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 (Internet of Things)[R22]

[CHOICE BASED CREDIT SYSTEM]

[This Curriculum and Syllabi are applicable to Students admitted from the academic year 2024-2025 onwards]

APRIL 2025

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.E – COMPUTER SCIENCE AND ENGINEERING (IoT)	
VISION	To be a centre of excellence providing high quality Computing and Internet of Things education to meet the ever growing needs of the smart society.
MISSION	• To provide quality education to produce Computer Science and Internet of Things professionals with social responsibility • To excel in research in the field of Computing and Internet of Things • To be a learner centric environment with continual progress to meet the global smart computing needs.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	The graduates of Computer Science and Engineering (Internet of Things) will be **PEO1: Core Competency:** To transform the graduates as experts in the computing profession and to satisfy the needs of the IoT industry. **PEO2: Research, Innovation and Entrepreneurship:** To empower the graduates with knowledge in communicating equipments using Internet with ability to offer solutions for real time applications **PEO3: Ethics, Human values and Life- Long Learning:** To possess the necessary soft skills for working in diverse cultural and inter disciplinary teams and ensure that the graduates practice professional ethics in IoT.
PROGRAMME SPECIFIC OUTCOMES (PSO)	The students of Computer Science and Engineering (Internet of Things) will be able to **PSO1: Knowledge Proficiency:** Students at the time of graduation will be equipped with knowledge of IoT equipments in various platforms, possess computing skills with secured network control and act responsibly in legal, ethical and security related issues. **PSO2: Recent Technology:** Students at the time of graduation will be able to apply emerging appropriate technology and programming skills to find optimal solutions for complex problems by applying domain knowledge to transform innovative ideas into reality.

PROGRAMME OUTCOMES:

At the end of a programme a students will be able to demonstrate ability 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 objectives and the 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	1	1	2	2	1	3	3
2	3	3	3	3	3	1	1	1	2	1	3	3
3	3	3	3	3	3	2	2	3	1	2	2	3

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**	**G**	**H**	**I**	**J**	**K**	**L**
1	3	3	3	3	2	1	2	2	1	2	2	3
2	3	3	3	3	3	2	3	3	3	3	3	3

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2022 **CHOICE BASED CREDIT SYSTEM**

B.E – Computer Science and Engineering (Internet of Things)

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	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	22MAN03	Yoga – I*	MC	-	1	0	0	1	0
				TOTAL	**29**	**15**	**1**	**13**	**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	22CIC01	Data Structures using C*	ESC	22CSC01	3	3	0	0	3
4	22CIC02	Python Programming	ESC	-	3	3	0	0	3
5	22CIC03	Digital Principles and Computer Organization*	ESC	-	3	3	0	0	3
6	22GYA02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22CIP01	Data Structures Laboratory*	ESC	22CSP01	4	0	0	4	2
8	22CIP02	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	22MAN02R	Soft/Analytical Skills – I**	MC	-	3	1	0	2	0
11	22MAN05	Yoga – II*	MC	-	1	0	0	1	0
				TOTAL	**34**	**16**	**1**	**17**	**23**

*Ratified in Eleventh Academic Council
**Ratified in Twelfth 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	22CIC04	Algorithms	PCC	-	3	3	0	0	3
3	22CIC05	Internet of Things and its Applications	PCC	-	3	3	0	0	3
4	22CIC06	Java Programming	PCC	-	3	3	0	0	3
5	22CIC07	Operating Systems	PCC	-	3	3	0	0	3
PRACTICAL									
6	22CIP03	Algorithms Laboratory	PCC	-	4	0	0	4	2
7	22CIP04	Internet of Things and its Applications Laboratory	PCC	-	4	0	0	4	2
8	22CIP05	Java Programming Laboratory	PCC	-	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	**32**	**17**	**1**	**14**	**22**

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SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC08	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
2	22CIC09	Computer Networks	PCC	-	3	3	0	0	3
3	22CIC10	Database Management System	PCC	-	3	3	0	0	3
4	22CIC11	Sensors and Actuator Devices	PCC	-	3	3	0	0	3
5	22CIC12	Privacy and Security in IoT	PCC	22CIC05	3	3	0	0	3
6	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3
PRACTICAL									
7	22CIP06	Computer Networks Laboratory	PCC	-	4	0	0	4	2
8	22CIP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
9	22CIP08	Sensors and Actuator Devices Lab	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN07R	Soft/Analytical Skills – III**	MC	-	3	1	0	2	0
11	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
				TOTAL	**33**	**19**	**0**	**15**	**24**

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SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC13	Embedded Systems	PCC	-	3	3	0	0	3
2	22CIC14	Automata Theory and Compiler Design	PCC	-	4	3	1	0	4
3	22CIC15	Full Stack Development	PCC	-	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/OEC	-	3	3	0	0	3
PRACTICAL									
7	22CIP09	Embedded Systems Laboratory	PCC	-	4	0	0	4	2
8	22CIP10	Full Stack Development Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN08R	Soft/Analytical Skills – IV**	MC	-	3	1	0	2	0
				TOTAL	**30**	**19**	**1**	**10**	**23**

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SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC16	Mobile Application Development for IoT	PCC	-	3	3	0	0	3
2	22CIC17	Computer Vision and Robotics	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	EM	Elective Management***	HSMC	-	3	2	0	2	3
6	E7	Elective(OEC/PEC)	PEC/OEC	-	3	3	0	0	3
PRACTICAL									
7	22CIP11	Mobile Application Development for IoT Laboratory	PCC	-	4	0	0	4	2
8	22CIP12	Computer Vision Laboratory	PCC	-	4	0	0	4	2
				TOTAL	**26**	**17**	**0**	**10**	**22**

***Approved by Thirteebnth 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	E6	Elective(OEC)*	OEC	-	3	3	0	0	3
3	E8	Elective(PEC)	PEC	-	3	3	0	0	3
4	E9	Elective(OEC/PEC)	PEC/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	22CID01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

*Approved by Thirteenth Academic council

(A) HSMC,BSC, and ESC Courses									
(a)Humanities and Management Sciences (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	தமிழர் மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
3.	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
4.	22GYA02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HSMC	-	1	1	0	0	1
5.	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
6.	EM	Elective - Management	HSMC	-	3	2	0	2	3

(b) Basic Sciences (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	Physics Laboratory	BSC	-	2	0	0	2	1
4.	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4
5.	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
6.	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3

(c) Engineering Sciences (ESC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
2.	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
3.	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
4.	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
5.	22CIC01	Data structures Using C	BSC	22CSC01	3	3	0	0	3
6.	22CIC02	Python Programming	BSC	-	3	3	0	0	3
7.	22CIC03	Digital Principles and Computer Organization	BSC	-	3	3	0	0	3
8.	22CIP01	Data structures Using C Laboratory	ESC	22CSP01	4	0	0	4	2
9.	22CIP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
10.	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2

(d) Mandatory Non Credit Courses (MC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MAN01	Induction Programme	MC	-	-	-	-	-	-
2.	22MAN03	Yoga – I	MC	-	1	0	0	1	0
3.	22MAN02R	Soft/Analytical Skills - I	MC	-	3	1	0	2	0
4.	22MAN05	Yoga – II	MC	-	1	0	0	1	0
5.	22MAN04R	Soft/Analytical Skills - II	MC	-	3	1	0	2	0
6.	22MAN07R	Soft/Analytical Skills - III	MC	-	3	1	0	2	0
7.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
8.	22MAN08R	Soft/Analytical Skills -	MC	-	3	1	0	2	0

		IV							
(B) PROGRAMME CORE (PCC)									
1.	22CIC04	Algorithms	PCC	-	3	3	0	0	3
2.	22CIC05	Internet of Things and its Applications	PCC	-	3	3	0	0	3
3.	22CIC06	Java Programming	PCC	-	3	3	0	0	3
4.	22CIC07	Operating Systems	PCC	-	3	3	0	0	3
5.	22CIP03	Algorithms Laboratory	PCC	-	4	0	0	4	2
6.	22CIP04	Internet of Things and its Applications Laboratory	PCC	-	4	0	0	4	2
7.	22CIP05	Java Programming Laboratory	PCC	-	4	0	0	4	2
8.	22CIC08	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
9.	22CIC09	Computer Networks	PCC	-	3	3	0	0	3
10.	22CIC10	Database Management System	PCC	-	3	3	0	0	3
11.	22CIC11	Sensors and Actuator Devices	PCC	-	3	3	0	0	3
12.	22CIC12	Privacy and Security in IoT	PCC	22CIC05	3	3	0	0	3
13.	22CIP06	Computer Networks Laboratory	PCC	-	4	0	0	4	2
14.	22CIP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
15.	22CIP08	Sensors and Actuator Devices Lab	PCC	-	4	0	0	4	2
16.	22CIC13	Embedded Systems	PCC	-	3	3	0	0	3
17.	22CIC14	Automata Theory and Compiler Design	PCC	-	3	3	0	0	3

18.	22CIC15	Full Stack Development	PCC	-	3	3	0	0	3
19.	22CIP09	Embedded Systems Laboratory	PCC	-	4	0	0	4	2
20.	22CIP10	Full Stack Development Laboratory	PCC	-	4	0	0	4	2
21.	22CIC16	Mobile Application Development for IoT	PCC	-	3	3	0	0	3
22.	22CIC17	Computer Vision and Robotics	PCC	-	3	3	0	0	3
23.	22CIP11	Mobile Application Development for IoT Laboratory	PCC	-	4	0	0	4	2
24.	22CIP12	Computer Vision Laboratory	PCC	-	4	0	0	4	2

(C) Engineering Employability Course (EEC)									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
2	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
3	22CID01	Project Work	EEC	-	20	0	0	20	10

PROGRAM SPECIFIC ELECTIVE									
Vertical I -UBIQUITOUS COMPUTING									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22CIX01	Industrial and Medical IoT	PSE	-	3	3	0	0	3
2	22CIX02	Block Chain Technology	PSE	-	3	3	0	0	3
3	22CIX03	Beyond 5G & IoT Technologies	PSE	-	3	3	0	0	3
4	22CIX04	Programming for IoT Boards	PSE	-	3	3	0	0	3
5	22CIX05	Wearable Computing	PSE	-	3	3	0	0	3
6	22CIX06	Fog and Edge Computing	PSE	-	3	3	0	0	3
7	22CIX07	Wireless Ad-hoc and Sensor Networks	PSE	-	3	3	0	0	3
8	22CIX08	Image Processing	PSE	-	3	3	0	0	3
Vertical II - Machine Intelligence									
1	22CIX11	Data Exploration and Visualization	PSE	-	3	3	0	0	3
2	22CIX12	Big Data Analytics	PSE	-	3	3	0	0	3
3	22CIX13	Deep Learning	PSE	-	3	3	0	0	3
4	22CIX14	Recommender Systems	PSE	-	3	3	0	0	3
5	22CIX15	Optimization Techniques	PSE	-	3	3	0	0	3
6	22CIX16	Computer vision	PSE	-	3	3	0	0	3
7	22CIX17	Ethics of AI	PSE	-	3	3	0	0	3
8	22CIX18	Robotic Process Automation	PSE	-	3	3	0	0	3
Vertical III - Data Analytics									
1	22CIX21	Pattern Recognition	PSE	-	3	3	0	0	3
2	22CIX22	Text and Speech Analytics	PSE	-	3	3	0	0	3
3	22CIX23	Time Series Analysis and Forecasting	PSE	-	3	3	0	0	3
4	22CIX24	Health care Analytics	PSE	-	3	3	0	0	3
5	22CIX25	Predictive Analytics	PSE	-	3	3	0	0	3
6	22CIX26	Image and Video Analytics	PSE	-	3	3	0	0	3
7	22CIX27	Natural Language Processing	PSE	-	3	3	0	0	3
8	22CIX28	Augmented Reality and Virtual Reality	PSE	-	3	3	0	0	3

