NANDHA ENGINEERING COLLEGE

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

Curriculum and Syllabi

for

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

[CHOICE BASED CREDIT SYSTEM]

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

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

PROGRAM OUTCOMES:

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

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

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

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

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

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

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

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

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

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – R22 CHOICE BASED CREDIT SYSTEM

B.TECH – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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

*Ratified by Eleventh Academic Council

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

*Ratified by Eleventh Academic Council

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

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

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

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

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

** Ratified by Twelfth Academic Council

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AIC15	Full Stack Development**	PCC	-	3	3	0	0	3
2	22AIC16	Big Data Analytics	PCC	-	3	3	0	0	3
3	EM1	Elective – Management***	HSMC	-	3	3	0	0	3
4	E4	Elective (PEC)	PEC	-	3	3	0	0	3
5	E5	Elective (OEC/PEC)	PEC/OEC	-	3	3	0	0	3
6	E6	Elective (PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AIP11	Big Data Analytics Laboratory	PCC	-	4	0	0	4	2
				TOTAL	**22**	**18**	**0**	**4**	**20**

** Ratified by Twelfth Academic Council
***Ratified by Thirteenth 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	E7	Elective (PEC)	PEC	-	3	3	0	0	3
3	E8	Elective (OEC)***	OEC	-	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	22AID01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

*** Ratified by Thirteenth Academic Council

REGULATIONS – 2022	CHOICE BASED CREDIT SYSTEM

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

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

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

(b) Basic Science Courses(BSC)

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

(c) Engineering Science Courses (ESC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
2.	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
3.	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
4.	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
5.	22AIC01	Data structures using C	ESC	22CSC01	3	3	0	0	3
6.	22AIC02	Python Programming	ESC	-	3	3	0	0	3

7.	22AIP01	Data structures using C Laboratory	ESC	22CSP01	4	0	0	4	2
8.	22AIP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
9.	22AIC03	Digital Principles and Computer Organization	ESC	-	3	3	0	0	3
10.	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
11.	22AIC14	Internet of Things and its Applications	ESC	-	3	3	0	0	3
12.	22AIP10	Internet of Things and its Applications Laboratory	ESC	-	4	0	0	4	2

(d) Mandatory Courses (MC)

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

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

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

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

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

Vertical I : Machine Intelligence

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

Vertical II : Data Analytics

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

Vertical III : Cyber Security

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

Vertical IV : IoT

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

Vertical V : Web Development

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

Vertical VI : Software Development Engineering

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

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

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
3	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
4	22GEA04	Professional Ethics	HSMC	-	3	3	0	0	3
5	22GEZ01	Entrepreneurship Development	HSMC	-	3	3	0	0	3

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

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

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

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

(G) **Minor degree courses -Data Science**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CSM01	Data Science for Engineers	PEC	-	3	3	0	0	3
2	22CSM02	Fundamentals of Data Engineering	PEC	-	3	3	0	0	3
3	22CSM03	Data Analysis and Visualization	PEC	-	3	3	0	0	3
4	22CSM04	Machine Learning for Data Science	PEC	-	3	3	0	0	3
5	22CSM05	No SQL Databases	PEC	-	3	3	0	0	3
6	22CSM06	Security and Privacy in Data Science	PEC	-	3	3	0	0	3
7	22CSM07	Cloud Computing for Data Science	PEC	-	3	3	0	0	3
8	22CSM08	Business Intelligence for Decision Making	PEC	-	3	3	0	0	3

Semester/ Category	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	Total
I	4	8		10				22
II	4	4		15				23
III		4	19					23
IV		7	18					25
V			8	5		9		22
VI	3		8			6	3	20
VII	2				2	3	9	16
VIII					10			10
Total	13	28	53	25	12	18	12	161
R22%	8.1	17.4	32.9	15.4	7.4	11.1	7.4	
AICTE Credits Recommended	16	23	59	29	15	12	9	163
AICTE MODEL CURRI %	10%	14%	36%	18%	9%	7%	6%	

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

22MAN01 INDUCTION PROGRAMME
(For Common To All Branches)

	L	T	P	C
	0	0	0	0

PRE-REQUISITE: NIL

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

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

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

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

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

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

(i) Physical Activity

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

(ii) Creative Arts

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

(iii) Universal Human Values

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

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

(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

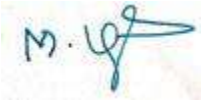
(ix) Department Specific Activities

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

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

REFERENCES:

1.Guide to Induction program from AICTE



22EYA01 - PROFESSIONAL COMMUNICATION - I (Common to All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To build essential English skills to address the challenges of communication • To enhance communication employing LSRW skills

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

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

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

LIST OF SKILLS ASSESSED IN THE LABORATORY

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

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

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCE:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

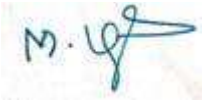
B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

WEB LINKS

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

Mapping of COs with POs / PSOs

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



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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

TOTAL (P:30) = 30 PERIODS

Mapping 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**		

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

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

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

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

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

List of Experiments

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

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

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

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

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

REFERENCES:

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

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

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

PRE-REQUISITE : NIL

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

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

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

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

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

Mapping of COs with POs / PSOs

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

*Ratified by Eleventh Academic Council

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

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

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

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

LIST OF SKILLS ASSESSED IN THE LABORATORY

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

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

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

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

22MYB03 – STATISTICS AND NUMERICAL METHODS

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

L	T	P	C
3	1	0	4

PRE-REQUISITE : NIL

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

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

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

*Ratified by Eleventh Academic Council

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

*Ratified by Eleventh Academic Council

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

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

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

*Ratified by Eleventh Academic Council

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

*Ratified by Eleventh Academic Council

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

*Ratified by Eleventh Academic Council

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

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : 22CSP01

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

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

LIST OF EXPERIMENTS:

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

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

Software:

