PERIODS

TEXT BOOK:
1. James A. Fitzsimmons, Mona J, Fitzsimmons, Sanjeev Bordoloi, Service Management – Operations, Strategy, Information Technology,McGraw-Hill Education – 8th Edition 2018.

REFERENCES:
1. Richard D. Metters, Successful Service Operations Management, Cengage Learning, 2nd Edition, 2012.
2. CengizHaksever, Barry Render, Service Management, Pearson Education, 2013.
3. Robert Johnston, Graham Clark, Service Operations Management, Pearson Education, 2ndEdition, 2005.
4. Bill Hollins and Sadie Shinkins, Managing Service Operations, Sage, 2006.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	3	2
CO2	3	2	2	2	2
CO3	3	2	3	3	2
CO4	2	2	2	2	2
CO5	2	2	2	3	2
CO(W.A)	**2.6**	**2**	**2.4**	**2.6**	**2**



22BAX23-PROJECT MANAGEMENT					
		L	**T**	**P**	**C**
		3	**0**	**0**	3
PRE REQUISITE : 22BAB09					
Course Objectives		**Course Outcomes**			
1.0	To learn the concepts of managing Projects.	**1.1**	The students will be able to Apply project management principles in business situations		
2.0	To gain knowledge on allocating resources and optimizing time.	**2.1**	The students will be able to Analyse scheduling and resource allocation describe project evaluation.		
3.0	To understand the roles and responsibilities on project manager.	**3.1**	The students will be able to Identify the role and the importance of project manager in the organization		
4.0	To understand the concept of scheduling and allocating resources.	**4.1**	The students will be able to Analyze scheduling and resource allocation and risk associated with the project.		
5.0	To learn the various quantitative techniques used in Management and decision making and to understand how they are applied in various real time Management Problems.	**5.1**	The students will be able to demonstrate planning and budgeting, managing conflict which helps to take effective decisions.		

UNIT I -INTRODUCTION TO PROJECT MANAGEMENT	**(9)**
Project Management – Definition-Lifecycles-Key features of project- Project Selection Methods- Project Portfolio Process – Project Formulation-Project Manager – Roles- Responsibilities and Selection – Project Teams.	
UNIT II - PLANNING AND BUDGETING AND RISK MANAGEMENT	**(9)**
The Planning Process – WBS (Work Breakdown Structure) and Linear Responsibility Chart - Budget the Project – Methods. Cost Estimating and Improvement. Stakeholder identification, analysis and communication planning-Managing risks - concepts, identification, assessment and response planning.	
UNIT III - SCHEDULING & RESOURCE ALLOCATION	**(9)**
PERT & CPM Networks-tools for Project Network – Crashing and resource leveling methods - Leadership styles and skills – Problem solving skills – Project Uncertainty– Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt 's Critical Chain.	
UNIT IV - CONTROL AND COMPLETION	**(9)**
The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Auditing and Termination.	
UNIT V - PROJECT ORGANISATION & CONFLICT MANAGEMENT	**(9)**
Formal Organization Structure – Organization Design – Types of project organizations. Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict.	
TOTAL (L: 45) :45 PERIODS	

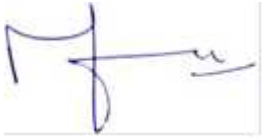
TEXT BOOKS:

1. John M. Nicholas, Herman Steyn, "Project Management for Business, Engineering and Technology", 6th Edition, Routledge, USA, 2020.
2. Kerzner H., "Project management: A Systems Approach to Planning, Scheduling and Controlling", 12th Edition, Wiley, New Delhi, 2017.

REFERENCES:

1. Erik Larson, Clifford Gray, "Project management: The managerial Process", 7th Edition, McGraw Hill Education, New Delhi, 2017.
2. Jack R. Meredith, "Project Management: A Managerial Approach", 10th Edition, Wiley, New Delhi, 2017.
3. Joseph Heagney, "Fundamentals of Project Management", 5th Edition, Amacom, New York, 2016.
4. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2005.
5. Gido and Clements, Successful Project Management, Seventh Edition, Thomson Learning, 2017.
6. Samuel J.M., Jack R.M., Scott M.S., Margaret M.S., and Gopalan M.R., Project Management, First Indian edition, Wiley-India, 2006.
7. Harvey Maylor, Project Management, Third Edition, Pearson Education, 2006.
8. Panneerselvam. R, Senthilkumar. P, Project Management, PHI Learning, 2009.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	2	2	2	2
CO3	3	2	2	3	2
CO4	2	3	2	2	3
CO5	2	2	2	2	2
CO(W.A)	**2.6**	**2.6**	**2.0**	**2.4**	**2.6**



22BAX24-SUPPLY CHAIN ANALYTICS					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 22BAB09					

Course Objectives		Course Outcomes	
1.0	To gain knowledge on understanding of supply chain analytics fundamentals.	**1.1**	The students will be able to understand the supply chain analytics fundamentals.
2.0	To impart knowledge for ability to design warehouse models to enhance supply chain performance	**2.1**	The students will be able to design warehouse models to enhance supply chain performance
3.0	To impart the knowledge on ability to analyse models and strategies in inventory management.	**3.1**	The students will be able to analyse models and strategies in inventory management.
4.0	To impart knowledge to understand network models in transportation.	**4.1**	The students will be able to identify the network models in transportation.
5.0	To impart knowledge on ability to make decision using multi-criteria in applications of SCM.	**5.1**	The students will be able to ability to make decision using multi-criteria in applications of SCM.

UNIT-I INTRODUCTION	**(9)**
Introduction to analytics – descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains, Barriers to implementation, Road Map.	
UNIT-II WAREHOUSING DECISIONS	**(9)**
Mathematical Programming Models - P-Median Methods - Guided LP Approach - Balmer – Wolfe Method, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods	
UNIT-III INVENTORY MANAGEMENT	**(9)**
Inventory aggregation Models, Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain - Measuring transit risks, supply risks, delivering risks, Risk pooling strategies.	
UNIT-IV TRANSPORTATION NETWORK MODELS	**(9)**
Notion of Graphs, Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Multistage Transshipment and Transportation Problems, Set covering and Set Partitioning Problems, Traveling Salesman Algorithms, Advanced Vehicle Routing Problem Heuristics, Scheduling Algorithms- Deficit function Approach and Linking Algorithms.	
UNIT-V MCDMMODELS	**(9)**
Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic and Techniques, the analytical network process (ANP), TOPSIS-Application in SCM.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

1. Nada R. Sanders, Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence, Pearson Education, 2014.

2.Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013

REFERENCES:

1. Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: Supply Chain Analytics for Perishable Products, Springer, 2013.
2. Muthu Mathirajan, ChandrasekharanRajendran, SowmyanarayananSadagopan, ArunachalamRavindran, ParasuramBalasubramanian, Analytics in Operations/Supply Chain Management , I.K. International Publishing House Pvt. Ltd., 2016.
3. Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, Taylor & Francis Group, 2014.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	3
CO2	3	2	2	2	2
CO3	3	2	2	2	2
CO4	2	3	2	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.6**	**2.4**	**2.0**	**2.0**	**2.2**

22BAX25-WAREHOUSE MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB09

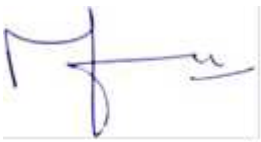
Course Objectives		Course Outcomes	
1.0	To help the students in explaining the significance of Warehousing.	**1.1**	The students will be able to get complete insight in to warehouse concepts,and significance of warehousing.
2.0	To explore the fundamental concepts of Inventory and distribution management	**2.1**	The students will be able to explicit the fundamental concepts of inventory and distribution management.
3.0	To impart knowledge in Inventory control techniques in warehousing operations.	**3.1**	The students will be able to analysis the various inventory control techniques and application of inventory management in warehouse control techniques.
4.0	To help the students to identify material handling techniques.	**4.1**	The students will be able to find out the various material handling techniques in warehouse management.
5.0	To inculcate the students to identify the modern warehousing significance	**5.1**	The students will be able to understand the modern warehousing significance.

UNIT-I INTRODUCTION WAREHOUSING	**(9)**
Introduction Warehousing – Basic Warehousing Decisions – Warehouse Operations – Types of Warehouses – Functions – Centralized & Decentralized – S rage Systems – Warehousing Cost Analysis – Warehouse Layout – Characteristics if Ideal Warehouse	
UNIT-II INVENTORY MANAGEMENT	**(9)**
Inventory: Basic Concepts – Role in Supply Chain – Role in Competitive Strategy – Independent Demand Systems – Dependent Demand Systems – Functions – Types _ Cost – Need for Inventory – Just in Time	
UNIT-III INVENTORY CONTROL	**(9)**
Inventory Control – ABC Inventory Control – Multi-Echelon Inventory Systems – Distribution Requirement Planning – Bull Whip Effect – Using WMS for Managing Warehousing Operations	
UNIT-IV MATERIALS HANDLING	**(9)**
Principles and Performance Measures Of Material Handling Systems – Fundamentals of Material Handling – Various Types of Material Handling Equipments – Types of Conveyors – Refrigerated Warehouses- Cold Chain- Agri SCM	
UNIT-V MODERN WAREHOUSING METHODS	**(9)**
Modern Warehousing – Au mated S rage & Retrieval Systems & their Operations – Bar Coding Technology &Applications in Logistics Industry – RFID Technology & Applications – Advantages of RFID	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOK:
1. Vinod.V.Sople, Logistics Management, Pearson Education, 2004. Arnold, Introduction Materials Management, Pearson Education, 2009.

REFERENCES:
1.Frazelle, World Class Warehousing & Material Handling, Tata McGraw-Hill, 2008 2. Satish K. Kapoor and PurvaKansal, Basics of Distribution Management - A Logistical Approach, Prentice Hall, 2003 3. Satish K. Kapoor and PurvaKansal Marketing, Logistics - A Supply Chain Approach , Pearson Education, 2003

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	3	3	2	2	3
CO4	2	3	2	2	2
CO5	3	2	2	2	2
CO(W.A)	**2.8**	**2.8**	**2.0**	**2.0**	**2.2**



22BAX26 - BUSINESS PLAN				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB07

Course Objectives		Course Outcomes	
1.0	To enable the students to understand the importance of a business plan preperation.	**1.1**	The students will able to familiarize in writing a business plan
2.0	To expose the students to learn about marketing their business.	**2.1**	The students will able to conduct a market research and plan for their business
3.0	To comprehend the various aspects of a human resource management.	**3.1**	The students will able to analyze ways and means to manage human resource for the business.
4.0	To establish a strong capital management and financial planing for their venture.	**4.1**	The students will able to appraise the sources of finance available for the business.
5.0	To develop skills in analyzing business to next level of establishment.	**5.1**	The students will able to analyze the entry level and growth strategies in new venture.

UNIT I - BUSINESS PLAN PREPARATION	**(9)**
Purpose of business plan, Benefits of a business plan, elements of the business plan, developing a well-conceived business plan, Format of Business Plan.	
UNIT II - MARKETING	**(9)**
Importance of market orientation, Market research, sales forecast - marketing research for the new venture, understanding the marketing plan, characteristics of marketing plan, steps in preparing the marketing plan.	
UNIT III - HUMAN RESOURCES	**(9)**
Introduction, Human Resources mobilization / head hunting, conducting interviews, induction, motivating employees, training, knowledge management, Human Resource Planning.	
UNIT IV - FINANCE	**(9)**
Raising Capital-sources, Family and friends, angel funding, venture capital, equity funding, debt financing, projected cash flow and profitability statements, DSCR and sensitivity analysis.	
UNIT V -FEASIBILITY STUDY	**(9)**
Pre-feasibility study, project profile preparation, feasibility report preparation and evaluation, operations planning, presenting a business plan. The seven domains of attractive opportunities by John Mullins	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

1. Paul Barrow, —The Best-Laid Business Plans, London: Virgin Publishing Ltd, 2005.
2. Rhonda Abrams, (2016), The Successful Business Plans: Secrets and strategies , The Planning Shop, Amazon
3. Charles Bronfman, Jeffrey R. Solomon, John Sedgwick, —The Art of Giving: Where the Soul Meets a Business Plan, New Delhi: Wiley, 2010.
4. Alex Genadinik, (2015), Marketing Plan Template & Example: How to Write a Marketing Plan, Amazon
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, "Entrepreneurship", 11th Edition, McGraw Hill Education, 2020.

REFERENCES:

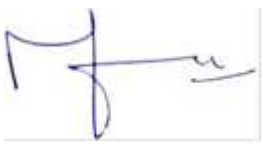
1. Robert D. Hisrich ,Veland Ramadani, "Entrepreneurial Marketing : A Practical Managerial Approach", First Edition, Edward Elgar Publishing, UK, 2018.

2.Bruce R. Barringer, Duane Ireland R "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, Noida, 2018.

3.Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8 th edition ,2017.

4. http://nptel.ac.in/courses/122106032/Pdf/7_2.pdf," Business Plan", Dr. T. J. Kamalanabhan, Indian Institute of Technology Madras.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	2	3
CO2	3	3	2	2	2
CO3	3	2	2	3	2
CO4	3	2	2	2	2
CO5	2	3	3	3	2
CO(W.A)	**2.8**	**2.4**	**2.4**	**2.4**	**2.2**



22BAX27 SOCIAL ENTREPRENEURSHIP			
L	T	P	C
3	0	0	3

PRE REQUISITE : 22BAB07

Course Objectives		Course Outcomes	
1.0	To introduce the concepts of social entrepreneurship, social business, and social value creation	**1.1**	The students will able to understand the drivers of social entrepreneurship and design a model to solve complex social issues.
2.0	To understand how social entrepreneurship help in resolving many critical issues such as poverty, social exclusion, digital divide, and illiteracy	**2.1**	The students will able to apply the skill and practices to the changing social and business environments.
3.0	To understand theoretical and motivational underpinnings of various social entrepreneurship models, and compare and contrast them.	**3.1**	The students will able to analyze the financial issues and identify the sources to mobilize fund to a social enterprise.
4.0	To enable the students to manage their innovativeness effectively	**4.1**	The students will able to develop a tools that can be applied for effective management and lead organizations in a global arena.
5.0	To equip them in building rapport with social problem.	**5.1**	The students will able to gain and progress capabilities relevant to the needs of the social sector.

UNIT I - Introduction	**(9)**
Social Entrepreneurship: Definition- characteristics of social entrepreneurs – Challenges - Strategies - Future. Drivers of Social Innovation - Human-Centered Design Thinking - Social Entrepreneurship vs. Entrepreneurship. Case study.	
UNIT II -Social Entrepreneur	**(9)**
Social Entrepreneur: Qualities - Factors impacting transformation into social entrepreneur - Issues in opting for Social Entrepreneurship- Social Entrepreneurial skills and practices-Leading Social Entrepreneurs in India. Interaction with practitioners	
UNIT III - Social Ventures	**(9)**
Social Ventures: Addressing persistent social problems. Financing Social ventures: angel funds-Venture capital- internal funding sources –Venture Valuation, In-house Corporate funding mechanism-Micro-finance	
UNIT IV - Social Innovations	**(9)**
Social Innovations: Types -Nature - challenges of "Markets of the Poor", Innovative designs and strategies to address the needs of these markets and communities. Business Models for Low Income Communities	

UNIT V -Leading for Change & Successful Social Entrepreneurship Initiatives	(9)
Leading for Change: Social problems as Business opportunities - Future of Social Enterprises in India/Global, Challenges of Growth and Scale.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

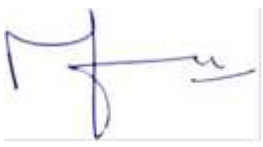
1. Bornstein, Davis, "Social Entrepreneurship", 1st Edition,Oxford University Press, New Delhi, 2016.
2. Madhukar Shukla , "Social Entrepreneurship in India",1st Edition, Sage Publications, New Delhi, 2020.
3. Social entrepreneurship: A modern approach to social value creation. Upper Saddle River, New J. Ridley- Duff, R and Bull, M (2011).

REFERENCES:

1. Elkington, J., Hartigan, P. "The power of unreasonable people: How social entrepreneurs create markets that change the world", 1st Edition, Harvard Business Publishing, USA, 2013.
2. Constant Beugré, "Social Entrepreneurship: Managing the Creation of Social Value", 1st Edition, Routledge, USA, 2016.
3. Margret Bonefiel, Ritesh Sharma,Robert A. Philips, "Social Entrepreneurship: The Next Big Business Opportunity",1st Edition, Global Vision Publishing House, New Delhi, 2011.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	3	2	2	3	2
CO3	2	2	2	2	2
CO4	3	3	3	2	3
CO5	2	2	2	2	2
CO(W.A)	**2.6**	**2.2**	**2.4**	**2.2**	**2.4**



22BAX28 INDIAN MODELS IN ENTREPRENEURSHIP				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB07

Course Objectives		Course Outcomes	
1.0	To understand the basic concepts Indian business models.	1.1	The Students will able to highlight the salient features of Indian entrepreneurial models.
2.0	To enhance the students in the area of India's start up revolution.	2.1	The Students will able to analyze the factors leading to success of Indian start-ups.
3.0	To create the ideas of students in Business Incubators.	3.1	The Students will able to Comprehend the importance and impact of business incubation to the start-ups.
4.0	To develop the knowledge of students in Rural and social entrepreneurship.	4.1	The Students will able to appreciate the value of how living rurally influences business and social enterprise objectives.
5.0	To enrich the knowledge of women entrepreneurs.	5.1	The Students will able to appreciate the role and contribution of women as an entrepreneur.

UNIT I – Introduction to Indian Business Models:	**(9)**
Introduction to Indian Business Models: Significance of Indian Business Models – Scope of Micro and Small Enterprises – Role of Micro Enterprise in Economic Development - Forms of Business- Family Business - First Generation Entrepreneurs – Clusters Development.	
UNIT II – India's start up revolution:	**(9)**
India's start up revolution: Trends –Imperatives – benefits- players involved in the ecosystem – Case Studies of successful startups.	
UNIT III – Business Incubators:	**(9)**
Business Incubators: Meaning – Definition- Services offered-Stages of Business Incubation- Types-importance.	
UNIT IV – Rural Entrepreneurship:	**(9)**
Rural Entrepreneurship : Policies factors and barriers of the development – Rural entrepreneurship and socio-economic environment of Indian market- concept of congenial environment and its role in promoting rural entrepreneurship.	

UNIT V - Women Entrepreneurs:	**(9)**
Women Entrepreneurs: Functions - Evolution in India- Entrepreneurial skills – Competency requirements-Opportunities – Challenges - Role of Women entrepreneurship in economic development.	
	TOTAL (L: 45) :45 PERIODS

TEXT BOOKS:

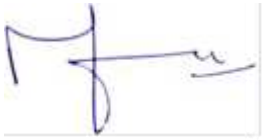
1. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters, Dean A. Shepherd, "Entrepreneurship", 9th Edition, McGraw Hill Education, New Delhi, 2014.
2. Dhananjaya B.R, Durgappa, Chandrashekarappa U., "Small Business Management", 1st Edition, Himalaya Publishing, Mumbai, 2016.

REFERENCES:

1. Dinanath Kaushik "Studies in Indian Entrepreneurship", 1st Edition, Cyber Tech Publications, New Delhi, 2013.
2. Poornima M Charantimath, "Entrepreneurship Development Small Business Enterprises", 2nd Edition, Pearson Education, Noida, 2014.
3. Jaynal Ud-Din Ahmed, Khundrakpam Devananda Singh, "Women Entrepreneurship in India", 1st Edition, New Century Publications, New Delhi, 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	2	2	2	2	3
CO3	2	2	3	3	3
CO4	3	2	3	2	2
CO5	3	2	2	2	2
CO(W.A)	**2.6**	**2**	**2.4**	**2.4**	**2.4**



22BAX29 ENTREPRENEURIAL MARKETING				
	L	**T**	**P**	**C**
	3	**0**	**0**	3

PRE REQUISITE : 22BAB07

	Course Objectives		Course Outcomes
1.0	To understand the basic concepts of Marketing and entrepreneurship.	1.1	The students will able to develop mission statement with the essence of marketing concepts as they apply to small and new ventures;
2.0	To enhance the students to create new market opportunities.	2.1	The students will able to prepare a basic marketing plan for an existing or proposed entrepreneurial venture
3.0	To develop the ideas for market development.	3.1	The students will able to develop skills in analyzing to progress in marketing by applying various strategies and methods in business by an entrepreneur.
4.0	To provide the knowledge of students in fixing the price and channel management.	4.1	The students will able to solve the problem of "newness" as they develop the pricing and distributing plan according to the dynamics of market.
5.0	To enrich the knowledge of students in customer relationship and Entrepreneurial strategy.	5.1	The students will able to establish a strong customer relationship in business with the use of appropriate technology.

UNIT I –Marketing and Entrepreneurship	**(9)**
Marketing and Entrepreneurship: Introduction- Identifying and Understanding Buyers - Sustaining Competitive Advantages of New Ventures-Build a Mission Statement-Integrate selling and marketing in a new business. Case study.	
UNIT II –Identifying Market Opportunities	**(9)**
Identifying Market Opportunities: Market Research -Developing Business Plans - Pitching Opportunities -Demand Forecasting - Linking marketing to financial outcomes- Tools and techniques for new market creation.	
UNIT III – Market Development	**(9)**
Market Development: Digital and online marketing - forward-looking product design- product features - added value- service dominant logic- build a strong brand from scratch- competing on loyalty-Segmentation - Targeting**.**	
UNIT IV –Pricing & Channel Management	**(9)**
Pricing: Tools- Market Expansion and Pricing- case study. Channel Management**:** Power of Trust in Manufacturer-Retailer Relationships-Developing effective Distribution Strategies.	

UNIT V -Building Customer Relationships & Entrepreneurial Communication Strategy	(9)
Building Customer Relationships: Managing Customers – Relationship Marketing - Traditional-Digital Marketing for Entrepreneurs- Media Marketing-customer value proposition. **Entrepreneurial Communication Strategy:** Inbound, outbound and social media strategy.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

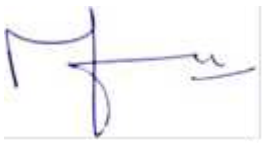
1. Bruce R. Barringer, Duane Ireland R "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, Noida, 2018.
2. Robert D. Hisrich ,Veland Ramadani, "Entrepreneurial Marketing : A Practical Managerial Approach", First Edition, Edward Elgar Publishing, UK, 2018.

REFERENCES:

1. Sheth J, Sisodia R., "4A's of Marketing: Creating Value for Customers, Companies and Society", 1st Edition,Routledge, USA, 2012.
2. Crane, G. Frederick., "Marketing for Entrepreneurs: Concepts and Applications for New Ventures" 2nd Edition, Sage Publications, New Delhi, 2012.
3. Mohr, J., Sengupta, S., Slater, S., "Marketing of High-Technology Products and Innovations", 3rd Edition, Pearson Education, Noida, 2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	2	2	2	2
CO3	2	3	2	2	2
CO4	3	2	2	3	2
CO5	3	2	2	3	2
CO(W.A)	**2.8**	**2.4**	**2**	**2.4**	**2**



22BAX30 SOFT SKILLS FOR ENTREPRENEURS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : 22BAB07

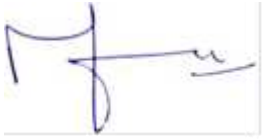
	Course Objectives		Course Outcomes
1.0	To heighten the awareness of developing emotional intelligence that may influence the running of business	1.0	To heighten the awareness of developing emotional intelligence that may influence the running of business
2.0	To enable the students to manage their time effectively	2.0	To enable the students to manage their time effectively
3.0	To equip them in building rapport and being ethical towards society	3.0	To equip them in building rapport and being ethical towards society
4.0	To understand how social networking can be done.	4.0	To understand how social networking can be done.
5.0	To enable the students to understand the ethical practices in business.	5.0	To enable the students to understand the ethical practices in business.

UNIT I - EMOTIONAL INTELLIGENCE	**(9)**
Introduction, perceiving emotions, understanding emotions, managing emotions, developing emotional intelligence, persuasion. Emotional Intelligence and Leadership Effectiveness	
UNIT II -SELF DEVELOPMENT	**(9)**
Johari window, Building Interpersonal Skills – Transactional Analysis, Time Management – Steven covey model, Power of Trust – Competencies for building Trust. Delegation	
UNIT III - COACHING AND MENTORING	**(9)**
Coaching – Methods, Executive coaching, Mentoring vs. counseling, being an effective mentor, reverse mentoring, Techniques of counseling, Leadership coaching. Emergence of Personal Theory of Counseling	
UNIT IV - NETWORKING	**(9)**
Importance of networking, making contacts, Getting connected, Building rapport, Building the bond, Business Etiquette, connecting on the phone, connecting in writing, social networking. Social Networking sites	
UNIT V -BUSINESS ETHICS	**(9)**
Does ethics pay? On becoming an ethical manager, Building an ethical organization, Ethics towards competitors, Corporate Social Responsibility. Roots of unethical behaviour	
	TOTAL (L: 45) :45 PERIODS

TEXT BOOKS:
1. Shikha Kapoor, "Personality development and soft skills: Preparing for tomorrow", 1st Edition, Dream Tech Press, New Delhi, 2020. 2. Bruce Tulgan., "Bridging the Soft Skills Gap", 1st Edition, Pan McMillan, New Delhi, 2016. 3. Barun K. Mitra, "Personality Development and Soft Skills", 2nd Edition, Oxford University Press, New Delhi, 2016.
REFERENCES:
1. Daniel Goleman, —Emotional Intelligence, New York: Bantam Books, 2006. 2. Joe Healey, —Radical Trust, New Delhi: Wiley India Pvt. Ltd, 2009. 3. Coaching and Mentoring, Boston: Harvard Business School Publishing Corporation, 2004. 4. JohnTimperley, —Network Your Way to Success, London: Piatkus,2010. 5. ManiKutty S, —Being Ethical –IIMA Business Books, Noida: Random House India, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	3	2	2	3	2
CO3	2	2	2	2	2
CO4	2	2	3	2	2
CO5	2	2	2	3	2
CO(W.A)	**2.2**	**2**	**2.4**	**2.6**	**2**



22BAV01-ARTIFICIAL INTELLIGENCE FOR MANAGERS				
	L	T	P	C
	0	0	2	1

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To provide students an insight of AI and its applications in various fields of management.	1.0	The students will be able to Understand the Fundamentals, Evolution and Economics of AI
2.0	To show the impact of AI in the fields of Fraud Detection and prevention of illegal mishaps.	2.0	The students will be able to Summarize when an organization should go technically smart
3.0	To impart knowledge on AI based services emerging across the globe	3.0	The students will be able to Execute decision making with AI for the customers future journey
4.0	To provide the insights about the AI involvement in leadership and decision making.	4.0	The students will be able to know the Breakdown ways to detect a fraud
5.0	To impart the knowledge in services Parse the myths and issues in services management.	5.0	The students will be able to analyze Parse the myths and issues in services management.

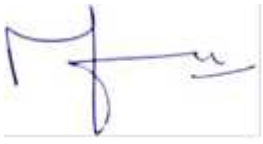
UNIT I INTRODUCTION TO AI	**6**
AI: History and Evolution, Foundation of Artificial Intelligence, Components of Intelligent AI System, Indian Scenario, Inorganic Growth, Different AI Technologies, Strategy to Succeed, AI Hybrid Workforce.	
UNIT II AI & CUSTOMER JOURNEY	**6**
AI – Emerging Services, Enhance Customer Experience, Management of Quality Portfolio, Robo Advisors – Its Impact on Industry, Chatbots, Virtual Assistants, Blueprinting with AI.	
UNIT III AI & FRAUD DETECTION	**6**
Fraud: Unique Characteristics, Types, Impacts and Consequences, Biometric Authentication, Facial Recognition, Future of Biometrics, Financial Crime Intelligence.	
UNIT IV AI IN ORGANISATION	**6**
Future of Businesses – Reshaping, Disruption, Opportunity, Adoption Cycle, AI: Leadership, Facets, Decision Making Process, Involvement of Leadership	

UNIT V AI IN SERVICES	6
AI and Frontline Public Service, Challenges of AI in Sectors: Transportation, Medical, Banking, Food and Hospitality, Robots and Virtual Agents in Public Service.	
TOTAL(P:30) : 30Hours	

REFERENCES:

1. Raj Singh, Artificial Intelligence in Banking and Finance: How AI is Impacting the Dynamics ofFinancial Services, Adhyyan Books publishing, 2019
2. AbderrahimAskouk, Artificial Intelligence is Changing the Frontline Workers Role, 2021
3. Ajit K Jha, Artificial Intelligence for Business Leaders, 2020
4. Russell, S Norwig, Artificial Intelligence: A Modern Approach (3rd Ed.). Prentice Hall, 2010
5. Khemani. D, A First Course in Artificial Intelligence, McGraw Hill, 2013

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO 2	2	2	2	3	2
CO 3	2	2	2	2	2
CO 4	2	3	2	2	2
CO 5	2	2	2	2	2
CO(W.A)	**2.0**	**2.4**	**2.0**	**2.2**	**2.0**



22BAV02-INTRODUCTION TO GOOGLE APPS					
		L	T	P	C
		0	0	2	1
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.1	To know the various google applications available in the market.	1.1	The students will be able to understand the various features available in Gmail.		
2.1	To learn how to collaborate with others using Google Apps.	2.1	The students will be able to use the Google calendar and Google drive for staying organized.		
3.1	To understand how the apps interact with each other.	3.1	The students will be able to carry out various tasks using Google Workspace applications.		
4.1	To learn the design website with basic essentials using Google Sites.	4.1	The students will be able to design website with basic essentials using Google Sites.		
5.1	To outline the various features available for students in Google Meet and Google Classroom.	5.1	The students will be able to outline the various features available for students in Google Meet and Google Classroom.		

List of Experiments:

1. Google Products – Overview

2. Gmail

3. Google Calendar and Google Drive

4. Google Docs Editors

5. Google Meet and Google Classroom

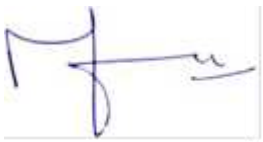
6. Online tools available in the market for documentation, website creation, meetings and other products of Google.

TOTAL(P:30) : 30Hours

REFERENCES:

1. James Bernsteinn, "Google Apps Made Easy: Learn to work in the cloud", 2019
2. Scott La Counte, "The Ridiculously Simple Guide to Google Apps (G Suite): A Practical Guide to Google Drive Google Docs, Google Sheets, Google Slides, and Google Forms", 2019
3. Website: https://about.google/products/
4. Website:https://sites.google.com/a/georgiasouthern.edu/google-apps-fac-staff/start
5. Owayid, Ali &Uden, Lorna. (2014). The Usage of Google Apps Services in Higher Education. Communications in Computer and Information Science. 446. 10.1007/978-3-319-10671-7_9.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	3	2	3	3	2
CO 2	3	3	2	3	3
CO 3	3	2	2	2	3
CO 4	2	2	3	2	3
CO 5	2	2	3	2	2
CO(W.A)	**2.6**	**2.2**	**2.6**	**2.6**	**2.4**



22BAM01-ENTREPRENEURSHIP DEVELOPMENT					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					

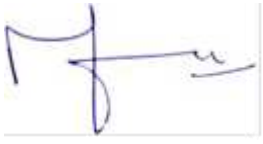
Course Objectives		Course Outcomes	
1.0	To understand the skills and characteristics of successful Entrepreneurs.	**1.1**	The students will be able to gain entrepreneurial competence to run the business efficiently.
2.0	To understand Entrepreneurial environment.	**2.1**	The students will be able to understand the entrepreneurial environment and make decisions.
3.0	To familiarize students to prepare feasible Business plan.	**3.1**	The students will be able to capable of preparing business plans and undertake feasible projects.
4.0	To impart knowledge on mobilizing resource and launching a new business.	**4.1**	The students will be able to efficient in launching and develop their business ventures successfully.
5.0	To impart knowledge to students in monitoring and evaluation of small business	**5.1**	The students will be able to monitor the business effectively towards growth and development.