Vertical IV - Digital Forensics & Infosec Auditing									
1	22CIX31	Cryptography and network security	PSE	-	3	3	0	0	3
2	22CIX32	Ethical Hacking	PSE	-	3	3	0	0	3
3	22CIX33	Cyber Forensics	PSE	-	3	3	0	0	3
4	22CIX34	Social network security	PSE	-	3	3	0	0	3
5	22CIX35	Biometric Security	PSE	-	3	3	0	0	3
6	22CIX36	Cyber Physical System	PSE	-	3	3	0	0	3
7	22CIX37	Mobile Device Security	PSE	-	3	3	0	0	3
8	22CIX38	Intrusion Detection System	PSE	-	3	3	0	0	3
Vertical V – Web Development									
1	22CIX41	Design Thinking	PSE	-	3	3	0	0	3
2	22CIX42	Fundamentals of Data Science	PSE	-	3	3	0	0	3
3	22CIX43	Agile Methodologies	PSE	-	3	3	0	0	3
4	22CIX44	Cloud Computing	PSE	-	3	3	0	0	3
5	22CIX45	UI and UX design	PSE	-	3	3	0	0	3
6	22CIX46	DevOps	PSE	-	3	3	0	0	3
7	22CIX47	Social and information networks	PSE	-	3	3	0	0	3
8	22CIX48	Multimedia Data Compression and Storage	PSE	-	3	3	0	0	3
Vertical VI – Software Development Engineering									
1	22CIX51	Cloud Service Management	PSE	-	3	3	0	0	3
2	22CIX52	Software Testing Tools and Techniques	PSE	-	3	3	0	0	3
3	22CIX53	Software Quality Assurance	PSE	-	3	3	0	0	3
4	22CIX54	Software project management	PSE	-	3	3	0	0	3
5	22CIX55	IT Operations	PSE	-	3	3	0	0	3
6	22CIX56	Mean Stack Development	PSE	-	3	3	0	0	3

7	22CIX57	Web Mining	PSE	-	3	3	0	0	3
8	22CIX58	Product life cycle management	PSE	-	3	3	0	0	3
MANAGEMENT ELECTIVES									
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 and Human Values	HSMC	-	3	3	0	0	3
4	22GEZ01	Entrepreneurship Development	HSMC	-	3	2	0	2	3
OPEN ELECTIVES									
1	22CIZ01	Internet of Everything	OEC	-	3	3	0	0	3
2	22CIZ02	Basic Sensors and Actuators	OEC	-	3	3	0	0	3

Minor degree courses Web Technologies									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22ITM01	Java Programming Basics	OEC	-	3	3	0	0	3
2	22ITM02	Database System Concepts	OEC	-	3	3	0	0	3
3	22ITM03	Web Essentials	OEC	-	3	3	0	0	3
4	22ITM04	Full Stack web Development	OEC	-	3	3	0	0	3
5	22ITM05	Fundamentals of Internet of Things	OEC	-	3	3	0	0	3
6	22ITM06	Data Acquisition for IoT	OEC	-	3	3	0	0	3
7	22ITM07	Web Application Security	OEC	-	3	3	0	0	3
8	22ITM08	Fundamentals Cyber Forensics	OEC	-	3	3	0	0	3

CREDIT DISTRIBUTION

SEM	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	PEC/OEC	TOTAL
I	4	8		10					22
II	4	4		15					23
III		4	18						22
IV		3	21						24
V			14			9			23
VI	3		10			6		3	22
VII	2				2	3	6	3	16
VIII					10				10
TOTAL	13	19	63	25	12	18	6	6	162
R22 %	8.0	11.7	38.8	15.4	7.4	11.1	3.7	3.7	

TOTAL CREDITS (22+23+22+24+23+22+16+10) = 162 CREDITS

22MAN01 INDUCTION PROGRAMME
(For Common To All Branches)

L	T	P	C
-	-	-	-

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 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** – 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 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 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

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) :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,42ndEdition,2012.
2. ErwinKreyszig,"Advanced Engineering mathematics",JohnWiley&sons,9th Edition,2013.
3. Veerarajan,T.,"Engineering Mathematics of semesterI&II",TataMcGrawHill,3rdEdition,2016.

REFERENCES:

1. Bali,N.P.,ManishGoyal,"A Textbook of Engineering Mathematics-Sem-II",Laxmi Publications, 6thEdition,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,7thEdition,2007.

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**		

*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 Physics, Tata McGraw-Hill. New Delhi.2019

REFERENCES:

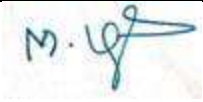
1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
3. B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

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**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**



22ECC01 - BASICS OF ELECTRONICS ENGINEERING *(Common to CSE, CS, IOT, AI&DS, IT Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• 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 circuits using Network theorems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Ohm's law and Kirchhoff's law to analyze simple DC circuits with resistors and sources	Ap	20%
CO2	Apply network theorems to determine currents, voltages and equivalent circuits in DC networks.	Ap	20%
CO3	Apply the characteristics of semiconductor devices (diode, BJT, FET, MOSFET, UJT) for circuit applications.	Ap	20%
CO4	Apply rectifier, filter, transformer and operational amplifier circuits to practical electronic systems.	Ap	20%
CO5	Analyze the performance of transducers, measuring instruments and digital circuits for measurement and logic applications..	An	20%

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 – Thevenin's 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," 8 th ed., Tata McGraw Hill publishers, New Delhi, 2013.
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGrawHill 4th ed. 2017.

REFERENCES:

1. Gupta.J.B, "Electronic Devices and Circuits," S. K. Kataria & Sons, 2013.
2. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 2018.
3. Nageswara Rao.T, "Circuit Theory", A.R. Publications, Chennai, 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												2	
3	3													2
4		3												2
5			1			2			2					
CO	**3**	**3**	**1**			**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 o 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

22ECP01 Basics of Electronics Engineering Lab *(Common to CSE,CSE(IoT),CSE(CS) and IT Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PRE-REQUISITE : NIL					
Course Objective:	• 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. Verification of Thevenin's Theorem
3. Verification 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													
4		3												
5						1			2	2				
CO (W.A)	**3**	**3**				**1**			**2**	**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	Apply flowcharting techniques using the raptor tool to model basic programming logic for simple problems.	Ap
CO2	Develop C programs using various operators, control structures and loops for solving computational problems.	Ap
CO3	Implement modular programming concepts using	Ap
CO4	Apply the concept of functions and dynamic memory allocation	Ap
CO5	Analyse and correct logical errors encountered during execution	Ap

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**		

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

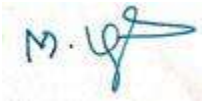
LIST OF EXPERIMENTS:

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

Mapping 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



22MAN03 YOGA – I (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**1**	**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	

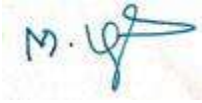
Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana - Diabetes: Procedure, Benefits and contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana – Asthema: Procedure, Benfits and contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, 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 BOOK/REFERENCE:

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**		



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 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

	POs												PSOs	
COs	**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.	
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:

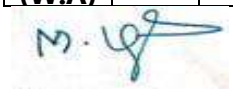
1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and 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													
5	3				2				3			2		
CO (W.A)	**3**	**2**			**2**				**3**			**2**		



22CIC01 –DATA STRUCTURES USING C *(Common to 22CSC02, 22CCC01, 22AIC01 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, and 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	

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**

*Ratified by Eleventh Academic Council

22CIC02* - PYTHON PROGRAMMING** ***(Common to 22CSC03, 22CCC02, 22AIC02 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 string and array operations for effective data handling in Python.	Ap	20%
CO3	Make use of list, tuples, dictionaries and sets data structures for developing applications	Ap	20%
CO4	Apply function concepts and file I/O operations to develop structured programs.	Ap	20%
CO5	Develop modular code and Perform data manipulation with NumPy arrays	Ap	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**

22CIC03 - DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION *(Common to 22AIC03, 22CCC03, 22AIC03 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 logic circuits.	An	20%
CO3	Apply fundamental computer architecture and multiplication techniques to optimize system operations.	Ap	20%
CO4	Analyze different types of control design and identify hazards	An	20%
CO5	Use memory mapping techniques, interconnection standards and identifies different ways of communication with I/O devices and interfaces.	Ap	20%

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	
2		3	3										3	
3				3										3
4					3								3	
5										3				
CO (W.A)	**3**	**3**	**3**	**3**	**3**					**3**			**3**	**3**

22CIP01– DATA STRUCTURES LABORATORY *(Common to 22CSP02, 22CCP01, 22AIP01 and 22ITP01)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
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	Implement and manipulate 1D and 2D arrays using pointers in C to perform various operations.	Ap			
CO2	Apply linear linked list structures to perform various operations.	Ap			
CO3	Apply stack based algorithms to solve computational problems.	Ap			
CO4	Implement and apply binary search trees and AVL trees for efficient data organization and retrieval.	Ap			
CO5	Apply priority queues using heaps and perform graph traversals using BFS and DFS to solve real world problems efficiently.	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

Mapping 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**

*Ratified by Eleventh Academic council

22CIP02 - PYTHON PROGRAMMING LABORATORY *(Common to 22CSP03, 22CCP02, 22AIP02, and 22ITP02)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
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 programming problems.	Ap			
CO2	Implement various string operations and manipulate basic data structures like lists, tuple and dictionaries effectively.	Ap			
CO3	Develop modular programming skills by writing functions and handling file operations for real world applications..	Ap			
CO4	Apply python modules and regular expressions to develop functional applications.	Ap			
CO5	Create interactive applications using basic Numpy operations for data handling and GUI programming techniques.	Ap			

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	3	2										3	2
2	3	3	2										3	2
3	3	3	3		2								3	3
4	3	3	3		3								3	3
5	3	2	3		3								3	3
CO (W.A)	**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**

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**

22MAN02R - SOFT/ANALYTICAL SKILLS – I (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE-REQUISITE : Nil

Course Objective:	• To analyze wide range of texts, understand and express interpretations • To learn various methods for faster numerical computations and to develop logical reasoning skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Respond to diverse texts, enhancing their comprehensive and expressive capabilities.	U	40%
CO2	Apply various techniques for quicker calculations.	Ap	30%
CO3	Solve mathematical problems by applying logical thinking.	An	30%

UNIT I – VERBAL ABILITY	**(5+10)**
Grammar- Synonyms - Antonyms - Articles - Preposition - **Listening -** IELTS Listening (Beginners) **- Speaking -** Presentation - JAM **- Reading -** Reading Comprehension **- Writing -** E-mail writing.	
UNIT II – APTITUDE	**(5+10)**
Square Root - Squaring of Numbers - Cube root -Cube of Numbers - Number Systems - L.C.M & H.C.F - Simplification - Problems on Numbers - Calendars - Clocks.	
UNIT III - REASONING	**(5+10)**
Odd Man Out & Number Series - Letter Series - Coding and Decoding - Analogy - Mirror and Water 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**				

** Ratified by Twelfth Academic Council

22MAN05 - YOGA – II (For Common To All Branches)					
		L	**T**	**P**	**C**
		0	**0**	**1**	**0**
PRE-REQUISITE : NIL					
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.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOK/REFERENCE:

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

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												3	
2		2												
3	3													
4		2												
5	3				2				3			2	3	
CO (W.A)	**3**	**2**			**2**				**3**			**2**	**3**	