Compiler – C

TOTAL (P:60) : 60 PERIODS

*Ratified by Eleventh Academic Council

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

*Ratified by Eleventh Academic Council

22AIP02 - PYTHON PROGRAMMING LABORATORY

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

L	T	P	C
0	0	4	2

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

TOTAL (P:60) = 60 PERIODS

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

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

22MEP01 - ENGINEERING GRAPHICS LABORATORY

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

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

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

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

LIST OF THE EXPERIMENTS:

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

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

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

PRE-REQUISITE : NIL

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

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

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

REFERENCES:

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

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

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

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

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

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

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

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

*Ratified by Eleventh Academic Council

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

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

TEXT-CUM-REFERENCE BOOKS

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

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

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

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

TEXT-CUM-REFERENCE BOOKS

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

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

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

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

TEXT-CUM-REFERENCE BOOKS

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

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

22GYA02 தமிழரும் தொழில்நுட்பமும் (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	1	0	0	1
முன் தேவை: இல்லை				

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

TEXT-CUM-REFERENCE BOOKS

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

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS:

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

REFERENCE:

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

Mapping of COs with POs / PSOs

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

22AIC05 – ARTIFICIAL INTELLIGENCE				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : 22AIC01

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

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

UNIT I - INTRODUCTION	**(9)**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.	
UNIT II - BRUTE FORCE AND DIVIDE-AND-CONQUER	**(9)**
Brute Force – Computing an – String Matching - Selection Sort and Bubble Sort – Sequential Search - Closest- Pair and Convex-Hull Problems - Exhaustive Search: Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort –Closest- Pair and Convex - Hull Problems.	
UNIT III - DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	**(9)**
Dynamic Programming : Computing a Binomial coefficient – Warshall's and Floyd's Algorithm – Optimal Binary Search trees - 0/1 Knapsack Problem. Greedy Technique: Prim's algorithm and Kruskal's Algorithm - Huffman Trees.	
UNIT IV - ITERATIVE IMPROVEMENT AND LIMITATIONS OF ALGORITHM POWER	**(9)**
Iterative Improvement - The Simplex Method - The Maximum-Flow Problem- Maximum Matching in Bipartite Graphs. Limitations of Algorithm Power: Lower bound arguments – Decision trees – P, NP and NP complete Problems.	

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

TEXT BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

UNIT I - EXPLORATORY DATA ANALYSIS	**(9)**
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.	
UNIT II – VISUALIZING USING MATPLOTLIB	**(9)**
Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.	
UNIT III - UNIVARIATE ANALYSIS	**(9)**
Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.	
UNIT IV - BIVARIATE ANALYSIS	**(9)**
Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.	
UNIT V - MULTIVARIATE AND TIME SERIES ANALYSIS	**(9)**
Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.	

LIST OF EXPERIMENTS:

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

HARDWARE:

Standalone Desktops with Linux OS

SOFTWARE:

Python

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

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

Software:

- Java / Equivalent Compiler

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS :

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

TOTAL (P:60) = 60 PERIODS

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

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

TOTAL (P:60) : 60 PERIODS

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

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

PRE-REQUISITE : NIL

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

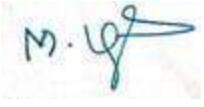
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Write grammatically correct and coherent sentences.	U	40%
CO2	Develop problem solving skills across all levels.	Ap	30%
CO3	Solve reasoning problems with ease.	An	30%

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

REFERENCES:

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

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



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

PRE-REQUISITE : NIL

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

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

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

REFERENCES:

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

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

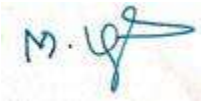
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain Knowledge about the Constitutional Law of India.	U	Internal Assessment
CO2	Know the Union Government and role of President and Prime Minister.	R	
CO3	Gain knowledge about State Government 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**		



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

PRE-REQUISITE : NIL

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

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

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

TEXT BOOKS:

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

RsEFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

UNIT IV – E- WASTE AND ITS MANAGEMENT	(9)

E-waste – sources of e-waste – hazardous substance in e-waste – chlorinated compounds – heavy metals - need for e-waste management – management of e-waste –Inventory management – production process – modification- Disposal treatment of e –waste – Incineration –acid baths – landfills.

UNIT V – BATTERIES AND RECYCLING OF E-WASTE (9)

Battery – types – Lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – process of recycling battery – lead acid battery – lithium ion battery – benefits of recycling battery – recycling of computing devices - mobile phones - PCB and servers.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

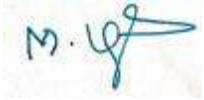
1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/080420202015128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

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



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

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

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

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

TEXT BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019. C

Mapping of COs with POs / PSOs

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

22AIC11-FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To understand the data analysis with an available data set.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of basic inferential statistics and sampling distribution	Ap	20%
CO2	Apply the knowledge to derive hypothesis for given data	Ap	20%
CO3	Analyze the case studies with sample data sets.	An	20%
CO4	Apply the techniques of analysis of variance.	Ap	40%
CO5	Design a model using predictive analytics techniques.	C	Internal Assessment

UNIT I – INFERENTIAL STATISTICS I	**(9)**
Populations–samples–randomsampling–probabilityandstatisticsSamplingdistribution–creatinga sampling distribution –mean of all sample means –standard error of the mean –other sampling distributions Hypothesis testing– z-test– z-test procedure–statement of the problem–null hypothesis– alternatehypotheses–decisionrule–calculations–decisions-interpretations	
UNIT II – INFERENTIALSTATISTICS II	**(9)**
Why hypothesis tests?–Strong or weak decisions–one-tailed and two-tailed tests–case studies Influence of sample size –power and sample size Estimation – point estimate –confidence interval – level of confidence – effect of sample size	
UNIT III - T-TEST	**(9)**
t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error–case studies t-test for two independent samples–statistical hypotheses–sampling distribution–test procedure–p-value–statistical significance–estimating effect size–meta analysis t-test for two related samples	
UNIT IV – ANALYSIS OF VARIANCE	**(9)**
F-test–ANOVA–estimating effect size–multiple comparisons–case studies Analysis of variance with repeated measures Two-factor experiments –three f-tests –two-factor ANOVA –other types of ANOVA Introduction to chi-square tests	

UNIT V – PREDICTIVE ANALYTICS	(9)
Linear least squares–implementation –goodness of fit –testing a linear model–weighted re-sampling Regression using Stats Models –multiple regression –nonlinear relationships –logistic regression – estimating parameters– accuracy Time series analysis– moving averages – missing values –serial correlation– autocorrelation Introduction to survival analysis	
TOTAL = 45 PERIODS	

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS :

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

TOTAL (P:60) = 60 PERIODS

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

22AIP07 - MACHINE LEARNING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS :

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

TOTAL (P:60) = 60 PERIODS

List of Equipments:(30 Students per Batch)

The programs can be implemented in either Python or R.