UNIT I – ENTREPRENEURAL COMPETENCE	**(9)**
Entrepreneurship – Types of entrepreneur – Entrepreneurship as a Career – Characteristics of Entrepreneur – Key Qualities of Good Entrepreneur.	
UNIT II – ENTREPRENEURAL ENVIRONMENT	**(9)**
Business Environment – Entrepreneurship Development Training and Other Support Organizational Services – Central and State Government Industrial Policies and Regulations.	
UNIT III – BUSINESS PLAN PREPARATION	**(9)**
Definition – Purposes of Business Plan – Benefits – Elements of Business plan – Developing an Effective Business Plan – Prefeasibility Study.	
UNIT IV – LAUNCHING OF SMALL BUSINESS	**(9)**
Finance and Human Resource Mobilization – Operations Planning – Market and Channel Selection – Product Launching – Incubation, Venture Capital, Start-ups.	
UNIT V - MANAGEMENTOF SMALL BUSINESS	**(9)**
Monitoring and Evaluation of Business – Business Sickness – Prevention and Rehabilitation of Business Units – Effective Management of Small Business.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:
1. S.S.Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016. 2. Robert D.Hisrich, Michael P. Peters, Dean A. Shepherd, "Entrepreneurship", Tata McGraw Hill; 11th Edition, 2020.

REFERENCES:
1.Rajeev Roy," Entrepreneurship", Oxford University Press, 2rd Edition, 2011. 2.Donald F Kuratko, T.V Rao. "Entrepreneurship: A South Asian perspective" Cengage Learning, 2012. 3.Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH, 2006. 4.Arya Kumar. Entrepreneurship, Pearson, 2012. 5.Charantimath Poornima M, "Entrepreneurship Development and Small Business Enterprises", Pearson Education; 3 rd Edition (2018). 6.Rashmi Bansal, "Stay Hungry Stay Foolish", IIM – Ahmadabad, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	3	1	3	-	3
CO2	3	2	2	3	1
CO3	3	1	2	-	1
CO4	3	2	3	1	2
CO5	3	2	2	1	2
CO(W.A)	**3**	**1.6**	**2.4**	**1.6**	**1.8**



22BAM02-BUSINESS PLAN					
		L	**T**	**P**	**C**
		3	**0**	**0**	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To enable the students to understand the importance of a business plan preperation.	**1.1**	The students will able to familiarize in writing a business plan		
2.0	To expose the students to learn about marketing their business.	**2.1**	The students will able to conduct a market research andplan for their business		
3.0	To comprehend the various aspects of a human resource management.	**3.1**	The students will able to analyze ways and means to manage human resource for the business.		
4.0	To establish a strong capital management and financial planing for their venture.	**4.1**	The students will able to appraise the sources of finance available for the business.		
5.0	To develop skills in analyzing business to next level of establishment.	**5.1**	The students will able to analyze the entry level and growth strategies in new venture.		

UNIT I - BUSINESS PLAN PREPARATION	**(9)**
Purpose of business plan, Benefits of a business plan, elements of the business plan, developing a well-conceived business plan, Format of Business Plan.	
UNIT II - MARKETING	**(9)**
Importance of market orientation, Market research, sales forecast - marketing research for the new venture, understanding the marketing plan, characteristics of marketing plan, and steps in preparing the marketing plan.	
UNIT III - HUMAN RESOURCES	**(9)**
Introduction, Human Resources mobilization / head hunting, conducting interviews, induction, motivating employees, training, knowledge management, Human Resource Planning.	
UNIT IV - FINANCE	**(9)**
Raising Capital-sources, Family and friends, angel funding, venture capital, equity funding, debt financing, projected cash flow and profitability statements, DSCR and sensitivity analysis.	
UNIT V -FEASIBILITY STUDY	**(9)**
Pre-feasibility study, project profile preparation, feasibility report preparation and evaluation, operations planning, presenting a business plan. The seven domains of attractive opportunities by John Mullins.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

1.Paul Barrow, —The Best-Laid Business Plans, London: Virgin Publishing Ltd, 2005.

2.Rhonda Abrams,The Successful Business Plans: Secrets and strategies , The Planning Shop, 2016.

3.Charles Bronfman, Jeffrey R. Solomon, John Sedgwick, —The Art of Giving: Where the Soul Meets a Business Plan, New Delhi: Wiley, 2010.

4.Alex Genadinik, (2015), Marketing Plan Template & Example: How to Write a Marketing Plan, Amazon

5.Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, "Entrepreneurship", 11th Edition, McGraw Hill Education, 2020.

REFERENCES:

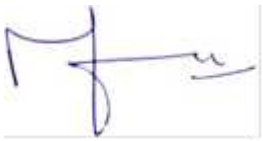
1. Robert D. Hisrich ,Veland Ramadani, "Entrepreneurial Marketing : A Practical Managerial Approach", First Edition, Edward Elgar Publishing, UK, 2018.

2. Bruce R. Barringer, Duane Ireland R "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, Noida, 2018.

3. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8 th edition ,2017.

4. http://nptel.ac.in/courses/122106032/Pdf/7_2.pdf," Business Plan", Dr. T. J. Kamalanabhan, Indian Institute of Technology Madras.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	3	2	3
CO2	3	3	2	2	2
CO3	3	2	2	3	2
CO4	3	2	2	2	2
CO5	2	3	3	3	2
CO(W.A)	**2.8**	**2.4**	**2.4**	**2.4**	**2.2**



22BAM03-SOCIAL ENTREPRENEURSHIP			
L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To introduce the concepts of social entrepreneurship, social business, and social value creation	**1.1**	The students will able to understand the drivers of social entrepreneurship and design a model to solve complex social issues.
2.0	To understand how social entrepreneurship help in resolving many critical issues such as poverty, social exclusion, digital divide, and illiteracy	**2.1**	The students will able to apply the skill and practices to the changing social and business environments.
3.0	To understand theoretical and motivational underpinnings of various social entrepreneurship models, and compare and contrast them.	**3.1**	The students will able to analyze the financial issues and identify the sources to mobilize fund to a social enterprise.
4.0	To enable the students to manage their innovativeness effectively	**4.1**	The students will able to develop a tools that can be applied for effective management and lead organizations in a global arena.
5.0	To equip them in building rapport with social problem	**5.1**	The students will able to gain and progress capabilities relevant to the needs of the social sector.

UNIT I - Introduction	**(9)**
Social Entrepreneurship: Definition- characteristics of social entrepreneurs – Challenges - Strategies - Future. Drivers of Social Innovation - Human-Centered Design Thinking - Social Entrepreneurship vs. Entrepreneurship. Case study.	
UNIT II -Social Entrepreneur	**(9)**
Social Entrepreneur: Qualities - Factors impacting transformation into social entrepreneur - Issues in opting for Social Entrepreneurship- Social Entrepreneurial skills and practices-Leading Social Entrepreneurs in India. Interaction with practitioners.	
UNIT III - Social Ventures	**(9)**
Social Ventures: Addressing persistent social problems. Financing Social ventures: angel funds-Venture capital- internal funding sources –Venture Valuation, In-house Corporate funding mechanism-Micro-finance.	
UNIT IV - Social Innovations	**(9)**
Social Innovations: Types -Nature - challenges of "Markets of the Poor", Innovative designs and strategies to address the needs of these markets and communities. Business Models for Low Income Communities.	

UNIT V -Leading for Change & Successful Social Entrepreneurship Initiatives	(9)
Leading for Change: Social problems as Business opportunities - Future of Social Enterprises in India/Global, Challenges of Growth and Scale.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:

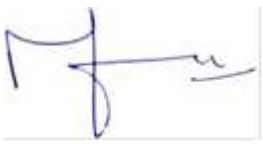
1. Bornstein, Davis, "Social Entrepreneurship", 1st Edition, Oxford University Press, New Delhi, 2016.
2. Madhukar Shukla , "Social Entrepreneurship in India",1st Edition, Sage Publications, New Delhi, 2020.
3. Social entrepreneurship: A modern approach to social value creation. Upper Saddle River, New J. Ridley- Duff, R and Bull, M (2011).

REFERENCES:

1.Elkington, J., Hartigan, P. "The power of unreasonable people: How social entrepreneurs Create markets that change the world", 1st Edition, Harvard Business Publishing, USA, 2013.
2. Constant Beugre, "Social Entrepreneurship: Managing the Creation of Social Value", 1st Edition, Routledge, USA, 2016.
3. Margret Bonefiel, Ritesh Sharma, Robert A. Philips, "Social Entrepreneurship: The Next Big Business Opportunity",1st Edition, Global Vision Publishing House, New Delhi, 2011.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	3	2	2	3	2
CO3	2	2	2	2	2
CO4	3	3	3	2	3
CO5	2	2	2	2	2
CO(W.A)	2.6	2.2	2.4	2.2	2.4



22BAM04-INDIAN MODELS IN ENTREPRENEURSHIP				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand the basic concepts Indian business models.	1.1	The Students will able to highlight the salient features of Indian entrepreneurial models.
2.0	To enhance the students in the area of India's startup revolution.	2.1	The Students will able to analyze the factors leading to success of Indian start-ups.
3.0	To create the ideas of students in Business Incubators.	3.1	The Students will able to Comprehend the importance and impact of business incubation to the start-ups.
4.0	To develop the knowledge of students in Rural and social entrepreneurship.	4.1	The Students will able to appreciate the value of how living rurally influences business and social enterprise objectives.
5.0	To enrich the knowledge of women entrepreneurs.	5.1	The Students will able to appreciate the role and contribution of women as an entrepreneur.

UNIT I – Introduction to Indian Business Models:	**(9)**
Introduction to Indian Business Models: Significance of Indian Business Models – Scope of Micro and Small Enterprises – Role of Micro Enterprise in Economic Development - Forms of Business- Family Business - First Generation Entrepreneurs – Clusters Development.	
UNIT II – India's start up revolution:	**(9)**
India's start up revolution: Trends –Imperatives – benefits- players involved in the ecosystem – Case Studies of successful startups.	
UNIT III – Business Incubators:	**(9)**
Business Incubators: Meaning – Definition- Services offered-Stages of Business Incubation- Types-importance.	
UNIT IV – Rural Entrepreneurship:	**(9)**
Rural Entrepreneurship : Policies factors and barriers of the development – Rural entrepreneurship and socio-economic environment of Indian market- concept of congenial environment and its role in promoting rural entrepreneurship.	
UNIT V - Women Entrepreneurs:	**(9)**
Women Entrepreneurs: Functions - Evolution in India- Entrepreneurial skills – Competency requirements- Opportunities – Challenges - Role of Women entrepreneurship in economic development.	
	TOTAL (L: 45) :45 PERIODS

TEXT BOOKS:

1. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters, Dean A. Shepherd, "Entrepreneurship", 9th Edition, McGraw Hill Education, New Delhi, 2014.
2. Dhananjaya B.R, Durgappa, Chandrashekarappa U., "Small Business Management", 1st Edition, Himalaya Publishing, Mumbai, 2016.

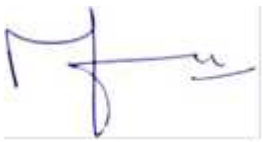
REFERENCES:

1.Dinanath Kaushik "Studies in Indian Entrepreneurship", 1st Edition, Cyber Tech Publications, New Delhi, 2013.

2.Poornima M Charantimath, "Entrepreneurship Development Small Business Enterprises", 2nd Edition, Pearson Education, Noida, 2014.

3. Jaynal Ud-Din Ahmed, Khundrakpam Devananda Singh, "Women Entrepreneurship in India", 1st Edition, New Century Publications, New Delhi, 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	**2**	**2**	3	2
CO2	2	**2**	2	2	3
CO3	2	**2**	3	3	3
CO4	3	**2**	3	2	2
CO5	3	2	2	2	2
CO(W.A)	**2.6**	**2**	**2.4**	**2.4**	**2.4**



22BAM05-ENTREPRENEURIAL MARKETING

	L	T	P	C
PRE REQUISITE : NIL	3	**0**	**0**	3

	Course Objectives		Course Outcomes
1.0	To understand the basic concepts of Marketing and entrepreneurship.	1.1	The students will able to develop mission statement with the essence of marketing concepts as they apply to small and new ventures;
2.0	To enhance the students to create new market opportunities.	2.1	The students will able to prepare a basic marketing plan for an existing or proposed entrepreneurial venture
3.0	To develop the ideas for market development.	3.1	The students will able to develop skills in analyzing to progress in marketing by applying various strategies and methods in business by an entrepreneur.
4.0	To provide the knowledge of students in fixing the price and channel management.	4.1	The students will able to solve the problem of "newness" as they develop the pricing and distributing plan according to the dynamics of market.
5.0	To enrich the knowledge of students in customer relationship and Entrepreneurial strategy.	5.1	The students will able to establish a strong customer relationship in business with the use of appropriate technology.

UNIT I –Marketing and Entrepreneurship **(9)**

Marketing and Entrepreneurship: Introduction- Identifying and Understanding Buyers -Sustaining Competitive Advantages of New Ventures-Build a Mission Statement-Integrate selling and marketing in a new business. Case study.

UNIT II –Identifying Market Opportunities **(9)**

Identifying Market Opportunities: Market Research -Developing Business Plans - Pitching Opportunities - Demand Forecasting - Linking marketing to financial outcomes- Tools and techniques for new market creation.

UNIT III – Market Development **(9)**

Market Development: Digital and online marketing - forward-looking product design- product features - added value- service dominant logic- build a strong brand from scratch- competing on loyalty-Segmentation - Targeting**.**

UNIT IV –Pricing & Channel Management **(9)**

Pricing: Tools- Market Expansion and Pricing- case study. Channel Management**:** Power of Trust in Manufacturer-Retailer Relationships-Developing effective Distribution Strategies.

UNIT V -Building Customer Relationships & Entrepreneurial Communication Strategy **(9)**

Building Customer Relationships: Managing Customers – Relationship Marketing - Traditional-Digital Marketing for Entrepreneurs- Media Marketing-Customer value proposition.Entrepreneurial Communication Strategy: Inbound, outbound and social media strategy.

TOTAL (L: 45) :45 PERIODS

TEXT BOOKS:

1. Bruce R. Barringer, Duane Ireland R "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, Noida, 2018.
2. Robert D. Hisrich ,Veland Ramadani, "Entrepreneurial Marketing : A Practical Managerial Approach", First Edition, Edward Elgar Publishing, UK, 2018.

REFERENCES:

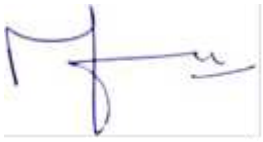
1. Sheth J, Sisodia R., "4A's of Marketing: Creating Value for Customers, Companies and Society", 1st Edition,Routledge, USA, 2012.

2.Crane, G. Frederick., "Marketing for Entrepreneurs: Concepts and Applications for New Ventures" 2nd Edition, Sage Publications, New Delhi, 2012.

3.Mohr, J., Sengupta, S., Slater, S., "Marketing of High-Technology Products and Innovations", 3rd Edition, Pearson Education, Noida, 2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	**3**	**2**	2	2
CO2	3	**2**	2	2	2
CO3	2	**3**	2	2	2
CO4	3	**2**	2	3	2
CO5	3	2	2	3	2
CO(W.A)	**2.8**	**2.4**	**2**	**2.4**	**2**



22BAM06-SOFT SKILLS FOR ENTREPRENEURS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

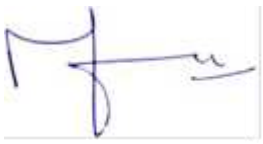
	Course Objectives		Course Outcomes
1.0	To heighten the awareness of developing emotional intelligence that may influence the running of business.	1.1	The students will be able to manage the emotions effectively to improve the leadership qualities.
2.0	To enable the students to manage their time effectively	2.1	The students will be able to build trust and strong interpersonal skills.
3.0	To equip them in building rapport and being ethical towards society	3.1	The students will be able to know the importance of coaching and mentoring.
4.0	To understand how social networking can be done.	4.1	The students will be able to understand networking and building social relationship.
5.0	To enable the students to understand the ethical practices in business.	5.1	The students will be able to follow ethical practices and responsibility towards society.

UNIT I - EMOTIONAL INTELLIGENCE	**(9)**
Introduction, perceiving emotions, understanding emotions, managing emotions, developing emotional intelligence, persuasion. Emotional Intelligence and Leadership Effectiveness.	
UNIT II -SELF DEVELOPMENT	**(9)**
Johari window, Building Interpersonal Skills – Transactional Analysis, Time Management – Steven covey model, Power of Trust – Competencies for building Trust. Delegation.	
UNIT III - COACHING AND MENTORING	**(9)**
Coaching – Methods, Executive coaching, Mentoring vs. counseling, being an effective mentor, reverse mentoring, Techniques of counseling, Leadership coaching. Emergence of Personal Theory of Counseling.	
UNIT IV - NETWORKING	**(9)**
Importance of networking, making contacts, Getting connected, Building rapport, Building the bond, Business Etiquette, connecting on the phone, connecting in writing, social networking. Social Networking sites.	
UNIT V -BUSINESS ETHICS	**(9)**
Does ethics pay? On becoming an ethical manager, Building an ethical organization, Ethics towards competitors, Corporate Social Responsibility. Roots of unethical behavior.	
TOTAL (L: 45) :45 PERIODS	

TEXT BOOKS:
1..Shikha Kapoor, "Personality development and soft skills: Preparing for tomorrow", 1st Edition, Dream Tech Press, New Delhi, 2020. 2.Bruce Tulgan., "Bridging the Soft Skills Gap", 1st Edition, Pan McMillan, New Delhi, 2016. 3.Barun K. Mitra, "Personality Development and Soft Skills", 2nd Edition, Oxford University Press, New Delhi, 2016.
REFERENCES:
1. Daniel Goleman, —Emotional Intelligence, New York: Bantam Books, 2006. 2. Joe Healey, —Radical Trust, NewDelhi: Wiley India Pvt. Ltd, 2009. 3. CoachingandMentoring, Boston: Harvard Business School Publishing Corporation, 2004. 4. JohnTimperley, —Network Your Way to Success, London: Piatkus,2010. 5. ManiKutty S, —Being Ethical –IIMA Business Books, Noida: Random House India, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

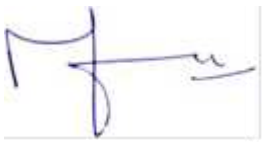
COs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	3	2	2	3	2
CO3	2	2	2	2	2
CO4	2	2	3	2	2
CO5	2	2	2	3	2
CO(W.A)	**2.2**	**2**	**2.4**	**2.6**	**2**



22BAM07-ENTERPRENEURIAL FINANCE					
		L	T	P	C
		3	0	0	3
PRE REQUISITE: NIL					
Course Objectives		**Course Outcomes**			
1.0	To describe the usefulness of a conceptual framework.	**1.1**	The students will be able to understand the importance of financial management and managing a new venture.		
2.0	To describe efforts to construct a conceptual framework.	**2.1**	The students will be able to analyze the various sources of investment and also know the support provided by the state and central government for entrepreneurship.		
3.0	To understand the objective of financial reporting.	**3.1**	The students will be able to determine the various financial support schemes provided different institutions to the entrepreneurs.		
4.0	To make students learn about technical analysis.	**4.1**	The Students will be able to apply technical analysis.		
5.0	To make students understand the strategies in developing portfolio investment and analysis.	**5.1**	The Students will be able to construct and manage portfolio investment and analysis.		
UNIT I - FINANCING AND MANAGING NEW VENTURE					**(9)**
Importance of Financial Management as an integral part of Entrepreneurship -Conducting a feasibility analysis - What lenders and investors look for in a business plan.					
UNIT II -SOURCES OF FINANCE					**(9)**
Importance of Financial Management as an integral part of Entrepreneurship -Conducting a feasibility analysis - What lenders and investors look for in a business plan.					
UNIT III -INSTITUTIONAL FINANCIAL SUPPORT					**(9)**
Schemes and functions of rate of Industries - District Industries Centres (DICs) - Industrial Development Corporation (IDC) - State Financial Corporation (SFCs) - Small Scale Industries Development Corporations (SSIDCs) -Khadi and Village Industries Commission (KVIC) - Technical Consultancy Organisation (TCO) - Small Industries Service Institute (SISI) - National Small Industries Corporation (NSIC) - Small Industries Development Bank of India (SIDBI).					
UNIT IV -VENTURE VALUATION					**(9)**
Valuing Early stage Ventures, Accounting Vs Equity Valuation Cash Flow. Venture Capital Valuation Methods: Basic Venture Capital Valuation Method, Earnings Multiplier, and Discounted Dividends.					
UNIT V -FINANCING FOR THE GROWING VENTURE					**(9)**
Professional Venture Capital, Venture Investing Cycle, Organizing the new fund, Other financing alternatives: Facilitators, Consultants and Intermediaries, Banking and Financial Institutions, Foreign Investors, State and Central Government Financing Programmes. Receivables Lending and Factoring, Mortgage Lending.					
TOTAL (L:45) : 45PERIODS					

TEXT BOOKS:
1.Leach/ Melicher, Entrepreneurial Finance, 5e, 2015. 2. Steven Rogers, Entrepreneurial Finance: Finance and Business Strategies for the Serious Entrepreneur 3e, Tata Mc Graw Hill, 2014. 3. Douglas Cumming, Entrepreneurial Finance, Oxford University Press, 2012.
REFERENCES:
1.M J Alhabeeb, Entrepreneurial Finance: Fundamentals of Financial Planning and Management for Small Business, Wiley, 2015. 2.Philip J. Adelman, Alan M. Marks, Entrepreneurial Finance, 5e, Pearson, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	2	3	3
CO3	2	3	2	3	2
CO4	3	2	2	2	2
CO5	2	3	3	2	3
CO(W.A)	**2.4**	**2.6**	**2.2**	**2.4**	**2.4**



22BAM08-FAMILY BUSINESS MANAGEMENT					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the importance of family-owned businesses for achieving competitive advantage in the market place.	**1.1**	Explain generation rules and theories of Family Business.		
2.0	To learn the methods of issuing securities.	**2.1**	Explain generation rules and theories of Family Business.		
3.0	To make Students understand the fee based services offered by merchant banks.	**3.1**	Develop next generation leaders as Successor for Family Business		
4.0	To make students learn the fund based services of merchant banks.	**4.1**	Outline life cycle stages and transgenerational entrepreneurship.		
5.0	To make students understand the novel fund based financial services.	**5.1**	Describe future of family business in Institutional change.		

UNIT I – INTRODUCTION TO FAMILY BUSINESS	**(9)**
Family Business as a unique synthesis- Succession and Continuity: The three generation rule- Building Family business that last- The systems theory model of Family Business - Agency Theory of Family business - The stewardship perspective of family business - Competitive Challenges and Competitive advantages of family businesses- Family emotional intelligence.	
UNIT II – OWNERSHIP CHALLENGES AND FAMILY GOVERNANCE	**(9)**
Shareholder Priorities – Managers vs Owners - Responsibilities of shareholders to the company - Effective Governance of the shareholder - firm relationship – Family Governance: Structure, Challenges to family governance, Managing the challenges of succession. Enterprise Sustainability: Twelve elements of strategic –fit and its implications on family firms.	
UNIT III –SUCCESSOR DEVELOPMENT	**(9)**
Characteristics of next-generation leaders - Next-generation attributes interests and abilities for responsible leadership- Next-generation personalities managing interdependence- CEO as an architect of succession and continuity - Types of CEO Spouse and the transfer of power.	
UNIT IV – STRATEGIC PLANNING AND TRANSGENERATIONAL ENTERPRENEURSHIP	**(9)**
Life cycle stages influencing family business strategy - Turning core competencies into competitive advantage – The unique vision of family-controlled businesses - Strategic regeneration- The Business Rejuvenation matrix - Intrapreneurship.	

UNIT V - FUND BASED FINANCIAL SERVICES	(9)
New Leaders of the Evolution - Three states of evolution - Continuity and culture - changing the culture - The change formula - Organization Development approaches to change - Commitment planning - Organic competencies and business's future - Thriving through competition - Institutionalizing the change.	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

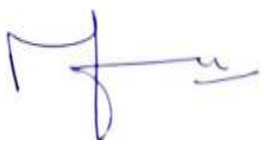
1. Ernesto J.Poza, Mary S. Daughterty, Family Business, 4e, Cengage Learning, 2015.
2. Frank Hoy, Pramodita Sharma, Entrepreneurial Family Firms, Prentice Hall, 2010
3. Sudipt Dutta, Family Business in India, Sage Publications, 1997.

REFERENCES:

1.Laura Hougaz, Entrepreneurs in Family Business Dynasties: Stories of Italian-Australian Family Businesses over 100 years, Springer, 2015.
2.John L. Ward, Keeping the Family Business Healthy: How to Plan for Continuing Growth, Profitability and Family Leadership, Palgrave Macmillan, 2011.
3. M. Nordqvist, T. Zellweger, Transgenerational Entrepreneurship: Exploring Growth and Performance in Family Firms across Generations, Edward and Elgar Publishing Limited, 2010

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

C0s/ POs	PO1	PO2	PO3	PO4	PO5
C01	3	2	2	3	2
C02	2	3	3	3	3
C03	3	3	2	2	2
C04	2	3	2	2	2
C05	2	2	2	2	2
CO(W.A)	2.4	2.6	2.2	2.4	2.2



22BAM09-FINANCIAL MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

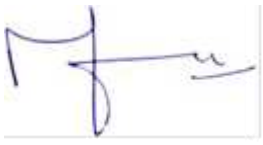
Course Objectives		Course Outcomes	
1.0	To enable the students to understand the concept of financial management	**1.1**	The students will be able to understanding of financial management concepts & principles.
2.0	To help the students to learn the investment decisions taken by the financial manager.	**2.1**	The students will be able to apply the techniques involved in the investment decision.
3.0	To make the students to understand the theories & determinants influencing financing & divided decisions taken in the firm.	**3.1**	The students will be able to understanding on financing & dividend decisions to raise the funds & increasing the market value of the firm.
4.0	To acquire knowledge on working capital requirement.	**4.1**	The students will be able to calculate the working capital requirement and also management of cash & receivables.
5.0	To educate the students to understand the long term sources of finance for raising the funds.	**5.1**	The students will be able to understanding on the various sources of finance.

UNIT I -FOUNDATIONS OF FINANCE	**(9)**
Financial management – Objectives, Scope, financial decisions - Time value of money- Introduction to the concept of risk and return of a single asset and of a portfolio- Valuation of bonds and shares.	
UNIT II - INVESTMENT DECISIONS	**(9)**
Capital Budgeting: Principles - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Project selection under capital rationing - Concept and measurement of cost of capital.	
UNIT III - FINANCING AND DIVIDEND DECISION	**(9)**
Financial and operating leverage - capital structure – Theories of capital structure – determinants of capitalstructure. Dividend policy - Aspects of dividend policy – relevance and irrelevance theories - forms of dividend policy - forms of dividends - share splits	
UNIT IV – LIQUIDITY DECISIONS	**(9)**
Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital requirements (Simple problems). Accounts Receivables Management and factoring – Inventory management - Cash management - Working capital finance: Trade credit, Bank finance and Commercial paper.	
UNIT V - LONG TERM SOURCES OF FINANCE	**(9)**
Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.	
	TOTAL (L:45) :45 PERIODS

TEXT BOOK:
1.M.Y. Khan and P.K.Jain, "Financial management", Text, Problems and cases, Tata Mc GrawHill, 8th Edition, 2018

REFERENCES:
1.I.M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 11th Edition, 2015.
2.Prasanna Chandra, "Financial Management", 10th Edition, Tata McGraw Hill, 2019.
3.Stephen Ross, Randolph Westerfield, Bradfordfordan, "Corporate Finance" Tata Mc grow Hill, 11th Edition, 2016.
4.R.P.Rustagi, "Financial Management Theory Concepts and Problems", Taxmann, 6th Edition | Reprint 2022.
5.http://nptel.ac.in/courses/110106043/3, "Basics of Financial Management", Prof. A. ThillaiRajan, Department of Management Studies Indian Institute of Technology, Madras.
6.http://nptel.ac.in/courses/110105057/, "International Financial Environment", Prof. A.K. Misra, Department of Management Indian Institute of Technology, Kharagpur.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
C0s/ POs	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**
CO1	3	2	1	2	3
CO2	3	3	1	3	3
CO3	3	3	3	1	1
CO4	3	3	1	2	2
CO5	2	2	-	2	2
C O (W.A)	**2.8**	**2.6**	**1.5**	**2.0**	**2.2**

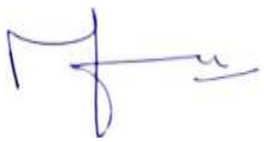


22BAM10-INTERNATIONAL TRADE FINANCE					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the International Trade finance concepts and basics.	**1.1**	The students will be able to understand the impact of international competitive forces on balance of payments and trade.		
2.0	To Know export import finance and FOREX management	**2.1**	The students will be able to know the major models of export import finance in international trade.		
3.0	To learn about FOREX Market.	**3.1**	The students will be able to determine the basic concepts in Forex Management.		
4.0	To Understand the documentation involved in international trade	**4.1**	The students will be able to construct documentation involved in international trade finance.		
5.0	To create awareness about the various schemes provided by government.	**5.1**	The students will be able to evaluate the export promotion schemes.		