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 problem-solving strategies and evaluate algorithm efficiency using asymptotic notations.	An	20%
CO2	Analyze problem-solving efficiency using brute force and divide-and-conquer approaches	An	20%
CO3	Apply dynamic programming and greedy algorithms to solve optimization and graph problems efficiently.	Ap	20%
CO4	Solve problems using iterative approaches and analyze their feasibility within computational complexity classes.	An	20%
CO5	Apply state space search techniques to address combinatorial and optimization challenges.	Ap	20%

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. 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	3	3	3			3	3						3	3
4	3	3	3			3	3						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	20%
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	Apply Arduino IDE and programming to control sensors, actuators and peripheral devices and develop solutions for real time applications.	Ap	20%
CO5	Perform in a team to build automation, agriculture and various real time applications using arduino.	Ap	20%

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	3												
2		3												
3	3	3	3										3	
4	3	3	3	3		3	3						3	3
5	3	3	3	3		3	3	1	1	2	3		3	3
CO (W.A)	3	3	3	3		3	3	1	1	2	3		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 problems using Java	Ap	20%
CO2	Analyze how oops concepts like inheritance, polymorphism improves code organization.	An	20%
CO3	Demonstrate exception handling and synchronization in multithreaded applications	Ap	40%
CO4	Build interactive applications using AWT and swing	Ap	20%
CO5	Develop Java projects for real-world applications	Ap	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										3	3
4	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**	**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	20%
CO3	Apply Synchronization Mechanisms and Deadlock handling techniques to ensure safe concurrent process execution	Ap	20%
CO4	Apply memory management techniques to optimize system performance.	Ap	20%
CO5	Apply appropriate disk scheduling, file allocation and I/O management techniques for efficient secondary storage operations.	Ap	20%

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	3
3	3		2										3	3
4	3		2	2	3								3	3
5				2	3								3	3
CO (W.A)	**3**	**3**	**2**	**2**	**3**								**3**	**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

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
2	3		3										3	3
3	3		3			3	3						3	3
4	3		3			3	3						3	3
5	3		3										3	3
CO (W. A)	**3**		**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			3									3
4			3		3								3	
5									3			3		
CO (W.A)	**3**	**3**	**3**		**3**				**3**			**3**	**3**	**3**

22MAN04R - SOFT/ANALYTICAL SKILLS – II (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**
PRE-REQUISITE : Nil				
Course Objective:	• To develop comprehensive English language skills • Toenhance logical reasoning skills and enhance problem-solving abilities			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Comprehend grammar, analyze texts, understand spoken language, articulate ideas in speech, and produce well-structured written compositions.	U	40%
CO2	Analyze quantitative aptitude problems and find solutions.	Ap	30%
CO3	Demonstrate the ability to solve problems through logical reasoning.	An	30%

UNIT I – VERBAL ABILITY	**(5+10)**
Grammar - One Word Substitutions - Phrasal Verbs - **Listening** - IELTS Listening (Intermediate) - **Speaking** - Group Discussion - **Reading** - Reading Newspaper / Articles -**Writing** - Proverb Expansion.	
UNIT II – APTITUDE	**(5+10)**
Ratio and Proportion - Allegation and Mixture - Partnership - Average - Problems on Ages - Percentage - Profit and Loss - Height and Distance.	
UNIT III - REASONING	**(5+10)**
Blood Relationship - Direction Sense - Paper Cutting and Folding - Logical Arrangements and Ranking - Venn Diagram.	
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**				

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 probability for problem solving using different searching techniques	Ap	40%
CO2	Apply the supervised machine learning models for solving the complex problem	Ap	20%
CO3	Analyze and apply the best suitable machine learning techniques	An	20%
CO4	Design neural networks to predict the solution for the real world problems	An	20%
CO5	Build, train, and evaluate a machine learning model using appropriate techniques to solve real-world problems collaboratively.	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 concepts of Internet architecture to analyze real-world networking scenarios.	Ap	20%
CO2	Analyze data link layer techniques for reliable and efficient network communication	An	20%
CO3	Develop solutions for efficient data delivery using network layer protocols and routing algorithms.	Ap	20%
CO4	Evaluate and manage transport layer protocols and congestion control techniques to ensure reliable communication and quality of service.	An	20%
CO5	Collaborate to implement secure and efficient application layer services using modern tools with ethical practices	Ap	20%

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	Analyze database design principles and data modeling techniques using ER models.	Ap	20%
CO2	Apply relational algebra and SQL to query and manage relational databases.	Ap	20%
CO3	Apply normalized relational schemas using functional dependencies and normal forms.	Ap	20%
CO4	Analyze data organization and indexing techniques for efficient query processing.	Ap	20%
CO5	Analyze transaction management and concurrency control techniques for reliable database operations.	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	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
CO (W.A)	**3**	**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 mechanical sensors and actuators to select suitable components for specific applications.	An	20%
CO4	Analyze different acoustic and chemical sensors in real time example.	An	20%
CO5	Apply the knowledge to address real world challenges involving radiation and smart 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.	An	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:

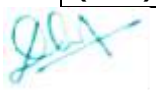
1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

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	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, 22CSP05 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			

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

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.

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		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											3	3
2	3												3	3
3			3										3	3
4					3								3	3
5			3				3		3		3	3	3	3
CO (W.A)	**3**	**3**	**3**		**3**		**3**		**3**		**3**	**3**	**3**	**3**

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**

22MAN07R - SOFT/ANALYTICAL SKILLS – III (Common to All Branches)				
	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%

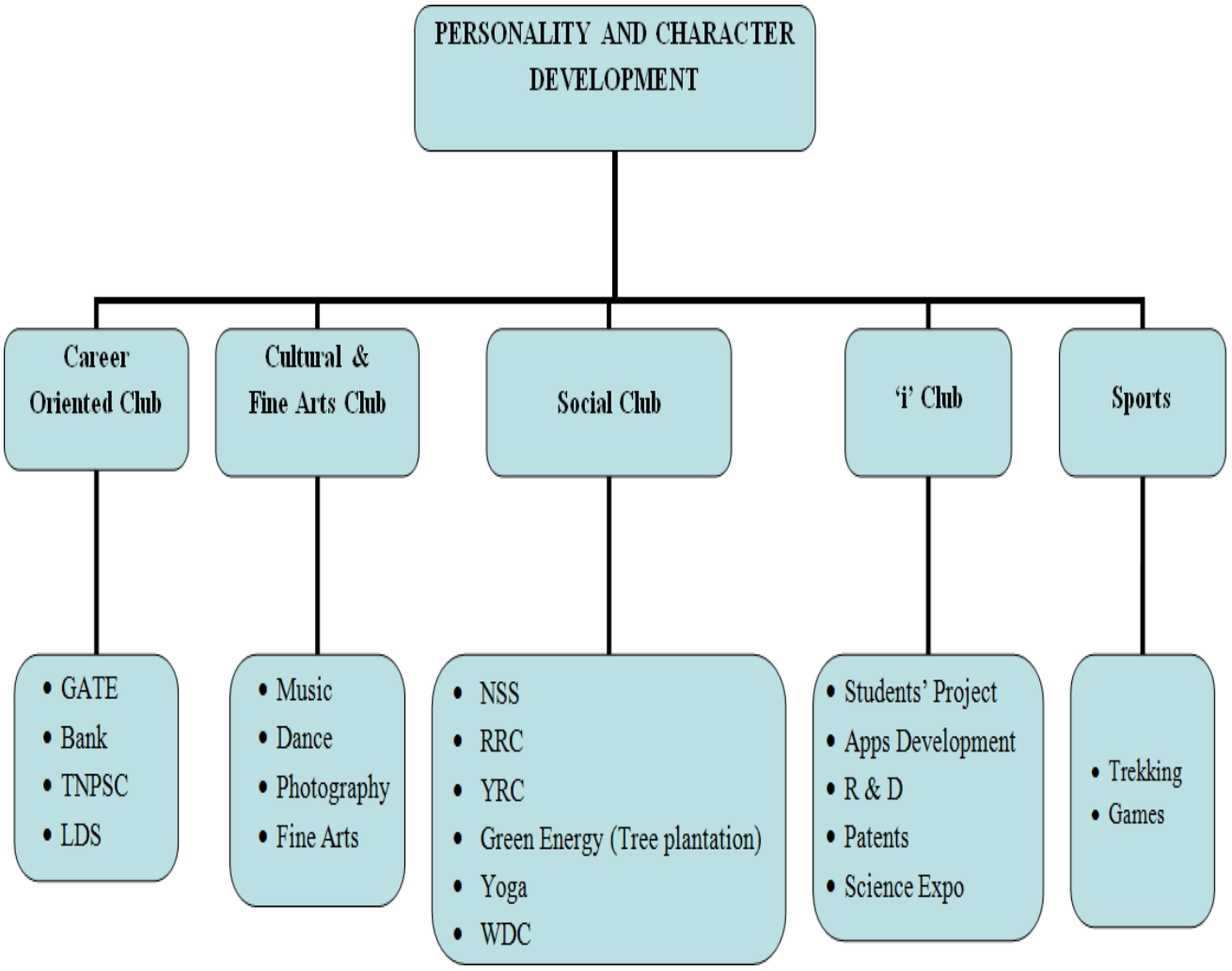
UNIT I – VERBAL ABILITY	**(5+10)**
Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.	
UNIT II – APTITUDE	**(5+10)**
Simple 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)		**2**		**2**					**2**	**3**				

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	20%
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	20%

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 SYSTEMS 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**

22MAN08R - SOFT/ANALYTICAL SKILLS – IV (Common to All Branches)				
	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			

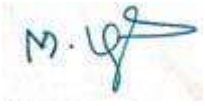
	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with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

UNIT I – VERBAL ABILITY	**(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**				



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	Develop an IoT solution development plan from a Product management perspective.	Ap	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

22CIP11-MOBILE APPLICATION DEVELOPMENT FOR IoT LABORATORY				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To provide hands-on experience in designing, developing, testing, and deploying mobile apps.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Analyze and identify the computing requirements appropriate to a real world problem	An
CO2	Design an Android application using layout, UI components using event listeners	C
CO3	Develop Android application with data storage	C
CO4	Develop a native mobile app	C
CO5	Publish the mobile application on Google Play Store.	C

LIST OF EXPERIMENTS :

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers.
3. Develop an application that uses event listeners.
4. Develop an application that uses adapters, Toast.
5. Develop an application that makes use of databases.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses Camera and writes the image to the storage.
9. Design a mobile IoT APP for a smart home.
10. Prepare and Publish Your Android Apps in Google Play Store.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development, Tools with appropriate emulators and debuggers and Rasberry Pi - 33 Nos.