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

22AIP08-DATA SCIENCE AND ANALYTICS LABORATORY

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

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

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

LISTOF EXPERIMENTS:

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

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

Software:

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

TOTAL(P:60)=60PERIODS

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

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

PRE-REQUISITE : NIL

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

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

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

REFERENCES:

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

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

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

PRE-REQUISITE : NIL

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

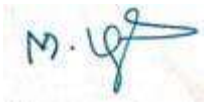
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with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

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

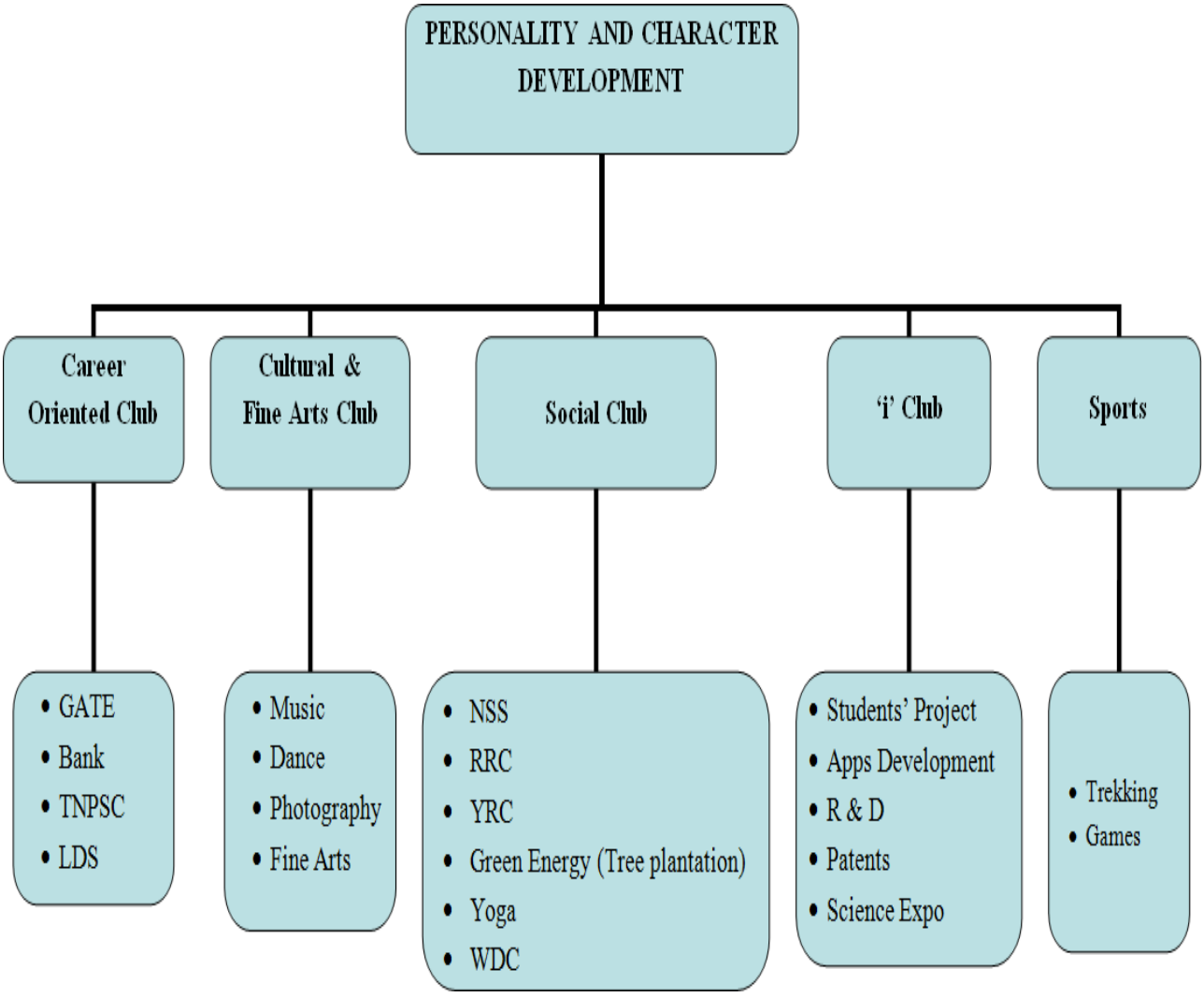
REFERENCES:

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

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



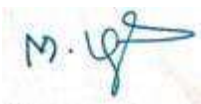
22GED01 – PERSONALITY AND CHARACTER DEVELOPMENT				
	L	T	P	C
	0	0	I	0
PRE-REQUISITE: NIL				



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

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

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



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

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

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

TEXT BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS *(Common to 22CIC05, 22ITC16,22CSC17)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

HARDWARE/SOFTWARE REQUIREMENTS

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

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS :

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

TOTAL (P:60) = 60 PERIODS

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

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

PRE-REQUISITE : NIL

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

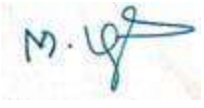
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns,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

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

REFERENCES:

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

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



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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22AIC16 - BIG DATA ANALYTICS *(Common to 22CSX13,22ITX13,22CSX25,22CIX12)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Acquire a deep understanding of big data and NoSQL. • Develop expertise in map reduce analytics using Hadoop and related tools • Explore the Hadoop related tools for Big Data Analytics.