UNIT I -INTERNATIONAL TRADE	**(9)**
International Trade - Meaning and Benefits - Basis of International Trade - Barriers to International Trade - Balance of Trade - Balance of Payment - WTO - Indian EXIM Policy.	
UNIT II -EXPORT AND IMPORT FINANCE	**(9)**
Special need for Finance in International Trade - Pre shipment finance - Post shipment Finance - Financial institutions - Forfeiting.	
UNIT III - FOREX MANAGEMENT	**(9)**
Foreign Exchange Markets – Spot Prices and Forward Prices – Factors Influencing Exchange Rates – The Effects of Exchange Rates in Foreign Trade – Tools for Hedging against Exchange Rate Variability – Forward, Futures and Currency Options – FEMA.	
UNIT IV - DOCUMENTATION IN INTERNATIONAL TRADE	**(9)**
Export Trade Documents: Financial Documents – Bill of Exchange- Type- Commercial Documents -Transport Documents - Risk Covering Document- Official Document - GSPS – UPDC Norms.	
UNIT V - EXPORT PROMOTION SCHEMES	**(9)**
Government Organizations Promoting Exports – Export Incentives: Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:
1.Franchis Cherunilam, "International Marketing (Text and cases)", 16th Edition, Himalaya Publishing, Mumbai, 2019. 2.Franchis Cherunilam, "International Trade and Export Management", 21st Edition, Himalaya Publishing, Mumbai, 2019.
REFERENCES:
1.Philip R Cateora, Bruce Money, Mary C.Gilly, John Graham, "International Marketing", 18thEdition, McGraw Hill Education, New Delhi, 2019. 2.Anders Grath, "The Handbook of International Trade and Finance", 2nd Edition, Nordia Publishing Ltd, United Kingdom, 2012. 3.Eun and Resnik, "International Financial Management", 5th Edition, McGraw Hill, New Delhi, 2011. 4.Apt P.G., "International Financial Management", 3rd Edition, McGraw Hill, New Delhi, 2011. 5.Jeff Madura, "International Corporate Finance", 9th Edition, Cengage Learning, New Delhi, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	2
CO2	2	2	2	2	2
CO3	3	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
CO(W.A)	**2.4**	**2.0**	**2.0**	**2.2**	**2.0**



22BAM11- FINANCIAL SERVICE,PRODUCT AND MARKETING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE: NIL

Course Objectives		Course Outcomes	
1.0	To make the students understand the concept of demand, revenue and cost.	**1.1**	The students will be able to Describe a financial service organisation's marketing-critical internal and external environments
2.0	To understand the financial services like banking, insurance.	**2.1**	The students will be able to Apply marketing theories, models, and/or frameworks appropriate to a financial service organisation's marketing environment.
3.0	To understand the strategies used by successful services marketers with reference financial services.	**3.1**	The students will be able to Analyse the financial services industry marketing environment using extant theories.
4.0	To overcome these difficulties will be discussed through case studies.	**4.1**	The students will be able to Create marketing strategies in a financial services industry setting.
5.0	To understand the problems commonly encountered in marketing services	**5.1**	The students will be able to Generate differentiated value propositions for a financial services organisation based on appropriate theories, models, and/or framework

UNIT I - : FINANCIAL SERVICES	**(9)**
Concepts, Types of Financial Services, Regulatory Framework of Financial Services in India.	
UNIT II - BANKING SERVICES	**(9)**
Commercial. Development, Investment and International Banking – Issues, Trends and Challenges, Marketing of Banking Services and Insurance Companies.	
UNIT III - MARKETING OF FINANCIAL SERVICES	**(9)**
Marketing Mix of Financial Services, Financial Products Development Strategies, Analysing Marketing Strategies Adopted by Selected Banks & Other Financial Service Providers, Ethical Issues in Marketing of Financial Services.	
UNIT IV –- BRANDING IN FINANCIAL SERVICES	**(9)**
Target Marketing & Customer Retention, Significance of Financial Brands, Targeting and Positioning Strategies, Impact of Branding on Customer Perception Towards Financial Service Providers, Creation of a Financial Brand.	
UNIT V - MERCHANT BANKING	**(9)**
Overview, Nature, Functions, Scope and Regulation	
TOTAL (L:45) :45PERIODS	

TEXT BOOKS:

1. Dr. Solanki, Dr. (Prof.) RB & Rajeshwari ,Marketing Of Financial Products And Services, Galgotia Publishing Company,(2019).
2. Ritu Srivastava (2023) Marketing of Consumer Financial Products: Insights From Service Marketing, Business Expert Press,2023.

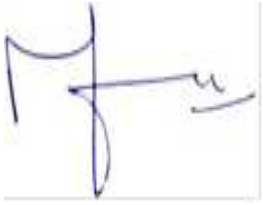
REFERENCES:

1.Akhgari M., Bruning E. R., Finlay J., & Bruning N. S. (2018). Image, performance, attitudes, trust, and loyalty in financial services. *International Journal of Bank Marketing*.

2.Al-Hawari M. A. (2015). How the personality of retail bank customers interferes with the relationship between service quality and loyalty. *International Journal of Bank Marketing*.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAM12-MERCHANT BANKING AND FINANCIAL SERVICES				
	L	T	P	C
	3	0	0	3

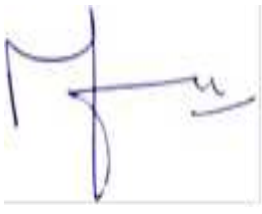
PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To examine Financial Services management as an important and contemporary area of financial management.	**1.1**	The students can able to understand the Contemporary area of financial management
2.0	To understand the various financial services and their future	**2.1**	The students will be able to forecast the future needs
3.0	To determine the most suitable financial service, given the situations and contingencies	**3.1**	The students can able to Illustrate the concepts of contingencies of financial management
4.0	To know the emergence and developments of Financial services in India	**4.1**	The students will be able to solve the financial issues in India
5.0	To observe the challenges ahead for financial services sector.	**5.1**	The students able to describe the challenges and functions of finance85

UNIT I -MERCHANT BANKING AND FINANCIAL SERVICES	**(9)**
Merchant Banking and Financial Services-Concept of merchant banking- financial system in India-development of merchant banks and regulations.	
UNIT II – ISSUES MANAGEMENT	**(9)**
Pre-issue and Post-issue management activities performed by merchant banks.	
UNIT III-UNDERWRITING AND BROKAGES	**(9)**
Introduction to the different roles played by underwriter and brokers in issue management and their responsibilities.	
UNIT IV -RAISING CAPITAL FROM INTERNATIONAL MARKETS	**(9)**
Needs of Indian companies for raising funds from foreign markets usage of euro issue- evaluation of various types of depository receipts- American Depository Receipts- Global Depository Receipts- FCCB	
UNIT V -FINANCIAL SERVICES	**(9)**
Financial services in India- types and importance- online trading- dematerialization and rematerialization.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
1.Gurusamy S, Merchant Banking and Financial Services, Vijay Nicole and Tata McGraw Hill, , 4th Edition, 2012, New Delhi 2. Khan M Y, "Financial Services", Tata McGraw Hill 3. Sri Ram, "Handbook of Leasing & Hire purchases", ICFAI Hyderabad
REFERENCES:
1. Dr. Natarajan K, 2009, —Financial Markets and Services‖, Himalaya Publishing House Pvt. Ltd., India 2. Dr. Guruswamy S, 2009 —Financial Service‖, Tata Mc Graw-hill Education, New Delhi. 3. Prasanna Chandra, 2011 — Financial Management Theory and Practice‖, Tata Mc Graw-hill Education, New Delhi. 4.Khan M Y and Jain P K, 2008, — Financial Management Text, Problems and Cases‖. Tata Mc Graw-hill Education, New Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAM13-BANKING LAWS AND OPERATION				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To familiarize the concept of banking Laws and Practice of Banking.	**1.1**	The students will be able to understand banking Laws and Practice of Banking.
2.0	To bring about awareness among students with changes and innovations in Banking Industry	**2.1**	The students will be able to know the new technology in banking.
3.0	To understand the Negotiable Instrument Act 1991.	**3.1**	The students will be able to analyze and prepare the Balance of Payments account for a country.
4.0	To familiarize the paying and collecting banker duties and responsibilities.	**4.1**	The students will be able to aware about paying and collecting banker duties and responsibilities.
5.0	To know the various advances and securities in banking operations.	**5.1**	The students will be able to know the various advances and securities in banking operations.

UNIT I-BANKING REGULATIONS ACT1949	**(9)**
History-definition of banking as per BR Act, other forms of business permitted and prohibited for banking companies. Concepts only- Paid-up-capital and reserve for an Indian banking company-licensing of banking company.	
UNIT II – RELATIONSHIP BETWEEN BANKER AND CUSTOMER	**(9)**
Definition of Banker and Customer-General relationship. Special relationship - Special types of customers- Minor, lunatic, married women, Joint Accounts, Partnership accounts. Private Limited Company, Public Limited Company, Non Trading Concerns, Trust Accounts - Closure of Accounts. KYC Policy.	
UNIT III-NEGOTIABLE INSTRUMENTS	**(9)**
Meaning - Characteristics of Negotiable Instruments - Parties to the Instruments - Different types of negotiable instruments - Bills of Exchange Essentials - Promissory Note - Essentials - Cheques - Essentials, MICR Cheques - Material alterations - Markings - Endorsement - Types of endorsement.	
UNIT IV -PAYING BANKER AND COLLECTING BANKER	**(9)**
Duties and responsibilities - Statutory Protection - Dishonor of Cheques -grounds - payment of cheques and other instruments..Collecting Banker Duties and Responsibilities - Statutory Protection, Banker as a holder in due course.Banker as holder for value.	

UNIT V -ADVANCES AND SECURITIES.	(9)
Principles of sound lending - Methods of granting advances - Secured unsecured advances - Methods of creating charges on securities - Lien, Pledge, Hypothecation and Mortgage..	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1.Indian Institute of Banking and Finance (IIBFAuthor) ,Banking Regulations & Business Laws, **Kindle Edition**,2023.

2. M.N.Gopinath, Banking Principles and Operations, Snow White publishers,2017.

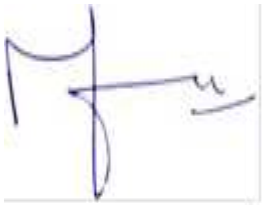
REFERENCES:

1. Indian Institute of Banking and Finance (IIBFAuthor),Principles and Practices of Banking, Kindle Edition,2022.

2. Bimal Jaiswal ,Banking Operation Management, Vikas Publishing House,2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAM14- DIGITAL TRANSFORMATION	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make the students to have a multidisciplinary skills and perspectives in order to enable them to architect digital innovations and disruption.	**1.1**	The students will be able to Develop a digital transformation framework for an organization as the blueprint for transformation
2.0	To help organizations build a digital culture by grooming a workforce who can leverage emerging digital technologies to transform business..	**2.1**	The students will be able to Imbibe digital culture that brings together new technologies and business processes
3.0	To improve design thinking and innovation.	**3.1**	The students will be able to Develop Advanced Skills in Digital Technologies to integrate it into the Business.
4.0	To make the students understand the concept of block chain and IOT	**4.1**	The students will be able to understand the concept of block chain and IOT
5.0	To learn the virtual and augmented reality	**5.1**	The students will be able to know virtual and augmented reality.

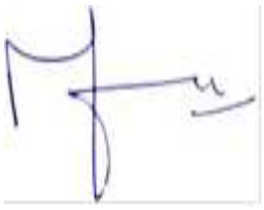
UNIT I-BUSINESS ANALYTICS AND BIG DATA.	**(9)**
Classification of Digital Data, Structured and Unstructured Data – Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments.	
UNIT II – DIGITAL MARKETING.	**(9)**
Introduction to digital marketing-traditional Vs. modern Digital marketing-Technology behind digital marketing-Characteristics of digital marketing-Digital marketing stratergy.	
UNIT III-CLOUD AND DEVOPS	**(9)**
Fundamentals of Devops: Deployments ,Orchestration, Need, instance of application-DevOps delivery pipeline.	
UNIT IV -BLOCK CHAIN AND IOT	**(9)**
Introduction to blockchain-challenges in block chain-advantages and disadvantages in blockchain-Introduction to IOT-functions and scope of IOT-advantages and disadvantages of IOT.	

UNIT V -VIRTUAL AND AUGMENTED REALITY	(9)
Introduction -VR Systems -Stereoscopic Vision & Haptic rendering - VR software development - 3D interaction techniques - AR software development - Applications of AR and VR.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. R N Prasad and Seema Acharya, Fundamentals of Business Analytics, 2ed, Wiley publishers,2016.
2. Jeremy Kagan (Author), Siddharth Shekhar Singh Digital Marketing: Strategy & Tactics,2020.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAM15-INVESTMENT MANAGEMENT					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide an overview of institutional details linked to financial markets and the trading process	**1.1**	The students will be able to describe about the trading process		
2.0	To provide an overview of historical trends and innovations in financial instruments and trading processes	**2.1**	The students will be able to know the applications of financial instruments		
3.0	To provide an overview of various financial instruments.	**3.1**	The students will be able to analyze and solve the issues in finance.		
4.0	To provide insight into the use of finance theory in investment management	**4.1**	The students will be able to know the measurement and analysis of risk of financial investments.		
5.0	To provide an overview of mutual funds.	**5.1**	The students will be able to understand the basic concepts of mutual funds.		

UNIT I-INTRODUCTION TO INVESTMENT MANAGEMENT	**(9)**
Investment Management, Nature and Scope, Investment Avenues, Types of Financial Assets and Real Assets, Security, Return and Risk – Systematic and Unsystematic Risk – Sources of Risk, Measurement of Risk and Return, Sources of Investment Information.	
UNIT II –SECURITY ANALYSIS	**(9)**
Analysis of Variable Income Securities, Fundamental Analysis – Analysis of Economy, Industry Analysis, Company Analysis – Financial and Non-financial – Equity Valuation Models, Options, Futures, Forwards, Warrants and their Valuations, Technical Analysis – Dow's Theory, Charts – Efficient Market Hypothesis and its Implication.	
UNIT III-PORTFOLIO MANAGEMENT	**(9)**
Meaning of Portfolio Management, Portfolio Analysis, Why Portfolios? Portfolio Objectives, Portfolio Management Process, Selection of Securities, Portfolio Theory, Markowitz Model, Sharpe's Single Index Model, Efficient Frontier with Lending and Borrowing.	
UNIT IV -PORTFOLIO MANAGEMENT STRATERGIES	**(9)**
Bond Portfolio Management Strategies, Equity Portfolio Management Strategies, Strategies using Derivatives, Hedging, Portfolio Revision – Rebalancing Plans, Portfolio Evaluation, Sharpe's Index, Treynor's Measure and Jenson's Measure..	
UNIT V -MUTUAL FUNDS	**(9)**
Mutual Funds, Investor's Life Cycle, Personal Investment, Personal Finance, Portfolio Management of Funds in Banks, Insurance Companies, Pension Funds, International Investing, International Funds Management, Emerging Opportunities, A Brief Survey of Software Packages for Portfolio Management.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
1.Investment Analysis and Portfolio management Prasanna Chandra Tata McGraw Hill Education 3/e, 2010 2.Investments ZviBodie, Kane, Marcus & Mohanty Tata McGraw Hill Education 8/e, 2010 3 Security Analysis & Portfolio Management J Kevin Tata McGraw Hill Education 2014
REFERENCES:
1.Analysis of Investments & Management Reilly & Brown Cengage Publications, 10e/2017 2.Security Analysis & Portfolio Management Punithavathy Ehavathy Pandian Vikas Publications 2/e, 201/8 3.Investment management (Security Analysis and & Portfolio Management) Bhalla V.K. Vikas Publications 19/e, 2018

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
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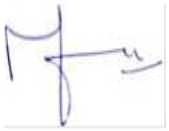
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22BAM16-FINANCIAL DERIVATIVES				
L	T	P	C	
3	0	0	3	

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To Understand the basics involved in derivatives	**1.1**	The students can able to understand the fundamental concepts of derivatives.
2.0	To Understand the basic operational mechanisms in derivatives	**2.1**	The students will be able to analyze the applications of future contracts.
3.0	To Utilize options contracts for portfolio management purpose	**3.1**	The students can able to Illustrate the concepts of options in financial market.
4.0	To discuss the uses of SWAP in stock market.	**4.1**	The students will be able to demonstrate the uses and application of SWAP in stock market.
5.0	To learn about history of derivatives in India.	**5.1**	The students able to describe the history of derivatives in India.

UNIT I -DERIVATIVES	**(9)**
Derivatives – Definition – Types – Forward Contracts – Futures Contracts – Options – Swaps – Differences between Cash and Future Markets – Types of Traders – OTC and Exchange Traded Securities – Types of Settlement – Uses and Advantages of Derivatives – Risks in Derivatives.	
UNIT II - FUTURES CONTRACT	**(9)**
Specifications of Futures Contract - Margin Requirements – Marking to Market – Hedging uses Futures – Types of Futures Contracts – Securities, Stock Index Futures, Currencies and Commodities – Delivery Options.	
UNIT III - OPTIONS	**(9)**
Definition – Exchange Traded Options, OTC Options – Specifications of Options – Call and Put Options – American and European Options – Intrinsic Value and Time Value of Options – Option payoff, options on Securities, Stock Indices, Currencies and Futures – Options pricing models – Differences between future and Option contracts.	
UNIT IV -SWAPS	**(9)**
Definition of SWAP – Interest Rate SWAP – Currency SWAP – Role of Financial Intermediary – Warehousing – Valuation of Interest rate SWAPs and Currency SWAPs Bonds and FRNs – Credit Risk.	
UNIT V -DERIVATIVES IN INDIA	**(9)**

Evolution of Derivatives Market in India – Regulations - Framework – Exchange Trading in Derivatives – Commodity Futures – Contract Terminology and Specifications for Stock Options and Index Options in NSE – Contract Terminology and specifications for Stock Futures, Index Futures in NSE and Interest Rate Derivatives.
TOTAL (L:45) : 45 PERIODS

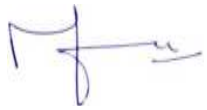
TEXT BOOKS:

1. Jiří Witzany, Derivatives, Theory and Practice of Trading, Valuation, and Risk Managementm,Springer International Publishing · 2020.
2. John C. Hull, Sankarshan Basu (2016), Options, Futures and other Derivatives, 9thEdition, Pearson education.

REFERENCES:

1. Prakash Yaragol, "Financial Derivatives: Text and Cases", 1stEdition, Vikas Publishing, New Delhi, 2018.
2. Gupta S.L., "Financial Derivatives Theory, Concept and Problems", 2ndEdition, PHI Learning, New Delhi, 2017.
3. John C. Hull, SankarshanBasu, "Options Futures & Other Derivatives", 10thEdition, Pearson Education, Noida, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)					
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	2	2	3	2	2
CO4	3	2	2	3	2
CO5	3	3	2	2	3
CO(W.A)	**2.6**	**2.4**	**2.4**	**2.4**	**2.4**



22CAB01 ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives:

- To develop operations on Linear and Non Linear Data Structures using appropriate Data Structures

Course Outcomes: The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply operations on Linear Data Structures	Ap	20%
CO2	Analyze and develop operations on Linear Data Structures	An	20%
CO3	Design solutions for applications using appropriate data structures	Ap	40%
CO4	Carry out independent investigations of operations on various data structures	An	20%
CO5	Discuss Algorithms for various applications using Data Structures	U	Internal Assessment

UNIT I - LINEAR DATA STRUCTURES	**(9)**
Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of Stack: Evaluating Arithmetic Expressions - Applications of Queue - Linked Lists - Singly Linked List - Doubly Linked lists – Applications of Linked List: Polynomial Manipulation.	
UNIT II - NON-LINEAR TREE STRUCTURES	**(9)**
Tree : Basic Terminologies, implementation of tree- Binary Tree – Types of Binary tree- Properties of Binary tree - Expression trees – Binary tree traversals – Applications of trees – Binary search tree - Balanced Trees - AVL Tree - B-Tree - Red black Tree.	
UNIT III – GRAPHS	**(9)**
Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – Shortest-path algorithms – Dijkstra's algorithm – Bellman-Ford algorithm – Floyd's Algorithm - Minimum spanning tree – Prim's and Kruskal's algorithms.	
UNIT IV - ALGORITHM DESIGN AND ANALYSIS	**(9)**
Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming: Characteristics, Components, and Comparison - Applications.	
UNIT V - ADVANCED ALGORITHM DESIGN AND ANALYSIS	**(9)**
Backtracking – N-Queen's Problem – Sum of Subset Problems –Graph Coloring Problem - Branch and Bound: Introduction, Travelling Salesman Problem, 0/1 Knapsack Problem - P & NP Problems – NP-Complete Problems – Approximation Algorithms for NP-Hard Problems.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2017.
2. M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Pearson Education Asia, 2013.
3. Rajesh K Shukla, "Analysis and Design of Algorithms: A Beginner's Approach", Wiley Publication, 2015.
4. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education, 2015.
5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2	3												
3			3									2	2	
4		3	3										2	
5			3									2	2	
CO	2	3	3									2	2	

22CAB02 OPERATING SYSTEMS				
	L	T	P	C
	3	0	0	3
PRE REQUISITE : NIL				
Course Objective:	• To describe operating system basics & features, Process management, Memory management and Device management and study various Operating Systems			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Be competent in recognizing operating systems features and issues.	Ap	20%
CO2	Analyze about Process, semaphores and deadlocks.	An	20%
CO3	Apply concept about Paging and Segmentation.	Ap	40%
CO4	Analyze the file system and I/O device management.	An	20%
CO5	Examine about design, memory and I/O management in various Operating Systems	U	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Introduction – Role of OS, Types of OS - Operating Systems operations - Operating Systems and services – Processes – CPU Scheduling approaches.	
UNIT II - PROCESS MANAGEMENT	**(9)**
Process Synchronization – Semaphores – Deadlocks – Handling Deadlocks – Threads – Multithreading.	
UNIT III - MEMORY MANAGEMENT	**(9)**
Memory Management – Paging – Segmentation – Virtual Memory – Demand Paging – Replacement Algorithms.	
UNIT IV - STORAGE MANAGEMENT	**(9)**
Disk Scheduling Approaches – File Systems – Design Issues – User interfaces to File Systems – I/O Device Management.	
UNIT V - CASE STUDIES	**(9)**
Case Study –Design and Implementation of the UNIX OS, Process Model and Structure – Memory Management - File System – UNIX I/O Management and Device Drivers – Windows – System Components – Process Management.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Abraham Silberschatz Peter B. Galvin, G. Gagne, "Operating System Concepts", Tenth Edition, John Wiley and Sons Inc., USA, 2018.
2. Willam Stalling, "Operating System", Seventh Edition, Pearson Education, 2012.
3. M. J. Bach, "Design of the Unix Operating System", Fifth Edition, Pearson Education, 1990.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2		3								2			2	2
3	3		2										2	
4		3	2											
5				2								2	2	2
CO	3	3	2	2								2	2	2

22CAB03 COMPUTER NETWORKS				
	L	T	P	C
	3	0	0	3
PRE REQUISITE : NIL				
Course Objective:	• To provide a comprehensive understanding of computer networks layers and solid foundation in data communications, network architecture, and protocols, with an emphasis on how different layers of the network interact to enable effective communication.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the Physical Layer's components, including transmission media, line coding schemes, and transmission modes, and evaluate their impact on network performance.	An	20%
CO2	Demonstrate understanding of link-layer addressing and implement error detection and correction techniques, including block coding and cyclic codes.	Ap	20%
CO3	Implement and evaluate routing algorithms, including Distance Vector Routing, Link State Routing, and BGP4, and assess their impact on network performance.	Ap	20%
CO4	Analyze and implement congestion control and avoidance techniques to optimize network traffic.	An	20%
CO5	Demonstrate the ability to configure and troubleshoot network applications and understand their role in supporting network communication.	An	20%

UNIT I - NETWORK INTRODUCTION & PHYSICAL LAYER	**(9)**
Data Communications – Networks – Network Types – Standards and Administration - Protocol Layering - TCP/IP Protocol Suite – OSI Model – Physical Layer: Transmission Media – Line Coding and its Schemes - Transmission Modes.	
UNIT II - DATA LINK LAYER	**(9)**
Introduction of DLL – Link-Layer Addressing - Error Detection and Correction: Types of Errors, Block Coding - Cyclic Codes – Checksum - Forward Error Correction: Hamming Distance – Data Link Control: DLC Services – Data-Link Layer Protocols - HDLC. Wired LANs: Standard Ethernet - Fast Ethernet - Gigabit Ethernet - Wireless LAN: IEEE 802.11 Project.	
UNIT III - NETWORK LAYER	**(9)**
Switching – Circuit Switched Networks - Packet Switching – Structure of a Switch – Network Layer Services and Performance – IPV4 Addresses – Routing Algorithms: Distance Vector Routing – Link State Routing – BGP4.	
UNIT IV - TRANSPORT LAYER	**(9)**
Transport Layer Services – Connection Establishment – Transport Layer Protocols – User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) – Congestion Control and Avoidance.	
UNIT V - APPLICATION LAYER	**(9)**
World Wide Web and HTTP – FTP – Electronic Mail – TELNET – Secure Shell (SSH) - Domain Name Space (DNS).	
	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Behrouz A. Forouzan, "Data Communication and Networking", Fifth Edition, Tata McGraw-Hill, 2013.
2. Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", Sixth Edition, 2022.
3. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2017.
4. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2	3												3	
3		3								3			3	
4										3			3	
5		3												
CO	3	3								3			3	

22CAB04 CLOUD COMPUTING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To provide a comprehensive understanding of cloud computing fundamentals, architecture, and services, including development, deployment, and management. • To equip students with practical skills in designing, implementing, and evaluating cloud-based solutions, including storage, sharing, and collaboration tools.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explore the complex cloud computing concepts.	An	20%
CO2	Apply their knowledge of cloud computing concepts to real-world scenarios and problems.	Ap	40%
CO3	Analyze and evaluate cloud computing solutions, services, and tools.	An	20%
CO4	Demonstrate hands-on application of cloud computing skills and knowledge.	Ap	20%
CO5	Generate and evaluate new ideas for cloud storage and sharing solutions.	C	Internal Assessment

UNIT I - CLOUD COMPUTING FUNDAMENTALS	**(9)**
Define Cloud Computing – Cloud Types – Examining the Characteristics – Benefits, Disadvantages – Cloud Computing Architecture – Exploring the Cloud Computing Stack – Connecting to the Cloud.	
UNIT II - DEVELOPING CLOUD SERVICES	**(9)**
Web–Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On Demand Computing – Discovering Cloud Services - Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.	
UNIT III - USING CLOUD SERVICES	**(9)**
Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing – Collaborating on Databases – String and Sharing Files.	
UNIT IV - OUTSIDE THE CLOUD	**(9)**
Evaluating Web Mail Services – Evaluating Instant Messaging – Evaluating Web Conference Tools – Creating Groups on Social Networks – Evaluating on Line Groupware – Collaborating via Blogs and Wikis.	

UNIT V - STORING AND SHARING	(9)
Understanding Cloud Storage – Evaluating on Line File Storage – Exploring on Line Book Marking Services – Exploring on Line Photo Applications – Exploring Photo Sharing Communities – Controlling it with Web Based Desktops. Introduction to Cloud Databases – Hadoop - Case Study.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Barrie Sosinsky, "Cloud Computing", First Edition, Wiley Publishing inc, Canada 2018.
2. Kai Hwang, Geoffrey C Fox, Jack G.Dongarra, "Distributed and Cloud Computing, from Parallel Processing to the Internet of Things", Morgan Kautomann Publishers, 2012.
3. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				3								3	
2		3												
3		3							3	3		3	3	3
4					3								3	3
5			3								3		3	
CO	3	3	3		3				3	3	3	3	3	3

22CAB05 PYTHON PROGRAMMING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To develop the logical thinking abilities and to propose novel solutions for real world problems through programming language constructs. • To deepen the empirical knowledge in solving real time problems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of Python programming to develop different applications	Ap	20%
CO2	Apply control statements and operators to solve basic programming problems.	Ap	20%
CO3	Enhance problem-solving skills by applying Python to a variety of challenges and scenarios across different disciplines.	Ap	20%
CO4	Develop modular code using functions and manage file operations efficiently.	C	20%
CO5	Develop a project using python's built in modules and frameworks.	C	20%

UNIT I - INTRODUCTION DATA, EXPRESSIONS, STATEMENTS	**(9)**
Introduction to Python and installation, variables, expressions, statements, Numeric data types: int, float, Boolean, string. Basic data types: List - List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters. Tuple - Create and Access, Operations, Functions, Inserting, Deleting and Modifying elements in Tuple. Sets: Operations and Methods. Dictionaries: Operations and Methods.	
UNIT II - CONTROL FLOW, LOOPS, FUNCTIONS	**(9)**
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if- elif-else); Iteration: statements break, continue. Functions - function and its use, pass keyword, flow of execution, parameters and arguments.	
UNIT III - ADVANCED FUNCTIONS, ARRAYS	**(9)**
Fruitful functions: return values, parameters, local and global scope, function composition, Recursion; Advanced Functions: lambda, map, filter, reduce, basic data type comprehensions. Python arrays: create an array, Access the Elements of an Array, array methods.	
UNIT IV - FILES, EXCEPTIONS	**(9)**
Files: Types of file, file I/O, Seek() and tell() methods, Zipping and Unzipping files Exception: Errors in python programs, Exceptions, Exception Handling, Types of Exceptions, Introduction to basic standard libraries.	
UNIT V - OBJECT ORIENTED PROGRAMMING, FRAMEWORK	**(9)**
Object, Class, Method, Inheritance, Polymorphism, Data Abstraction, Encapsulation, Python Frameworks: Explore Django Framework.	
	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2017.
2. Dr. R. Nageswara Rao, "Core Python Programming", 3rd edition revised and updated, Dream tech Press, 2022.
3. Vamsi Kurama, "Python Programming: A Modern Approach", Kindle Edition, Pearson Publication, 2018.
4. Kenneth A. Lambert, Martin Osborne, "Fundamentals of Python: First program, Introduction to Python", Course Technology Cengage, Edition: import, 2011.
5. John V.Guttg, "Introduction to Computation and Programming using Python", MIT press, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			3											3
2			3											3
3	3	3												3
4		3	3											3
5											3		3	
CO	3	3	3								3		3	3

22CAB06 DATABASE MANAGEMENT SYSTEMS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objective:	• To understand how a real world problem can be mapped to schemas • To solve different industry level problems & to learn its applications

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze a given database application scenario to use ER model for conceptual design of the database	Ap	20%
CO2	Apply SQL to find solutions to a broad range of queries	Ap	20%
CO3	Apply normalization techniques to improve database design	Ap	20%
CO4	Apply principles of database transaction management, database recovery, and security.	C	20%
CO5	Develop, install and configure a database management system for business application and formulate queries to access the database.	C	20%

UNIT I - INTRODUCTION TO DATABASE SYSTEMS	**(9)**
Introduction to database systems – Definition of DBMS- Advantages of DBMS – Views of data – Levels of data Abstraction – Data Models and types – Database architecture – Entity Relationship Model – ER diagram – EER MODEL.	
UNIT II - RELATIONAL DATA MODEL	**(9)**
Relational database structure – Procedural and Non procedural languages – Relational algebra : operations - Integrity Constraints – SQL Commands : DDL – DML – TCL –DCL Set operations – Join Operations - Aggregation in SQL - Using the group by clause.	
UNIT III - SQL AND PL/SQL	**(9)**
PL/SQL Block – Introduction to PL/SQL – The Advantages of PL/SQL - PL/SQL Architecture - PL/SQL Data types - Variable and Constants – Using Built-in Functions – Conditional and Unconditional Statements – Stored procedures – Procedure with Parameters (IN,OUT and IN OUT) – Procedure with Cursors – Dropping a Procedure. Functions in PL/SQL : Difference between Procedures and Functions – User Defined Functions – Nested Functions –Using stored function in SQL statements – Trigger – Types of Triggers – Row Level Triggers – Statement Level Triggers –DDL Triggers.	
UNIT IV - DEPENDENCY PRESERVATION AND DB DESIGN	**(9)**
Functional Dependency: Full Functional Dependency - Partial dependency – Transitive dependency - Multi Valued Dependency – Decomposition – Normalization – Normal Forms: 1 NF- 2 NF – 3 NF – BCNF - 4 NF- 5 NF.	
UNIT V - TRANSACTIONAL PROCESSING	**(9)**
Transaction – Properties of transaction – Transaction state – Serialization : types – Need for Serialization – Two Phase Commit – Save Point – Concurrency – Locking protocols – Time stamp protocol – Next Generation Databases : No SQL, New SQL and Big Data – Document Databases – Data Models and Storage – No SQL APIs.	
	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Abraham Silber Schatz, Henry F. Korthand S.Sudarshan,"Database System Concepts", 7th Edition, McGraw Hill, 2020.
2. Elmasri R, S. V. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson, New Delhi, 2017.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, New Delhi, 2003.
4. C. J. Date, "An Introduction to Database Systems", 8th Edition, Addison Wesley, 2006.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			3										3	
2		3											3	
3		3												3
4			3											3
5											3			3
CO		**3**	**3**								**3**		**3**	**3**