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
3			3		3	3		3					2	2
4			3						3				2	3
5	3									3	3	3	2	3
CO (W.A)	**3**	**3**	**3**		**3**	**3**		**3**	**3**	**3**	**3**	**3**	**2**	**2**

*Ratified by Thirteenth Academic council

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	Apply 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**	**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	Construct a framework that incorporates value inputs into formal education and execute strategies to implement these values in their daily life and career decisions."	Ap	20%
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	20%
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	20%
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	20%
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	Ap	20%

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	

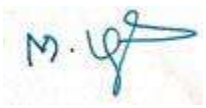
TEXT BOOK:

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.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key technologies in IIoT and examine the use cases of Industry 4.0.	Ap	20%
CO2	Analyze various Industrial process and its requirements.	An	20%
CO3	Illustrate the technical and Industrial requirement procedures for IIoT applications.	Ap	20%
CO4	Apply the IoMT system architecture by designing a basic framework that includes integration of each component.	Ap	20%
CO5	Analyze case studies from various medical IoT domains, focusing on operational efficiency, safety improvements, and sustainability impacts.	An	20%

UNIT I- INTRODUCTION TO INDUSTIAL IOT (IIOT) AND INDUSTRY 4.0	**(9)**
IoT enabling factors-Use cases of I-IoT, IoT analytics and AI, The Industrial Process –automation in industrial process-control & measurement system-Types of industrial process-The CIM pyramid-The I-IoT data flow. Industry 4.0 Use cases.	
UNIT II - INDUSTRIAL DATA FLOW AND DEVICES	**(9)**
Technical requirements- I-Io T data flow in the factory- Measurements and the Actuator chain-Controllers-Industrial protocols- SCADA-Historian-ERP and MES.	
UNIT III – IMPLEMENTING THE IIoT DATA FLOW & CASE STUDY	**(9)**
OPC Classic-OPC UA information model-security model- data exchange-IIoT edge:IoT edge Vs IIoT edge – edge architecture- edge implementations, IIoT data sources and data gathering-edge deployment and data flow scenarios. IIoT case studies: Manufacturing, Milk processing and packaging, Automotive, Oil, Chemical and pharmaceutical Industry, AR/VR and UAV.	
UNIT IV – 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, IoMT Attack types-challenges in IoMT security schemes-Current security plans and potential solutions.	
UNIT V – APPLICATION DESIGN AND CASE STUDY	**(9)**
Protecting the privacy of IoT based health records-Medical data compression for loseless data transmission- healthcare monitoring for parkinsons disease in smart way- Machine learning and IoT techniques to assist type I diabetics-Security measures in IoT systems using machine and deep learning Techniques.	
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. 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. Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 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	
5							3							
CO (W.A)	**3**	**3**	**3**	**3**			**3**						**3**	**3**

*Ratified by Thirteenth Academic council

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	Analyze the effectiveness of different consensus algorithms in specific blockchain applications.	An	20%
CO3	Analyze the impact of 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	20%
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	20%

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	Implement wearable systems for health monitoring considering components and limitations.	Ap	20%
CO2	Analyze signal processing techniques for wearability, energy, and data challenges.	An	20%
CO3	Establish a Body Area Network for real-time healthcare monitoring with secure and reliable communication.	Ap	20%
CO4	Analyze passive and active smart textiles for health monitoring.	An	20%
CO5	Evaluate wearable computing in medical diagnostics, sports, and elderly care.	An	20%

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	20%
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	20%

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	Apply the fundamental concepts of multiple access techniques in wireless sensor networks	Ap	20%
CO2	Apply the concept of MAC Protocols for ad hoc networks	Ap	20%
CO3	Apply the working of Routing Protocols for ad hoc networks	Ap	20%
CO4	Analyze transport layer protocol for ad hoc wireless networks.	An	20%
CO5	Design wireless sensor network with evolving standards.	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	Apply different components of image processing system in real time processing.	Ap	20%
CO2	Describe various image transforms, enhancement techniques using various processing methods	Ap	20%
CO3	Apply the compression and segmentation techniques on a given image	Ap	20%
CO4	Demonstrate the filtering and restoration of images(pixels) with examples	Ap	20%
CO5	Analyze 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**	**3**

22CIX11 - DATA EXPLORATION AND VISUALIZATION
(Common to 22AIC07)

L	T	P	C
3	0	0	3

PRER-EQUISITE : 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.	Ap	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.

TOTAL : 45 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**

22CIX12 - BIG DATA ANALYTICS (Common to 22CSX13,22ITX13,22AIC16 and 22CCX25)				
	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	Analyze Big Data concepts, analytics types, challenges, terminologies, BASE principles, and tools	An	20%
CO2	Use CQLSH for importing, exporting, and querying system tables in Cassandra	Ap	20%
CO3	Analyze the benefits of cloud-based Hadoop solutions and Hadoop use cases in real-world applications	An	20%
CO4	Apply MapReduce APIs to write, test, and execute distributed programs using MRUnit and Hadoop cluster	Ap	20%
CO5	Perform data analytics on structured and unstructured data including multimedia and streaming data using Hadoop tools.	Ap	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**	**3**

22CIX13 - DEEP LEARNING (Common to 22CSX01,22ITX01 and 22AIC13)					
		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	Design and evaluate neural network architectures for solving the real world problems	Ap	20%
CO2	Implement suitable type of autoencoders for the anomaly detection and data compression	An	20%
CO3	Apply training algorithms for RBMs	An	20%
CO4	Design CNN and RNN models for problem solving	An	40%
CO5	Build, train, and evaluate deep learning model using appropriate techniques to solve real-world problems collaboratively	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", 1 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

22CIX14 - RECOMMENDER SYSTEMS (Common to 22CSX03,22ITX03 and 22AIX02)				
	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**

22CIX15 - OPTIMIZATION TECHNIQUES (Common to 22AIX04 and 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	Apply linear programming methods to solve optimization problems.	Ap	20%
CO2	Evaluate transportation algorithms in engineering problems.	An	20%
CO3	Analyze game theory concepts in practical situations.	An	20%
CO4	Analyze project management techniques and apply crashing and trade-offs.	An	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 BOOK:

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. 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				3								3	
2			3										3	
3					3								3	
4	3		3										3	
5	3		3										3	
CO (W.A)	**3**		**3**		**3**								**3**	

22CIX16 - COMPUTER VISION (Common to 22CSX05,22ITX05,22AIX05 and 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	Apply image processing for Feature Extraction and enhancement in Computer Vision Applications.	Ap	20%
CO2	Apply recognition systems and object detection using various techniques.	Ap	20%
CO3	Apply optimization techniques for image alignment and geometric transformation.	Ap	20%
CO4	Apply depth estimation techniques to synthesize images for advanced photography.	Ap	20%
CO5	Analyze 3D reconstruction and image based rendering techniques in real time applications.	Ap	20%

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

22CIX17 - ETHICS OF AI (Common to 22CSX06,22ITX06 and 22AIX06)					
		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 the morality and ethics in AI.	Ap	20%
CO2	Apply the knowledge of ethics in AI with real time case studies and applications.	Ap	20%
CO3	Analyze the AI Standards and Regulations like ethical driven robotics and automation systems.	An	20%
CO4	Apply and impart the knowledge of Roboethics and ethical implication of robotics.	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

22CIX18 - ROBOTICS PROCESS AUTOMATION (Common to 22CSX08,22ITX08,22AIX08 and 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 Industrial robot and to apply programming concepts to move robot.	Ap	20%
CO2	Apply the Robot Technology to control the system and organize intelligence in Robots.	Ap	20%
CO3	Apply the knowledge of end effectors, grippers and sensors.	Ap	20%
CO4	Analyze the machine intelligence and machine Vision using AI techniques in Robots.	An	20%
CO5	Design and Build a robot to automate an industry.	C	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 BOOK:

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

REFERENCES:

1. Richared D.Klafter,Thomas Achmielewski and Mickael Negin," Robotic Engineering an Integrated approach"prentice hall India- newdelhi-2001
2. "Robotics technology and flexible automation" by S.R. Deb, Dr Sankha Deb ,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**

22CIX21 - PATTERN RECOGNITION (Common to 22CSX11,22ITX11,22AIX11 and 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	20%
CO2	Use Bayesian regression and probabilistic models for prediction and model selection.	Ap	20%
CO3	Implement linear classification models using generative and discriminative approaches, including Bayesian methods.	Ap	20%
CO4	Use neural networks and kernel methods to solve regression and classification tasks.	Ap	20%
CO5	Analyze graphical and sequential models, including HMMs and Bayesian networks, for structured data applications.	An	20%

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.

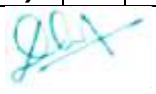
2.David J.C. MacKay"Information Theory, Inference, and Learning Algorithms" Cambridge University Press, 2003.

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



22CIX22 - TEXT AND SPEECH ANALYTICS (Common to 22CSX12,22ITX12 and 22AIX12)				
	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 ResponsibilityRoboethics 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 BOOK:

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**

22CIX23 - TIME SERIES ANALYSIS AND FORECASTING (Common to 22AIX13)				
	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	Apply exploratory data analysis techniques to visualize and summarize time series data effectively.	Ap	20%
CO2	Apply exponential smoothing methods to forecast both seasonal and non-seasonal time series data.	Ap	20%
CO3	Analyze ARIMA models to assess their suitability for forecasting stationary and non-stationary time series data.	An	20%
CO4	Apply transfer function and noise models to real-life data and use intervention analysis to study the effect of external changes.	Ap	20%
CO5	Apply advanced forecasting methods, including multivariate models, state-space models, and neural networks, to improve prediction accuracy.	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 BOOK:

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

REFERENCE:

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**

22CIX24 - HEALTH CARE ANALYTICS (Common to 22CSX14,22ITX14,22AIX14 and 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	3

22CIX25 - PREDICTIVE ANALYTICS (Common to 22CSX15,22ITX15 and 22AIX15)				
	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

22CIX26 - IMAGE AND VIDEO ANALYTICS (Common to 22CSX16,22ITX16,22AIX16 and 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**

22CIX27 - NATURAL LANGUAGE PROCESSING (Common to 22CSX17,22ITX17 and 22AIX17)					
		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 The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply core NLP techniques for text preprocessing and statistical modeling	Ap	20%
CO2	Apply Vector Embedding to words and build Neural Language models.	Ap	20%
CO3	Analyze sequence labeling tasks and implement deep learning architectures	An	20%
CO4	Apply the Machine translation model to dialogue systems.	Ap	20%
CO5	Analyze the techniques in speech recognition, parsing and information retrieval	An	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**	**3**

22CIX28 - AUGUMENTED REALITY AND VIRTUAL REALITY (Common to 22CSX16,22ITX18 and 22AIX18)					
		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 basic VR and AR concepts and identify key components.	Ap	20%
CO2	Analyze how input and output devices work in VR systems.	An	20%
CO3	Apply modeling techniques to build virtual environments	Ap	20%
CO4	Analyze user performance and safety in VR applications.	An	20%
CO5	Apply VR tools like Unity and Unreal to create simple VR projects.	Ap	20%

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**

22CIX31 – CRYPTOGRAPHY AND NETWORK SECURITY (Common to 22CCC12)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: 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 in End 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 secure data 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 protocols such as SSL/TLS, HTTPS, and IPsec.	An	20%

UNIT I-INTRODUCTION AND NUMBER THEORY	**(9)**
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: Divisibility and Division algorithm–Euclid's algorithm-Modular arithmetic-Groups, Rings, Fields – Finite fields– Polynomial Arithmetic–Prime numbers-Fermat's and Euler's theorem- Testing for primarily-The Chinese remainder theorem-Discrete logarithms.	
UNIT II-BLOCK CIPHERS AND ENCRYPTION STANDARDS	**(9)**
Block cipher and Data Encryption Standard–Advanced Encryption Standards: Finite field arithmetic–AES structure–AES transformation functions–AES key expansion–AES implementation-Block cipher operation : Multiple Encryption and triple DES - Electronic Codebook - Cipher Block Chaining Mode - Cipher Feedback Mode – Output Feedback Mode-Counter Mode–Pseudo random Number Generation-Stream cipher–RC4.	
UNIT III- PUBLIC KEY CRYPTOGRAPHY	**(9)**
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.	
UNIT IV -MESSAGE AUTHENTICATION AND DIGITAL SIGNATURES	**(9)**
Cryptographic Hash Function s- Message Authentication Code – Digital signature – Key management and distribution – user authentication.	
UNITV– NETWORK AND INTERNET SECURITY	**(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. David Cielen, Arno D.B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. RobertS. Witte and JohnS. Witte, "Statistics", EleventhEdition, WileyPublications, 2017. (Units II and III).
3. Jake Vander Plas,"PythonDataScienceHandbook",O'Reilly,2016.(Units IV and V)