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

LIST OF EXPERIMENTS:

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

TOTAL (P:60) = 60 PERIODS

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

22GEA01 UNIVERSAL HUMAN VALUES (Common To All Branches)				
	L	T	P	C
	2	0	0	2
PRE-REQUISITE : NIL				

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

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

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

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

TEXT BOOKS

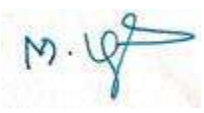
1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi

REFERENCES:

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

Mapping of COs with POs / PSOs

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



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

PRE-REQUISITE : NIL

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

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

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

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

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

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

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

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

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

22AIX01 - KNOWLEDGE ENGINEERING *(Common to 22CSX02,22ITX02,22CCX21)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To implement various techniques for knowledge acquisition and representation.

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

UNIT I – INTRODUCTION	(9)
Knowledge Representation and Reasoning – Syntax, Semantics, Pragmatics, Explicit and Implicit Belief - Expressing Knowledge – Resolution: Propositional Case-Handling Variables and Quantifiers-Dealing with Computational Intractability	
UNIT II – HORN CLAUSES	(9)
Horn Clauses-SLD Resolution-g SLD Derivations-Procedural Control of Reasoning - Rules in Production Systems: Production Rules- Conflict Resolution- Applications and Advantages	
UNIT III – OBJECT-ORIENTED REPRESENTATION	(9)
Objects and Frames-Frame Formalism-Frames to Plan a Trip-Beyond the Basics-Structured Descriptions-A Description Language-Meaning and Entailment-Computing Entailments-Taxonomies and Classification	
UNIT IV – INHERITANCE AND DEFAULTS	(9)
Inheritance Networks-Strategies for Defeasible Inheritance-A Formal Account of Inheritance Networks-Defaults: Introduction-Closed-World Reasoning-Circumscription-Default Logic-Autoepistemic Logic	
UNIT V – VAGUENESS, UNCERTAINTY AND DEGREES OF BELIEF	(9)
Noncategorical Reasoning-Objective Probability-Subjective Probability-Vagueness-Diagnosis-Explanation-Actions-Planning- Tradeoff between Expressiveness and Tractability.	
TOTAL (L:45) = 45 PERIODS	

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

22AIX05 - COMPUTER VISION *(Common to 22CSX05,22ITX05,22CIX16,22CCX23)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To impart knowledge and understanding about the application of algorithms and techniques used to interpret and analyze visual data from the world.				

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

22AIX08 - ROBOTICS PROCESS AUTOMATION *(Common to 22CSX08,22ITX08,22CIX18,22CCX38)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To implement the fundamental concepts of AI in robotics and the major paradigms for achieving it.			

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

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

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

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22AIX15 - PREDICTIVE ANALYTICS *(Common to 22CSX15,22ITX15,22CIX25)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Proficient in different predictive modeling approaches, such as regression analysis, classification, and clustering.

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

22AIX16 - IMAGE AND VIDEO ANALYTICS *(Common to 22CSX16,22ITX16,22CIX26,22CCX27)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide a broad view on processing and analyzing images and videos.				

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

22AIX18 - AUGUMENTED REALITY AND VIRTUAL REALITY *(Common to 22CSX18,22ITX18,22CIX28)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	• To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies.				

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

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

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

TEXT BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

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

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

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

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

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

22AIX24 - DATA PRIVACY AND PROTECTION *(Common to 22CSX26,22ITX26,22CCX06)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide students with a comprehensive understanding of how to safeguard personal and sensitive data from unauthorized access, breaches, and misuse.

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

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

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

TEXT BOOKS

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

REFERENCES

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

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

Mapping of COs with POs / PSOs

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

22AIX26 - MOBILE DEVICE SECURITY *(Common to 22CIX37,22CCX11)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To equip students with the knowledge and skills necessary to protect mobile devices and the data they hold.

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

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

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

TEXTBOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

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

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

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

TEXTBOOKS:

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

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explain the basics of digital forensics process.	AP	20%
CO2	Describe about digital crime and investigations procedures.	An	20%
CO3	Outline the Frameworks, Standards and Methodologies for digital forensics.	AP	20%
CO4	Identify the digital evidences and tools for iOS devices	AP	20%
CO5	Create clear and detailed forensic reports that summarize findings, methodologies, and conclusions, suitable for legal proceedings or organizational review.	C	20%

UNIT I - INTRODUCTION	**(9)**
Introduction - Computer Forensics Fundamentals, Types of Computer Forensics Technology, Types of Computer Forensics Systems; Vendor and Computer Forensics Services.	
UNIT II - COMPUTERFORENSICSEVIDENCEAND CAPTURE	**(9)**
Computer forensics evidence and capture - Data Recovery - Evidence Collection and Data Seizure - DuplicationandPreservationofDigitalEvidence-ComputerImageVerificationandAuthentication.	
UNIT III - COMPUTER FORENSIC ANALYSIS	**(9)**
Discover of Electronic Evidence - Identification of Data, Reconstructing Past Events - Fighting against Macro Threats; Tactics of the Military - Tactics of Terrorist and Rogues -Tactics of Private Companies.	
UNIT IV - INFORMATION OPERATIONS	**(9)**
Arsenal and Surveillance Tools - Hackers and Theft of Components, Contemporary Computer Crime, Identity Theft and Identity Fraud; Organized Crime &Terrorism - Applying the First Amendment to Computer Related Crime, The Fourth Amendment and other Legal Issues.	

UNIT V – DIGITAL FORENSIC CASES	(9)
Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence, Processing Evidence and Report Preparation, - Future Issues.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. JohnR.Vacca, "Computer Forensics: Computer Crime Scene Investigation", CengageLearning,2nd Edition,
   2005.
2. MarjieTBritz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2ndEdition,2008.