22CAB07 DATA MINING AND DATA WAREHOUSING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : 22CAB06

Course Objective:	• To determine the concepts of Data Mining, the importance of data cleaning and data preprocessing., Analyze various classification and clustering • To discuss various patterns, various Data Warehousing design and its usage

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of Data Mining and various types of data that can be mined.	Ap	20%
CO2	Apply the concepts of Preprocessing and to gain awareness about the importance of data cleaning.	Ap	20%
CO3	Analyze about the various classification methods and the evaluation of clustering.	An	40%
CO4	Apply various patterns in data mining.	Ap	20%
CO5	Acquire knowledge about various data warehousing design and its usage.	U	Internal Assessment

UNIT I - INTRODUCTION TO DATA MINING	**(9)**
Data Mining Definition - Why Data Mining - Types of Data can be Mined – Patterns – Technologies - Applications-Issues in Data Mining - Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity - Case Study.	
UNIT II - DATA PREPROCESSING	**(9)**
Data Preprocessing: An Overview - Data Cleaning - Data Integration - Data Reduction - Data Transformation and Data Discretization.	
UNIT III - CLASSIFICATION AND CLUSTERING	**(9)**
Classification: Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule Based Classification– Model Evaluation and Selection. Clustering: Analysis – Partitioning, Hierarchical, Density Based Methods and Grid Based Methods – Evaluation of Clustering.	
UNIT IV - PATTERN MINING	**(9)**
Pattern Mining in Multilevel, Multidimensional Space - Constraint: Based Frequent Pattern Mining - Mining High Dimensional Data and Colossal Patterns - Mining Compressed Patterns - Pattern Exploration and Application.	
UNIT V - DATA WAREHOUSING	**(9)**
Data Warehouse: Basic Concepts - Data Warehouse Modeling Data Cube and OLAP - Data Warehouse Design and Usage – Implementation - Data Generalization- Case Study.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers, 2012.
2. George M. Marakas, "Modern Data Warehousing, Mining and Visualization: Core Concepts", Spring, 2012.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3												
2	2						2							
3		3									2			
4	2											2	2	
5			3	2									2	
CO	2	3	3	2			2				2	2	2	

22CAB08 PROGRAMMING IN JAVA				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To develop the ability to design, implement, and maintain robust, efficient, and scalable software applications using Java

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze core programming concepts such as syntax, data types and control structures.	An	20%
CO2	Applying OOP principles like encapsulation, inheritance, polymorphism, and abstraction, helps in creating modular, reusable, and maintainable code.	Ap	20%
CO3	Design applications that are portable across different operating systems and hardware.	Ap	20%
CO4	Enhance their problem-solving skills that analyze and optimize code performance to handle complex computational tasks effectively.	An	20%
CO5	Apply Generics, string handling, and the collection framework to equip with essential tools and techniques to write robust, efficient, and maintainable Java code.	Ap	20%

UNIT I - BASICS IN JAVA	**(9)**
History and Evolution of Java – An Overview of Java – Data Types, Variables, Type Conversions and Casting, Arrays – Operators – Control Statements - Command Line Arguments – Lambda Expressions.	
UNIT II - CLASSES AND OBJECTS, OVERLOADING	**(9)**
Introducing Classes : Class Fundamentals - Declaring Objects - Methods - Constructors - this Keyword - Garbage Collection – Overloading Methods and Constructors – Object as Argument and Returning Objects – Array of Objects –Recursion - Understanding Static – Final – Nested and Inner Class.	
UNIT III - INHERITANCE, PACKAGES AND INTERFACES	**(9)**
Inheritance Basics – Using Super – Method Overriding – Dynamic Method Dispatch – Abstract Classes –Using Final with Inheritance – Packages Member Access – Importing Packages – Interfaces – Using Static Methods in an Interface.	
UNIT IV - EXCEPTION HANDLING, MULTITHREADING AND I/O	**(9)**
Exception Handling Fundamentals – Exception Types – Using Try and Catch – Multiple Catch Clauses – Nested Try – Throw –Throws – Finally - Built-in Exceptions – User Defined Exceptions – Multithreaded Programming : Main Thread – Creating Threads - Thread Priorities – Synchronization – Inter Thread Communication – Enumeration - Type Wrappers – Auto boxing - I/O Basics : Buffered Input Stream – Buffered Output Stream – Print Stream – Print Writer- Reading and Writing a File.	

UNIT V - GENERICS, STRING HANDLING AND COLLECTION FRAMEWORK	(9)
Generic Class – Bounded Types – Generic Methods - String Handling : String Class –String Buffer and String Builder Class - Collection Frame works : Collection Interfaces – Collection Classes : Array List – Linked List – Hash Set – Tree Set – Priority Queue – Iterator – Map : Map Interfaces – Map Classes : Hash Map – Tree Map - Comparators.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Herbert Schildt, "Java: The Complete Reference", Eleventh Edition, Oracle Press, McGraw – Hill Education, 2019.
2. Cay S. Horstmann, "Core Java Volume I - Fundamentals", Tenth Edition, Prentice Hall, 2016.
3. Herbert Schildt, "Java : A Beginner's Guide", Seventh Edition, Oracle Press, McGraw – Hill Education, 2017.

TOTAL (L:45) : 45 PERIODS

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3											
4			3							3			3	3
5										3	3	3	3	3
CO	3	3	3							3	3	3	3	3

22CAB09 BIG DATA ANALYTICS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• Apply big data analytics techniques to solve real-world problems, demonstrating the ability to derive actionable insights from complex data sets.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge about the basic terminology of Big Data Analytics.	Ap	20%
CO2	Knowledge of Data mining tool and practical experience of applying data mining algorithms.	Ap	20%
CO3	Design applications using NoSQL and HADOOP	Ap	20%
CO4	To recognize and make appropriate use of different types of data structures.	C	20%
CO5	Design and write functions in R and to create sophisticated figures and graphs.	C	20%

UNIT I – INTRODUCTION	**(9)**
Introduction – Characteristics and Considerations – Data Structures – Business drivers – Business intelligence Vs Data science – Analytical Architecture –Key Roles of the New Big Data Ecosystem – Data Scientist - Big Data Applications.	
UNIT II - DATA ANALYTICS LIFECYCLE & ADVANCED ANALYTICS THEORY AND METHODS	**(9)**
Data Analytics Lifecycle: Discovery – Data preparation – Model Planning – Model Building – Communicate results – Operationalize – Key Roles for a Successful Analytic Project – Case Studies. Association Rules: Apriori Algorithm – Applications of Association Rules - Regression: Linear Regression – Logistic Regression.	
UNIT III - NoSQL, HADOOP AND MAP REDUCE	**(9)**
Base Concept. NoSQL: Types of Databases – Advantages – NewSQL – SQL vs. NoSQL vs NewSQL. Introduction to Hadoop: Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Interacting with Hadoop Eco systems.	

UNIT IV - R PROGRAMMING	(9)
Overview – Environment Setup – Data Types – Variables – Operators – Decision Making – Loops Statements – Function – Strings – Vectors: Scalars, Recycling, Operations – Function: All and Any, Vectorized operations, NA and NULL values, Filtering , Vectorized if-then else, Vector Equality, Vector Element names. Lists: Creation, Operations – Accessing List Components and Values, Applying functions to lists, Recursive List. Matrices: Creation, Operations – Applying functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction- Avoiding Dimension Reduction, Higher Dimensional arrays.	
UNIT V - ARRAYS, DATAFRAMES, INTERFACING AND GRAPHICS	**(9)**
Arrays: Creating, Accessing, Manipulating Array Elements – Factors: Factors and Tables, Factors and Levels, Functions, Working with tables. Data Frames: Creation, Matrix-like Operations, and Merging Data frames – Applying functions to Data Frames. R Data Interfaces: CSV Files – Excel files – Databases. Graphics: Creating Graphs, Customizing Graphs, Saving graphs to files, Creating three-dimensional plots. Charts: Pie chart – Bar Chart – Box plots – Histograms – Line Graphs – Scatter plots.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons Publications.
2. Tom White, "Hadoop: The Definitive Guide", Third Edition, Oreilly Media, 2011.
3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2											3		3	
3											3			3
4		3												3
5											3			3
CO		3									3		3	3

22CAB10 MACHINE LEARNING				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives :

- Provides a concise introduction to the fundamental concepts of machine learning and popular machine learning algorithms.
- To discover patterns in the data and make predictions based on often complex findings to answer business questions, detect and analyze trends and help solve

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the foundations of machine learning and apply suitable techniques for data collection and data processing.	Ap	20%
CO2	Select the appropriate model and use feature engineering	An	20%
CO3	To analyze data, model uncertainties, and make decisions based on statistical and probabilistic reasoning.	An	20%
CO4	Select appropriate task to build effective models whether to categorize data into discrete classes or to predict a quantity.	Ap	20%
CO5	Apply clustering to find a structure in a collection of unlabeled data and ANN to create complex patterns of a model and predict problems.	Ap	20%

UNIT I – INTRODUCTION	**(9)**
Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Preprocessing.	
UNIT II - MODEL EVALUATION AND FEATURE ENGINEERING	**(9)**
Model Evaluation: Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Introduction - Feature Transformation – Feature Subset Selection.	
UNIT III – PROBABILITY AND BAYESIAN LEARNING	**(9)**
Importance of Statistic Tools – Concept of Probability-Random Variables - Discrete distributions-Continuous distributions- Multiple Random Variables. Bayesian Concept Learning: Bayes Theorem-Concept Learning- Bayesian Belief Network.	
UNIT IV - SUPERVISED LEARNING	**(9)**
Classification: Introduction-Example-Classification model-Learning steps- Common classification algorithms- K-Nearest Neighbor-Decision Tree-Random Forest Model - Support Vector Machines. Regression: Introduction-Example-Simple linear regression-Multiple linear regression-Assumptions and problems in Regression Analysis- Improving the accuracy.	

UNIT V - UNSUPERVISED LEARNING AND ARTIFICIAL NEURAL NETWORKS	(9)
Unsupervised Learning Vs Supervised Learning – Applications – Clustering - Biological Neuron - Artificial Neuron- Types of Activation Function-Architectures of NN – Learning process in ANN – Back Propagation. Reinforcement Learning.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019.
2. AurelienGeron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly, 2019.
3. Willi Richert, Luis Pedro Coelho, "Building Machine Learning Systems with Python", 2ndEdition, Packt Publishing Ltd., 2015.
4. T. Hastie, R. Tibshirani, J. H. Friedman, "Introduction to Statistical Machine Learning", First Edition, Springer, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2		3												
3	3		3											
4										3	3		3	3
5										3	3		3	3
CO	3	3	3							3	3		3	3

22CAB11 WEB TECHNOLOGY				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the fundamental web technologies • To develop practical skills for building web applications

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the necessary HTML elements to the Document's design.	An	20%
CO2	Create Programs Using Scripting Language and CSS Presentation	Ap	40%
CO3	Explore DOM concepts.	An	20%
CO4	Develop XML and JSP Programs.	Ap	20%
CO5	Implement React JS	C	Internal Assessment

UNIT I - WEB ESSENTIALS	**(9)**
Clients, Servers and Communication : The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - Response Message - Web Clients - Web Servers - Markup Languages : HTML – History and Versions - Basic XHTML Syntax and Semantics – HTML Elements - Relative URLs – Lists – Tables – Frames –Forms - XML – Creating HTML Documents.	
UNIT II - STYLE SHEETS AND JAVASCRIPT	**(9)**
CSS – Features - Core Syntax - Style Sheets and HTML - Style Rule Cascading and Inheritance - Text Properties - Box Model – Normal Flow Box Layout - Client-Side Programming: The JavaScript Language- JavaScript in Perspective – Syntax - Variables and Data Types-Statements-Operators– Literals– Functions– Objects– Arrays -Built-in Objects-JavaScript Debuggers.	
UNIT III – DOM	**(9)**
DOM - DOM History and Levels - Intrinsic Event Handling - Modifying Element Style -The Document Tree - DOM Event Handling - Accommodating Noncompliant Browsers - Properties of Window.	
UNIT IV - XML AND JSP	**(9)**
XML - Documents and Vocabularies - Versions and Declaration - Namespaces - JavaScript and XML: Ajax - DOM based XML Processing- JSP Technology - JSP and Servlets - Running JSP Applications -Basic JSP-Tag Libraries and Files-Model-View- Controller Paradigm.	
UNIT V - REACT JS	**(9)**
Fundamentals of React JS – JSX – Components – Events – Lists – Forms – Styling React using CSS –Building a React Web Application.	
	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Jeffrey C.Jackson, "Web Technologies - A Computer Science Perspective", 1st Edition, Pearson Education, 2015.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", 5th Edition, Pearson Education, 2012.
3. Cory Gackenheimer, Introduction to React, Apress, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		3						3			3	3	2
2	3	3							3					
3	3		3										3	
4		3			3				3			3	3	3
5	3							3	3		3	3	3	
CO	3	3	3		3			3	3		3	3	3	2.5

22CAB12 CYBER SECURITY				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22CAB03				

Course Objective:	• To develop graduates that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets. • A cyber security policy establishes the guidelines for data security activities such as encrypting emails, limiting access to critical systems, and maintaining data integrity.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify risk management processes, risk treatment methods, organization of information security.	Ap	20%
CO2	Explore the various tools and methods used in security controls.	An	20%
CO3	Classify cyber security solutions and network management.	Ap	20%
CO4	Examine software vulnerabilities and security solutions to reduce the risk of exploitation.	An	20%
CO5	Analyze the cyber security needs of a Security assessment.	An	20%

UNIT I – PLANNING FOR CYBER SECURITY	**(9)**
Introduction - Standards and a Plan of Action - Security Governance Principles, Components and Approach - Information Risk Management - Asset Identification - Threat Identification - Vulnerability Identification - Risk Assessment Approaches - Likelihood and Impact Assessment - Risk Determination, Evaluation and Treatment - Security Management Function - Security Policy - Acceptable Use Policy - Security Management.	
UNIT II – SECURITY CONTROLS	**(9)**
People Management - Human Resource Security - Security Awareness and Education - Information Management - Information Classification and handling – Privacy - Documents and Record Management - Physical Asset Management - Office Equipment - Industrial Control Systems - Mobile Device Security - System Development - Incorporating Security into SDLC Case study on information security policies.	
UNIT III - CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS	**(9)**
Business Application Management - Corporate Business Application Security - End user Developed Applications - System Access - Authentication Mechanisms - Access Control - System Management - Virtual Servers - Network Storage Systems - Network Management Concepts - Firewall-IP Security - Electronic Communications – Case study on OWASP vulnerabilities using OWASP ZAP tool.	
UNIT IV - TECHNICAL SECURITY	**(9)**
Supply Chain Management - Cloud Security - Security Architecture - Malware Protection - Intrusion Detection - Digital Rights Management - Cryptographic Techniques - Threat and Incident Management - Vulnerability Management - Security Event Management - Forensic Investigations -Local Environment Management - Business Continuity – Case study on cloud and cryptographic vulnerabilities.	
UNIT V - SECURITY ASSESSMENT	**(9)**
Security Monitoring and Improvement - Security Audit - Security Performance - Information Risk Reporting - Information Security Compliance Monitoring - Security Monitoring and Improvement Best Practices – Case study on vulnerability assessment using ACUNETIX.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. William Stallings, "Effective Cyber Security-A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2018.
2. Adam Shostack, "Threat Modelling- Designing for Security", Wiley Publications, First Edition, 2014.
3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives- A Practical Guide", Wiley Publications, First Edition, 2014.
4. RaefMeeuwisse, "Cyber Security for Beginners", Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Second Edition, Syngress, 2013.
6. OWASP ZAP : https://owasp.org/www-project-zap/ACUNETIX: https://www.acunetix.com/

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3											3	
3		3	3											3
4				3									3	
5							3							
CO	3	3	3	3			3						3	3

22CAE01 ENGLISH FOR PRAGMATIC USAGE				
	L	T	P	C
	0	0	2	1

PREREQUISITE : NIL

Course Objective:	• To enable the students to incorporate the correct usage of grammar in communication • To improve the communicative competence through various discourse

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate proficiency in grammar, syntax, and sentence structure in their writing, informed by their learning experiences.	U	40%
CO2	Develop adequate speaking skills to convey information effectively and present information logically and coherently, ensuring clarity and engagement.	R	30%
CO3	Develop well-organized and logically structured writing precisely and creatively.	Ap	30%

UNIT I – GRAMMAR	**(10)**
Verb - Tenses - Subject Verb Agreement - Error Spotting - Sentence Completion - Conditional Clauses.	
UNIT II - JOB REQUISITES	**(10)**
Self Introduction - Mini Presentation - Team Building Practices - Facing Interview Panel - Answering Familiar Questions - Company Profile - Stress Interviews - Group Discussion.	
UNIT III - WRITING NUANCE	**(10)**
Email Writing and Netiquettes - Job Application and Resume - Passage Writing (Topic & Picture Description) - Technical Report (Project Report)	
TOTAL (P:30) :30 PERIODS	

REFERENCES:

1. Rizvi, Ashraf M. *Effective Technical Communication* Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
2. Sudharshana, N.P and Saveetha.C. *English for Technical Communication* Cambridge University Press, New Delhi, 2017. .

Mapping of COs with POs / PSOs														
Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					2	3								
2					2	3								
3					2	3								
CO					2	3								

22CAE02 MINI PROJECT				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To apply theoretical knowledge to practical to the real-world problems and enhance students' technical skills in their respective fields of study. • To develop critical thinking, problem-solving skill, innovation, creativity in approaching and solving project-related challenges.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the problem and analyze the project requirements	An	10%
CO2	Apply current techniques and software tools necessary for solving complex modules.	Ap	15%
CO3	Improve their individuality and work as team player	Ap	15%
CO4	Show their individuality and inspiration in the mini project by designing a specific to real time applications	C	20%
CO5	Interpret data and synthesis the information to derive conclusion for implementation of project.	C	20%

DESCRIPTION

The Mini Project may be allotted to a single student or to a group of students not exceeding four per group. The Head of the department shall constitute a project review committee for the mini project. The title of the project is approved by head of the department under the guidance of the project review committee. Student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. There shall be three reviews during the semester and the progress will be reviewed by the committee. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per regulations.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3											3	
2		3											3	
3								3						3
4			3											3
5												3		3
CO		**3**	**3**					**3**				**3**	**3**	**3**

22CAE03 PROJECT WORK				
	L	T	P	C
	0	0	24	12
PREREQUISITE : 22CAE02				

Course Objective:	• To acquire knowledge by applying various techniques in plan, analyze, design and implement software project. • Apply programming language concepts and choose from various software developments process models appropriate for project. • Apply principles such as cost estimation and time estimation for project, focus on getting the working project done on time, demonstrate ability to communicate and do document effectively.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the problem of software application.	An	10%
CO2	Planning the schedule for project to analyze, design, implementation of software project.	Ap, E	15%
CO3	Implementation of project by selecting the programming languages, software tools / components required and demonstrates the project.	An, C	15%
CO4	Engage in effective written communication through the project report, effective oral communication through presentation of the project work and demonstration of project.	E	25%
CO5	Demonstrate compliance to the prescribed standards or safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work.	Ap, An	35%

DESCRIPTION

The Project Work may be allotted to a single student. The Head of the department shall constitute a project review committee for the project work. The title of the project is approved by head of the department under the guidance of the project review committee. Student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. There shall be three reviews during the semester and the progress will be reviewed by the committee. Student(s) shall make presentation on the progress made by him / her before the committee and evaluation is done as per regulations.

TOTAL (P:24x15)= 360 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3		3						3				
2	3	3	3			3	2		3		3		3	2
3		3	3				2	2		3		3		2
4						3		2			3			
5						3	2	2	3				3	
CO	**3**	**3**	**3**	**3**		**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

Open Elective Courses

22CAO01 EMPLOYABILITY ENHANCEMENT AND ANALYTICAL SKILLS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To enable learners to achieve linguistic competence in oral and written discourse efficiently • To enhance analytical, mathematical, and critical thinking skills for solving quantitative problems and logical puzzles efficiently.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Develop a foundation in grammar that supports lifelong learning, enabling them to continue improving their language skills.	U	20%
CO2	Develop various listening strategies and resources for continuing to improve their listening and speaking skills independently.	U	20%
CO3	Demonstrate the ability to comprehend and to write coherently and fluently across different genres and purposes.	Ap	20%
CO4	Exhibit sound knowledge to solve problems of quantitative aptitude.	Ap	20%
CO5	Draw valid conclusions, identify patterns, and solve problems.	Ap	20%

UNIT I – GRAMMAR	**(9)**
Parts of Speech – Synonyms & Antonyms - Primary Auxiliary Verbs – Modal Auxiliary Verbs - Tenses – Articles– Preposition – Conjunction–Common Errors - Subject Verb Agreement – Error Spotting – One word Substitution – Jumbled Sentences – Confusable word – Idioms and Phrases – Degrees of Comparison – Sentence Completion.	
UNIT II - LISTENING AND SPEAKING	**(9)**
LISTENING - Listening Strategies - Listening for Specific Information- Listening to TED & INK Talks - Listening for Signpost Language - Listening to Telephonic Conversations. SPEAKING - Group/Pair Presentations - Visume - Interview Skills – GD.	
UNIT III - READING AND WRITING	**(9)**
READING - Strategies for Effective Reading - Reading for Specific Information - Speed Reading Techniques - Critical Reading. WRITING - Job Application Letter with Resume - E-mail Writing - Paragraph Writing.	
UNIT IV – APTITUDE	**(9)**
Number System- Ratio & Proportion-Percentages-Averages-Profit & Loss.	
UNIT V – REASONING	**(9)**
Figure Series-Blood Relation-Analogy-Coding and Decoding-Odd one out.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Tickoo, M. L., A. E. & Subramaniam, P. R., "Intermediate Grammar Usage & Composition", Orient Blackswan, 1976.
2. Davis, Jason and Liss, Rhonda, "Effective Academic Writing (Level 3)", Oxford University Press, 2006.
3. Koneru, Aruna, "English Language Skills" Tata McGraw-Hill Education, 2011.
4. Raman, Meenakshi and Sharma, Sangeeta, "Technical Communication English Skills for Engineers", Oxford University Press, 2008.
5. Khattar, Dinesh, "Quantitative Aptitude", Third Edition New Delhi: Pearson, 2014.
6. Aggarwal R.S., "A Modern Approach to Verbal & Non Verbal Reasoning", Revised Edition, S. Chand Publishers, New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					2	3								
2					2	3								
3					2	3								
4		2		2										
5		2		2										
CO		1		1	2	3								

22CAP01 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

Course Objective:

- To demonstrate the concepts of Stack, Queue, Linked List and solving Applications for given problems
- To Analyze and demonstrate Trees, Graphs, Searching and Sorting

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply concepts of Stack, Queue, Linked List.	Ap	20%
CO2	Analyze and demonstrate concepts of Tree and Graph.	An	20%
CO3	Demonstrate the Sorting Algorithms.	Ap	20%
CO4	The students will be able to demonstrate Searching and Sorting Techniques.	An	20%
CO5	The students will be able to code to implement object oriented paradigm	Ap	20%

List of Experiments (Implementation using Python)

1. Array implementation of Stack and Queue ADTs.
2. Linked list implementation of Stack and Queue ADTs.
3. Applications of Stack ADT.
4. Implementation of Binary Search Trees.
5. Implementation of AVL Trees.
6. Graph representation and Traversal Algorithms.
7. Given a graph with appropriate weights for each node, find the single source shortest path using Dijkstra's algorithm.
8. To implement Merge Sort and Quick Sort.
9. Given a program to implement 0/1 Knapsack using Dynamic Programming.
10. Given the Eight Queens Puzzle Problem of placing Eight Chess Queens on an 8×8 Chessboard so that no two queens attack each other.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	2							2		2	
2	3	3	3	2				2			2		2	
3	3	3	3	2				2		2		3		2
4	3	3	3	2						2		3		2
5	3	3	3	2						2	2		2	
CO	**3**	**3**	**3**	**2**				**2**		**2**	**2**	**3**	**2**	**2**

22CAP02 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

Course Objective:	• Develop and implement efficient database schemas using Entity-Relationship (ER) diagrams and relational models. • To design and implement database applications on their own.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement the basic knowledge of SQL queries and relational algebra.	An	20%
CO2	Construct database models for different database applications.	Ap	20%
CO3	Apply normalization techniques for refining of databases.	Ap	20%
CO4	Practice various triggers, procedures, and cursors usingPL/SQL.	App	20%
CO5	Implement appropriate exception handling mechanisms in SQL and database operations to manage errors gracefully and maintain application stability.	C	20%

List of Experiments

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Creation of database Triggers and Functions.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1			3										3	
2			3										3	
3		3												3
4				3										3
5									3					3
CO		**3**	**3**	**3**					**3**				**3**	**3**

22CAP03 PROGRAMMING IN JAVA LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To develop proficiency in Java programming with a focus on designing, implementing, and debugging Java applications across various domains and scenarios.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Develop proficiency in Core Java Concepts and Syntax	Ap	20%
CO2	Implement Object-Oriented Programming (OOP) Skills	Ap	25%
CO3	Implement advanced Java Programming Techniques	C	20%
CO4	Implement exception Handling and Robust Programming	Ap	15%
CO5	Design User Interface Development with AWT	C	20%

List of Experiments

1. Write a java Program with Multi- dimensional Array.
2. Write a java program to work with Operators and Control Structures.
3. Design a Java Program with Class and Objects and Constructors.
4. Write a Java Program to implement Overloading in Java.
5. Write a Java Program on Inheritance.
6. Write a Java Program to implement Runtime Polymorphism and Interfaces.
7. Design a java Program to implement the User-Defined Package.
8. Create a Java Program with Threads.
9. Write a Java Program to handle the Exception.
10. Create a web page using AWT.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3											3		
2		3										3	3	
3			3								3	3	3	3
4			3								3	3		3
5			3								3	3	3	3
CO	**3**	**3**	**3**								**3**	**3**	**3**	**3**

22CAP04 BIG DATA ANALYTICS LABORATORY				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• Apply big data analytics techniques to solve real-world problems,

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Proficient the basic concepts of R programming	An	20%
CO2	Provide the solution to the real time problems.	Ap	20%
CO3	Analyze the data using different data mining algorithms.	Ap	20%
CO4	Apply the tool to visualize dataset for data analytics	Ap	20%
CO5	Develop the projects and provide the solution to the problems.	C	20%

List of Experiments

1. Use of Array and List
2. Use of Strings
3. Use of Matrices
4. Use of Vectors
5. Use of Function
6. Implement Discrete Distributions
7. Implement Continuous Distribution
8. Perform the Testing of Hypothesis
9. Visualize data using different Plots
10. Implement Association Rules
11. Implement Linear and Logistic Regression

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3											3	
2			3										3	
3			3											3
4											3			3
5									3					3
CO		**3**	**3**						**3**		**3**		**3**	**3**

22CAP05 MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

PRE REQUISITE : NIL

Course Objectives :

- Learn to create, manipulate, and analyze datasets using pandas and numpy libraries in Python.
- Gain skills in data cleaning, exploration, and basic data manipulation techniques.
- Designed to provide a comprehensive foundation in data analysis, statistical methods, and machine learning techniques using Python.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Manipulate datasets using pandas and numpy including data cleaning, transformation, and basic exploratory data analysis.	An	10%
CO2	Analyze the relationships between numerical variables, enhancing their descriptive statistics skills.	An	10%
CO3	Apply a variety of data preprocessing techniques such as handling missing values, normalization, scaling, and encoding to improve data quality and model performance.	Ap	30%
CO4	Apply supervised to various types of data and interpret their results.	Ap	30%
CO5	Apply unsupervised algorithms to various types of data and interpret their results.	Ap	20%

LIST OF EXPERIMENTS

1. Exploration of a Data Set in the IDE and create dataset and perform pandas and numpy operations.
2. Python program to calculate mean, median, variance, standard deviation and exploring relationship between variables of the given numerical data.
3. Implementation of various data preprocessing techniques on real time dataset.
4. Program to implement Naïve Bayes Classifier Algorithm using Python.
5. Program to find the attribute with maximum information gain and gain ratio and construct the decision tree for the given data using Python.
6. Program to implement Random Forest Algorithm and K-NN algorithm using Python.
7. Program to implement Support Vector Machines learning algorithm using Python.
8. Python program to implement Simple Linear regression, Multi Linear regression and Logistic Regression algorithms.
9. Program to implement K-Means Clustering algorithm using Python.
10. Program to implement multi-layer Artificial Neural Network using Python.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2	3													
3		3	3							3	3	3		
4			3							3	3	3	3	3
5			3							3	3	3	3	3
CO	3	3	3							3	3	3	3	3

22CAP06 WEB TECHNOLOGY LABORATORY				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• Design and develop web pages using HTML, CSS, and React JS, with proper alignment, styling, and validation. • Understand and apply scripting languages and XML to store and validate data, and create interactive web applications.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Display webpage using HTML tags	Ap	20%
CO2	Know image map concepts	An	20%
CO3	Validate fields using scripting languages	Ap	20%
CO4	Store data using XML program	An	20%
CO5	Program using React JS	C	20%

LIST OF EXPERIMENTS

1. Create a HTML page, which has properly aligned paragraphs with image along with it.
2. Write a program to display list of items in different styles.
3. Create both client side and server side image maps.
4. Create your own style sheets and use them in your web page.
5. Create a form with various fields and appropriate front and validations using any one of the scripting languages.
6. Create a web page using XML.
7. Create React JS program to validate user input.
8. Develop a program for User Registration Form using React JS.
9. Develop a web application project using React JS.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	3	3								3	3
2	3		3										3	
3													3	
4							2			3			3	3
5		3		3	3		2			3				3
CO	**3**	**3**	**3**	**3**	**3**		**2**			**3**			**3**	**3**

Professional Electives - Artificial Intelligence and Data Science

22CAX01 INTERNET OF THINGS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To introduce students to the fundamentals of electrical and electronic devices, IoT, Arduino, and Raspberry Pi. • To enable students to design and implement IoT systems using Arduino and Raspberry Pi.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explain basics of electrical circuits, electronic devices, and IoT characteristics	An	20%
CO2	Describe working of Arduino and Raspberry Pi, including Analog and Digital I/O pins, communication protocols, and programming	Ap	40%
CO3	Analyze IoT applications, including home automation, smart parking, weather monitoring, and smart irrigation.	An	20%
CO4	Design and implement IoT systems using Arduino and Raspberry Pi	Ap	20%
CO5	Implement IoT systems for real-time applications, such as home automation, smart parking, weather monitoring, and smart irrigation..	C	Internal Assessment

UNIT I - BASIC ELECTRONICS	**(9)**
Introduction - Current, Voltage and Resistance - Analog and Digital Signal - Conductors Vs Insulators – KCL- KVL - Basic Electronics components - calculating equivalent resistance for series and parallel circuits- Ohm's law- Color coding for a resistor – LED – LCD – LDR - Case Studies.	
UNIT II - FUNDAMENTALS OF IOT	**(9)**
Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT Communication Models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry - Case Studies.	
UNIT III - PROGRAMMING USING ARDUINO	**(9)**
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.	
UNIT IV - PROGRAMMING USING RASPBERRY PI	**(9)**
Technical Description of Raspberry Pi - comparison of Raspberry Pi Vs Arduino - Operating Systems for RPi - Preparing SD Card for Pi - Connecting Raspberry Pi as PC - Exploring Raspberry Pi Environment- Logical design using Python - Case Studies.	