REFERENCE:

1. Allen B.Downey, "Think Stats :Exploratory Data AnalysisinPython",GreenTeaPress,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	3									
5			3	3	3									3
CO (W.A)	**3**	**3**	**3**	**3**	**3**								**3**	**3**

22CIX32 – ETHICAL HACKING (Common to CSX22,22ITX22 and 22CCC14)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• To provide a comprehensive understanding of computer-based vulnerabilities, including various kinds of malware and attacks, and to explore tools and techniques for foot printing, social engineering, port scanning, and ping sweeping. • The course aims to equip students with practical skills in ethical hacking to identify and expose system vulnerabilities.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze and gain knowledge on the basics of computer- based vulnerabilities	Ap	20%
CO2	Demonstrate and analyze the network and vulnerability attacks in system.	An	20%
CO3	Investigation about foot printing, reconnaissance and scanning methods using tools	Ap	20%
CO4	Analyze the basics of scanning methodologies and exploitation techniques using modern tools	An	20%
CO5	Perform in a team to identify the options for network protection and firewall protection in ethical hacking.	Ap	20%

UNITI-INTRODUCTION

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer- The Internet Layer - IP Address

UNITII-NETWORK AND COMPUTER ATTACKS

Network and Computer Attacks - Malware - Protecting Against Malware Attacks. - Intruder Attacks -Denial-of-Service Attacks- Distributed Denial-of-Service Attacks-- Buffer Overflow Attacks- Ping of Death Attacks - Session Hijacking-Addressing Physical Security- Key loggers

UNITIII-FOOT PRINTING AND SOCIAL ENGINEERING

Web tools for Foot printing , Competitive Intelligence - Analyzing a Company's Web Site-Using Other Foot printing Tools-Using E-mail Addresses-Using HTTP Basics-Other Methods of Gathering Information-Using Domain Name System Zone Transfers .-Introduction to Social Engineering-The

Art of Shoulder Surfing-The Art of Dumpster Diving-The Art of Piggybacking-Phishing	
UNITIV-PORT SCANNING	
Introduction to Port Scanning- Types of Port Scans - Port-Scanning Tools – Nmap- Unicorns can — Nessus and OpenVAS-Ping Sweeps - Fping - Hoping-Crafting IP Packets	
UNITV-DESKTOP AND SERVEROS VULNERABILITIES	**(9)**
Windows OS Vulnerabilities-Windows File Systems-Remote Procedure Call—NetBIOS-Server Message Block-Common Internet File System-Null Sessions-Web Services-SQL Server-Buffer Overflows-Passwords and Authentication-Tools for Identifying Vulnerabilities in Windows-Best Practices for Hardening Windows Systems	
TOTAL(L:45):45PERIODS	

TEXTBOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.

REFERENCES:

1 Dr. John Smith, Dr. Emily Johnson, Dr. Mohammad Khan, A Survey of Ethical Hacking Techniques and Tools for Penetration Testing,2020

2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 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		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**

22CIX33 - CYBER FORENSICS (Common to 22CCC16)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• Aware of fundamentals on cyber forensics and usage of cyber forensics tools and enhance the knowledge on database, email and threats in crypto currency systems.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explain the basic of Forensics investigation process.	Ap	20%
CO2	Explain Linux forensics and file systems and the challenges in various devices.	An	20%
CO3	Develop expertise network forensics, mastering techniques to investigate and analyze network activities for identifying security breaches and Threats effectively.	Ap	20%
CO4	Explain forensic investigations in cloud environments, focusing on data retrieval, analysis.	Ap	20%
CO5	Analyze the specialized skills in Bit coin forensics, Enabling the mtotrace transactions, investigate illicit activities.	An	20%

UNIT I - INTRODUCTION TO COMPUTER FORENSICS	**(9)**
Introduction to Cyber forensics: Forensics investigation process –Forensics protocol– Digital forensics standards– Digital evidence – Types of cybercrime – Notable data breaches– Case study- Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis–Challenges-Case Study.	

UNIT II – LINUX FORENSICS AND FILE SYSTEM	**(9)**
Linux forensics: Popular Linux– File systems –Process –Artifacts –Linux distribution used for forensics analysis –Challenges –Case study. Mac OS forensics: File systems– Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics: Data wiping and shredding – Trial Obfuscation –Encryption–Data hiding–Anti-forensics detection technique.	

UNIT III – NETWORK FORENSICS	(9)
Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip – off – Micro – read – Challenges –iOS operating system.	
UNIT IV – CLOUD FORENSICS DATA	**(9)**
Cloud forensics: Cloud computing model – Server – side forensics – Client – side forensics – Challenges – Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis –Tools – Challenges –Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics – Log Forensics – Content analysis – File metadata forensics	
UNIT V - BITCOIN FORENSICS	**(9)**
Email sand email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components – Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1.Niranjan Reddy , Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations,Apress,FirstEdition,2019

2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

1.John Vacca, — Computer Forensics, Cengage Learning, 2005 Marjie Tabriz, —Computer Forensics and Cyber Crime: An Introduction, 3rdEdition, Prentice Hall , 2013.

2.Ankit Fadia — Ethical Hacking Second Edition, Mac millanIndia Ltd, 2006

3.Kenneth C. Brancik— Insider Computer Fraud Auerbach Publications Taylor & amp; Francis Group –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
2	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**

22CIX34 - SOCIAL NETWORK SECURITY (Common to 22CSX25,22ITX25,22AIX21 and 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 techniques to practical problems in real-world scenarios.	Ap	20%
CO2	Analyze the role of ontologies in the Semantic Web by examining how ontology-based knowledge representation structures and connects information.	An	20%
CO3	Analyze the evolution of web communities by examining their structural changes and interaction patterns over time.	An	20%
CO4	Analyze patterns of human behavior in social communities using reality mining techniques.	An	20%
CO5	Analyze social network structures across various technologies to identify patterns and relationships.	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:

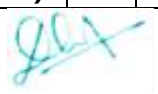
1. PeterMika, —Social Networks and the Semantic Web||, First Edition, Springer2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications||,1stEdition, Springer, 2010.

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

	POs												PSOs	
COs	**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
4		3					3						3	3
5		3		3	3								3	3
CO (W.A)		**3**	**3**	**3**	**3**	**3**	**3**						**3**	**3**



22CIX35 - BIOMETRIC SECURITY (Common to 22CSX28,22ITX28,22AIX22 and 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 components, functionalities, underlying principles, and real-world applications of biometric systems by examining their interrelationships and effectiveness.	An	20%
CO2	Apply the face recognition and face detection methods.	Ap	20%
CO3	Analyze the encoding and matching algorithms used to extract distinctive features from there is for Verification purposes.	An	20%
CO4	Analyze the roles and interactions of components in the architecture for 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

22CIX36 - CYBER PHYSICAL SYSTEMS (Common to 22AIX25 and 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	Analyze Cyber-Physical Systems (CPS) by breaking down their components and distinguishing specific subsystems.	An	20%
CO2	Apply techniques to interpret information and its symbolic representations in practical contexts.	Ap	20%
CO3	Analyze and compare various decision-making techniques applicable to cyber-physical systems, focusing on their processes and effectiveness.	An	20%
CO4	Analyze the integration and impact of data networks, wireless communications, artificial intelligence, and machine learning within Cyber-Physical Systems	An	20%
CO5	Analyze upcoming technologies by evaluating their potential applications across sectors and examining associated ethical considerations.	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**

22CIX37 - MOBILE DEVICE SECURITY (Common to 22AIX26 and 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	Examine the diverse categories of threats that affect Mobile Ad Hoc Network (MANET) applications, considering their impact on network reliability, data integrity, and security protocols.	An	20%
CO5	Analyze the security challenges in mobile commerce and evaluate how vulnerabilities like weak authentication enable attacks such as phishing and MITM.	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**

22CIX38 - INTRUSION DETECTION SYSTEMS (Common to 22CCX08)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE: NIL					
Course Objective:	• To provide students with a comprehensive understanding of how IDS work, their implementation, and their role in network security				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain practical skills in deploying and configuring IDS in different environments.	An	20%
CO2	Differentiate various IDS technologies and configure a network using IDS tools.	An	20%
CO3	Configure a server and its hosts for real-time Intrusion Detection	Ap	20%
CO4	Select and install a IDS system such as Snort to secure the network.	An	20%
CO5	Create comprehensive reports summarizing Snort activity, detected threats, and response actions.	C	20%

UNIT I - INTRODUCTION	**(9)**

Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anamoly detection – specification-based detection – hybrid detection-methodologies-Signature & Anomaly based Detection, Stateful protocol analysis Types of IDS, Information sources Host based information sources, Network based information sources.

UNIT II - THEORETICAL FOUNDATIONS OF DETECTION TECHNOLOGIES	**(9)**

Taxonomy of anomaly detection system – fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine - IDS TECHNOLOGIES: Components & Architecture-Typical components, Network Architectures Security capabilities - Information gathering capabilities, logging capabilities, detection & prevention capabilities. Network protocol-based IDS, Hybrid IDS, and Analysis schemes.

UNIT III - NETWORK BASED IDS	**(9)**

Networking Overview- OSI layers. Components and Architecture - Typical components, Network architectures and sensor locations. Security capabilities Wireless IDPS – Wireless Networking overview- WLAN standards & components. Components Network Behavior analysis system.

UNIT IV - HOST BASED IDS	(9)
Components and Architecture-Typical components, Network architectures, Agent locations, host architectures. Security capabilities-Logging, detection, prevention and other capabilities. Using & Integrating multiple IDPS technologies-Need for multiple IDPS technologies, Integrating different IDPS technologies-Other technologies with IDPS capabilities, Anti – malware technologies, Firewalls and Routers, Honeypots.	
UNIT V - APPLICATIONS AND SNORT TOOLS	**(9)**
Tool Selection and Acquisition Process - Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS - Snorts Intrusion Detection – NFR security - Introduction to Snort, Working with Snort Rules, Snort configuration, Snort with MySQL, Running Snort on Multiple Network Interfaces.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Carl Endorf, Eugene Schultz and Jim Mellander" Intrusion Detection & Prevention" , 1st Edition, Tata McGraw-Hill, 2006.
2. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.