REFERENCES:

1. Cyber security – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication 2019.
2. The basics of digital Forensics (Latest Edition)–The primer for getting started in digital forensics by John Sammons–ElsevierSyngressImprint2015.
3. Practical Digital Forensics – Richard Boddington [PACKT] Publication, Open-source community2010.
4. MajidYar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover,2nd Edition, 2013.

Mapping of COs with POs / PSOs

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

22AIX31 - INDUSTRIAL & MEDICAL IOT *(Common to 22CSX31,22ITX31,22CIX01,22CCX31)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with good depth of knowledge of Designing Industrial and Medical IoT Systems for various applications. • Students will learn the new evolution in hardware, software, and data				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply data management techniques to analyze and manipulate IIoT data, using tools for basic analytics and mining.	Ap	20%
CO2	Analyze various attack types targeting IoMT devices and systems, demonstrating the ability to identify specific vulnerabilities in real-world scenarios.	An	20%
CO3	Apply the IoMT system architecture by designing a basic framework that includes data collection, management, and server layers, ensuring proper integration of each component.	Ap	40%
CO4	Analyze the impact of smart medicinal packages on medication adherence, examining data on patient outcomes and adherence rates.	An	20%
CO5	Analyze case studies from various industrial IoT domains, focusing on operational efficiency, safety improvements, and sustainability impacts.	An	Internal Assessment

UNIT I- INTRODUCTION TO INDUSTIAL IOT (IIOT)	(9)
Introduction to IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT	
UNIT II - INTERNET OF MEDICAL THINGS SECURITY THREATS, SECURITY CHALLENGES AND POTENTIAL SOLUTIONS	(9)
IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.	
UNIT III - INTERNET OF MEDICAL THINGS INTRODUCTION AND SYSTEM ARCHITECTURE	**(9)**
Introduction, IoMT Devices-On-Body Devices, In-Home Devices, Community Devices, In-Clinic Devices, In- Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer.	

UNIT IV – HEALTH CARE TECHNOLOGIES & IoMT	(9)
Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases-What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare.	
UNIT V – APPLICATION DESIGN & CASE STUDY	**(9)**
Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process. Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.
2. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.
3. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.

REFERENCES:

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
2. Aboul Ella Hassanien, NilanjanDey and SureakaBoara, Medical Big Data and Internet of
3. Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

Mapping of COs with POs / PSOs

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

22AIX32 - BLOCKCHAIN TECHNOLOGY *(Common to 22CSX32,22ITX32,22CIX02)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To impart knowledge of distributed ledgers in business • To acquire knowledge in emerging concepts using blockchain				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of blockchain technology to articulate their significance.	Ap	20%
CO2	Evaluate the effectiveness of different consensus algorithms in specific blockchain applications.	An	20%
CO3	Evaluate their impact on security and privacy in digital transactions.	An	20%
CO4	Implement a strategic plan for integrating specific distributed ledger technologies into a business environment, considering operational efficiency, security, and regulatory compliance.	Ap	20%
CO5	Apply appropriate techniques to manage trust-based business networks, considering societal, environmental, economic, and global perspectives.	Ap	20%

UNIT I –INTRODUCTION	(9)
The growth of blockchain technology – Distributed Systems – P2P – Distributed Ledger – Cryptographically Secure - Generic Element of Blockchain – Benefits and limitations of blockchain - Block chain Challenges - Tiers of BT – Types of Blockchain - Consensus.	
UNIT II –DECENTRALIZATION	(9)
Methods of Decentralization – Routes to Decentralization – Smart Contract – Decentralized Organization – Platforms for Decentralization – Consensus Algorithms.	
UNIT III –CRYPTOCURRENCIES	(9)
Cryptographic Hash Functions – Cryptography basic and Concepts – Introduction Bitcoin – Bitcoin Network and Payments – Bitcoin clients and APIs – Alternative Coins.	
UNIT IV -DISTRIBUTED LEDGERS FOR BUSINESS	(9)
Ethereum: Introduction – Ethereum Network – Components – Programming Languages; Hyperledger: Introduction – Reference Architecture – Fabric – Sawtooth Lake – Corda.	

UNIT V -BLOCKCHAIN DEVELOPMENT TOOLS AND FRAMEWORKS	(9)
Compilers: Solidity Complier – Ganache – Metamask – Truffle; Languages: Solidity – Go – Java – NodeJS; Blockchain Use case: Financials – Insurance - Supply Chain Management – HealthCare – IoT.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
2. Imran Bashir, "Mastering Blockchain" Packt 2nd Ediction, 2018.

REFERENCES:

1. Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.
2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.

Mapping of COs with POs / PSOs

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

22AIX33 - BEYOND 5G AND IOT TECHNOLOGIES *(Common to* 22CSX33,22ITX33,22CIX03,22CCX33)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Explore the evolution from 5G to 6G and the implications for data rates, latency, and connectivity. • Examine the role of edge computing in reducing latency and improving real-time data processing in IoT systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of key capabilities and requirements of 5G to evaluate their implications for specific industry applications, such as IoT, smart cities, and autonomous vehicles.	Ap	20%
CO2	Analyze the specific requirements for 5G waveform design, including spectral efficiency, flexibility, and resilience to interference.	An	20%
CO3	Apply knowledge of the 5G architecture framework to design a basic model of a 5G network, incorporating elements such as the Radio Access Network (RAN) and core network components.	Ap	40%
CO4	Analyze the theoretical foundations of multi-antenna systems, identifying key requirements and performance indicators essential for effective MIMO operation.	An	20%
CO5	Conduct a detailed case study on a specific implementation of V2X or terahertz communication technology, evaluating its design, performance outcomes, and lessons learned.	An	Internal Assessment