UNIT V - APPLICATIONS OF IOT	(9)
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
2. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley Publications, Second Edition, 2013.
4. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
5. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3		3			3	3	3			3	3	
2	3		3										3	
3		3	3					3					3	3
4		3					3					3	3	
5		3		3			3	3	3			3	3	3
CO	3	3	3	3			3	3	3			3	3	3

22CAX10 USER INTERFACE DESIGN				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To apply fundamental concepts and techniques in design of UI, to handle responsive multimedia screen layouts and do testing.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts and techniques in designing user interface and get the benefits of good design	Ap	20%
CO2	Analyze the user interface design process and business functions	An	20%
CO3	Understand the types of system of windows, and navigation schemes and screen based controls	Ap	40%
CO4	Apply the multimedia for web pages, dealing problems with colors, hierarchical content	Ap	20%
CO5	Understand the organizing and layout of screen and undergo various kinds of tests.	U	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Human–Computer Interface – Graphical User Interface: Direct Manipulation Graphical System, advantages and disadvantages, Characteristics of Graphics Interface — Web User Interface: Popularity –Characteristic & Principles.	
UNIT II HUMAN COMPUTER INTERACTION	**(9)**
User Interface Design Process: Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed – Business Functions: Requirement Analysis – Direct – Indirect Methods – Basic Business Functions: Design Standards – System Training and documentation needs– Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus– Contents Of Menus– Formatting the Menus – Phrasing the Menu – Selecting Menu Choice – Navigating Menus– Graphical Menus.	
UNIT III WINDOWS	**(9)**
Characteristics – Components – Presentation Styles – Types– Managements– Organizations – Operations– Web Systems– Device – Based Controls: Characteristics–Screen – Based Controls: Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.	
UNIT IV MULTIMEDIA	**(9)**
Text for Web Pages – Effective Feedback and Guidance and Assistance–Internationalization and Accessibility – Icons and Image: Icons – Multimedia – Colors: color uses – possible problems with colors – colors and human vision – choosing colors.	
UNIT V WINDOWS LAYOUT AND TEST	**(9)**
Organizing and laying out screens, Test, test and retest: Prototypes – Kinds of Tests – Developing and conducting the test – Analyze, Modify and Retest, Information Search – Visualization – Hypermedia – WWW– Software Tools.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. Wilbent. O. Galitz ,"The Essential Guide To User Interface Design", John Wiley& Sons, 2001.
2. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.
3. Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd., 2002.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2	2										2	
3			2								2			
4			2										2	
5			2								2	2	2	
CO	2	2	2								2	2	2	

22CAX12 ENTREPRENEURSHIP				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To provide the concepts of entrepreneurship, its types, scope and its challenges, process of entrepreneurial development and the steps in venture development.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Application of Entrepreneurship theories in Ventures	Ap	20%
CO2	Analyzing the social perspectives and Social Entrepreneurship regarding Legal Aspects and IPR.	An	20%
CO3	Applying of Creativity and Idea to Opportunity in Entrepreneurship.	Ap	40%
CO4	Distinguish between different plans and planning process.	An	20%
CO5	Describe the basic theories of Entrepreneurship	U	Internal Assessment

UNIT I - FUNDAMENTALS OF ENTREPRENEURSHIP	**(9)**
Introduction – Key to Development - Evolving concepts – Resource Organization – Entrepreneurial Traits – Difference Between Inventors and Entrepreneurs – Role Models – Social Support – Business Model – Entrepreneurship Mindset – Big Companies and Start-ups – Misconceptions and Myths. Entrepreneurship Developments: Types of start-ups – Intrapreneurship – Careers – Female Entrepreneurship – Small and Medium Business Enterprises – International Entrepreneurship – Role of Educational Institutions -Mistakes Startup Make – Emerging Trends.	
UNIT II - CREATIVITY AND IDEA TO OPPORTUNITY	**(9)**
Creativity: Introduction – Creativity and Entrepreneurship – Characteristics – Blocks to creativity – Creativity at work – Sources of New Ideas – Techniques for Generating Ideas – Idea to Opportunity: Definition – Recognition – Process – Sources of Opportunity – Steps for Assessing Business Potential – Steps for Tapping Opportunity.	
UNIT III - LEGAL ASPECTS AND IPR	**(9)**
Legal Aspects for Business: Introduction – Formation of Business Entity – Taxation – Deemed Public Limited Company – Requirements of Private/Public Company – Board of Directors – Roles and Responsibilities – Procedure – Legal Acts Governing Business in India – Winding up a Registered Company – Need of Lawyer – Intellectual Property Rights: University Research – IPR Importance – IP Importance for Startups – IP Rights – Patents – Trademarks – Copyrights.	
UNIT IV - BUSINESS AND MARKETING PLAN	**(9)**
Business Plan: Entrepreneurial Opportunities and Business Plan – Necessity – Drivers – Business Failures – Preparation – Prepare a Plan – Basics of Business Plan – Importance – Reasons for Failures – Marketing Plan: Marketing Research – Benefits – Scope – Types – Marketing Research on Internet – Industry Analysis – Competitor Analysis – Target Market – Market Segmentation – Market Positioning – Building a Market Plan – Marketing Mix.	

UNIT V – VENTURES	(9)
Venture Team and Organisational Plan – Venture success – Importance – Team Building – Effective Venture Team – Venture Team Development – People Management – Organisational Structure and Systems – Effective Organisational Structure – Financing Venture: Need Money – Different Stages – Sources of Finance - Seed Funding – Venture Capital Funding – Funding from Banks – Lease Financing – Launching a Venture: Steps – Incorporation and Issuance of Stocks – Stockholders Agreement – Raise Different Resources – Leverage of Intellectual Property – Build a Winning Team – Motivation and Inspiring the Team – Pilot Testing – Record Keeping of Expenses – Todo Checklist – Managing Cash – Due Diligence – Scheduling.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016.
2. Arya Kumar, "Entrepreneurship", Pearson Publication, 2012.
3. Dr. Robert D Hisrichis, Dr Michael P Peters, Dr Dean Shepherd, Dr Sabyasachi Sinha, "Entrepreneurship", Eleventh Edition, McGraw Hill, 2022.
4. Charantimath Poornima M, "Entrepreneurship Development and Small Business Enterprises", Pearson Education, 3rd Edition (2018).

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3									2			
3		3					3							
4								2		2				
5							3		2					
CO	3	3					3	2	2	2	2			

22CYB05 CHEMISTRY FOR AGRICULTURAL ENGINEERS (For AGRI Branch Only)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE - REQUISITE : NIL

Course Objectives:	• To make the students conversant with water treatment, boiler feed water techniques, nature of bonding, engineering materials and corrosive nature of metals. • To impart knowledge to the students on the basic concepts of nanochemistry and fundamentals of soil science and endow skills on weathering

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO2	Categorize the properties of lubricants and refractories for various applications.	Ap	20%
CO3	Explore the type of corrosion and its control measures.	An	20%
CO4	Implement the basic concepts of soil and identify the effects of fertilizers and pesticides in modern agriculture.	Ap	20%
CO5	Illustrate the concepts of nanoscience and its various applications.	Ap	20%

UNIT I – WATER TECHNOLOGY	(9)
Hardness – types – estimation by EDTA method. Water quality parameter – BOD and COD - Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – Internal conditioning (carbonate, phosphate and calgon) – External conditioning – demineralization process – desalination – reverse osmosis method.	
UNIT II – CHEMICAL BONDING AND ENGINEERING MATERIALS	(9)
Chemical bond – Types of bonds - Covalent bond – Hydrogen fluoride, Methane (overview only) - Ionic bond – Sodium Chloride, Magnesium Oxide (overview only) - Coordinate bond – Hydrogen Peroxide, Ozone (overview only) - Hydrogen Bond – Types of hydrogen bond (overview only). Engineering Materials : Synthesis of Abrasives – Properties of Refractories – Lubricants.	
UNIT III – SCIENCE OF CORRISION	(9)
Corrosion – types - chemical corrosion - pilling bedworth rule - electrochemical corrosion – mechanism - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors.	

UNIT IV – BASICS OF SOIL	(9)
Soil – Pedological and edaphological concepts – Earth – Interior and Exterior of earth -Composition of earth's crust – Rocks and minerals – types – Weathering of rocks and minerals – physical weathering - chemical weathering – biological weathering -- Fundamental soil forming process – Humification – Eluviation – Illuviation – Horizonation and specific soil forming process – Calcification – Decalcification – Fertilizers and pesticides – Effects of using fertilizers and pesticides in modern agriculture.	
UNIT – V – NANOCHEMISTRY	(9)
Introduction - Types of nanomaterials - Properties and uses of – nanoparticle - nanocluster- nanorod, nanowire and nanotube. - Synthesis of nanomaterials - sol-gel – solvothermal - laser ablation - chemical vapour deposition - electrochemical deposition and electro spinning - Applications of nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Ravikrishnan, A., "Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem., Co. Pvt. Ltd., 13th ed., Chennai , 2020.
2. Dilip kumar Das, "Introductory soil science", Kalyani publishers, 2018.

REFERENCES:

1. Jain, P.C. and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co., New Delhi 15th ed., 2018.
2. "Fundamentals of Soil Science", ISSS Publication, New Delhi, 2019.

WEB LINK:

1. https://www.sciencedirect.com/book/9781856177054/water-technology\
2. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Chemical_Compounds/Introduction_to_Chemical_Bonding
3. https://www.sciencedirect.com/topics/materials-science/corrosion
4. https://www.soils.org/about-soils/basics/
5. https://www.sciencedirect.com/topics/chemistry/nanochemistry

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2												
2		2					2							
3		2					2		2					
4			2				2							
5						2						2		
CO (W.A)	**3**	**2**	**2**			**2**	**2**		**2**			**2**		

22MAN06 ENVIRONMENTAL SCIENCE (Common to AGRI (2nd semester) and MECH (4th semester) Branches)				
	L	T	P	C
	2	0	0	0

PRE - REQUISITE : NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Produce the renewable and non-renewable resources and preserve them for future generations.	Ap	20%
CO4	Organize the different goals of sustainable development and apply them for societal development.	Ap	20%
CO5	Evaluate the recycling of battery, cell phone , laptop and PCB	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	(6)
Environment - scope and importance - Eco-system: Structure and function of an ecosystem- types of biodiversity - genetic - species and ecosystem diversity – values of biodiversity - hot-spots of biodiversity – conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(6)
Pollution – Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act – Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(6)
Energy management and conservation - New Energy Sources: Different types of new energy sources – Solar energy – wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV – SUSTAINABILITY AND MANAGEMENT	(6)
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - concept of carbon credit – carbon footprint – Environmental management.	

UNIT V – BATTERIES AND RECYCLING OF E-WASTE	(6)
Battery lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – benefits of recycling battery – E-waste – sources of e-waste - recycling of computing devices - mobile phones - PCB.	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Ravikrishan, A., "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing Co. Pvt. Ltd., 15thEdition, Chennai, 2023.
2. Anubha Kaushik and Kaushik's, C. P., "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R., "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
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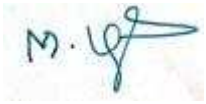
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3		2					
5						3						2		
CO (W.A)	2	2	2			3	3	2	2			2		



22CYB01 – INTRODUCTION TO BIOCHEMISTRY (For BME Branch Only)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	• To make the students conversant with water treatment, boiler feed water techniques, energy storage devices. • To recognize the basic concepts of biotechnology, structural and basic properties of carbohydrates, lipids and clinical application of enzymes.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify the types of hardness in water and its removal by various water treatment techniques.	An	20%
CO2	Investigate on renewable energy sources like nuclear, solar, wind energy and also on storage devices.	E	20%
CO3	Interpret the various properties of carbohydrates, lipids and fatty acids.	Ap	20%
CO4	Analyze the factors affecting enzymatic activity by adding activators and inhibitors.	An	20%
CO5	Predict the nature, oxidation and reduction potential of an electrode.	An	20%

UNIT I - WATER TECHNOLOGY AND NANO MATERIALS	(9)
Municipal water treatment - disinfection methods (UV, ozonation, chlorination) - desalination of brackish water - reverse osmosis - boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) - treatment of boiler feed water - internal treatment (carbonate, phosphate and calgon conditioning) - external treatment - demineralization process. Nano materials - synthesis (laser ablation, and chemical vapour deposition method), properties and applications of nanomaterials in medicine, energy, electronics and catalysis.	
UNIT II - ENERGY SOURCES AND STORAGE DEVICES	(9)
Nuclear energy - nuclear fission - nuclear fusion - light water nuclear power plants - breeder reactor - solar energy conversion - solar cells - solar water heater - wind energy - batteries - types of batteries - lead acid storage battery –lithium - ion battery, Electric vehicles - working principles.	
UNIT III - CARBOHYDRATES AND LIPIDS	(9)
Carbohydrate - classification of carbohydrates - monosaccharides - Structure: trioses - properties of monosaccharides. Disaccharides - Structure: sucrose. Oligosaccharides - Raffinose - Polysaccharides - starch. Lipids - Classification of lipids - simple - complex - derived lipids - Nomenclature of fatty acids - physical	

and chemical properties of fat.
UNIT IV – ENZYMOLOGY (9)
Enzymes - Classifications of enzymes - Kinetics of Enzymes - Michaelis - Menten equation - Factors affecting enzymatic activity - temperature - pH - concentration of substrate - Enzyme concentration - product concentration – activators - Enzyme inhibitors - reversible inhibitors - competitive - non competitive - irreversible inhibitors - active site directed irreversible inhibitors - Suicide inhibitors - Difference between reversible and irreversible inhibitors.
UNIT V - BIOTECHNOLOGY AND ELECTROCHEMISTRY (9)
Biotechnology - Importance - types - applications. Electrochemistry - Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode -calomel electrode - potentiometric titrations (redox) - conductometric titrations (acid-base).
TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

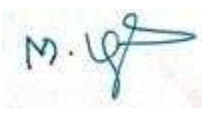
1. Dr.Ravikrishnan A., "Engineering Chemistry I & Engineering Chemistry II", 13th Edition, Sri Krishna Hitech Publishing Company Pvt. Ltd., Chennai, 2020.
2. Lehninger A L., Nelson D L and Cox M M., "Principles of Biochemistry", 4th Edition, Freeman Publishers, New York, 2017.

REFERENCES:

1. Jain P C. and Monica Jain, "Engineering Chemistry", Volume I and II, 15th Edition, Dhanpat Rai Publishing Company, New Delhi 2018.
2. Keith Wilson and John Walker, "Practical Bio Chemistry – Principles & Techniques", Oxford University Press, 2018.
3. Donald Voet and Judith G. Voet, "Biochemistry", 3rd Edition, Wiley, John & Sons, 2019.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2						2					
2		2							2					
3		2							2				1	
4			2				2						1	
5						2	2					2	1	
CO (W.A)	3	2	2			2	2		2			2	1	



22CYB03 CHEMISTRY (For CHEMICAL Branch Only)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objective:	• To make the students conversant with water treatment, boiler feed water techniques, nature of bonding, engineering materials and corrosive nature of metals. • To impart knowledge on the basic principles and preparatory methods of Nanomaterials.				

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO2	Categorize the properties of lubricants and refractories for various applications.	Ap	20%
CO3	Explore the type of corrosion and its control measures.	An	20%
CO4	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO5	Illustrate the principles, theory of analytical techniques and investigate the nanomaterials.	Ap	20%

UNIT I – WATER TECHNOLOGY	(9)
Hardness – types – estimation by EDTA method. Water quality parameter – BOD and COD. Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – Internal conditioning (carbonate, phosphate and calgon) – External conditioning – demineralization process – desalination – reverse osmosis method.	
UNIT II – CHEMICAL BONDING AND ENGINEERING MATERIALS	(9)
Chemical bond – Types of bonds - Covalent bond – Hydrogen fluoride, Methane (overview only) - Ionic bond – Sodium Chloride, Magnesium Oxide (overview only) - Coordinate bond – Hydrogen Peroxide, Ozone (overview only) - Hydrogen Bond – Types of hydrogen bond (overview only). Engineering Materials : Synthesis of Abrasives – Properties of Refractories – Properties of Lubricants	
UNIT III – SCIENCE OF CORROSION	(9)
Corrosion – types - chemical corrosion - pilling bedworth rule - electrochemical corrosion – mechanism - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors.	

UNIT IV – ELECTROCHEMISTRY AND FUEL CELLS	(9)
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode -calomel electrode - potentiometric titrations (redox) - conductometric titrations (acid-base).- Fuel cell – hydrogen and oxygen fuel cell – microbial fuel cell – polymer electrolyte membrane fuel cell.	
UNIT V –ANALYTICAL TECHNIQUES AND NANOCHEMISTRY	(9)
Colorimetry – principle - estimation of iron by colorimetry – UV- Visible spectroscopy – principle – instrumentation (Block diagram only) - IR spectroscopy - principle –instrumentation (Block diagram only) - Atomic absorption spectroscopy – principle – estimation of nickel by atomic absorption spectroscopy - Nanomaterials – synthesis (laser ablation, and chemical vapour deposition method) - applications of nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

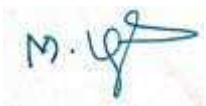
1. Dr.Ravikrishnan, A," Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem.. Co. Pvt Ltd., 13th ed., Chennai , 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand&Co.Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, DhanpatRai Pub, Co,New Delhi 15th ed.,2018.
2. B.Sivasankar, "Engineering Chemistry" , Tata McGraw- Hill Pub.Co.Ltd.,New Delhi,2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3								2					
2		2												
3														
4			2				2							
5		2				2						2		
CO (W.A)	3	2	2			2	2		2			2		



22CYP01 CHEMISTRY LABORATORY (Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)				
	L	T	P	C
	0	0	2	1
PRE-REQUISITE : NIL				
Course Objective:	• To determine the copper in brass in the given solution and explain the origin of hardness, alkalinity, chloride and dissolved oxygen in water. • To perform a potentiometric, conductometric titration and pH of an acidic solution of known Normality.			

Course Outcomes The Student will be able to		Cognitive Level
CO1	Predict the various water quality parameters by volumetric analysis.	An
CO2	Evaluate the amount of copper in the given solution by titration method.	E
CO3	Analyze the conductance and emf of the different solutions.	An
CO4	Analyze and gain experimental skill about potential of hydrogen ion.	An
CO5	Examine the pH of various acidic, basic and neutral solutions.	An

LIST OF EXPERIMENTS :

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of DO content of water sample by Winkler's method.
5. Estimation of copper in brass by EDTA.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of strength of given hydrochloric acid using pH meter.

Total (30 P) = 30 periods

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3									
2							2							
3							2							
4					3									
5							2							
CO (W.A)					3		2							

*Ratified in Eleventh Academic Council

22CYB02 - CHEMISTRY FOR ENGINEERS (Common to CIVIL and MECH Branches)				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To make the students conversant with water treatment, boiler feed water techniques, energy storage devices and corrosive nature of metals. • To impart knowledge on the basic principles, preparatory methods of nanomaterials and combustion nature of fuels.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO2	Investigate on renewable energy sources like nuclear, solar, wind energy and also on storage devices.	E	20%
CO3	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO4	Explore the type of corrosion and its control measures.	An	20%
CO5	Recommend suitable fuels for engineering processes and applications.	E	20%

UNIT I - ELECTROCHEMISTRY	**(9)**
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode - calomel electrode - electrochemical series - significance - Types of cell - electrolytic and electrochemical cells - reversible and irreversible cells - potentiometric titrations (redox) - conductometric titrations (acid-base).	
UNIT II - ENERGY SOURCES AND STORAGE DEVICES	**(9)**
Nuclear energy - nuclear fission - nuclear fusion - light water nuclear power plants - breeder reactor - solar energy conversion - solar cells - solar water heater - Recent developments in solar cell materials - wind energy - batteries - types of batteries - lead acid storage battery - lithium-ion battery, Electric vehicles - working principles.	
UNIT III - WATER TECHNOLOGY AND NANO MATERIALS	**(9)**
Municipal water treatment - disinfection methods (uv, ozonation, chlorination) - desalination of brackish water - reverse osmosis - boiler troubles (scale, sludge , priming, foaming and caustic embrittlement) - treatment of boiler feed water - internal treatment (carbonate, phosphate and calgon conditioning) - external treatment - demineralization process. Nanomaterials - synthesis (laser ablation, and chemical vapour deposition method) and applications of nanomaterials.	
UNIT IV - CORROSION AND ITS CONTROL	**(9)**
Corrosion - types - chemical corrosion - pilling bedworth rule - electrochemical corrosion - mechanism-galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors - protective coatings - paints - constituents and their functions	

UNIT V - FUELS AND COMBUSTION	(9)
Fuels: Introduction: Classification of fuels: Coal and coke: Analysis of coal (Proximate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process) - Knocking - octane number - diesel oil - cetane number: Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT method. CO2 emission and carbon foot print.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Dr.Ravikrishnan, A,"Engineering Chemistry I & Engineering Chemistry II", Sri Krishna Hitech Publishing chem., Co. Pvt Ltd., 13th Edition, Chennai, 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand & Co.Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co, New Delhi, 15th Edition, 2018.
2. B.Sivasankar, "Engineering Chemistry", Tata McGraw- Hill Pub.Co.Ltd., New Delhi, 2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3								2					
2		2												
3														2
4			2				2							
5		2				2						2		
CO (W.A)	3	2	2			2	2		2			2		2

22CYB08 - ENVIRONMENT AND SUSTAINABILITY				
	L	T	P	C
	2	0	0	2
PREREQUISITE : NIL				

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Analyse the renewable and non-renewable resources and preserve them for future generations.	An	20%
CO4	Examine the different goals of sustainable development and apply them for suitable technological advancement and societal development.	An	20%
CO5	Execute the sustainability practices, identify green materials and energy cycles.	Ap	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(6)**
Environment - scope and importance - Eco-system: Structure and function of an ecosystem - types of biodiversity - genetic - species and ecosystem diversity - values of biodiversity - hot-spots of biodiversity – conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(6)**
Pollution - Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act - Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(6)**
Energy management and conservation - New Energy Sources: Different types of new energy sources - Solar energy - wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV - SUSTAINABILITY AND MANAGEMENT	**(6)**
Development - Factors affecting development - advantages - disadvantages - GDP - Sustainability - needs - concept - concept of carbon credit - carbon footprint - Environmental management.	
UNIT V - SUSTAINABILITY PRACTICES	**(6)**
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable energy: Energy Cycles- carbon cycle and carbon emission - Green Engineering: Sustainable urbanization.	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15th Edition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEBLINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3							
5						3			2			2		2
CO (W.A)	**2**	**2**	**2**			**3**	**3**	**2**	**2**			**2**		**2**

- Ratified by Eleventh Academic Council

22CYB07 - ENVIRONMENTAL SCIENCE AND ENGINEERING *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE- REQUISITE : NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Produce the renewable and non-renewable resources and preserve them for future generations.	Ap	20%
CO4	Inspect the different methods of management of e-waste and apply them for suitable technological advancement and societal development.	An	20%
CO5	Evaluate the recycling of battery, cell phone , laptop and PCB	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(9)**
Environment - scope and importance - Eco-system- Structure and function of an ecosystem-types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(9)**
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(9)**
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	

UNIT IV - E- WASTE AND ITS MANAGEMENT	(9)
E-waste – sources of e-waste – hazardous substance in e-waste – chlorinated compounds – heavy metals - need for e-waste management – management of e-waste – Inventory management – production process – modification- Disposal treatment of e –waste – Incineration –acid baths – landfills.	
UNIT V - BATTERIES AND RECYCLING OF E-WASTE	**(9)**
Battery – types – Lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – process of recycling battery – lead acid battery – lithium ion battery – benefits of recycling battery – recycling of computing devices - mobile phones - PCB and servers.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

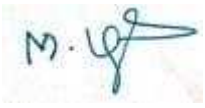
1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK :

1. http://www.jnkvv.org/PDF/080420202015128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3							
5						3			2			2		
CO (W.A)	2	2	2			3	3	2	2			2		



22CYB04 - ENGINEERING CHEMISTRY *(Common to ECE and EEE Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE REQUISITE : NIL				
Course Objective:	• To facilitate the students to achieve a clear conceptual understanding of electrochemistry, technical and commercial aspects of energy sources and storage devices. • To make the students conversant with water treatment, boiler feed water techniques, surface chemistry, polymers and various analytical techniques.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO2	Investigate on renewable energy sources like nuclear, solar, wind energy and also on storage devices.	E	20%
CO3	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO4	Compare the relationship between various types of adsorption, polymers and polymer processing.	An	20%
CO5	Illustrate the principles, theory of analytical techniques and study about the nature of chemical compounds.	Ap	20%

UNIT I - ELECTROCHEMISTRY	**(9)**
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode -calomel electrode - electrochemical series - significance - Types of cell - electrolytic and electrochemical cells -reversible and irreversible cells - potentiometric titrations (redox) - conductometric titrations (acid-base).	
UNIT II - ENERGY SOURCES AND STORAGE DEVICES	**(9)**
Nuclear energy - nuclear fission - nuclear fusion - light water nuclear power plants - breeder reactor - solar energy conversion - solar cells - solar water heater - Recent developments in solar cell materials - wind energy - batteries - types of batteries - lead acid storage battery - lithium-ion battery, Electric vehicles - working principles.	
UNIT III - WATER TECHNOLOGY AND NANO MATERIALS	**(9)**
Municipal water treatment - disinfection methods (UV, ozonation, chlorination) - desalination of brackish water - reverse osmosis - boiler troubles (scale, sludge , priming, foaming and caustic embrittlement) - treatment of boiler feed water - internal treatment (carbonate, phosphate and calgon conditioning) - external treatment - demineralization process. Nanomaterials - synthesis (laser ablation, and chemical vapour deposition method) and applications of nanomaterials.	

UNIT IV - SURFACE CHEMISTRY AND POLYMERS	(9)
Surface chemistry - Adsorption - types - Differentiate between physical and chemical adsorption - Freundlich adsorption isotherm - Langmuir adsorption isotherm. Polymers - classification - addition - condensation - copolymerization – plastics - thermoplastics and thermosetting plastics - preparation, properties and uses of PVC and nylon- polymer processing - compression and injection moulding techniques.	
UNIT V - ANALYTICAL TECHNIQUES	**(9)**
Colorimetry - principles- estimation of Iron by colorimetry - UV-Visible spectroscopy- principles - instrumentation (block diagram only) - IR spectroscopy - principles - instrumentation (block diagram only) - Flame Photometry - principles - instrumentation (block diagram only) - estimation of sodium by flame photometry - Atomic absorption spectroscopy - principles - instrumentation (block diagram only) - estimation of nickel by atomic absorption spectroscopy.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan, A," Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem. Co. Pvt Ltd., 13th ed., Chennai, 2020.
2. S.S. Dara," A text book of Engineering Chemistry", S.Chand & Co. Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co, New Delhi 15th ed.,2018.
2. B.Sivasankar, "Engineering Chemistry", Tata McGraw- Hill Pub. Co. Ltd., New Delhi,2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			2				2							
2		2							2					2
3	3						2						3	
4		2	2											2
5						2						2		
CO (W.A)	**3**	**2**	**2**			**2**	**2**		**2**			**2**	**3**	**2**

22CYB06 - ENVIRONMENTAL SCIENCE AND SUSTAINABILITY *(Common to CHEM-2nd, BME-3rd, ECE-5th AND EEE-4th SEM)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL				
Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity.	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Analyze the renewable and non-renewable resources and preserve them for future generations.	An	20%
CO4	Examine the different goals of sustainable development and apply them for suitable technological advancement and societal development.	Ap	20%
CO5	Execute the sustainability practices, identify green materials and energy cycles.	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	(9)
Environment - scope and importance - Eco-system- Structure and function of an ecosystem - types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(9)
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(9)
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	
UNIT IV – SUSTAINABILITY AND MANAGEMENT	(9)
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - from unsustainability to sustainability - millennium development goal - Sustainable Development goals - Climate change – Concept of carbon credit – carbon footprint - Environmental management.	

UNIT V – SUSTAINABILITY PRACTICES	(9)
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable habitat - Green buildings - Green materials- Sustainable energy - Non-conventional Sources - Energy Cycles- carbon cycle and carbon emission - Green Engineering - Sustainable urbanization.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing Co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

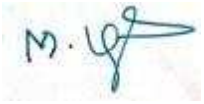
1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
3. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic- issues/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2		2					2						
4							3							
5						3						2		
CO (W.A)	2	2	2			3	3	2				2		



22MAN07R - SOFT/ANALYTICAL SKILLS – III
(Common to All Branches)

L	T	P	C
1	0	2	0

PREREQUISITE : Nil

Course Objective:

- To improve language proficiency for personal or professional reasons
- To enhance students' mathematical problem-solving and critical thinking skills

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in Continuous Assessment Test
CO1	Demonstrate effective communication skills by listening actively, speaking clearly, reading critically, and writing coherently in contexts.	U	40%
CO2	Develop proficiency in applying mathematical concepts of time, speed, distance, and financial calculations involving simple and compound interest.	Ap	30%
CO3	Analyse logical reasoning skills through various forms of statements.	An	30%

UNIT I – VERBAL ABILITY **(5+10)**

Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.

UNIT II – APTITUDE **(5+10)**

Simple and Compound Interest - Time, Speed and Distance - Problems on Trains - Boats and Streams - Chain Rule - Time and Work - Pipe and Cisterns.

UNIT III - REASONING **(5+10)**

Seating Arrangements - Syllogism - Statement and Conclusion - Statement and Assumption - Statement and Course of Action.

TOTAL(L:45) = 45 PERIODS

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				

22MAN08R - SOFT/ANALYTICAL SKILLS – IV
(Common to All Branches)

L	T	P	C
1	0	2	0

PREREQUISITE : NIL

Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts • To develop quantitative aptitude and analytical reasoning skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - VERBAL ABILITY	**(15)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II - APTITUDE	**(15)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(15)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning*. PHI Learning Pvt. Ltd., 2016.