REFERENCES:

1. Stephen Northcutt, Judy Novak: "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook ", Prentice Hall, 2001.
3. Rafeeq Rehman: "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall, 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	
3	3		3		3									
4			3			2								3
5	3													
CO (W.A)	3		3	2	3	2							3	3

22CIX41 DESIGN THINKING (Common to 22ITC08)					
		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 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**

22CIX42 - FUNDAMENTALS OF DATA SCIENCE (Common to 22ITC10)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To provide insights from data using data science concepts in python				

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 different types of data and variables to determine appropriate descriptive techniques.	An	20%
CO3	Design data analysis models using correlation, regression, and Python libraries for data wrangling and prediction.	Ap	40%
CO4	conduct experiments to visualize data using Matplotlib and Seaborn for effective interpretation.	An	20%
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) 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	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**

22CIX43 - AGILE METHODOLOGIES (Common to 22CSX51 and 22AIX51)					
		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	Apply the framework for getting work done within agile.	Ap	20%
CO2	Apply scrum practices in project management.	Ap	20%
CO3	Analyze the agile software development approaches for any real-time problem.	An	20%
CO4	Conduct Effective Requirements Engineering in Agile.	An	20%
CO5	Apply agile testing practices to ensure high product quality.	Ap	20%

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												3	3
2	3		3		3			2	2		2		3	3
3		3									2		3	3
4		3						2		2			3	3
5	3		3		3						2		3	3
CO (W.A)	3	3	3		3			2	2	2	2		3	3

22CIX44 - CLOUD COMPUTING (Common to 22CSX41,22ITC15 and 22AIX41)					
		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	An	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**							**3**	**3**

22CIX45 - UI AND UX DESIGN (Common to 22CSX42,22ITX42,22AIX42 and 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.	Ap	20%
CO3	Implement UX techniques in the design and development of applications.	Ap	20%
CO4	Analyze user personas and ideation strategies to determine effective approaches for creating wireframes and prototypes	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**

22CIX46 – DEVOPS (Common to 22CSX43,22ITX43,22AIX43 and 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	Analyze different actions performed through Version control tools like Git	An	20%
CO2	Apply Jenkins for Continuous Integration and Continuous Testing and Continuous Deployment by building automating test cases using Maven & Gradle.	Ap	20%
CO3	Apply Ansible to manage configuration in a given environment.	Ap	20%
CO4	Implement the configuration management using Ansible and leverage Cloud-based DevOps tools using Azure DevOps	Ap	40%
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 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

22CIX47 - SOCIAL AND INFORMATION NETWORKS (Common to 22CSX46,22ITX46,22AIX46 and 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	20%
CO2	Analyze network structures and diffusion processes to identify patterns and detect communities in complex networks.	An	40%
CO3	Develop real-world applications of network analysis in various domains.	Ap	20%
CO4	Implement the solutions for problems in case studies related to social and information networks.	An	20%
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**

22CIX48 - MULTIMEDIA DATA COMPRESSION AND STORAGE (Common to 22CSX48,22ITX48,22AIX48 and 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	Analyze advanced video compression techniques and disk placement strategies to determine their impact on storage efficiency	An	40%
CO4	Implement scheduling methods for request streams	Ap	20%
CO5	Demonstrate multimedia presentation on assigned topics.	Ap	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**

22CIX51-CLOUD SERVICES MANAGEMENT (Common to 22CCX42 and 22ITX41)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Cloud Service Management terminology, definition & concepts and predict benefits of cloud service management with traditional IT service management.	Ap	20%
CO2	Analyze strategies to reduce risk and manage issues associated with adoption of cloud services	An	40%
CO3	Exhibit cloud-design skills to build and automate business solutions using cloud technologies.	Ap	20%
CO4	Demonstrate the strategies for designing, deploying and running cloud-based services in a business environment	An	20%
CO5	Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services	An	Internal Assessment

UNIT-I CLOUD SERVICE MANAGEMENT FUNDAMENTALS	**(9)**
Cloud Ecosystem-The Essential Characteristics-Basics of Information Technology Service Management and Cloud Service Management-Service Perspectives-Cloud Service Models-Cloud Service Deployment Models	
UNIT-II CLOUD SERVICES STRATEGY	**(9)**
Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture	
UNIT-III CLOUD SERVICE MANAGEMENT	**(9)**
Cloud Service Reference Model-Cloud Service Life Cycle-Basics of Cloud Service Design-Dealing with Legacy Systems and Services-Benchmarking of Cloud Services-Cloud Service Capacity	

Planning-Cloud Service Deployment and Migration-Cloud Marketplace-Cloud Service Operations Management.
UNIT- IV CLOUD SERVICE ECONOMICS **(9)**
Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models
UNIT –V CLOUD SERVICE GOVERNANCE & VALUE **(9)**
IT Governance Definition-Cloud Governance Definition-Cloud Governance Framework-Cloud Governance Structure-Cloud Governance Considerations-Cloud Service Model Risk Matrix-Understanding Value of Cloud Services- Measuring the value of Cloud Services- Balanced Scorecard-Total Cost of Ownership
TOTAL (L:45) = 45 PERIODS
TEXT BOOKS:
1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications 2020. 2. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour 2017. 3. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013.
REFERENCES:
1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing 2020. 2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi 2013.

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		3
CO (W.A)	**3**	**3**	**3**	**3**	**3**					**3**		**3**	**3**	**3**

22CIX52 - SOFTWARE TESTING TOOLS AND TECHNIQUES (Common to 22CSX54,22ITX54,22AIX54 and 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	20%
CO2	Analyze various software testing levels	An	20%
CO3	Make use of structured and analytical testing approaches to ensure thorough testing	Ap	20%
CO4	Identify quality testing processes and tools in projects	An	20%
CO5	Apply software testing tools to validate projects.	Ap	20%

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.

REFERENCE:

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**

22CIX53 - SOFTWARE QUALITY ASSURANCE (Common to 22CSX55,22ITX55,22AIX56 and 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	Analyze 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	Analyze 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**	**3**

22CIX54 - SOFTWARE PROJECT MANAGEMENT (Common to 22CSX53,22ITX53,22AIX53 and 22CCX53)					
		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 the project management concepts and techniques for developing a project	Ap	20%
CO2	Apply different techniques in monitoring and control of project.	Ap	20%
CO3	Apply Key project management system techniques like PERT,CRM.	Ap	20%
CO4	Identify the issues that could lead to a project's success or failure.	An	20%
CO5	Managing people and organizing teams while developing a software project	Ap	20%

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 BOOKS:

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	2													3
2			3										3	3
3		3												3
4				3										3
5										2	2			3
CO (W.A)	**2**	**3**	**3**	**3**						**2**	**2**		**3**	**3**

22CIX55 - IT OPERATIONS (Common to 22CSX57,22ITX57,22AIX55 and 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	20%
CO2	Analyze existing health and safety regulations applicable to IT operations environments	An	20%
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	20%

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**

22CIX56 -MEAN STACK DEVELOPMENT (Common to 22CSX45,22ITX45,22AIX45 and 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	Analyze the integration of MongoDB with Node.js for developing scalable applications.	An	20%
CO3	Design dynamic web applications using TypeScript features and Angular components with effective data binding and modular architecture	Ap	20%
CO4	Implement AngularJS features for dynamic web application development.	Ap	20%
CO5	Involve in independent study and stay aware of technological advances in programming language concepts, implementation techniques, and paradigms.	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**

22CIX57 - WEB MINING (Common to 22CSX47,22ITX47,22AIX47 and 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	20%
CO2	Analyse the data on web using crawlers and extract strutured data.	An	40%
CO3	Compare and analyze various web usage mining methods and evaluate their effectiveness for different applications.	An	20%
CO4	Demonstrate techniques for sentiment classification and opinion spam detection.	Ap	20%
CO5	Read and comprehend research articles related to web search and mining techniques, and interpret recent advancements in the field.	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 – WEB CRAWLING	**(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 – WEB USAGE MINING	**(9)**

Web Usage Mining–Click stream Analysis–Log Files–Data Collection and Pre-Processing–Data Modeling for Web Usage Mining–The BIRCH Clustering Algorithm–Affinity Analysis and the A Priori Algorithm–Discretizing the Numerical Variable	
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 Edition2011for unitsI,II,III&V 2. Zdravko Markov, DanielT.Larose, "Data Mining the Web: Uncovering Patternsin Web Content, Structure, and Usage", JohnWiley& Sons, Inc.,2010 for unit IV.	
REFERENCE: 1. Anthony Scime,"Web Mining Applications and Techniques",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**

22CIX58 - PRODUCT LIFE CYCLE MANAGEMENT (Common to 22CSX58,22ITX58,22AIX58 and 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	20%
CO2	Analyze global impacts of PLM on product development	An	20%
CO3	Examine PLM deployment stages for decision-making	An	20%
CO4	Interpret and use PLM strategies for enhancing productization	An	20%
CO5	Analyze product lifecycle and management strategies, and apply the Scrum framework to enhance product development.	An	20%

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		3					2	3				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	20%
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	20%
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	20%

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 Weihrich and 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														
	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				
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	20%
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	20%

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, Urdhwareshe Hemant, 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", 8th Edition, Pearson, 2017.

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													
4		3												
5	3				2									
CO (W.A)	**3**	**3**			**2**									

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	20%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	20%
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	20%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	20%

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" 5th Edition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. Senthil Kumar,"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

	POs												PSOs	
COs	**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**						

22GEZ01-Entrepreneurship Development				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**

PRE REQUISITE : Nil

Course Objective:	• Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship • Apply process of problem –opportunity identification and validation through human centred approach to design thinking in building solutions as part of engineering projects. • Analyze market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product. • Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise. • Prepare and present an investible pitch deck of their practice venture to attract stakeholders.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze different types of entrepreneurs and their impact on emerging economies through case studies of successful and failed engineering entrepreneurs	An	20%
CO2	Apply concepts related to societal problems, generate and validate ideas, and assess business opportunities by studying emerging markets and their potential	Ap	20%
CO3	Develop prototypes using various methods and tools, understand their importance in the entrepreneurial process, and iterate based on feedback to enhance their designs	C	20%
CO4	Apply the Lean Canvas to develop business models and craft effective pitches that engage investors and customers	Ap	20%
CO5	Analyze the entrepreneurial ecosystem, including its components, financing models, and stakeholder networks through interactive activities such as visits and interactions with startup founders	Ap	20%

MODULE–I: ENTREPRENEURIAL MINDSET	(6+6)
Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics–Developing and Understanding an Entrepreneurial Mindset– Importance of Technology Entrepreneurship – Benefits to the Society. Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks.	
MODULE– II: OPPORTUNITIES	(6+6)
ProblemsandOpportunities–IdeasandOpportunities–Identifyingproblemsinsociety– Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities. Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation – Analyse feedback to refine the opportunity.	
MODULE–III: PROTOTYPING & ITERATION	(6+6)
Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques.Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.	
MODULE– IV: BUSINESS MODELS & PITCHING	(6+6)
Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching Techniques:Importanceofpitching-Typesofpitches-craftingacompellingpitch –pitch presentation skills - using storytelling to gain investor/customer attention. ActivitySession:Developabusinessmodelcanvasfortheprototype;presentandreceive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback.	
MODULE–V:ENTREPRENEURIAL ECOSYSTEM	(6+6)
Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models–equity, debt, crowd funding, etc, Support from the government and corporate. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network. Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or maker space or interact with startup founders).	
	TOTAL(L:30,P:30) = 60 PERIODS

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGraw Hill, 11th Edition.
2. Ries,E.(2011).The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.

REFERENCES:

1.Blank, S.G.,& Dorf,B.(2012).The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch.
2. Roy, R.(2017).Indian Entrepreneurship: Theory and Practice New Delhi: Oxford University Press.
3. Osterwalder,A.,& Pigneur, Y.(2010).Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.