UNIT I- OVERVIEW OF 5G WIRELESS COMMUNICATIONS	**(9)**
Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.	
UNITII-WAVEFORM DESIGN FOR 5G & BEYOND	**(9)**
Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multicarriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods.	
UNITIII- 5G ARCHITECTURE AND 5G NEXTGEN CORE NETWORK	**(9)**
5G Architecture: Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements	

UNIT IV - MASSIVE MIMO SYSTEMS	(9)
Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming.	
UNITV -V2X COMMUNICATIONS AND NOVEL ASPECTS IN TERAHERTZ WIRELESS COMMUNICATIONS	**(9)**
Vehicle-to-Vehicle (V2V) Communications, Vehicle-to-Infrastructure (V2I) Communications, Vehicle-to-Pedestrian (V2P) Communication, Self-driving Vehicles & its challenges, Vehicle-to-Network (V2N) Communications.Overview, potential spectral windows at THz frequencies, Terahertz wave propagation characteristics, opportunities & challenges, application	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
2. Suvra Sekhar Das and Ramjee Prasad, "Evolution of Air Interface Towards 5G: Radio Access Technology andPerformance Analysis", Gistrup, Denmark: River Publishers series in Communication, 2018.
3. Wei Xiang, KanZheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer publications-2016.
4. William Stallings "5G Wireless: A Comprehensive Introduction", Pearson Education, 2021.
5. AfifOsseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology"Cambridge University Press-2016.

REFERENCES:

1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK,2017.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.

Mapping of COs with POs / PSOs

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

22AIX34 – PROGRAMMING FOR IoT BOARDS *(Common to 22CSX34,22ITX34,22CIX04,22CCX34)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce Internet of Things (IoT) environment and its technologies for designing smart systems • To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Investigate various challenges and explore open source hardware prototyping platforms for designing IoT devices	Ap	20%
CO2	Analyze basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world	An	20%
CO3	Apply knowledge on Tkinter GUI using python in different sensors	Ap	20%
CO4	Program SBC by exploring protocols, data conversion process, API and expansion boards for practical IoT devices using Python	Ap	20%
CO5	Apply embedded programming constructs and constraints in real time systems for real world socio-economic problems	Ap	20%

UNIT I- INTRODUCTION TO RASPBERRY PI	**(9)**
Raspberry Pi components-Installation of NOOBS and Raspbian on SD card- Terminal commands-Installation of Libraries on Raspberry pi- Getting the static IP address of Raspberry Pi-run a program-Installing the remote desktop server.	
UNIT II - INTERFACING WITH RASPBERRY PI	**(9)**
Interfacing of relay with raspberry Pi-LCD-DHT11 sensor-ultrasonic sensor- camera-play with digital sensor, analog sensor and actuator.	
UNIT III – PYTHON GUI WITH TKINTER	**(9)**
Tkinter for GUI design-LED Blink-brightness control-selection from multiple options-Reading a PIR sensor-Reading a analog sensor.	
UNIT IV – DATA ACQUISITION WITH PYTHON	**(9)**
Basics-CSV File- Storing Arduino data with CSV file- plotting random numbers using Matplotlib-Plotting real time from arduino- Integrating the plots in the TKinter window.	

UNIT V – CONNECTING TO THE CLOUD	(9)
Smart IoT systems- DHT11 data logger with thinkspeak server-ultrasonic sensor data logger-air quality monitoring system-landslide detection and disaster management system-smart motion detector and upload image to gmail.com.	

TEXT BOOKS :

1. Rajesh singh, AnithaGehlot, Lovi raj gupta, Bhupendrasingh and MahendranSwain "Internet of things with Raspberry Pi and Arduino" CRC Press 2020.

REFERENCES:

1. SaiYamanoor, SrihariYamanoor " Python programming with Raspberry Pi" Packet Publishing Ltd, Ist edition, 2017.
2. Wolfram Donat "Learn raspberry Pi programming in python" A Press 2014.

Mapping of COs with POs / PSOs

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

22AIX35 – PRIVACY AND SECURITY IN IOT *(Common to 22CIC12)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge on the state of the art methodologies and security in internet of things. • To implement the blockchain Technology and Privacy Preservation in Internet of Things (IoT).

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement the security mechanisms from the designing to the deployment of the IOT system using suitable protocols.	Ap	40%
CO2	Analyze IOT applications which are suitable for using Blockchain technology in development.	An	20%
CO3	Implement the privacy protection and preservation schemes for IOT applications	Ap	20%
CO4	Analyze the IOT application and select appropriate trust model for improving the security	An	20%
CO5	Review the literature related to Privacy and Security in IOT and presents a report with example application.	U	Internal Assessment

UNIT I - SECURITY IN IOT, NETWORK ROBUSTNESS AND MALWARE PROPAGATION CONTROL IN IOT	(9)
IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle. Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification - Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.	
UNIT II -BLOCKCHAIN TECHNOLOGY IN IOT, PRIVACY PRESERVATION IN IOT	(9)
Technical Aspects - Integrated Platforms for IoT Enablement - Intersections between IoT and Distributed Ledger - Testing at scale of IoTBlockchain Applications - Access Control Framework for Security and Privacy of IoT - Blockchain Applications in Healthcare. Privacy Preservation Data Dissemination: Network Model, Threat Model - Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building.	