22MAN10R - COMMUNICATION AND QUANTITATIVE REASONING

L	T	P	C
1	0	2	0

PREREQUISITE : NIL

Course Objective:	• To enhance the proficiency of the students in both spoken and written communication • To acquire skills required to solve quantitative aptitude problems

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in Continuous Assessment Test
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - LANGUAGE BOOSTERS	**(5+10)**
JAM - General Topic Presentation - Group Discussion - Mock Interview - E Mail Writing - Essay writing	
UNIT II - APTITUDE	**(5+10)**
Mensuration - Area, Shapes, Perimeter - Races and Games - Data Interpretation on Multiple Charts.	
UNIT III - REASONING	**(5+10)**
Venn diagram - Syllogism - Data Sufficiency - Cubes & Embedded Images.	
TOTAL (L:15, P:30) : 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. "Effective Technical Communication", Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. "Quantitative Aptitude for Competitive Examinations." S.Chand Publishing Company Ltd(s), 2022.
3. Arun Sharma. "How to Prepare for Quantitative Aptitude for the CAT", Tata McGraw - Hill Publishing, 2022.
4. Praveen R V., "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		1		1					1	1				

22MYB01-CALCULUS AND LINEAR ALGEBRA
(Common to All Branches)

	L	T	P	C
	3	1	0	4

PRE-REQUISITE : NIL

Course Objectives :	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNIT I - MATRICES	**(9+3)**
Characteristic Equation - Eigen values and Eigen vectors of a matrix - Cayley Hamilton Theorem (excluding proof) and its applications - Quadratic form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II – ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane – Angle between two planes – Equation of straight lines - Coplanar lines –Equation of sphere – Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL (L:45+T:15) :60 PERIODS	

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test**)**:

1. Introduction to MATLAB
2. Matrix operations – Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

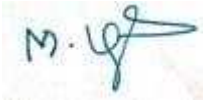
1. Dr.B.S.Grewal, "Higher Engineering mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig , "Advanced Engineering mathematics" , 9th Edition , John Wiley & Sons ,2013
3. Veerarajan.T, "Engineering Mathematics of semester I & II", 3rd Edition, Tata McGraw Hill. ,2016

REFERENCES:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics -Sem-II", 6th Edition, Laxmi Publications, 2014.
2. Kandasamy.P, Thilagavathy.K, Gunavathy .K," Engineering Mathematics for first year", 9 th Rev.Edition, S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics" , 7th Edition, Wiley India, 2007

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2												
3		2											3	
4	3												3	
5	3				2				3			2		
CO (W.A)	3	2			2				3			2	3	



*Ratified by Eleventh Academic Council

22MYB05 - DISCRETE MATHEMATICS
(Common to CSE, AI&DS, CSE(IoT), CSE(CS) and IT Branches)

	L	T	P	C
	3	I	0	4

PRE- REQUISITE : NIL

Course Objective:	• To understand the basic concepts of logic, properties of set theory and their applications in Algorithms. • To understand the ideas about Lattices and general counting methods involving permutations and combinations.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of logic to solve the problems in Artificial Intelligence.	Ap	20%
CO2	Calculate the applications of predicate logic used in data science.	An	20%
CO3	Solve different properties of injection, surjection, bijection, composition and inverse functions in software engineering.	Ap	20%
CO4	Determine the concepts of lattices, Permutations, Combinations and Mathematical induction in the experience of network theory and analysis of algorithms.	An	40%
CO5	Demonstrate the importance of lattice theory using the modern tools and solve the real time problems in various contexts.	Ap	Internal Assessment

UNIT I - PROPOSITIONAL CALCULUS	**(9+3)**
Propositions-Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables-Tautologies and Contradictions-Logical Equivalences and implications – De morgan's Laws-Normal forms-Rules of inference-Arguments-Validity of arguments.	
UNIT II - PREDICATE CALCULUS	**(9+3)**
Predicates-Statement Function-Variables-free and bound variables-Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements-Theory of inference-The rules of universal specification and generalization-Validity of arguments.	
UNIT III - SET THEORY AND FUNCTIONS	**(9+3)**
Set Operations-Properties-Power set-Relations-Graph and matrix of a relation-Partial Ordering-Equivalence relation-Functions-Types of functions-Composition of relation and functions-Inverse functions.	
UNIT IV - COMBINATORICS	**(9+3)**
Basics of counting - Counting arguments - Pigeonhole Principle - Permutations and Combinations- Recursion and recurrence relations - Generating Functions - Mathematical Induction – Inclusion and Exclusion.	

UNIT V - LATTICES	(9+3)
Posets-Lattices as posets-Properties of lattices-Lattices as Algebraic systems – Sub lattices - Direct product and Homomorphism.	
TOTAL (L:45+ L:15) : 60 PERIODS	

TEXT BOOKS:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science " , Tata McGraw-Hill, New Delhi, Reprint 2010.
2. Veerarajan.T, "Discrete Mathematics with Graph Theory and Combinatorics", 4th edition, Tata McGraw Hill, New Delhi, 2008.
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5th edition, Tata McGraw Hill Publications, New Delhi, 2007.

REFERENCES:

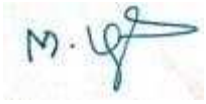
1. Venkatraman M.K., "Discrete Mathematics" , the National Publishing Company, Chennai, 2007.
2. S.Santha, "Discrete Mathematics with Combinatorics and Graph Theory" ,Cengage Learning India Pvt. Ltd. 2010 .
3. Swapan Kumar Sarkar, "A Text Book of Discrete Mathematics" , S. Chand & Company Ltd., New Delhi.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/106/108/106108227/
2. https://www.youtube.com/watch?v=dK8iaQYcbms

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		2												
3	3													
4		2												
5	3				2				3			2	3	
CO (W.A)	**3**	**2**			**2**				**3**			**2**	**3**	



22MYB07- PROBABILITY AND COMPLEX FUNCTIONS
(For EEE Branch only)

	L	T	P	C
	3	I	0	4

PRE-REQUISITE: NIL

Course Objective:	• Develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering • Provide adequate knowledge in Complex Analysis and Special functions familiarize the Power series solution required to analyze the Engineering Problems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the concepts of the probability and random variable, joint distribution functions in the area of communication engineering.	An	40%
CO2	Obtain the concepts of analytic function and conformal mapping in electrical circuits.	An	20%
CO3	Apply complex integration techniques and contour integration techniques in circuit theory problems.	Ap	20%
CO4	Solve the new techniques for differential equations in electrical theory problems.	Ap	20%
CO5	Demonstrate the importance of complex variables, and differential equations using programming tools in Control systems.	Ap	Internal Assessment

UNIT I - PROBABILITY AND RANDOM VARIABLES	**(9+3)**
Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous randomvariables–Moments–Momentgeneratingfunctions–Binomial,Poisson, Uniform and Normal distributions.	
UNIT II -TWO-DIMENSIONAL RANDOM VARIABLES	**(9+3)**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression–Transformation of random variables–Central limit theorem (Excluding proof).	

UNIT III- ANALYTIC FUNCTIONS	(9+3)

Analytic functions–Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates-Properties–Harmonic conjugates–Construction of analytic function–Conformal mapping – Mapping by functions w = z+c, cz, c/z, Bilinear transformation.

UNIT IV - COMPLEX INTEGRATION	(9+3)

Line integral-Cauchy's integral theorem–Cauchy's integral formula–Taylor's and Laurent's series–Singularities–Residues–Residue theorem–Application of residue theorem for evaluation of real integrals-Evaluation of contour integration over unit circle and semi circle

UNIT V - ORDINARYDIFFERENTIALEQUATIONS	(9+3)

Higher order linear differential equations with constant coefficients-Method of variation of parameters–Homogenous equation of Euler's and Legendre's type–System of simultaneous linear first order differential equations with constant coefficients.

TOTAL (L:45+ T:15) : 60 PERIODS

TEXT BOOKS:

1. Milton.J.S. and Arnold.J.C., "Introduction to Probability and Statistics", Tata McGraw Hill,4th Edition, 2007.
2. Johnson.R.A., Miller.I and Freund.J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
3. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, NewDelhi,44thEdition, 2018.

REFERENCES:

1. Papoulis. A. and Unnikrishna pillai.S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4thEdition, New Delhi, 2010.
2. Ross.S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier,2014.
3. Kreyszig.E, "Advanced Engineering Mathematics", JohnWiley and Sons,10th Edition, NewDelhi, 2016.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		2												
3		2												
4	3													
5	3				2				3			2		
CO (W.A)	**3**	**2**			**2**				**3**			**2**		

22MYB02 - PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES

(Common to AGRI,CIVIL,CHEMICAL, MECH Branches)

L	T	P	C
3	1	0	4

PREREQUISITE : NIL

Course Objective:	• To make the conversant with concepts of Laplace transforms, Fourier series, Fourier Transforms to represent periodical physical problems in engineering analysis. • To provide adequate knowledge in partial differential equation and to analyze the boundary value problems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the various techniques of Fourier series to obtain solution for different functions.	Ap	20%
CO2	Interpret the methods of partial differential equations in fluid mechanics and water resource management.	Ap	20%
CO3	Solve the initial and boundary value problems by using Fourier series.	Ap	20%
CO4	Analyze the concepts of Transform Techniques to solve the problems in stability analysis, Structural Analysis, control system design and analysis.	An	40%
CO5	Demonstrate the importance of Transform Techniques and partial differential equations in engineering using modern tools.	Ap	Internal Assessment

UNIT I - FOURIER SERIES (9+3)

Dirichlet's condition - Fourier series: Half range sine series - Half range cosine series - Parseval's identity for half range series - Root mean square value of a function - Harmonic analysis.

UNIT II - PARTIAL DIFFERENTIAL EQUATIONS (9+3)

Formulation of partial differential equations by eliminating arbitrary constants and functions - Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form - Lagrange's linear equations - Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.

UNIT III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (9+3)

Classification of second order quasi linear partial differential equations - Solution of one dimensional wave equation (Zero and non-zero velocity) - One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) - Steady state solution of two dimensional heat equation(Finite and infinite plate).

UNIT IV - FOURIER TRANSFORM (9+3)

Fourier integral theorem(Statement only) - Fourier transform pair - Sine and Cosine transforms - Properties -Transforms of simple functions – Convolution theorem - Parseval's identity(Excluding proof).

UNIT V - LAPLACE TRANSFORM (9+3)

Condition for existence - Transforms of Elementary functions - Basic Properties - First & Second Shifting Theorems (Statement only) - Initial and Final value Theorems. Inverse Laplace transforms - Convolution theorem (Excluding proof) - Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.

TOTAL (L:45+T:15) : 60 PERIODS

TEXT BOOKS:

1. Veerarajan.T, "Engineering Mathematics (for semester III)", 3rd Edition, Tata McGraw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics; Volume III", S.Chand&Coltd., 2008.
3. GrewalB.S,"Higher Engineering Mathematics", 42nd Edition, Khanna publishers, New Delhi, 2012.

REFERENCES:

1. Goyal Manish and Bali.N.P, "A Text book of Engineering mathematics", 6th Edition, Laxmi Publication (P) Ltd, New Delhi, 2012.
2. Kreyszig, Erwin, "Advanced Engineering Mathematics", 9th Edition, Wiley Publications, New Delhi, 2006.
3. Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2	3													
3	3													2
4	3													2
5	3				2				3			3		
CO (W.A)	**3**	**2**			**2**				**3**			**3**		**2**

- Ratified by Eleventh Academic Council

22MYB06 – PROBABILITY AND RANDOM PROCESSES *(Common to BME and ECE Branches)*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PREREQUISITE : NIL

Course Objective:	• Develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering • To learn about the classification of random processes and strict stationary, wide sense stationary and Ergodic, correlation functions and power spectral density and solve the signal problems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic principles of probability to solve the problems involving multiple events and practical problems in communication engineering, including signal processing and information theory.	Ap	30%
CO2	Interpret the distribution to model and solve problems involving binary outcomes, such as error detection and correction in digital communications.	Ap	30%
CO3	Determine and enhance problem-solving skills through practical examples, case studies, and applications in fields such as signal processing, time series analysis, and system modeling.	An	20%
CO4	Analyze and interpret signals and their interactions in the frequency domain.	An	20%
CO5	Demonstrate the methods to solve the spectrum estimation and spectral density function by using mathematical tools in analog communication.	Ap	Internal Assessment mode

UNIT I – ONE DIMENSIONAL RANDOM VARIABLES	**(9+3)**
Probability: Random variable – Probability mass function – Probability density functions – Properties – Moments –Moment generating functions and their properties	
UNIT II-STANDARD DISTRIBUTIONS	**(9+3)**
Discrete distributions: Binomial, Poisson and Geometric distribution – Continuous distributions: Uniform, Exponential and Normal distribution and its properties.	
UNIT III –TWO DIMENSIONAL RANDOM VARIABLES	**(9+3)**
Joint distributions – Marginal distributions and conditional distribution – Covariance – correlation and Regression – Transformation of random variables – Central limit theorem (Excluding proof).	
UNIT IV–RANDOM PROCESSES	**(9+3)**
Definition and examples – first order, second order strictly stationary, wide-sense stationary and Ergodic process- Markov process – Binomial, Poisson processes.	

UNIT V – CORRELATION AND SPECTRAL DENSITIES	(9+3)
Auto correlation – Cross correlation – Properties –Power spectral density – Cross spectral density – Properties – Wiener – Khintchine relation (statement only) – Relationship between cross power spectrum and cross correlation function.	
TOTAL (L:45+T:15) :60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T, "Probability, Statistics and Random Processes,"3rded.,NewDelhi,Tata McGraw-Hill,2008
2. Venkatarama Krishnan, "Probability and Random Process,"2ndEdition,John Wiley & Sons , New Jersey,2016
3. Scott L. Miller and Donald Childers, "Probability and Random Processes with applications to Signal Processingand communications," Elsevier, 2012.

REFERENCES:

1. GubnerA.John, "Probability and Random Processes for Electrical and Computer Engineers", Cambridge University press, Newyork, 2006.
2. Charles W.Therrien, MuraliTummala, "Probability and random process for electrical and computer Engineers",CRC Press, Newyork, 2012.
3. Singaravelu.A, Sivasubramanian, Ramaa, "Probability, Statistics and Random Processes," 2nd ed., MeenakshiPublication, Chennai, 2003.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2		2												
3	3													
4		2												
5	3				2				3			2		
CO (W.A)	3	2			2				3			2		

22MYBO8– PROBABILITY AND STATISTICS				
	L	T	P	C
	3	1	0	4
PRE-REQUISITE : NIL				

Course Objective:	• To understand the mathematical concept of probability and random variable in various distributions. • To understand the concepts of testing the hypothesis of large and small samples and statistical quality control.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the axioms of probability and the moments of discrete and continuous random variables to engineering problems.	Ap	20%
CO2	Solve the concepts of discrete probability distributions including requirements of mean and variance fordecision making in algorithms.	Ap	20%
CO3	Determine the correlation and linear regression with respect to random variables in data science.	An	20%
CO4	Analyze large and small sample tests to perform non-parametric tests in machine learning and quality control.	An	40%
CO5	Demonstrate the statistical methods to solve the real life problems by using modern techniques.	Ap	Internal Assessment

UNIT I -PROBABILITY AND RANDOM VARIABLES	**(9+3)**
Probability: Random variable – Probability mass function – Probability density functions -Properties-Moments-Moments generating functions.	
UNIT II - STANDARD DISTRIBUTIONS	**(9+3)**
Discrete distributions: Binomial, Poisson and Geometric- Continuous distribution: Uniform, Exponential and normal distributions.	
UNIT III- TWO-DIMENSIONAL RANDOM VARIABLES	**(9+3)**
Joint distributions-Marginal and conditional distributions-Covariance-Correlation and linear regression.	
UNIT IV –ESTIMATION THEORY AND NON-PARAMETRIC TESTS	**(9+3)**
Differences between means, variations and ratio of two variances- Non-parametric Tests: Introduction-The sign test-The signed – Rank test- Rank-sum tests-The U test-The H test.	
UNIT V – STATISTICAL QUALITY CONTROL	**(9+3)**
Control charts for measurements ($\overline{X}$ and R-charts)-Control charts for attributes(p,c and np charts)-Tolerance limits-Acceptance sampling.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T, "Probability, Statistics and Random Processes with Queuing Theory and Queuing Networks",4ed. ,Tata McGraw-Hill, New Delhi 2018.
2. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12thedition,Sultan Chand & Sons, New Delhi- 2020.
3. Johnson.R.A., Miller.I.RandFreud.J.E,"Miller and Freund's Probability and Statistics for Engineers",Pearson Education,Asia,9 th edition,2016.

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1. Allen, 0. Arnold, "Probability, Statistics and Queuing Theory with Computer Applications ", 2nd ed., Elsevier, New Delhi, 1990.
2. Taha, H.A., "Operations Research -An Introduction", 8th ed., Pearson Education, New Delhi, 2008.
3. Trivedi, S.K, "Probability and Statistics with Reliability, Queuing and Computer Science applications", 2ndEd. John Wiley & Sons, New Delhi, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	
3		2											2	2
4		2											2	2
5	3				2				2			2		2
CO (W.A)	**3**	**2**			**2**				**2**			**2**	**2**	**2**

22MYB03- STATISTICS AND NUMERICAL METHODS

(Common to AGRI,AI&DS,CSE, IT, CSE(IoT) , CSE(CS),CIVIL,CHEMICAL,EEE and MECH Branches)

L	T	P	C
3	1	0	4

PRE-REQUISITE : NIL

Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t -distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(9+3)**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method – Iterative methods of Gauss Jacobi and Gauss Seidel Methods- Eigen values of a matrix by Power method .	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules -Romberg's Methods.	

UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	(9+3)
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

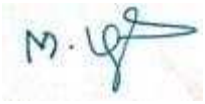
1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3													
3		2											3	
4	3													
5	3				2				3			2	3	
CO (W.A)	3	2			2				3			2	3	



*Ratified by Eleventh Academic Council

22MYB04 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to BME and ECE Branches)

	L	T	P	C
	3	1	0	4

PRE REQUISITE : NIL

Course Objective:	• To make the Conversant with concepts of Z-transforms, Fourier series, Fourier transforms to represent periodical physical problems in engineering analysis. • To provide adequate knowledge in partial differential equation and to analyze the boundary value problems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the Fourier series in various fields such as signal processing, communications, control systems, and biomedical engineering.	Ap	30%
CO2	Solve the initial and boundary value problems by using Fourier series in wave equation.	Ap	30%
CO3	Apply the methods of partial differential equations in Circuit Analysis and Biomedical Signal Processing.	Ap	20%
CO4	Analyze the concepts of Transform Techniques to solve the engineering problem.	An	20%
CO5	Identify the mathematical tools for solving transform techniques in real time applications.	Ap	Internal Assessment

UNIT I – FOURIER SERIES	**(9+3)**
Dirichlet's condition – Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – RMS value – Harmonic Analysis.	
UNIT II – PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Formulation of partial differential equations by eliminating arbitrary constants and functions – Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form – Lagrange's linear equations –Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.	
UNIT III – APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Classification of second order Quasi linear partial differential equations – Solution of one dimensional wave equation (Zero and non-zero velocity) – One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) – Steady state solution of two dimensional heat equation(Finite and infinite plate).	
UNIT IV – FOURIER TRANSFORM	**(9+3)**
Fourier integral theorem(Statement only) – Fourier transform pair - Sine and Cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity(Excluding proof).	
UNIT V – Z-TRANSFORM AND DIFFERENCE EQUATIONS	**(9+3)**

Z-transforms – Elementary properties – Inverse Z-transform (Partial fraction method and Residue method) – Convolution theorem (Excluding proof) – formation of difference equations – Solution of difference equation using Z transform.
TOTAL (L:45+T:15) :60 PERIODS

TEXT BOOKS:
1. Veerajan.T,"Engineering Mathematics (for semester III), 3rd ed., Tata Mc Graw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy. K., "Engineering Mathematics; Volume III", S.Chand & Coltd., 2008.
3. Grewal B.S,"Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.
REFERENCES:
1. Goyal Manish and Bali. N.P,"A Text book of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd, New Delhi, 2012.
2. Kreyszig, Erwin,"Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.
3. Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.
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1. https://youtu.be/B025y1UWkvI
2. https://youtu.be/IkAvgVUvYvY
3. https://youtu.be/RtVE2Gt-KQ4
4. https://youtube.com/playlist?list=PLs7oDAL8_ouKSagWiC_IwrEsRwvD2WJ73

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													1
4		2											2	
5	3				2				3			3	1	
CO (W.A)	**3**	**2**			**2**				**3**			**3**	**1.5**	**1**

- **Ratified by Eleventh Academic Council**

22PYB01 - SEMICONDUCTOR PHYSICS
(Common to CSE, CSE (CS), CSE (IoT), IT & AI&DS)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To expose the concepts of conducting materials and electrical properties of semiconductors. • To expand familiarity in the field of photo detectors and new engineering materials

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the properties of intrinsic semiconductor in photovoltaic cells.	Ap	20%
CO2	Compare various types of semiconducting materials to fabricate laptop circuits	An	20%
CO3	Implement the principles of laser in engineering and medical applications.	Ap	20%
CO4	Analyze proficient in photo doctors in device fabrications.	An	20%
CO5	Examine new engineering materials to assess their performance in electronic applications.	Ev	20%

UNIT I -INTRODUCTION TO CONDUCTING MATERIALS	(9)
Classical free electron theory – Expression for electrical conductivity – Thermal conductivity, expression – Wiedemann – Franz law- Success and failure – electrons in metals - Fermi- Dirac statistics – Density of energy states- - Particle in a three-dimensional box- degenerate states -Energy bands in solids- - Electron effective mass- concept of hole.	
UNIT II -ELECTRICAL PROPERTIES OF SEMICONDUCTORS	(9)
Elemental and compound semiconductors - Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – variation of Fermi level with temperature and impurity concentration – Hall effect –determination of Hall coefficient – Applications	
UNIT III -SEMICONDUCTOR LASER	(9)
Population of energy levels – Einstein's A and B coefficients derivation -Resonant cavity – Types of Semiconductor lasers: homo junction and hetero junction- Determination of particle size using laser - Holography – construction – reconstruction – Engineering applications of lasers -Medical field (Surgery).	
UNIT IV -PHOTO DETECTORS	(9)
Classification of optical materials- Carrier generation and recombination processes- Absorption, emission and scattering of light in metals, insulators and semiconductors (concept only)- Formation of P-N junction - Barrier potential and depletion layer – P-N junction diode-Solar cell–LED–organic LED- Laser diode – optical data storage technique.	

UNIT V -ADVANCED NEW ENGINEERING MATERIALS	(9)
Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): Characteristics, properties of NiTi alloy, application. Nano materials: Properties - Preparation – Pulsed laser deposition – chemical vapour deposition of nano particles and applications. Carbon nano tubes: fabrication – arc method – pulsed laser deposition –structure – properties and application.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. R. A. Serway and J.W. Jewett, "Physics for Scientists and Engineers", Ninth Edition. Cengage Learning, 2018.
2. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. V.Rajendran, — Engineering Physicsll, Tata McGraw-Hill. New Delhi.2019

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.

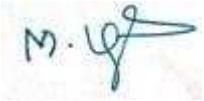
   B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

WEB LINKS

1. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
2. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
3. https://zenodo.org/record/243407#.ZEgPZXZBzIU
4. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3	2												
3	3		2											
4	3													
5	3					2	2					2		
CO (W.A)	**3**	**2**	**2**			**2**	**2**					**2**		



22PYB02 - ADVANCED MATERIALS AND NANO TECHNOLOGY (Common to CIVIL, CHEM & AGRI)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE - REQUISITE: Nil

Course Objectives:	• To gain adequate information about the properties of matter and nano materials. • To expose the concepts of Photonics, fiber optics and Advanced new engineering materials.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Correlate the stress and strain ratio to apply the elasticity for spring materials.	An	20%
CO2	Discriminate the thermal conductivity of the medium to employing in instrument applications.	An	20%
CO3	Articulate the role of nanotechnology in environmental sustainability for the field of agriculture.	Ap	20%
CO4	Operate the optical fibers in sensor devices.	Ap	20%
CO5	Appraise the classification of composites in the applications of aerospace components, automotive parts, and sports equipment.	Ev	20%

UNIT I -PROPERTIES OF MATTER	(9)
Elasticity – Hooke's law Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment - bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders - stress due to bending in beams.	
UNIT II -THERMAL PHYSICS	(9)
Mode of heat transfer-thermal conductivity-Newton 's law of cooling –thermal conduction through compound media (bodies in series and parallel) – Thermal conductivity of a good conductor – Forbe's method - Thermal conductivity of bad conductor – Lee's disc – Hazards– Cyclone and flood hazards – Fire hazards and fire protection, fire – proofing of materials, fire safety regulations and firefighting equipment. Prevention and safety measures.	
UNIT III -SYNTHESIS AND PROPERTIES OF NANOSTRUCTURES	(9)
Introduction to Nanoscience – Types of nanostructure and properties of Nanomaterials – Synthesis and preparation of Nanomaterials – Nanosensors – Biosensors – Nanoscience and Environment.	
UNIT IV -PHOTONICS AND FIBER OPTICS	(9)
Photonics: Population of energy levels – Einstein's A and B coefficients derivation – Resonant cavity – Types of lasers – solid state laser (Neodymium) – gas laser (CO_2) Applications of lasers in science – Engineering – Medicine.	

Fibre optics: Principle, numerical aperture and acceptance angle - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication Fibre optic sensors (pressure and displacement).

UNIT V -ADVANCED NEW ENGINEERING MATERIALS	(9)

Ceramics - Types and applications - Composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - Shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy and application - Bio material - applications.

TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

2. Dattuprasad, Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2019.
3. V.Rajendran, — Engineering Physics, Tata McGraw-Hill. New Delhi.2017.
4. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2018.

REFERENCES:

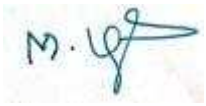
1. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand& Co. Ltd, New Delhi, 2017.
2. Kongbamchandramanisingh, "Basic Physics", PHI, 2018.
3. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand&company Ltd, 2017.

WEB LINKS:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3	2												
3	3						2							
4	3		2											
5	3					2	2					2		
CO (WA)	**3**	**2**	**2**			**2**	**2**					**2**		



22PYB03 - SOLID STATE PHYSICS

(Common to ECE, EEE & BME)

	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objective:	• To gain adequate information about the properties of matterand properties of nanostructures. • To expose the concepts of Photonics and fiber optics and Advanced new engineering materials

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of semiconductor physics to the design and optimization of semiconductor-based biomedical equipment.	Ap	20%
CO2	Employ their knowledge of dielectric properties to optimize and enhance the performance of electronic components such as capacitors and transformer.	Ap	20%
CO3	Examine how magnetic moments and superconductivity are utilized in the design of biomedical devices like MRI machines and magnetic sensors.	An	20%
CO4	Analyze the impact of fabrication techniques on enhancing the performance and efficiency of microprocessors.	An	20%
CO5	Evaluate how the properties and preparation methods of advanced materials can be utilized to develop innovative solutions in material science.	Ev	20%

UNIT I – SEMICONDUCTING MATERIALS	**(9)**
Introduction to semiconducting materials – Elemental and compound semiconductors – Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – Hall effect – determination of Hall coefficient – Applications	
UNIT II – DIELECTRIC MATERIALS	**(9)**
Electrical susceptibility – dielectric constant – electronic, ionic, orientation and space charge polarization – frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferro electricity and applications.	
UNIT III – MAGNETIC AND SUPERCONDUCTING MATERIALS	**(9)**
Origin of magnetic moment – Bohr Magneton – Types of magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials – Ferrites – applications – Superconductivity – properties – types of superconductors – BCS theory of superconductivity (qualitative) – High Tc superconductors – Application of superconductors – Magnetic levitation.	

UNIT IV – FABRICATION PROCESS OF INTERGATED CIRCUITS	(9)
Bulk crystal growth – Epitaxial growth – masking and etching-diffusion of impurities-selective diffusion – Formation of PN junction – resistors – capacitors – inductors – isolation methods – metal semiconductor contact – Introduction to integrated circuit – monolithic and hybrid circuits – Thin film and Thick film technology – Definition of LSI, MSI, VLSI circuits.	
UNIT V – ADVANCED MATERIALS AND NANO TECHNOLOGY	**(9)**
Metallic glasses: preparation, properties and applications – Shape Memory Alloys (SMA): Characteristics, properties of NiTi alloy, application – Nano materials: Properties, Preparation – Pulsed laser deposition – chemical vapour deposition of nano particles and applications – Carbon nano tubes: fabrication – arc method – structure – properties and application.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. M.N.Avadhanulu and P.G.Kshirsagar, "A text book of Engineering Physics", S. Chand and Company, New Delhi, 2019.
2. A.Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. M.A.Wahab, "Solid State Physics", 3rd edition ,Narosa Publishing House Pvt.Ltd., 2016.

REFERENCES:

1. B.Rogers , J. Adams and S.Pennathur, "Nanotechnology : Understanding Small System" CRC Press, 2017.
2. Jacob Millman, Charistos C Halkilas, SatyabrataJit "Electronic Devices & Circuits", Tata McGraw Hill, Education Private Limited, 2016, Third Edition.
3. Subrahmanyam N, Brijlal, "A Text Book Of Optics" S.Chand & Co. Ltd, New Delhi, 2019.

WEB LINKS:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU

https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.

6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3													
3	3													
4	3		3				2						3	
5	3					2	2					2		
CO (W.A)	**3**	**2**	**3**			**2**	**2**					**2**	**3**	

22PYB04 - PHYSICS FOR MECHANICAL ENGINEERING (Mechanical Engineering)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE: Nil				
Course Objective:	• To update the knowledge about the properties of matter and elements of thermodynamics. • To identify knowledge in the field of electromagnetic theory and optics & laser.			

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Correlate the stress and strain ratio to apply the elasticity for spring materials.	An	20%
CO2	Discriminate the thermal conductivity of the medium to employing in instrument applications.	An	20%
CO3	Manipulate the thermodynamic principles for heat engines.	Ap	20%
CO4	Illustrate concept of electromagnetic theory to design electromagnetic coil.	Ap	20%
CO5	Appraise the advantages and limitations of laser technology in industrial applications.	Ev	20%

UNIT I -PROPERTIES OF MATTER	(9)
Elasticity – Hooke's law Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.	
UNIT II -THERMAL PHYSICS	(9)
Mode of heat transfer-thermal conductivity - Newton 's law of cooling - thermal conduction through compound media (bodies in series and parallel) - thermal conductivity of a good conductor – Forbe's method-thermal conductivity of bad conductor - Lee's disc - radial flow of heat-expression for thermal conductivity of rubber - experimental determination - practical applications of conduction.	
UNIT III -ELEMENTS OF THERMODYNAMICS	(9)
Concept of temperature – Heat - Thermodynamics - work – Heat in Thermodynamics – Comparison of heat and work – internal energy - first law of thermodynamics – applications of first law - second law of thermodynamics – the Carnot engine – heat engine – heat pump refrigerator -Third law of thermodynamics.	

UNIT IV -ELECTRO MAGNETIC THEORY	(9)
Force on a moving Charge - Force on a differential Current Element - Force & Torque Magnetization & Permeability - Magnetic Boundary Conditions -Inductance & Mutual Inductance - Time Varying Fields: Faraday's Law - Displacement Current - Maxwell's Equation.	
UNIT V -OPTICS AND LASERS	(9)
Interference: Air wedge – theory – uses – testing of flat surfaces – determination of thickness of a thin wire – Introduction of laser - Properties of laser beams: mono - chromaticity, coherence, directionality and Intensity - Einstein's A and B coefficients derivation - Resonant cavity - Types of lasers – solid state laser (Neodymium) – Gas laser (CO_2) – Materials processing – Laser Cutting – Drilling – Welding – Soldering – Industrial Applications.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2019.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2017.
3. A. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2019.