Mapping of COs with POs / PSOs

COs / POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3							3	3		3		
CO2		3	3				2		3	3		3		
CO3			3		3				3	3		3		
CO4									3	3	3	3		
CO5									3	3	3	3		
Weighted average	-	3	3	-	3	-	2	-	3	3	3	3	-	-

22CIZ01– INTERNET OF EVERYTHING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To provide Compressive understanding of IoE systems, design connected applications, and address challenges in security.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply IoT concepts and sensors to analyze the interaction between humans, machines, and IoT systems in society.	An	20%
CO2	Analyze IoT access technologies and protocols	An	20%
CO3	Apply cloud and edge computing concepts	Ap	20%
CO4	Apply security principles to implement protection mechanisms for IoT systems	Ap	20%
CO5	Design and implement solutions for IoT-driven applications.	Ap	20%

UNIT I- Introduction to IoT	**(9)**
IoT and Human Society-Understanding IoE - Characteristics of Internet of Things-Sensors and WSN-Interaction of H2M and IoT Senses (IoTS).	
UNIT II – Communication Technology	**(9)**
Introduction-Wired and Wireless Access of IoT-WLAN and Wi-Fi 6-IEEE 802.11p(DSRC) and VANETs-WPAN/IEEE 802.15.4 and ZigBee-Gateways and Protocols.	
UNIT III – Services and Platform Layer of IoT	**(9)**
Middleware-Primitive IoT and Grids-Cloud Computing-Cloud paradigm-Azure and Google clouds as examples-collaborative cloud in industrial IoT sector-Edge computing-Fog Computing-Requirement analysis and architecture of edge computing-MEC and 5G-User case of edge deployment of Azure.	
UNIT IV – IoT Security	**(9)**
Introduction-The Baseline of IoT Security-Security in Perception Layer-Security in Network and a Reference Architecture-IoT Security and secure Communication-Security of Platform and Application.	
UNIT V – Applications Layer of IoT	**(9)**
Protocols of Applications-Digital Twin-Applications in Smart Building and Smart Energy-Applications in Smart City-Smart Agriculture-Applications of IoT.	

TEXT BOOK :

1. Hang Song, Internet of Everything Key Technologies, Practical applications and Security of IoT, 2023, Tsinghua University Press.

REFERENCES:

1. Nilanjan Dey, Gitanjali Shinde, Parikshit Mahalle, Henning Olesen, The Internet of Everything: Advances, Challenges and Applications ,2019, CPI books by GmbH
2. Beniamino Di Martino, Kuan-Ching Li, Laurence T. Yang, "Internet of Everything : Algorithms, Methodologies, Technologies and Perspectives", 2008, Springer

Mapping 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	3				

22CIZ02 – BASIC SENSORS AND ACTUATORS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : Nil				
Course Objective:	• To create a conceptual understanding of the basic principles of sensors, actuators, and their operations.			

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.	An	20%
CO2	Analyze thermal, optical & electric sensors and actuators to select suitable components for specific applications.	An	20%
CO3	Apply mechanical sensors and actuators in real world applications.	Ap	20%
CO4	Demonstrate the working principle of acoustic sensors for sound detection and measurement.	Ap	20%
CO5	Apply the knowledge of radiation and MEMS sensors to address real world challenges.	Ap	20%

UNIT I - OVERVIEW OF SENSORS AND ACTUATORS & TEMPERATURE SENSORS AND THERMAL ACTUATORS	**(9)**
Definitions: Sensors & Actuators – Overview of Sensor and Actuator classifications – Performance characteristics of Sensors & Actuators. Thermo resistive sensors: Thermistors, Resistance temperature, and silicon resistive sensors – Thermoelectric sensors – Other Temperature sensors: Optical and Acoustical – Thermo mechanical Sensors and Actuators.	
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 – Active infrared (AFIR) sensors – Optical Actuators . The Electric field: Capacitive Sensors & Actuators – Magnetic sensors and actuators – Magnetoresistance – Magnetostrictive Sensors and Actuators – Magnetic actuators: Voice Coil Actuators, Motors as Actuators.	
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,– Inertial sensors and actuators: Mechanical or Rotor & Optical Gyroscopes.	

UNIT IV - ACOUSTIC SENSORS	(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.	
UNIT V - RADIATION SENSORS AND MEMS 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.	
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

CO	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									

22ITM01 JAVA PROGRAMMING BASICS					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: Nil					
Course Objective:	To understand Object Oriented Programming concepts and basic characteristics of Java				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamental concepts of Java to solve simple problems.	Ap	20%
CO2	Analyse how oops concepts like inheritance, polymorphism improves code organization and enhances flexibility.	Ap	20%
CO3	Build programs that efficiently handles errors through exception handling	Ap	20%
CO4	Demonstrate the use of packages and interfaces in achieving loose coupling.	An	20%
CO5	To create, manage, and synchronize threads to build high-performance, multi-threaded applications	An	20%

UNIT I - NTRODUCTION	**(9)**
Introduction of Java - Features of Java – Application of Java – Data Types –Statements – Operators – Control statements - Basics of Oops Concepts: Class – Objects – Methods –Constructor – finalizer –Access Control.	
UNIT II - INHERITANCE AND KEYWORDS	**(9)**
Inheritance: Types of Inheritance – Polymorphism – Method Overloading – Method Overriding- super – final with inheritance – Abstract Class - Keywords: static –final - this - String – Arrays	
UNIT III EXCEPTION HANDLING AND FILES	**(9)**
Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Using Exceptions. I/O Basics- Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	
UNIT IV PACKAGES AND INTERFACES	**(9)**
Packages and Interfaces: Packages, Access Protection, Importing Packages. Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.	
UNIT V THREADS	**(9)**

Java Thread Model - Main Thread - Creating a Thread - Creating Multiple Threads - Thread Priorities - Synchronization - Interthread Communication - Suspending, Resuming, and Stopping Threads- Using Multithreading.
TOTAL (L:45) : 45 PERIODS

TEXT BOOK:
Herbert Schildt, "JAVA THE COMPLETE REFERENCE", 13th Edition, March 2024
REFERENCES:
Deital & Deital, "Java How to Program: Early Objects", Eleventh Edition, Pearson,July 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												
3			3											
4				3										
5					3									
CO (W.A)	**3**	**3**	**3**	**3**	**3**									

22ITM02 DATABASE SYSTEM CONCEPTS					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: Nil					
Course Objective:	To focus on database fundamentals, database designing and implementation of queries				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply relational algebra operations to write basic queries to access database	An	20%
CO2	Analyse the use of DDL in building queries for accessing and modifying database	Ap	20%
CO3	Design entity relationship modeling	Ap	20%
CO4	Implement normalization techniques during database design	An	20%
CO5	Analyze and Implement transaction properties and concurrency protocols in SQL	An	20%

UNIT I - INTRODUCTION	**(9)**
Database System Applications- Purpose - View of Data - Data Models- Transaction Management - Database Architecture- Data Mining and Information Retrieval – Specialty Databases – Users and Administrators – History of Database Systems - Relational Model: Structure of Relational Databases- Database Schema – Keys – Schema Diagrams – Relational Query Languages - Relational Algebra Operations	
UNIT II - SQL	**(9)**
Introduction to SQL: - SQL – Data Definition – Basic Structure –Basic Operations – Set Operations – Null Values and Aggregate Functions– Nested Sub Queries- Modification of Databases	
UNIT III - INTERMEDIATE SQL AND ER MODELING	**(9)**
Join Expressions – Views – Transactions – Integrity Constraints – SQL - Data Types and Schemas - Authorization – Triggers – Database Design and ER Model – ER Diagrams – Extended ER Features	
UNIT IV - RELATIONAL DATABASE DESIGN	**(9)**
Features of Good Relational Designs - 1NF-Functional Dependencies-Decomposition Using Functional Dependencies - 2NF- Boyce Codd Normal Form - 3NF - Functional Dependency theory.	
UNIT V - TRANSACTIONS	**(9)**
Transactions: Desirable properties of Transactions – Serializability – Transactions Statements– Concurrency Control: Lock-Based Protocols – Deadlock Handling – Timestamp-Based Protocols	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOK:
Silberschatz, Abraham, Korth, Henry F., Sudarshan S, "Database System Concepts", 7th Edition, Mc Graw Hill, 2020.
REFERENCES:
Ramez Elmasri, Shamkanth B.Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016 C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 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											
4				3										
5			3		3									
CO (W.A)	**3**	**3**	**3**	**3**	**3**									

22ITM03 WEB ESSENTIALS					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: Nil					
Course Objective:	● To Understand the fundamental concepts of website basics.				
Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Analyze how websites are structured, how they are accessed, and the roles of HTML, CSS, and JavaScript.	An	20%		
CO2	Build simple, static web pages using HTML and CSS.	Ap	20%		
CO3	Apply JavaScript to add simple interactive elements to web pages, such as buttons, forms, or basic animations.	Ap	20%		
CO4	Implement functions and browser handling power of PHP	Ap	20%		
CO5	Critically evaluate interactive web applications using Java Servlets with session management and database integration via JDBC.	An	20%		

UNIT I - WEBSITE BASICS	**(9)**
Internet Overview – Fundamental computer network concepts – Web Protocols – URL – Domain Name- Web Browsers and Web Servers- Working principle of a website –Creating a website – Client-side and server-side scripting	
UNIT II - WEB DESIGNING	**(9)**
HTML – Form Elements – Input types and Media elements – CSS3 – Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.	
UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING	**(9)**
JavaScript Introduction – Variables and Data Types-Statements – Operators – Literals-Functions-Objects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation – JavaScript Debuggers.	

UNIT IV SERVER-SIDE PROCESSING AND SCRIPTING – PHP	(9)
PHP – Working principle of PHP – PHP Variables – Constants – Operators – Flow Control and Looping – Arrays – Strings – Functions – File Handling – File Uploading – Email Basics – Email with attachments – PHP and HTML – Simple PHP scripts – Databases with PHP	
UNIT V SERVLETS AND DATABASE CONNECTIVITY	**(9)**
Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions -Sessions – Cookies – Database connectivity–JDBC Creation of simple interactive applications – Simple database applications	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014.
2. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web – How to Program", 5th edition, Pearson Education, 2012.

REFERENCES:

1. Jeffrey C. Jackson, "Web Technologies–A Computer Science Perspective", Pearson Education,2006.
2. James F. Kurose, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson Education,2012
3. Steven Holzener, "PHP – The Complete Reference", 1st Edition, Mc-Graw Hill, 2017
4. Fritz Schneider, Thomas Powell, "JavaScript – The Complete Reference", 3rd Edition, McGraw Hill Publishers,2017
5. Bates, "Developing Web Applications", Wiley Publishers, 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											
4				3	3									
5					3						2			
CO (W.A)	3	3	3	3	3						2			

22ITM04 FULL STACK WEB DEVELOPMENT					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: Nil					
Course Objective:	To learn the basics of JavaScript and importance of MERN stack				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Set up MERN environment for node.js	Ap	20%
CO2	Design and develop front end application using Bootstrap and MongoDB.	Ap	20%
CO3	Apply the knowledge of react based web programming	Ap	20%
CO4	Deal with Node based programming and Express and analyze Express based web development	An	20%
CO5	Implement MVC and responsive design to scale well across PC, tablet and Mobile Phone using jQuery to solve real world problems.	An	20%

UNIT I - MERN Stack Foundations	**(9)**
Introduction to the MERN Stack and its Ecosystem, setting up the Development Environment (Node.js, npm, MongoDB), Introduction to Terminal/Command Line (basic commands, navigating directories), Version Control with Git (basic commands: init, add, commit, push, pull, Overview of JavaScript for Node.js (modules, callbacks, promises)	
UNIT II - Frontend Development with React	**(9)**
Introduction to React.js and JSX, Components, Props, and State, Handling Events in React (on Click, on Change, etc.), Introduction to React Hooks (use State, use Effect - basic usage), Building Simple React Components (Lists, Forms, Conditional Rendering), Styling React Components (CSS-in-JS, inline styles, external CSS)	
UNIT III - Backend Development with Node.js & Express.js	**(9)**
Introduction to Node.js and its Event Loop, Building a Basic HTTP Server with Node.js, Introduction to Express.js Framework (routing, middleware), Creating RESTful APIs with Express.js (GET, POST, PUT, DELETE), Data Handling and Validation in Express.js, Error Handling and Middleware (basic implementation)	
UNIT IV - Database Management with MongoDB	**(9)**
Introduction to NoSQL Databases and MongoDB, MongoDB Basics (Documents, Collections, Databases), CRUD Operations in MongoDB (Create, Read, Update, Delete), Basic MongoDB Query Language (find, filter, sort, limit), Connecting Node.js to MongoDB (using a driver), Data Modeling and Schema Design (basic concepts)	

UNIT V – MERN Project: Building a Simple Application	(9)
Project Planning and Design (small, focused project), Developing the Frontend with React (components, state management), Creating the Backend API with Node.js & Express.js (API endpoints, data handling), Integrating MongoDB for Data Storage (connecting frontend to backend). Testing and Debugging (basic testing techniques), Project Presentation and Demonstration.	
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. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.