UNIT III - PRIVACY PROTECTION IN IOT	(9)
Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing	
UNIT IV - TRUST MODELS FOR IOT	(9)
Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT.	
UNIT V - SECURITY PROTOCOLS FOR IOT ACCESS NETWORKS	(9)
Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers - Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

1. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK
2. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.
3. Whitehouse O Security of things: An Implementers' guide to cyber-security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Mapping of COs with POs / PSOs

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

22AIX36 - WEARABLE COMPUTING *(Common to 22CSX36,22ITX36,22CIX05,22CCX36)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Explore various applications of wearable computing across industries, such as healthcare, sports, entertainment, and fitness. • Examine the technical challenges associated with wearable systems, including power management, data accuracy, and user comfort.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply theoretical knowledge to practical situations, fostering skills in design, evaluation, and innovative thinking within the field of wearable technology.	Ap	20%
CO2	Analyze different signal processing techniques can be integrated into wearable systems to improve data quality and user experience.	An	20%
CO3	Apply knowledge of different wireless communication techniques to evaluate their suitability for implementing BANs in healthcare settings.	Ap	40%
CO4	Apply theoretical knowledge to practical challenges in wireless health systems, fostering skills in design, problem-solving, and innovation within the context of healthcare technology.	An	20%
CO5	Analyze case studies focused on wearable technologies used for monitoring patients with chronic diseases, assessing their impact on patient care and management.	An	Internal Assessment

UNIT-I INTRODUCTION TO WEARABLE SYSTEMS	(9)
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems- Wearable ground reaction force sensor.	
UNIT-II SIGNAL PROCESSING	(9)
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation**.**	
UNIT-III WIRELESS HEALTH SYSTEM	**(9)**
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges-System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.	

UNIT-IV SMART TEXTILE	(9)
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study- smart fabric for monitoring biological parameters - ECG, respiration.	
UNIT-V APPLICATIONS OF WEARABLE COMPUTING	**(9)**
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Title: "Wearable Sensors: Fundamentals, Implementation and Applications" Author: Edward Sazonov, Sergey G. Togov Publisher: Elsevier Year: 2014

REFERENCES:

1. Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Subhas Chandra Mukhopadhyay.
2. "Wearable Sensors: Fundamentals, Implementation, and Applications" edited by Robert Matthews and Alberto Piaggesi.
3. "Wearable Sensors and Systems" edited by Mehmet R. Yuce.

Mapping of COs with POs / PSOs

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

22AIX37 – FOG AND EDGE COMPUTING *(Common to 22CSX37,22ITX37,22CIX06,22CCX37)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce IoT enabling technologies and its opportunities. • To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explore technologies behind the communication and management of fogs and edge resources.	Ap	20%
CO2	Analyze the techniques for storage and computation in fogs, edges and clouds.	An	20%
CO3	Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same	Ap	40%
CO4	Analyze the goals of middleware for fog and edge computing.	An	20%
CO5	Review the performance and issues of the applications developed using fog and edge architecture.	Ap	Internal Assessment

UNIT I- Internet of Things (IoT) and New Computing Paradigms	**(9)**
Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges	
UNIT II - Challenges in Federating Edge Resources	**(9)**
Introduction –the networking challenge - the management challenge- Miscellaneous challenges - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics.	
UNIT III – Optimization Problems in Fog and Edge Computing	**(9)**
Introduction- Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing – optimization Techniques.	
UNIT IV – Middleware for Fog and Edge Computing	**(9)**
Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Fog Data Management - Smart Building - Predictive Analysis with FogTorch .	

UNIT V – Applications of Fog and Edge Computing	**(9)**
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.	
TEXT BOOKS : 1. Buyya, Rajkumar, and SatishNarayanaSrirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.	
REFERENCES: 1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2ndedition, CreateSpace Independent Publishing Platform, USA 2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India	

Mapping of COs with POs / PSOs

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

22AIX38 - MOBILE APPLICATION DEVELOPMENT FOR IOT *(Common to 22CIC16)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To introduce mobile design principles and implementation of Application development with Android and IOS. • To develop competency in the students to independently design and develop their own professional apps.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyzes the fundamental mobile application architecture for IoT through outlining.	An	20%
CO2	Evaluates the design constraints for mobile applications, ensuring performance, usability, security, availability, and modifiability.	An	20%
CO3	Implements IoT applications using standardized hardware and software platforms.	Ap	20%
CO4	Apply low power communication technologies to create a prototype.	Ap	20%
CO5	Create an IoT solution development plan from a Product management perspective.	C	20%

UNIT I -INTRODUCTION TO IOT ECOSYSTEM	(9)
IoT ecosystem; Industry 4.0; Application development platforms for IoT; IoT Data sources - GPS and WIFI integration with social media applications.	
UNIT II - BASIC DESIGN	(9)
Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.	
UNIT III - SENSOR DATA PROCESSING	(9)
Sensor Data-Gathering and Data-Dissemination Mechanisms; Sensor Database system architecture; Sensor data-fusion mechanisms; Data-fusion Architectures and models.	

UNIT IV - PROGRAMMING FRAMEWORKS FOR INTERNET OF THINGS	(9)
IoT Programming Approaches: Node-Centric Programming - Database approach - Model-Driven Development - IoT Programming Frameworks: Android Things - ThingSpeak - IoTivity - Node-RED - DeviceHive - Contiki and Cooja – Zetta.	
UNIT V - COMMUNICATION TECHNOLOGIES FOR LOW POWER WIRELESS INTERACTIONS	(9)
Wireless communications in product development – Bluetooth LE - Near Field Communications (NFC) – WiFi; Prototyping Bluetooth LE with ArduinoNano; Power management strategies and practices - Case Study: E-Health - Telemedicine.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
2. Lea, Perry. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 1st edition, Packt Publishing Ltd, 2018.