REFERENCES:

1. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
2. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand& Co. Ltd, New Delhi, 2017.
3. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand&company Ltd, 2015.

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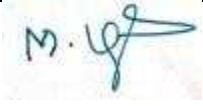
1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	2	-	-	-	2	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	-	3	-	-	-	-	-	-	-	-	-	-	-
5	3	-	-	-	-	2	2	-	-	-	-	2	-	-
CO (WA)	**3**	**2**	**3**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**2**	**3**	**0**



22EYA01 - PROFESSIONAL COMMUNICATION I (Common to All Branches)					
		L	T	P	C
		2	0	2	3
PRE-REQUISITE : NIL					
Course Objective:	• To build essential English skills to address the challenges of communication • To enhance communication employing LSRW skills				
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Communicate effectively in various work environments.	R	20%		
CO2	Involve in diverse discourse forms utilizing LSRW Skills.	U	20%		
CO3	Participate actively in communication activities that enhance the creative skill.	U	20%		
CO4	Associate with the target audience and contexts using varied types of communication.	Ap	20%		
CO5	Convey the ideas distinctly both in verbal and non-verbal communication in work culture.	U	20%		

UNIT I –INTRODUCTORY SKILLS	(6+6)
Grammar – Parts of Speech – Verb (Auxiliaries – Primary & Modal, Main Verb) -Listening – Listening to Short Conversations or Monologues - Listening to Experiences – Listening to Descriptions- Speaking Introducing Oneself – Exchanging Personal information - Talking about food and culture - Reading– Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting - Writing – Seeking Permission for Industrial Visit & In-plant Training	
UNIT II – LANGUAGE ACUMEN	(6+6)
Grammar – Word Formation – Tenses (Present Tense) – Synonyms & Antonyms - Listening – Listening to Announcements – Listening to Interviews - Listening and Note-taking - Speaking – Talking about Holidays & Vacations – Narrating Unforgettable Anecdotes - Reading – Skimming – Scanning (Short Texts and Longer Passages) – Critical Reading - Writing – Instruction – Process Description	
UNIT III – COMMUNICATION ROOTERS	(6+6)
Grammar– Cause and Effect – Tenses (Past Tense) – Discourse Markers - Listening – Listening to Telephonic Conversations – Listening to Podcasts - Speaking – Talking about neoteric Technologies – Eliciting information to fill a form - Reading –Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - Writing – Checklist – Circular, Agenda & Minutes of the Meeting	

UNIT IV - DISCOURSE FORTE	(6+6)
Grammar – Tenses (Future Tense) –Yes/No & WH type questions – Negatives - Listening – Listening to TED/ Ink talks -Speaking – Participating in Short Conversations - Reading – Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - Writing - E-Mail Writing	
UNIT V - LINGUISTIC COMPETENCIES	(6+6)
Grammar – Articles – Homophones & Homonyms – Single line Definition – Phrasal Verb - Listening – Intensive listening to fill in the gapped text - Speaking –Expressing opinions through Situations & Role play - Reading – Cloze Texts - Writing – Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOK:

1. Shoba K N., Deepa Mary Francis. English for Engineers and Technologists. Volume 1, 3rd Edition, Orient Black Swan Pvt. Ltd, Telangana, 2022.

REFERENCES:

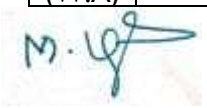
1. Koneru, Aruna . English Language Skills. Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings, M. Advanced English Grammar. Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor. Interchange. Cambridge University Press New Delhi, 2015 (Reprint 2021).

WEB REFERENCE:

1. https://youtu.be/f0uqUzEf3A8?si=vyzu5KGIfbu35_IQ

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									2	3				



22MYB01-CALCULUS AND LINEAR ALGEBRA (Common to All Branches)				
	L	T	P	C
	3	1	0	4
PRE-REQUISITE : NIL				
Course Objective:	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNIT I–MATRICES	(9+3)
Characteristic Equation-Eigen values and Eigen vectors of a matrix- Cayley Hamilton Theorem(excluding proof)and its applications-Quadratic Form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II–ANALYTICAL GEOMETRY OF THREE DIMENSIONS	(9+3)
Equation of plane–Angle between two planes-Equation of straight lines-Coplanar lines–Equation of sphere –Orthogonal spheres.	
UNIT III-GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	(9+3)
Curvature–Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNIT IV-FUNCTIONS OF SEVERAL VARIABLES	(9+3)
Partial derivatives-Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of Two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V-MULTIPLE INTEGRALS	(9+3)
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral-Triple Integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL(L:45+T:15) :60 PERIODS	

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test):

1. Introduction to MATLAB
2. Matrix operations–Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Grewal, B.S., "Higher Engineering Mathematics", Khanna publications,42nd Edition, 2012.
2. Erwin Kreyszig, "Advanced Engineering mathematics",JohnWiley&sons,9th Edition, 2013.
3. Veerarajan,T., "Engineering Mathematics of semesterI&II",TataMcGrawHill,3rd Edition, 2016.

REFERENCES:

1. Bali,N.P., Manish Goyal, "A Textbook of Engineering Mathematics-Sem-II", Laxmi Publications, 6th Edition,2014.
2. Kandasamy,P., Thilagavathy,K., Gunavathy,K., "Engineering Mathematics for first year", Scand & Co Ltd,9th Revised Edition, 2013.
3. GlynJames, "Advanced Engineering Mathematics", Wiley India, 7th Edition, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2												
3		2												
4	3													
5	3				2				3			2		
CO (W.A)	3	2			2				3			2		

*Ratified in Eleventh Academic Council

22CYB03 CHEMISTRY (For CHEMICAL Branch Only)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To make the students conversant with water treatment, boiler feed water techniques, nature of bonding, engineering materials and corrosive nature of metals. • To impart knowledge on the basic principles and preparatory methods of Nanomaterials.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO2	Categorize the properties of lubricants and refractories for various applications.	Ap	20%
CO3	Explore the type of corrosion and its control measures.	An	20%
CO4	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO5	Illustrate the principles, theory of analytical techniques and investigate the nanomaterials.	Ap	20%

UNIT I – WATER TECHNOLOGY	(9)
Hardness – types – estimation by EDTA method. Water quality parameter – BOD and COD. Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – Internal conditioning (carbonate, phosphate and calgon) – External conditioning – demineralization process – desalination – reverse osmosis method	
UNIT II – CHEMICAL BONDING AND ENGINEERING MATERIALS	(9)
Chemical bond – Types of bonds - Covalent bond – Hydrogen fluoride, Methane (overview only) - Ionic bond – Sodium Chloride, Magnesium Oxide (overview only) - Coordinate bond – Hydrogen Peroxide, Ozone (overview only) - Hydrogen Bond – Types of hydrogen bond (overview only). Engineering Materials : Synthesis of Abrasives – Properties of Refractories – Properties of Lubricants	
UNIT III – SCIENCE OF CORROSION	(9)
Corrosion – types - chemical corrosion - pilling bedworth rule - electrochemical corrosion – mechanism - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors.	

UNIT IV – ELECTROCHEMISTRY AND FUEL CELLS	(9)
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode -calomel electrode - potentiometric titrations (redox) - conductometric titrations (acid-base).- Fuel cell – hydrogen and oxygen fuel cell – microbial fuel cell – polymer electrolyte membrane fuel cell.	
UNIT V –ANALYTICAL TECHNIQUES AND NANOCHEMISTRY	(9)
Colorimetry – principle - estimation of iron by colorimetry – UV- Visible spectroscopy – principle – instrumentation (Block diagram only) - IR spectroscopy - principle –instrumentation (Block diagram only) - Atomic absorption spectroscopy – principle – estimation of nickel by atomic absorption spectroscopy - Nanomaterials – synthesis (laser ablation, and chemical vapour deposition method) - applications of nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan, A," Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem.. Co. Pvt Ltd., 13th ed., Chennai , 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand&Co.Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, DhanpatRai Pub, Co,New Delhi 15th ed.,2018.
2. B.Sivasankar, "Engineering Chemistry" , Tata McGraw- Hill Pub.Co.Ltd.,New Delhi,2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3								2					
2		2												
3														
4			2				2							
5		2				2						2		
CO (W.A)	3	2	2			2	2		2			2		

22EEC01 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to CHEMICAL and CIVIL Branches)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To impart knowledge on the concepts of electrical circuit laws, measuring instruments, AC and DC machines. • To Gain information on the basic principles of semiconductor devices with applications and digital systems.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply principles of semiconductor physics to predict the behavior of electrical circuits, diodes, bipolar junction transistors (BJTs) in different circuit configurations and basics of digital systems using logic gates.	Ap	25%
CO2	Illustrate the operation and types of electrical circuits and machines including measuring instruments.	Ap	25%
CO3	Analyze the Characteristics for various diodes, AC machines and DC machines.	An	25%
CO4	Design digital circuits that meet specified needs with appropriate consideration and develop a simple electronic circuit using diodes and transistors	Ap	25%
CO5	Achieve as an independent learner in a team to build an authentic application of electrical and electronics engineering and make an effective oral presentation.	C	Internal Assessment (Seminar)

UNIT I - ELECTRICAL CIRCUITS AND MEASURMENTS	(9)
Introduction to DC circuits - Ohm's Law - Kirchhoff's Laws - Resistive circuits - Resistors in Series and parallel - Introduction to AC circuits - Power and Power factor - Classification of measuring instruments - Dynamometer type wattmeter - Induction type energy meter	
UNIT II - DC MACHINES	(9)
DC Generator: Construction, Types, Principle of operation, EMF equation, Characteristics. DC Motor: Principle of operation, Types, Torque equation, Characteristics and Applications.	
UNIT III - AC MACHINES	(9)
Single phase induction motor: Construction, Types, working principle - Three phase induction motor: Construction, Types, Torque - Slip Characteristics - Synchronous motor: Construction, working principle.	

UNIT IV - SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	(9)
Introduction - Characteristics of PN junction diode and Zener diode - Half wave rectifier - Bipolar junction transistor: CB, CE, CC configurations and characteristics.	
UNIT V - DIGITAL SYSTEMS	(9)
Number System - Binary, Decimal, Octal, Hexadecimal - Binary arithmetic - Boolean Algebra - Logic Gates - Applications: Half Adder.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 4th Edition, Third Reprint, 2019.
2. R Muthusubramaian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd Edition, Tata McGraw Hill publishers, New Delhi, 2012

REFERENCES:

1. Jr.,William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M. "Engineering Circuits Analysis," 9th Edition, Tata McGraw Hill publishers, New Delhi, 2020
2. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson India, New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2	3												2	
3		3											2	
4	3												2	
5									3	3	3	3		
CO (W.A)	3	3							3	3	3	3	2	

22MEC01 - ENGINEERING GRAPHICS (Common to AGRI, CIVIL, CHEMICAL and EEE Branches)				
	L	T	P	C
	2	0	2	3
PRE-REQUISITE : Nil				
Course Objective:	• To Construct various plane curves • To Construct the concept of projection of points, lines and plane • To Develop the projection of solids • To Solve problems in sectioning of solids and developing the surfaces • To Apply the concepts of orthographic and isometric			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the knowledge of engineering drawing standards to drawn 2D Engineering drawings.	Ap	40%
CO2	Apply the knowledge of engineering drawing standards to solve the given 2D problem using first angle of projection.	Ap	20%
CO3	Apply the knowledge of engineering drawing standards solve the 3D problem using first angle of projection	Ap	20%
CO4	Analyze the given problem to create 3D drawing	An	20%
CO5	Engage independent study as a member of team and make effective oral presentation on engineering graphics	U	Internal Assessment

CONCEPTS AND CONVENTIONS (Not for Examination)	
Importance of graphics in engineering applications - use of drafting instruments - BIS conventions and specifications - size, layout and folding of drawing sheets - lettering and dimensioning - scales.	
UNIT I - PLANE CURVES	(6+6)
Basic geometrical constructions, curves used in engineering practices - conics - construction of ellipse, parabola and hyperbola by eccentricity method - construction of cycloid - construction of involutes of square and circle - drawing of tangents and normal to the above curves - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.	
UNIT II - PROJECTION OF POINTS, LINES AND PLANES	(6+6)
Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.	
UNIT III - PROJECTION OF SOLIDS	(6+6)
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and parallel to another by rotating object method.	

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	(6+6)
Sectioning of solids (prism, cube, pyramid, cylinder and cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section - development of lateral surfaces of simple and sectioned solids - prisms, pyramids cylinder and cone.	
UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	(6+6)
Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones – free hand sketching of orthographic views from isometric views of objects.	
TOTAL (L:30+P:30) : 60 PERIODS	

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna, "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. Luzzader, Warren.J, and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			3								1	3	
2	3			3								1	3	
3	3			3								1	3	
4	3			3								1	3	
5	3			3					2			1	3	
CO (W.A)	3			3					2			1	3	

22EYA02- PROFESSIONAL COMMUNICATION- II (Common to All Branches)				
	L	T	P	C
	2	0	2	3
PRE-REQUISITE : 22EYA01				
Course Objective:	• To enhance the students with necessary English language skills • To enable students to communicate effectively in an academic setting			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Frame sentences both in written and spoken forms with accuracy and fluency.	R	20%
CO2	Use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.	U	20%
CO3	Gain essential competency to express one's thoughts orally and in writing in a meaningful way.	U	20%
CO4	Attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.	Ap	20%
CO5	Perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.	U	20%

UNIT I - LANGUAGE RUDIMENTS	(6+6)
Grammar – Active and Passive Voice – Impersonal Passive Voice – Numerical Expressions - Listening – Listening for Specific Information and Match / Choose / Fill in the texts - Speaking – Describing a Person - Making Plans -Reading – Intensive Reading -Writing – Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	(6+6)
Grammar – Reported Speech – Infinitive and Gerund - Listening – Listening to Iconic Speeches and making notes - Listening news / documentaries - Speaking –Talking over Phone – Narrating Incidents - Reading – Extensive Reading (Motivational Books) - Writing – Recommendation	
UNIT III - TECHNICAL CORRESPONDENCE	(6+6)
Grammar – If Conditionals – Blended Words - Listening – Listening to business conversation on audio and video of Short Films, News, Biographies - Speaking – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- Reading - Finding key information in a given text - Writing –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	(6+6)
Grammar – Concord – Compound Words - Listening – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - Speaking – Introduction to Technical Presentation - Story Telling - Reading – Reading and Understanding Technical Articles - Writing – Report Writing (Accident, Survey and feasibility)	

UNIT V - LANGUAGE BOOSTERS	(6+6)
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - Listening – Listening to different kinds of Interviews - Listening to Group Discussion - Speaking – Group Discussion - Reading – Reading and Interpreting Visual Materials - Writing – Analytical Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOK:

1. Sudharshana, N.P and Saveetha.C. English for Technical Communication. Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf. Effective Technical Communication. Second Edition, McGraw Hill Education India Pv Ltd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds. A Student's Introduction to English Grammar. Second Edition, Cambridge University Press, New Delhi, 2022.

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									2	3				

22MYB02 – PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES (Common to AGRI,CIVIL,CHEMICAL, MECH Branches)				
	L	T	P	C
	3	1	0	4
PRE-REQUISITE : NIL				
Course Objective:	• To make the conversant with concepts of Laplace transforms, Fourier series, Fourier Transforms to represent periodical physical problems in engineering analysis. • To provide adequate knowledge in partial differential equation and to analyze the boundary value problems.			

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the various techniques of Fourier series to obtain solution for different functions.	Ap	20%
CO2	Interpret the methods of partial differential equations in fluid mechanics and water resource management.	Ap	20%
CO3	Solve the initial and boundary value problems by using Fourier series.	Ap	20%
CO4	Analyze the concepts of Transform Techniques to solve the problems in stability analysis, Structural Analysis, control system design and analysis.	An	40%
CO5	Demonstrate the importance of Transform Techniques and partial differential equations in engineering using modern tools.	Ap	Internal Assessment

UNIT I – FOURIER SERIES	(9+3)
Dirichlet's condition – Fourier series: Half range sine series – Half range cosine series – Parseval's identity for half range series – Root mean square value of a function – Harmonic analysis.	
UNIT II –PARTIAL DIFFERENTIAL EQUATIONS	(9+3)
Formulation of partial differential equations by eliminating arbitrary constants and functions – Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form – Lagrange's linear equations –Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.	
UNIT III –APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	(9+3)
Classification of second order quasi linear partial differential equations – Solution of one dimensional wave equation (Zero and non-zero velocity) – One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) – Steady state solution of two dimensional heat equation(Finite and infinite plate).	

UNIT IV –-FOURIER TRANSFORM	(9+3)
Fourier integral theorem(Statement only) – Fourier transform pair - Sine and Cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity(Excluding proof).	
UNIT V –LAPLACE TRANSFORM	(9+3)
Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems(Statement only) - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Excluding proof)- Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T, "Engineering Mathematics (for semester III), 3rd ed., Tata McGraw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics; Volume III", S.Chand&Coltd., 2008.
1. GrewalB.S,"Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.

REFERENCES:

1. Goyal Manish and Bali.N.P,"A Text book of Engineering mathematics", 6th ed.,Laxmi Publication (P) Ltd,New Delhi, 2012.
2. Kreyszig, Erwin,"Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.

Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2	3													
3	3													
4	3													
5	3				2				3			3		
CO (W.A)	3	2			2				3			3		

*Ratified in Eleventh Academic Council

22PYB02 - ADVANCED MATERIALS AND NANO TECHNOLOGY (Common to CIVIL, CHEM & AGRI)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE: Nil				
Course Objective:	• To gain adequate information about the properties of matter and nanomaterial's. • To expose the concepts of Photonics, fiber optics and Advanced new engineering materials.			

Course Outcomes The student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Correlate the stress and strain ratio to apply the elasticity for spring materials.	An	20%
CO2	Discriminate the thermal conductivity of the medium to employing in instrument applications.	An	20%
CO3	Articulate the role of nanotechnology in environmental sustainability for the field of agriculture.	Ap	20%
CO4	Operate the optical fibers in sensor devices.	Ap	20%
CO5	Appraise the classification of composites in the applications of aerospace components, automotive parts, and sports equipment.	Ev	20%

UNIT I -PROPERTIES OF MATTER	(9)
Elasticity – Hooke's law Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment - bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders - stress due to bending in beams.	
UNIT II -THERMAL PHYSICS	(9)
Mode of heat transfer-thermal conductivity-Newton 's law of cooling –thermal conduction through compound media (bodies in series and parallel) – Thermal conductivity of a good conductor – Forbe's method - Thermal conductivity of bad conductor – Lee's disc – Hazards– Cyclone and flood hazards – Fire hazards and fire protection, fire – proofing of materials, fire safety regulations and firefighting equipment. Prevention and safety measures.	
UNIT III -SYNTHESIS AND PROPERTIES OF NANOSTRUCTURES	(9)
Introduction to Nanoscience – Types of nanostructure and properties of Nanomaterials – Synthesis and preparation of Nanomaterials – Nanosensors – Biosensors – Nanoscience and Environment.	
UNIT IV -PHOTONICS AND FIBER OPTICS	(9)
Photonics: Population of energy levels – Einstein's A and B coefficients derivation – Resonant cavity – Types of lasers – solid state laser (Neodymium) – gas laser (CO_2) Applications of lasers in science – Engineering – Medicine.	

Fibre optics: Principle, numerical aperture and acceptance angle - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication Fibre optic sensors (pressure and displacement).

UNIT V -ADVANCED NEW ENGINEERING MATERIALS	(9)

Ceramics - Types and applications - Composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - Shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy and application - Bio material - applications.

TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

1. Dattu prasad, Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2019.
2. V.Rajendran, — Engineering Physics, Tata McGraw-Hill. New Delhi.2017.
3. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2018.

REFERENCES:

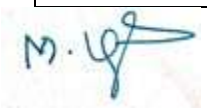
1. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand & Co. Ltd, New Delhi, 2017.
2. Kongbam chandramanisingh, "Basic Physics", PHI, 2018.
3. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand & company Ltd, 2017.

WEB LINKS:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3	2												
3	3						2							
4	3		2											
5	3					2	2					2		
CO	3	2	2	0	0	2	2	0	0	0	0	2	0	0



22CYB06 - ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to CHEM-2nd, BME-3rd, ECE-5th AND EEE-4th SEM)				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Illustrate the values and conservation methods of biodiversity.	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Analyze the renewable and non-renewable resources and preserve them for future generations.	An	20%
CO4	Examine the different goals of sustainable development and apply them for suitable technological advancement and societal development.	Ap	20%
CO5	Execute the sustainability practices, identify green materials and energy cycles.	E	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	(9)
Environment - scope and importance - Eco-system- Structure and function of an ecosystem - types of biodiversity- genetic - species and ecosystem diversity– Values of biodiversity - India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity - habitat loss - poaching of wildlife - man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity - In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(9)
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(9)
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion.	

UNIT IV – SUSTAINABILITY AND MANAGEMENT	(9)
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - from unsustainability to sustainability - millennium development goal - Sustainable Development goals - Climate change – Concept of carbon credit – carbon footprint - Environmental management.	
UNIT V – SUSTAINABILITY PRACTICES	(9)
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable habitat - Green buildings - Green materials- Sustainable energy - Non-conventional Sources - Energy Cycles- carbon cycle and carbon emission - Green Engineering - Sustainable urbanization.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering. Sri Krishna Hitech Publishing Co. Pvt.Ltd., Chennai,15thEdition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

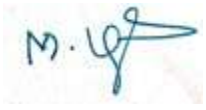
1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINKS:

1. http://www.jnkvv.org/PDF/080420202015128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2		2					2						
4							3							
5						3						2		
CO (W.A)	2	2	2			3	3	2				2		



*Ratified in Eleventh Academic Council

22CSC01 - PROBLEM SOLVING AND C PROGRAMMING (Common to All Branches)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objectives:	To equip students with the essential skills and knowledge to solve computational problems using the C programming language.				
Course Outcomes The student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Apply basic syntax and semantics of C language to write clear and structured code.	Ap	20%		
CO2	Make use of both conditional statements and iterative control structures for developing applications.	Ap	20%		
CO3	Apply knowledge of arrays and strings to solve computational problems.	Ap	20%		
CO4	Identify modular solutions that integrate problem-solving techniques to solve complex computational problems.	An	20%		
CO5	Analyze the performance implications using pointers and to manage file operations efficiently.	An	20%		

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	(9)
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms Basics o C Programming : Introduction to C - Structure of C program - Programming Rules –Compilation – Errors C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initializatior - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	(9)
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	(9)
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	(9)
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	

UNIT V - POINTERS AND FILE MANAGEMENT	(9)
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
TOTAL (L:45) :45 PERIODS	

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. Reema Thareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3	3											3	3	
4		3										3	3	
5		3											3	2
CO (W.A)	3	3										3	3	2

*Ratified in Eleventh Academic Council

22MYB03 – STATISTICS AND NUMERICAL METHODS (Common to AGRI, AI&DS,CSE,IT,IOT,CS(Cyber security)CIVIL,CHEMICAL,EEE,MECH Branches)					
		L	T	P	C
		3	1	0	4
PRE-REQUISITE : NIL					
Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.				

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	(9+3)
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t - distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	(9+3)
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	(9+3)
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method – Iterative methods of Gauss Jacobi and Gauss Seidel Methods– Eigenvalues of a matrix by Power method .	

UNIT IV - INTERPOLATION AND APPROXIMATION	(9+3)
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules -Romberg's Methods.	
UNITV - NUMERICAL DIFFERENTIATION AND INTEGRATION	(9+3)
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		2												
4	3													
5	3				2				3			2		
CO (W.A)	3	2			2				3			2		

22MEC08- BASICS OF MECHANICAL ENGINEERING (Chemical Engineering only)				
	L	T	P	C
	3	0	0	3
PREREQUISITE : Nil				

Course Objective:	• To acquire knowledge on the effect of pressure and temperature on gases • To introduce the properties of steam and energy conservation opportunities in steam systems • To introduce types of boilers, mounting and accessories • To acquire knowledge of turbines and vacuum systems • To know about basic machine elements parts and its functions

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the effect of pressure and temperature on gases	Ap	30%
CO2	Identify energy conservation opportunities by analyzing the steam distribution and utilization systems.	An	20%
CO3	Analyze the fundamentals of boilers and calculate boiler efficiency using simple calculations.	An	20%
CO4	To comprehend, apply the principles of steam turbines and calculate turbine efficiency.	Ap	30%
CO5	Identify the parts and comprehend the functions of basic machine elements.	U	Internal Assessment

UNIT I - HEATING AND EXPANSION OF GASES	**(9)**
Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.	
UNIT II - PROPERTIES OF STEAM	**(9)**
Properties of steam, Mollier chart, dryness fraction of steam- Different types of calorimeters. Concept of Steam distribution systems. Steam traps- types and their characteristics. Energy conservation opportunities in steam systems.	
UNIT III - BOILERS	**(9)**
Types and classification of boilers: water tube, fire tube, coal, oil and gas fired boilers; Stoker fired, pulverized and fluidized bed boilers. Mountings and accessories. Performance and Efficiency of boilers.	
UNIT IV - TURBINES AND VACUUM SYSTEMS	**(9)**
Steam turbines- types and working principles: Reaction and impulse turbines; Application of co-generation principles in process industries. Gas turbines- principle and working. Production of Vacuum: Systems and Equipment- Vacuum Pumps, Steam Ejectors; Instrumental methods of Vacuum measurement.	

UNIT V – BASIC MECHINE ELEMENTS	(9)
Gears (Terminology, spur, helical and bevel gear, gear train) Belt drives. Robe drives, Chain drives - types and its applications. Simple problems.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rajput R.K., "Thermal Engineering", 10th Edition, Laxmi Publications, 2010.
2. Rudramoorthy R., "Thermal Engineering", 4thEdition, Tata McGraw Hill PublishingCompany, New Delhi, 2006.
3. Kumar. T, LeenusJesu Martin and Murali. G., "Basic Mechanical Engineering", Suma Publications, Chennai, 2007.

REFERENCES:

1. Kothandaraman, C.P., Domkundwar and Domkundwar, "Course in Thermodynamics and Heat Engines", 3rdEdition, DhanpatRai& Sons, New Delhi, 2011.
2. Ballaney P.L., "Thermal Engineering", Khanna Publishers, New Delhi, 2005.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												1	1
2		3											1	
3		3												
4	3												1	
5												2	1	
CO (W.A)	3	3										2	1	1

22CHC02 CHEMICAL ENGINEERING FLUID MECHANICS					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : 22CHC01					
Course Objective:	• To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems				
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Apply basic principles of pressure & conservation laws to solve fluid flow problems	Ap	20%		
CO2	Develop correlations / solutions for flow processes that meet specific needs	An	20%		
CO3	Categorize the equipments used to transport the fluids	Ap	30%		
CO4	Estimate energy requirements and losses in transportation and metering of fluids.	An	30%		
CO5	Engage in independent study to make oral presentation on topic related to the course	U	Internal Assessment		

UNIT I - FLUID STATICS AND DIMENSIONAL ANALYSIS	(9)
Introduction to Fluid statics, properties and Based problems; Hydrostatic equation and its applications; Pressure measurement – Manometers and its types - Decanters; Units and Dimensions; Dimensional analysis – Models and Similitude –Types and principles of Similarity;	
UNIT II - FLOW THROUGH CONDUITS	(9)
Types of flow – Shear stress distribution - Laminar and turbulent flow in pipes; Friction factor - Moody Chart – Losses in piping system; Introduction to Boundary layer; Flow through non-circular conduits; Basic equations - Continuity equation - Bernoulli's equation and its applications;	
UNIT III - FLOW AROUND SOLIDS	(9)
Drag and its types - Drag coefficient; Industrial applications of Packed and fluidized bed - Packing materials; Pressure drop across packed bed - Ergun's equation; Fluidization and its classification - Pressure drop across the fluidized bed – Minimum fluidization velocity- Motion of particles through fluids – Terminal settling velocity;	
UNIT IV - FLOW METERING	(9)
Classification and Selection of flow meters; Principle, working and applications of Venturimeter, Orificemeter, rotameters and pitot tube; Determination of discharge coefficient; Other meters: Anemometer - Mass flow meter - High viscous flow meter; Notches and weirs;	

UNIT V - FLUID MOVING MACHINERY	(9)
Classification and selection of fluid moving machinery; Principle, working and applications of Centrifugal pump and Reciprocating pump - Characteristics curves of centrifugal pump; Elementary principles of gear, air lift, diaphragm and submersible pumps; Types and application of valves and pipe fittings;	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Dr. R.K.Banzal ,"A Textbook of Fluid Mechanics and Hydraulic Machines , 9th edition. 2010.
2. McCabe W.L, Smith J.C. and Harriot P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill International Edition, New York, 2006.
3. Noel De Nevers, "Fluid Mechanics for Chemical Engineers", 3rd Edition, McGraw Hill, New York, 2004.

REFERENCES:

1. Cengel, Yunus and Cimbala John M, "Fluid Mechanics Fundamentals and Applications", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2006
2. J.M. Coulson and J.F. Richordson, "Chemical Engineering Vol - I & II", 6th Edition Butterworth – New Delhi-2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												
3	3												3	
4		3												
5												3		
CO (W.A)	3	3										3	3	

22CHC07 PROCESS HEAT TRANSFER				
	L	T	P	C
	2	1	0	3
PRE-REQUISITE : 22CHC01				

Course Objective:	• To impart the basic laws of various modes of heat transfer and their applications • To make conversant with the heat transfer analysis related to the design of heat exchangers and evaporators.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply important basic concepts and principles to draw conclusions about heat transfer operations.	Ap	20%
CO2	Analyze a design problem associated to conduction, convection and radiation.	An	20%
CO3	Calculate an analyze heat utilization and heat loss in any heat exchangers and evaporators.	An	40%
CO4	Design heat exchangers using LMTD and NTU methods and also evaporators.	Ap	20%
CO5	Prepare a consolidated report on the prescribed standards/ safety norms to run heat transfer equipments	U	Internal Assessment

UNIT I: CONDUCTION	(9)
Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer – Concept of thermal conductivity measurement-effect of temperature on thermal conductivity - Fourier's Law - One dimensional steady state heat conduction through plane and composite walls, hollow cylinder and composite cylinder - critical thickness of insulation; fundamental concepts in extended surfaces heat transfer; Transient heat conduction.	
UNIT II : CONVECTION (without phase change)	(9)
Concepts of heat transfer by convection - Natural and forced convection - Application of dimensional analysis for convection and dimensionless numbers - Relationship between Individual and overall heat transfer coefficients - Equations for natural convection in vertical plates and vertical and horizontal cylinders - Equations for forced convection under laminar and turbulent flow conditions in pipes.	
UNIT III: CONVECTION (with phase change) AND RADIATION	(9)
Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation - Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling - condensers-vertical and horizontal types. Concept and nature of thermal radiations -Concept of Black and grey bodies; Stefan Boltzmann, Kirchhoff,,s, Planck,,s and Wien laws- Radiation shield.	
UNIT IV: HEAT EXCHANGERS	(9)
Heat Exchangers – Classification- Types and practical application (Double Pipe and Shell and Tube heat exchanger) – LMTD - use of correction factor charts - Fouling factors - surface area calculations for double pipe and shell and tube heat exchangers - NTU and efficiency of Heat exchangers.	