5. 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

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													
2		3	3		3									
3	3			3	3									
4				3										
5					3	2					2			
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**2**					**2**			

22ITM05 – FUNDAMENTALS OF INTERNET OF THINGS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : Nil				
Course Objective:	• To provide an understanding of the technologies and the standards relating to the Internet of Things.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of IoT and digitization on industries	Ap	20%
CO2	Analyze the concepts of sensors and other smart objects.	An	20%
CO3	Examine the various requirements of IoT access technologies.	Ap	20%
CO4	Analyze and implement security measures in IoT.	An	20%
CO5	Summarize applications of IoT in real time scenario.	Ap	20%

UNIT I - INTRODUCTION TO INTERNET OF THINGS	**(9)**
IoT and Digitization-IoT Impact-Convergence of IT and OT, Network architecture and Design: Drivers behind network architecture-one M2M-IoT world forum (IoTWF).	
UNIT II – SMART OBJECTS: The "Things "in IoT	**(9)**
Sensors-Actuators-Micro Electro Mechanical Systems(MEMS)-Sensor networks: Wireless Sensor Networks(WSN)- Communication protocols for WSN -Connecting smart objects: range-frequency band-power consumption –topology.	
UNIT III - IOT ACCESS TECHNOLOGIES	**(9)**
Physical layer – MAC layer-the need for optimization-optimizing IP for IoT- the transport layer-IoT application transport methods-SCADA- CoAP-MQTT.	
UNIT IV – SECURING IoT	**(9)**
Common challenges-pervasive legacy system- insecure operational protocols-modbus-DNP3-ICCP-OPC-other protocols-formal risk analysis structure-OCTAVE-FAIR-phased application of security in an operational environment.	

UNIT V - APPLICATIONS OF IOT	(9)
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, CISCO Press, India, First Edition, 2017.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES:

1. Perry Lea, Internet of things for architects, Packt Publishing, UK, First Edition, 2018.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, US, First 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	3													
3			3											
4					3									
5									2		2	2		
CO (W.A)	3		3		3				2		2	2		

22ITM06 DATA ACQUISITION FOR IOT				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To design and implement power supplies, amplifiers, and sensor circuits for accurate data acquisition and signal conditioning. • Understand and apply communication protocols and interfacing techniques to connect sensors and microcontrollers for efficient data transfer and system control.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the behavior of amplifiers and power supplies under different conditions.	An	20%
CO2	Analyze the performance of signal conditioning circuits and identify potential sources of error.	An	20%
CO3	Apply RS232, RS485, and IEEE488 standards in real-world communication systems.	Ap	20%
CO4	Apply time-division and space-division channeling methods in designing data acquisition systems for multi-channel sensor applications.	Ap	20%
CO5	Apply interfacing techniques to connect memory, sensors (LVDT, RPM meter), and microcontrollers to collect and process data	Ap	20%

UNIT-I: Power Supplies & Filters	(9)
Amplifiers-Instrumentation amplifiers-isolation-chopper and low drift amplifier -Lock- in amplifiers electrometer and trans-impedance amplifiers-modulation-filters-Constant voltage and constant current regulators, DC-DC converter, SMPS. D/A converters, Comparator,PLL.	
UNIT-II:Sensor Signal Conditioning Circuits	(9)
Signal conditioning for resistive sensors, Reactive variation sensors and Self generating sensors-Error budget analysis.	
UNIT-III: Basic Signal Conversion and Communication	(9)
RS232 interface standard, S485 interface standard. Distributed and stand alone data loggers, IEEE488 standard. methods of frequency-to-code conversion-standard, indirect and combined counting method, two wire transmission-four wire, six wire sensing.	

UNIT-IV:Data Acquisition Methods for Multi Channel Sensor Systems	(9)
Data acquisition method with time-division channeling, data acquisition with space- division channeling, and main errors of multi channel data-acquisition systems, data transmission and error protection.	
Unit-V:Serial Communication and Networks	(9)
Serial data communication –transmission modes,SPI,I2C, CAN. Examples of Implementation on a 8051 based microcontroller. Interfacing: memory interfacing, linear variable Differential Transformer (LVDT), speed measurement (RPM meter), Digital Thermometer	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 3rd edition, Springer, 2003.
2. Jon.S. Wilson, "Sensor Technology Hand Book", Elsevier Inc., 2005.

REFERENCES:

1. Pallas Areny. R, Webster. J. G, "Sensors and Signal conditioning", 2nd ed. John Wiley and Sons, 2001.
2. Taylor H Rosemary, "Data Acquisition for Sensor Systems", Kluwer Academic Publishers Group, 1997
3. Microcontrollers (Theory & Applications) –A.V. Deshmuk, WTMH 2005
4. Embedded Systems Architecture, programming and Design 2nd ed. Rajkaml McGraw –Hill

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										
4				3										
5							3							
CO (W.A)	**3**	**3**		**3**			**3**							

22ITM07 – WEB APPLICATION SECURITY				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE – REQUISITE: Nil				

Course Objective:	• To equip students with the knowledge and skills required to secure web applications by identifying vulnerabilities, implementing protective measures, and adhering to security best practices.

Course Outcomes: The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Analyze the Basic Concepts and Structure of Web Applications, Including the Role of Frontend and Backend Components	An	20%
CO2	Critically evaluate different web application architecture models to understand their strengths, weaknesses, and appropriate use cases in modern web development.	An	20%
CO3	Critically assess the difference between authentication and authorization, and evaluate how both concepts play distinct but complementary roles in securing web applications and systems.	An	20%
CO4	Analyze encryption methods and hashing algorithms to assess their strengths, weaknesses, and use cases in securing sensitive data both in transit and at rest.	An	20%
CO5	Apply encryption techniques to secure sensitive data at rest and in transit, and implement data masking and tokenization to protect data in non-production environments.	Ap	20%

UNIT - I INTRODUCTION TO WEB APPLICATION	**(9)**
Fundamentals of Web Application - Confidentiality, Integrity, and Availability (CIA Triad) - Common attack vectors in web applications - Frontend (Client-side) - Backend (Server-side)	

UNIT - II WEB APPLICATION ARCHITECTURE	**(9)**
Introduction - Microservices Architecture - Monolithic Architecture - Microservices Architecture - Serverless Architecture - Web Application Layers.	

UNIT – III AUTHENTICATION AND AUTHORIZATION	**(9)**
Introduction - Authentication Basics - Authorization Fundamentals - Session Management - OAuth and OpenID Connect - Single Sign-On	
UNIT – IV DATA SECURITY BASICS	**(9)**
Data Security - Types of Data - Encryption Techniques - Data Integrity - Data Access Control - Data Security Tools.	
UNIT – V APPLICATION SECURITY	**(9)**
Security in the Software Development Lifecycle - Web Application Vulnerabilities - Secure Coding - Application Security Testing - API Security - Cloud Security - Application Security Management.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Web Application Security: Exploitation and Countermeasures, by Andrew Hoffman, McGraw-Hill Education Publishers, 1 February 2013.

REFERENCE:

1. The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws by Dafydd Stuttard & Marcus Pinto , 2011, Wiley.
2. OWASP Top 10: The Most Critical Web Application Security Risks
3. Security Engineering: A Guide to Building Dependable Distributed System by Ross Anderson, Wiley, 2020 (3rd Edition)

Mapping 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									
4	3				3									
5	3	3							3		3			3
CO (W.A)	**3**	**3**	**3**	**3**	**3**				**3**		**3**			**3**

22ITM08 – FUNDAMENTALS CYBER FORENSICS					
		L	T	P	C
		3	0	0	3
PRE – REQUISITE: Nil					
Course Objective:	• To equip students with the develop a fundamental understanding of information security and data integrity.				

Course Outcomes: The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Analytical experience in utilizing the Wireshark tool for advanced packet sniffing, network traffic analysis, anomaly detection, and protocol investigation.	An	20%
CO2	Develop a deep understanding and hands-on expertise in utilizing open-source forensic tools for advanced data extraction, in-depth analysis, and digital evidence processing.	An	20%
CO3	Advanced practical knowledge in image hiding and recovery using Steganography tools, conduct in-depth metadata analysis of images (JPG) and videos (MP4) using EXIF viewers, and perform comprehensive time-based forensic analysis using Decode	An	20%
CO4	Utilize expertise in the Digital Forensics process through forensic imaging using a Write-blocker and Forensic Duplicator and performing comprehensive forensic examinations with Autopsy and FTK.	An	20%
CO5	Develop the ability to properly handle, preserve, and analyze digital evidence while ensuring integrity, chain of custody, and compliance with forensic best practices.	Ap	20%

UNIT - I DIGITAL INVESTIGATION	**(9)**
Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process - Investigative Reconstruction - Modus Operandi, Motive and Technology - Digital Evidence in the Courtroom.	

UNIT - II INFORMATION INVESTIGATION	(9)
Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers used by the most common CD and DVD writing applications	
UNIT – III COMPUTER BASICS FOR DIGITAL INVESTIGATORS	**(9)**
Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology - Steps taken by computer forensic specialists.	
UNIT – IV TYPES OF COMPUTER FORENSICS TOOLS AND TECHNOLOGY	**(9)**
Tools and Types of Military Computer Forensics Technology - Tools and Types of Law Enforcement Computer Forensic Technology - Tools and Types of Business Computer Forensic Technology	
UNIT – V ELECTRONIC DISCOVERY	**(9)**
Introduction to Electronic Discovery - Legal Context - Case management - Identification of Electronic Data - Forensic Preservation of Data - Data Processing - Production f electronic data - Case studies	
TOTAL (L: 45) = 45 PERIODS	

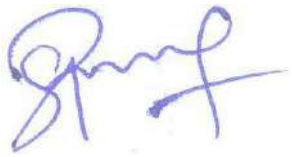
TEXT BOOKS:

1. Computer Forensics: Cyber Criminals, Laws and Evidence by Marie-Helen Maras, 1st edition, Jones and Bartlett Publishers, 1 February 2011
2. Computer Forensics, Computer Crime Scene Investigation by John.R.Vacca, 2nd Edition, Charles River Media Publication, 15 June 2002

REFERENCE:

1. Cyber Forensics: A field manual for collecting, Examining, preserving evidence of computer crimes by Albert Marcella, Jr., Doug Menendez, Second Edition, CRC Press 2007

2. Guide to Computer Forensics and Investigations, Processing Digital Evidence by Bill Nelson, Amelia Phillips, Christopher Steuart, 4th edition, Delmar Cengage Learning, 28 Oct 2009

3. Digital Forensics for Legal Professionals - Understanding Digital Evidence from the Warrant to the Courtroom by Larry Daniel, Lars Daniel, 1st edition, Syngress, 14 October 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	3
2	3	3	3	3									3	
3	3													
4	3													
5			3											3
CO (W.A)	**3**	**3**	**3**	**3**										**3**