UNIT V: EVAPORATORS	(9)
Introduction – Types of Evaporators (Standard vertical tube, long tube, Forced circulation)– Capacity – Steam economy – Boiling point elevation - Material and energy balance of single effect evaporator - surface area calculations for single effect evaporator - Theory of multiple effect evaporators.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. B.K. Dutta, Heat transfer principles and applications, PHI Learning PVT Ltd, 2016
2. Holman, J. P., 'Heat Transfer ', 10th Edn., McGraw Hill,2010.
3. Kern, D.Q., "Process Heat Transfer ", McGraw-Hill, 1999.
4. Ozisik, M. N., Heat Transfer: A Basic Approach, McGraw-Hill, 1984

REFERENCES:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 6th Edn., McGraw-Hill, 2001.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3		3	3										3	
4	2		3										3	
5						3								
CO (W.A)	3	3	3			3							3	

22CHC10 INSTRUMENTAL METHODS OF ANALYSIS					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objective:	• Know the principle and importance of various analytical instruments used for the characterization of various materials. • Understand the basis processes and applications of various chemical analysis techniques.				

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the knowledge to perform analytical instruments	Ap	20%
CO2	Apply knowledge to test and analyze the solid sample	Ap/An	20%
CO3	Apply knowledge to test and analyze the liquid sample	Ap/An	40%
CO4	Apply knowledge to test and analyze the gaseous sample	Ap/An	20%
CO5	Prepare a report on analysis of sample as per the standards/norms.	U	Internal Assessment

UNIT I: INTRODUCTION OF INSTRUMENTAL METHODS	(9)
Introduction-Methods of detecting analytes - Qualitative and Quantitative Analysis-Volumetric analysis – Gravimetry -Traditional analytical techniques - Spectroscopy, Crystallography, Electrochemical analysis and separation techniques	
UNIT II: MOLECULAR SPECTROSCOPY	(9)
Modern instrumental Methods of analysis - Principles and applications of UV-Visible Spectroscopy, IR Spectroscopy and Non –dispersive IR, Raman spectroscopy, NMR Spectroscopy, Atomic absorption spectroscopy, X-ray fluorescence and ION Chromatography	
UNIT III: THERMAL METHODS AND MORPHOLOGY ANALYSIS	(9)
Thermogravimetry: Principle, instrumentation and applications, factors affecting shapes of thermograms. Differential Thermal Analysis: Principle, instrumentation and applications. Differences between DSC and DTA. Application of DSC (Inorganic & Polymer samples). Morphology Analysis – Scanning Electron Microscopy – Transmission Electron Microscopy – Principle and Applications	
UNIT IV: CONDUCTANCE, POTENTIAL MEASUREMENT AND ELECTROPHORESIS	(9)
Definitions, conductance measurements, applications, Types, advantages and disadvantages of Conductometric titrations. Potential measurements, pH determination, Potentiometric Titrations. Basic principles of electrophoresis, theory and application of paper, starch gel, agarose, PAGE, SDS-PAGE electrophoresis.	

UNIT V: CHROMATOGRAPHIC METHODS	(9)
Introduction – Classification of chromatographic methods: Column chromatography, Thin Layer chromatography, Paper chromatography, Gas chromatography and High-Performance Liquid Chromatography (HPLC) – Principle, important components and their functions mode of separation, Instrumentation and applications	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Gurdeep R. Chatwal Shan K Anand, "Instrumental methods of Chemical Analysis", 5th Edition, Himalaya Publishing House, New Delhi, 2018
2. MuralidharanRao.D ,Swamy A.V.N , Dharaneeswaran Reddy D, "Instrumental Method of Analysis", CBS Publishers and Distributors, 2013.

REFERENCES:

1. Willard H.H., Merritt L.L., Dean J.A., and Settle F.A., "Instrumental Methods of Analysis", 7th Edition, C B S Publishers & Distributors, Delhi, 2004.
2. Daniel C. Harris, "Qualitative chemical analysis", 9th Edition, W. H. Freeman and Company, New York, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3	2											3	
3		2												
4		2												
5						2							3	
CO (W.A)	3	2				2							3	

17CHC13 –CHEMICAL EQUIPMENT DESIGN - I					
			L	T	P	C
			0	6	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
Course Objectives and outcomes					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	Design machine elements; Develop Process Flow Diagrams and Piping Instrumentation Diagrams	**1.1**	Able to design machine elements; Develop Process Flow Diagrams and Piping Instrumentation Diagrams		**a, b, c, d**
2.0	Understand the basic design of various reactors.	**2.1**	Able to design various reactors used in chemical industry.		**b, c, d**
3.0	Understand thermal design of heat exchangers	**3.1**	Able to design heat exchangers for chemical process		**a, b, c, d, f**
4.0	Perform the process design of evaporators	**4.1**	Able to design evaporators for chemical process		**a, b, c, g**
5.0	Perform design calculations of crystallizers and centrifuges	**5.1**	Able to design crystallizers and centrifuges for chemical process		**a, b, c, i**

UNIT I : DESIGN BASICS	**(12)**
Basic design and drawing considerations of machine elements (bolts, nuts), PFD- Flow sheet presentation-computer aided flow sheets, PID-Mechanical design of piping systems and piping design.	
UNIT II : REACTOR DESIGN	**(12)**
Design equation for batch reactor, plug flow reactor and continuous stirred tank reactor. Reactors in series and parallel.	
UNIT III : HEAT EXCHANGERS	**(12)**
Design of Heat Exchangers - Shell and tube – Heat transfer area, Pressure drop on shell side and tube side. Double pipe heat exchangers – overall heat transfer coefficient, heat transfer area.	
UNIT IV : EVAPORATORS AND CONDENSERS	**(12)**
Design of single and double effect Evaporators - capacity and steam economy. Design of Condensers-Pressure drop in condensers.	

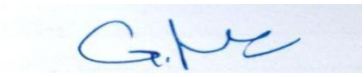
UNIT V : CRYSTALLIZERS AND CENTRIFUGE	(12)
Design of Crystallizers - yield of crystals – tip speed - wash liquor requirement – length of crystallizer. Design of centrifuge –separating power- tubular and disk centrifuge.	
TOTAL(T:60) = 60 PERIODS	

TEXT BOOKS:

1. Thakore S.B. and Bhatt B.I., "Introduction to Process Engineering and Design", 2nd Reprint, Tata McGraw-Hill Publishing Company Ltd., 2009
2. Towler C. Gavin and Sinnott Ray, "Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design", 2nd Edition, Elsevier, 2008

REFERENCES:

1. Sinnot R.K., "Chemical Equipment Design: Chemical Engineering", Volume - 6, 4th Edition, Elsevier-Butterworth, 2005
2. Joshi M.V. and Mahajan V.V., "Process Equipment Design", 3rd Edition, Macmillan India Ltd., 1996



17CHC15 –CHEMICAL EQUIPMENT DESIGN-II					
		L	T	P	C
		0	6	0	3
PREREQUISITE : 17CHC13		**QUESTION PATTERN: TYPE - 3**			
Course Objectives and outcomes					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	Develop thermal design of distillation column	**1.1**	Able to calculate the number of plate and height of distillation column		**b, c, d, e**
2.0	Perform design calculations for absorption column	**2.1**	Able to Design absorption column by calculating height and number of plate of the column		**a, b, c, d, f**
3.0	Perform the process design of drying column	**3.1**	Able to design drying rate in the process calculation		**a, b, c, d**
4.0	Assess the design of pressure vessels	**4.1**	Able to design pressure vessels for chemical process		**a, c, d, e**
5.0	Understand the concepts involved in design of storage vessels.	**5.1**	Able to design storage vessels		**a, b, c, d**

UNIT I : DISTILLATION COLUMN	**(12)**
Binary continuous distillation – design methods for binary systems- McCabe-Thiele method- column sizing. Design procedure of Ponchon-Savarit method.	
UNIT II : ABSORPTION COLUMN	**(12)**
Packed column - Height of packing required- prediction of height of transfer units- column diameter- absorption factor- Plate column - number of plates.	
UNIT III :DRYERS	**(12)**
Introduction – rate of drying- time for drying, design of freeze dryer, Rotary dryer- length and diameter; Fluid bed dryer – area and diameter.	
NIT IV : TALL COLUMN AND PRESSURE VESSELS	**(12)**
Introduction – axial stress due to dead loads, pressures, longitudinal bending stresses due to dynamic loads, Design consideration. Pressure vessels – operating at low and elevated temperatures, Design of shell and its components.	

Unit V : STORAGE VESSELS	(12)
Storage vessels – fluids - volatile and non-volatile liquid, gases. Design of shell.	

TOTAL(T:60): 60 PERIODS

TEXT BOOKS:

1. Walas, Stanley M., "Chemical Process Equipment Selection and Design", 3rd Edition, Butterworth - Heinemann, Boston, 2012
2. Lloyd E. Brownell and Edwin H. Young, " Process Equipment Design", John Wiley and Sons

REFERENCES:

1. Uzimann, "Principles of Chemical Reactor Analysis and Design", 2nd Edition, John Wiley and Sons, 2009
2. Nicholas P. Cherimisinoff., "Handbook of Chemical Processing Equipment", Butterworth, 2000

17CHC16 - PROCESS INSTRUMENTATION DYNAMICS AND CONTROL					
		L	T	P	C
		2	2	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the importance of measurement in process industries	**1.1**	Acquire the the importance of measurement in process industries		a, b, e
2.0	To know of systems and their responses to different input methods	**2.1**	Gain knowledge of systems and their responses to different input methods		b, c, d, e, l
3.0	To understand the principles of controllers and control elements for different applications & To development of block diagram	**3.1**	Comprehend the principles of controllers and control elements for different applications and development of block diagram		b, c, d, k
4.0	To study transient response & Stability of closed loop system	**4.1**	Gain familiarity with transient response & Stability of closed loops		c, d, k
5.0	To Understand frequency response and stability analyses & Exhibit familiarity with advance technique	**5.1**	Understand frequency response and stability analyses & Exhibit familiarity with advance technique		b, c, d, e, k

UNIT I : MEASUREMENT AND INSTRUMENTATION	**(12)**
Principles of measurements, static and dynamic characteristic classification instruments, measurements of temperature, pressure, fluid flow, level, viscosity and consistency and humidity of gases.	
UNIT II : OPEN LOOP	**(12)**
Laplace transformation and its application in process control. First order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.	
UNIT III : CLOSED LOOPS	**(12)**
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, transient response of closed-loop control systems and their stability.	
UNIT IV : FREQUENCY RESPONSE	**(12)**
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controllers Z-N tuning rules.	

UNIT V : ADVANCED CONTROL SYSTEMS	(12)
Introduction to advanced control systems, cascade control, feed forward control. Control of distillation towers and heat exchangers, introduction to computer control of chemical processes.	

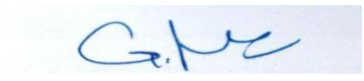
TOTAL (L:30 T:30) =60 PERIODS

TEXT BOOKS:

1. Donald R. Coughanowr, Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill Company Ltd., New Delhi, 2013.
2. Seborg D.E., Edgar D.F., Mellichamp D.A. and Doyle III F.J., "Process Dynamics and Control", 3rd Edition, Prentice Hall of India, 2011.

REFERENCES:

1. Stephanopoulos S.G., "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall of India, New Delhi, 2011.
2. BhagadeSudheer S. and NageshwarGovind Das, "Process Dynamics and Control", Prentice Hall of India, New Delhi, 2011.
3. Eckman, D.P., "Industrial Instrumentation", Wiley, 1978.



17CHC17 - CHEMICAL PROCESS PLANT SAFETY AND HAZARD ANALYSIS					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the importance of safety in industry	1.1	Demonstrate the awareness of plant safety, plant layout and the usage of safety codes.		**b, d, e, g, i**
2.0	To learn about the plant layout and plant maintenance	2.1	Understand the selection and replacement of process equipment		**d, e, g, i, k**
3.0	To learn about the plant hazards	3.1	Exhibit the skill in classifying chemical, fire, explosion hazards		**a, d, e, f, i, k**
4.0	To learn about risk analysis and assessment, hazard identification	4.1	Analyze the response to health hazards and to implement the effective process control		**d, e, g, i, k**
5.0	To learn about safe working rules and industrial act	5.1	Understand the rules and act framed by government for safe working environment		**d, e, g, i, j, k**

UNIT I– INTRODUCTION TO SAFETY PROGRAMMES	**(9)**
Need for safety in industries –Good layout of plant - Safety measures in storage and transportation of chemicals. Color code for pipelines, safety symbols and codes – spill control.	
UNIT II - SAFETY PROCEDURES	**(9)**
Plant maintenance, Personal protective equipment – Breathing and respiratory protection; Fire prevention – classification of fire – suppression – foam, dry chemical powder. Emergency planning.	
UNIT III PLANT HAZARDS	**(9)**
Potential hazards-Hazard classification chemical, mechanical, noise hazards – Hazards due to ammonia, chlorine, sulphuric acid. Safety data sheet.	

UNIT IV - HAZARD IDENTIFICATION AND CONTROL	(9)
HAZOP, Job safety analysis – Fault tree analysis – Event tree analysis – Failure modes and effect analysis Safety audit – Plant inspection –Past accident analysis–case study.	
UNIT V - LEGAL FRAMEWORK FOR SAFETY AND ENVIRONMENT	**(9)**
Rules – safe working environments – factories act – labour welfare act – ESI Act. Role of Government in safety organizations, OHSAS and ISO standards.	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOK:

1. Hyatt, N., Guidelines for process hazards analysis, hazards identification & risk analysis, Dyadem Press, 2004.
2. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl, J.F. Louvar, Prantice Hall, NJ, 1990.
3. Marcel, V.C., Major Chemical Hazard- Ellis Harwood Ltd., Chi Chester, UK, 1987.
4. Fawatt, H.H. and Wood, W.S., "Safety and Accident Prevention in Chemical Operation", Wiley Interscience, 1965.

REFERENCES:

1. Taylor, J.R., Risk analysis for process plant, pipelines and transport, Chapman and Hall, London, 1994
2. Heinrich, H.W. Dan Peterson, P.E. and Rood, N., " Industrial Accident Prevention", McGraw- Hill Book Co., 1980
3. Handley, W., "Industrial Safety Hand Book ", 2nd Edn., McGraw-Hill Book Company, 1969.

17CHC18 - PROCESS ENGINEERING ECONOMICS AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand basic of interest and capital cost	1.1	Able to understand value of money and depreciation with time		**a, b, d, e, h**
2.0	To understand the feasibility of project and selection for investment	2.1	Able to select profitable project and calculate economic balance sheet		**a, b, c, f, h, i**
3.0	To have a basic idea of economic balance	3.1	Can make economic balance on unit operations		**c, d, e, g, h, k**
4.0	To understand the various concepts of economics and management	4.1	Able to understand the theory behind Inventory Control and organization Types		**f, g, h, l, j, k**
5.0	To understand the principle of time study and production planning	5.1	Able to understand the theory behind the process development		**f, h, l, j, k**

UNIT I INTEREST AND PLANT COST	**(9)**
Time value of money - equivalence, Depreciation, Depletion, estimation of capital cost, Capital requirement for complete plant, cost indices, capital recovery.	
UNIT II COST ESTIMATION AND FINANCIAL RATIOS	**(9)**
Estimation of project profitability, process optimization, Investment alternatives, income statement and financial ratios, balance sheet preparation- problems.	
UNIT III ECONOMIC BALANCE	**(9)**
Essentials of economic balance, economic balance in batch operations, cyclic operations, economic balance for insulation, evaporation, heat transfer equipments.	

UNIT IV PRINCIPLES OF MANAGEMENT	(9)
Principles of management, planning, organizing, staffing, coordinating, directing, controlling and communicating. Types of organizations, Management information systems (MIS).	
UNIT V PRODUCTION PLANNING AND CONTROL	**(9)**
Work measurement techniques, motion study, principles of time study, elements of production control, forecasting, planning, routing, scheduling, dispatching, inventory and control, role of control charts in production and quality control.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, McGraw Hill 5th Edition, 2004.
2. Ahuja K.K, Industrial management, Khanna publishers, New Delhi, 1985.
3. Schweyer. H.E, "Process Engineering Economics", Mc Graw Hill, 1969.
4. Engineering economics, R.Panneersevam, eastern economy edition.

REFERENCES:

1. F.C. Jelen and J.H. Black, "Cost and Optimization Engineering", McGraw Hill, 3rd Edn., 1992

17CHC20 - PROCESS MODELING AND SIMULATION					
		L	T	P	C
		2	0	2	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**			**Related Program outcomes**
1.0	To understand the fundamentals of modeling and chemical kinetics.	**1.1**	Understand the fundamentals of modeling and their applications to transport/energy equations, chemical and phase equilibria kinetics		**b, c, d, e**
2.0	To develop a mathematical model for fluid flow operations	**2.1**	Create mathematical models for fluid flow operations and various models on momentum transfer		**a, b, c, d, k**
3.0	To develop a mathematical model for heat flow operations	**3.1**	Understand the physical phenomena occurring in the heat transfer system		**a, b, c, d, k**
4.0	To develop a mathematical model for mass flow operations	**4.1**	Develop mathematical models for Distillation / Absorption / Extraction Columns		**a, b, c, d, k**
5.0	To create a mathematical model for reactor and process simulator.	**5.1**	Create the mathematical models for reactors and to know about the process simulators like ASPEN and HYSYS		**b, c, d, k**

UNIT I : INTRODUCTION TO MODELING	**(9)**
Physical, Mathematical and Chemical Systems Modeling; Principles of model Formulation; Representation of Model; Fundamental Laws; Types of Modeling Equations; Boundary Condition; Black Box Principles; Validation of Model and Application of Modeling and Simulation in Industries.	
UNIT II : MODELS IN FLUID FLOW OPERATIONS	**(9)**
Laminar flow in a Pipe, Narrow Slit and Gravity Flow Tank, Flow of the film on the Outside of a Circular Tube, Annular flow with Inner Cylinder Moving Axially, Flow between Coaxial Cylinders and Concentric Spheres, Creeping Flow Between Two Concentric Spheres, Parallel Disc Viscometer	
UNIT III : MODELS IN HEAT TRANSFER OPERATIONS	**(9)**
Steady state Heat Conduction Through a Hollow Cylindrical Pipe; Unsteady state Steam Heating of a Liquid; Two Heated Tanks; Counter Current Cooling of Tanks, Single-Component Vaporizer; Multicomponent Flash Drum; Double Pipe Heat Exchanger; Triple Effect Evaporator; Heat Transfer through extended surfaces(spine fin); Unsteady State Heat Transfer in a Tubular Gas Preheater.	
UNIT IV :MODELS IN MASS TRANSFER OPERATIONS	**(9)**
Multistage Absorption; Compartmental Distillation Model; Ideal Binary Distillation Column; Multicomponent Non Ideal Distillation Column; Batch Distillation with Holdup; Binary Continuous Distillation Column; Steady State Single and Multistage Extraction.	

UNIT V :MODELS IN REACTION ENGINEERING AND INTRODUCTION TO PROCESS SIMULATORS	(9)
Batch Reactor; Chemical Reaction with Diffusion in a Tubular Reactor; Series of Isothermal, Constant-Holdup CSTRs; CSTRs with Variable Holdups; Gas-Phase Pressurized CSTR; Non Isothermal CSTR; Introduction to Process Simulators like ASPEN PLUS and HYSYS.	

LIST OF EXPERIMENTS(Any Ten):

1. Estimation of physical property for a non data bank component
2. Analysis of physical properties and generation of T-x-y and P-x-y diagram for different systems
3. Calculation of Bubble Point and Dew Point Temperature/Pressure
4. Simulation of mixer and flash separator
5. Simulation of heat exchanger
6. Simulation of distillation rate
7. Simulation of batch and flow reactors
8. Simulation and analysis of absorption/extraction column
9. Sensitivity analysis and optimization of parameters
10. Simulation and analysis of simple flow sheets problems
11. Simulation of drying of solids
12. Design of heat exchangers and air cooler

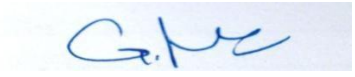
TOTAL(L:30 P:30) = 60 PERIODS

TEXT BOOKS:

1. Babu B.V., ―Process Plant Simulation‖, Oxford University Press, New Delhi, 2004
2. Luyben W.L., ―Process Modeling, Simulation and Control for Chemical Engineers‖, 2nd Edition, McGraw Hill Book Company, New York, 1990.

REFERENCES:

1. Amiya K. Jana, ―Chemical Process Modeling and Computer Simulation‖, Prentice Hall of India, 2014.
2. Gaikwad R.W. and Dhirendra, ―Process Modeling and Simulation‖, 2nd Edition, Denett and Company, Nagpur, 2006



17CHX09 - CHEMICAL PROCESS UTILITIES					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes		Related Program outcomes
1.0	To learn the importance of compressed air, Psychrometric and PSA systems	**1.1**	recognize the importance of compressed air, humidification and dehumidification process and PSA systems	a, b, g
2.0	To learn the requirement of water and steam i process industries	**2.1**	Comprehend the water treatment and steam utilization practices in process industries	a, b, l
3.0	To understand the vacuum systems for different chemical processes	**3.1**	Select suitable vacuum systems for different chemical processes	a, f, g
4.0	To study the principles of refrigeration process for application in chemical process industries	**4.1**	Grasp the principles of refrigeration process for application in chemical process industries	a, f, g
5.0	To know the importance of insulation and inert gases& To find the critical thickness of insulation; Gain an insight into the characteristics of	**5.1**	Understand the importance of insulation and calculate critical thickness of insulation; Gain an insight into the characteristics of inert gases.	a, f, g, l

UNIT I : AIR AND HUMIDIFICATION	**(9)**
Air, Compressed air, Types and characteristics of fans, blowers and compressors. Air drying systems. Humidification and dehumidification of air. Production of oxygen and nitrogen by PSA systems.	
UNIT II : WATER AND HEATING SYSTEM	**(9)**
Source and characteristics of water; soft water, hard water and Demineralised water. Treatment of water for boiler and cooling towers. Fuel and its Classification; Properties of steam; waste heat boilers. Thermic fluid System for process applications. Steam trap - classification, selection and applications. Efficient use of steam in process plants;	
UNIT III : VACUUM SYSTEM	**(9)**
Selection of vacuum systems; types and characteristics of vacuum pumps, steam jet ejectors and auxiliaries. Process equipment under vacuum – Separation columns, Reactors, Evaporators and Dryers.	
UNIT IV : REFRIGERATION	**(9)**
Principles, compression and absorption refrigeration systems. Types and properties of refrigerants, eco-friendly refrigerants.	

UNIT V : INSULATION AND INERT GAS	(9)
Importance of insulation. Insulation materials for high, intermediate, low and very low temperatures. Calculation of critical thickness of insulation. Properties of inert gases and their uses	
LECTURE(L:45)=45 PERIODS	

TEXT BOOKS:

1. Lyle O., "Efficient use of steam", HMSO Publishers, 2000
2. Jack Broughton, "Process Utility System- Introduction to Design Operation and Maintenance", Institution of Chemical Engineers, UK, 1994.

REFERENCES:

1. Mcquiston F.C and Parker J., "Heating, Ventilating & Air Conditioning – Analysis and Design", 3rd Edition, John Wiley, New York, 1988.
2. Eskel Nordell, "Water treatment for industrial and other uses", Reinhold Publishing Corporation, New York, 1961

17CHX10 – SEPARATION AND PURIFICATION PROCESSES					
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	Students will gain a basic knowledge about recent separation methods.	1.1	Understand the separation processes for selecting optimal process for new and innovative applications.	**a, b, d, e, g**	
2.0	To gain a knowledge about various membrane separation techniques	2.1	Able to select a suitable membrane separation technique.	**a, c, d, e, g, h**	
3.0	To gain a knowledge about adsorption and chromatography separation technique.	3.1	Understand the adsorption separation process and chromatography methods.	**c, e, f, g, h**	
4.0	To learn about various separation technique available in process industries.	4.1	Can apply the latest concepts like super critical fluid extraction, pervaporation, lyophilisation etc., in Chemical process industries.	**c, d, e, g**	
5.0	To learn about modern separation technique.	5.1	Understand Innovative techniques of controlling and managing oil spills.	**b, c, e, f, h, j**	

UNIT I BASICS OF SEPARATION PROCESS	**(9)**
Review of Conventional Processes, Modern Separation Techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and Equipment used in cross flow Filtration, cross flow Electro Filtration, Surface based solid – liquid separations involving a second liquid.	
UNIT II MEMBRANE SEPARATIONS	**(9)**
Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fibre, Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration diafiltration and Micro filtration, Ceramic- Bio Membranes.	
UNIT III SEPARATION BY ADSORPTION	**(9)**
Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.	

UNIT V INORGANIC SEPARATIONS	(9)
Controlling factors, Applications, Types of Equipment employed for Electrophoresis, Dielectrophoresis, Electrodialysis, EDR, Bipolar Membranes	
UNIT V APPLICATION OF MODERN SEPARATION TECHNIQUES	**(9)**
Separation involving Lyophilisation, Pervaporation and Permeation Techniques for solids, liquids and gases, zone melting, Adductive Crystallization, other Separation Processes, Supercritical fluid Extraction, Oil spill Management, Industrial Effluent Treatment by Modern Techniques.	
TOTAL(L:45) = 45 PERIODS	

TEXTBOOKS

1. J D Seader and Ernest J Henley, Separation Process Principles, Wiley; 1 edition (January 23, 1998)
2. Judson king Separation processes, McGraw-Hill College; Subsequent edition (January 1, 1980

REFERENCES:

1. Nakagawal, O. V., "Membrane Science and Technology"' Marcel Dekkar, 1992
2. Roussel, R. W., "Handbook of Separation Process Technology", John Wiley, New York, 1987.

17CHX11 – AIR POLLUTION AND CONTROL					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
Course Objectives and outcomes					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To know about air pollution sources and its effect	**1.1**	Know about the various sources of air pollution and its effect	**b, c, f**	
2.0	To understand the the chemical and physical properties of gases; Gain knowledge about the design and performance of incinerators	**2.1**	Analyze the chemical and physical properties of gases; Able to design incinerators	**a, b, c, f**	
3.0	To explore the fundamentals of particulate matter and to design absorber air pollution control	**3.1**	Asses the fundamentals of particulate matter and design absorber to control air pollution	**a. b, c, f**	
4.0	To understand the design of air cleaning equipments and evaluate their performance	**4.1**	Perform the design of air cleaning equipments and evaluate their performance	**b, c, f**	
5.0	To know about air pollution regulation and different laws related to air pollution and control	**5.1**	Remember the air pollution regulation and different laws related to air pollution and control	**a, b, c, e, f**	

UNIT I : AIR POLLUTION	**(9)**
Air Pollution-Sources and Effects Definitions, Scope, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, Sources of air pollution- stationary and mobile sources. Effects of Air pollutants on humans, materials and vegetation. Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.	
UNIT II : FUNDAMENTALS OF GASES AND INCINERATORS	**(9)**
Measurement fundamentals – Chemicals and Physical properties – Phase equilibrium- Conservation laws, Incinerators- Design and performance – Operation and maintenance	
UNIT III : ABSORBER DESIGN AND BASICS OF PARTICULATE MATTERS	**(9)**
Absorbers – Design operation and improving performances of absorbers, Particle collection mechanisms– Fluid particle dynamics – Particle size distribution – Collection efficiency	
UNIT IV : AIR POLLUTION CONTROL EQUIPMENTS	**(9)**
Gravity settling chambers, Electrostatic precipitators, Bag houses – Design and Performance equations- Operation and maintenance	

UNIT I : AIR POLLUTION REGULATIONS	(9)
Air pollution Regulatory framework - History – Regulator system – Laws and Regulations – Clean air act – Provisions for recent developments	
	TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

1. M.N Rao and H.V.N Rao, Air Pollution, , 2007, Tata McGraw- Hill Publishing Company Limited, New Delhi.
2. R.K Trivedy and P.K Goel, An Introduction to Air Pollution, 2009, BS Publications, Hyderabad

REFERENCES:

1. Noel de Nevers, "Air Pollution Control Engineering", 2nd Edition, Waveland Pr Inc., 2010
2. Rao M.N. and Rao H.V.N., "Air Pollution", 1st Edition, McGraw Hill Education India Pvt. Ltd., 2001

17CHX16 – PULP AND PAPER TECHNOLOGY					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		**QUESTION PATTERN: TYPE - 3**			
Course Objectives and outcomes					
Course Objectives		**Course Outcomes**		**Related Program outcomes**	
1.0	To Understand the various methods of wood preparation and pulping	**1.1**	Recognize various methods of wood preparation and pulping	**a, b, c, f**	
2.0	To describe the knowledge of processing and bleaching of pulp in paper making process	**2.1**	Apply the knowledge of processing and bleaching of pulp in paper making process	**b, c, f**	
3.0	To analyze the finishing and surface treatment of various grades of paper	**3.1**	Comprehend the finishing and surface treatment of various grades of paper	**a, b, c, f**	
4.0	To explore knowledge on various methods for testing of pulp and paper	**4.1**	Exhibit familiarity with various methods for testing of pulp and paper	**b, c, f**	
5.0	To understand the type of pollution and apply appropriate techniques to control pollution	**5.1**	Identify the type of pollution and apply appropriate techniques to control pollution	**a, b, c, e, f**	

UNIT I : WOOD PREPARATION AND PULPING METHODOLOGY	**(9)**
Pulp and Paper: Importance and definitions- Characteristics of wood - Wood as resource- Wood harvesting, handling and storage- Chemistry and Process description of Mechanical pulping, Sulfite pulping and Kraft pulping.	
UNIT II : PROCESSING AND BLEACHING OF PULP	**(9)**
Processing of pulp- Cooking, Defibering, Deknotting ,Washing, Screening and Thickening- Bleaching- Oxygen bleaching, Chlorine-dioxide bleaching, Hydrosulfite bleaching, Peroxide bleaching, Ozone bleaching – Stock preparation for paper making	
UNIT III : PAPER MANUFACTURE OPERATIONS	**(9)**
Secondary fiber processing- Paper manufacture operations- Wet and dry end operations- Surface treatments and finishing operations -Specific paper and board grades.	
UNIT IV : PROPERTIES AND TESTING OF PULP AND PAPER	**(9)**
Properties of pulp and paper-Testing of pulp and paper : Objectives and procedures–Introduction to paper end uses- Process control- Quality assurance.	

UNIT V : POLLUTION ABATEMENT	(9)
Water pollution control: Source, Standards and regulations, Monitoring and testing, Process- Air pollution control: Source, Standards and regulations, Monitoring and testing, Process.	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOKS:

1. Smook G.A., "Handbook for Pulp & Paper Technologists", 3rd Edition, Angus Wilde Publications, Incorporation, 2003
2. Kenneth W. Brittt, "Handbook of Pulp and Paper Technology", 2nd Revised Edition, John Wiley & Sons, 1971.

REFERENCES:

1. Austin, G.T., "Shreve's Chemical Process Industries", 5th Edition, McGraw-Hill International Book Company, Singapore, 1984
2. Kent J.A., "Riggel's Hand Book of Industrial Chemistry", Van Nostrant Reinhold, 1974