REFERENCES:

1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press,2019
2. GiacomoVeneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packt Publishing,2018

Mapping of COs with POs / PSOs

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

22AIX41 - CLOUD COMPUTING *(Common to 22CSX41,22ITC15,22CIX44)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of virtualization and Experiment with virtualization of hardware resources and Docker.	Ap	40%
CO2	Analyze various cloud programming models and apply them to solve problems on the cloud.	An	20%
CO3	Develop and deploy services on the cloud and set up a cloud environment.	Ap	20%
CO4	Evaluate the security issues related to cloud computing and handle the security threats and construct different cloud delivery design models.	An	20%
CO5	Build cloud solutions for the societal problems.	C	Internal Assessment

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE	**(9)**
Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges	
UNIT II -VIRTUALIZATION BASICS	**(9)**
Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.	
UNIT III -VIRTUALIZATION INFRASTRUCTURE AND DOCKER	**(9)**
Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories	

UNIT IV -CLOUD DEPLOYMENT ENVIRONMENT	(9)
Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack	
UNIT V -CLOUD SECURITY	**(9)**
Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

Mapping of COs with POs / PSOs

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

22AIX42 - UI AND UX DESIGN *(Common to 22CSX42,22ITX42,22CIX45,22CCX41)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To understand fundamental concepts of UI/UX design and to develop real time applications.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply UI design concepts for building user Applications.	Ap	20%
CO2	Demonstrate UI Design of any product or application.	An	20%
CO3	Evaluate UX Skills in product development.	Ap	20%
CO4	Create Wireframe and Prototype and learns to design successful products through personas and ideation.	An	40%
CO5	Present their web design demonstrating teamwork and reflective learning.	Ap	Internal Assessment

UNIT I - FOUNDATIONS OF DESIGN	**(9)**
UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.	
UNIT II - FOUNDATIONS OF UI DESIGN	**(9)**
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.	
UNIT III - FOUNDATIONS OF UX DESIGN	**(9)**
Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals- FIGMA tool	
UNIT IV - WIREFRAMING, PROTOTYPING AND TESTING	**(9)**
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.	
UNIT V – RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE	**(9)**
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.	

TEXT BOOKS:
1. Joel Marsh, "UX for Beginners", O'Reilly , 2022. 2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021.
REFERENCES:
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rdEdition , O'Reilly 2020. 2. Steve Schoger, Adam Wathan "Refactoring UI", 2018. 3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015. 4. https://www.nngroup.com/articles/ 5. https://www.interaction-design.org/literature.

Mapping of COs with POs / PSOs

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

22AIX43 – DEVOPS *(Common to 22CSX43,22ITX43,22CIX46,22CCX46)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To introduce DevOps terminology, definition & concepts, version control tools and configuration management.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyse different actions performed through Version control tools like Git	An	20%
CO2	Apply Jenkinsfor Continuous Integration and Continuous Testing and Continuous Deployment by building automating test cases using Maven & Gradle.	Ap	30%
CO3	Design configuration management application using Ansible	An	20%
CO4	Implement the configuration management using Ansible and leverage Cloud-based DevOps tools using Azure DevOps	An	30%
CO5	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems	An	Internal Assessment

UNIT I- INTRODUCTION TO DEVOPS	**(9)**
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.	
UNIT II - COMPILE AND BUILD USING MAVEN & GRADLE	**(9)**
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle	
UNIT III - CONTINUOUS INTEGRATION USING JENKINS	**(9)**
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.	
UNIT IV - CONFIGURATION MANAGEMENT USING ANSIBLE	**(9)**
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible	
UNIT V – BUILDING DEVOPS PIPELINES USING AZURE	**(9)**
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file	

TEXT BOOKS :

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. by Mitesh Soni
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
5. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
6. https://www.jenkins.io/user-handbook.pdf
7. https://maven.apache.org/guides/getting-started/

Mapping of COs with POs / PSOs

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

22AIX44 - PRINCIPLES OF PROGRAMMING LANGUAGES *(Common to 22CSX44,22ITX44,22CCX47)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	• To understand design concepts for programming languages.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply programming languages for problem solving.	Ap	20%
CO2	Analyze object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog.	Ap	40%
CO3	Design a solution for given problem using programming languages structures	An	20%
CO4	Demonstrate the different functionalities of programming languages.	An	20%
CO5	Make an Oral presentation related to course.	Ap	Internal Assessment

UNIT I -SYNTAX AND SEMANTICS	(9)
Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing	
UNIT II -DATA, DATA TYPES, AND BASIC STATEMENTS	(9)
Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements	
UNIT III - SUBPROGRAMS AND IMPLEMENTATIONS	(9)
Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions -implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping.	
UNIT IV - OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING	(9)
Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – statement level concurrency – Event handling	

UNIT V – FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	(9)
Introduction to lambda calculus – fundamentals of functional programming languages -Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Robert W. Segesta, Concepts of Programming Languages, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, Programming Language Pragmatics, Fourth Edition, Elsevier, 2018.
3. Jeffrey D. Ullman, Elements of programming, Second Edition, Pearson, 1997.
4. W. F. Clocksin and C. S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

REFERENCES:

1. Ghezzi, —Programming Languages‖, 3rd Edition, John Wiley, 2008
2. John C. Mitchell, —Concepts in Programming Language, Cambridge University Press, 2004

Lutz M, "Programming Python", SPD/O'reilly, (4th Edition),(2015).

3. Allen Tucker, Robert Noonan, "Programming Languages: Principles and Paradigms", Tata McGraw Hill, (2nd edition),(2007).

Mapping of COs with POs / PSOs

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

22AIX45 - MEAN STACK DEVELOPMENT *(Common to 22CSX45,22ITX45,22CIX56,22CCX45)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To build complex web application with using minimum code.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Node JS and NOSQL concepts for front end and back-end design	Ap	40%
CO2	Analyse the various stacks available for web application development and finds the best for given application.	An	20%
CO3	Design responsive pages using scripting technologies and Mongo DB.	Ap	20%
CO4	Implement interactive web pages using Angular JS	An	20%
CO5	Involve in independent study and aware of technological advances related to the course	An	Internal Assessment

UNIT I- INTRODUCTION TO NOSQL DATABASE	**(9)**
Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	
UNIT II - Node JS	**(9)**
Introduction – Architecture – Features- Creating Web Servers with HTTP -Request - Response – Event Handling - GET and POST Methods –File Upload - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.	
UNIT III MONGO DB	**(9)**
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications	
UNIT IV–TYPESCRIPT AND ANGULAR	**(9)**
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces. Angular : Introduction - Needs - Evolution – Features – Architecture - Setup and Configuration – Components and Modules –Templates - Controllers – Scope – Directives – Data Binding.	
UNIT V - ANGULARJS FRAMEWORK	**(9)**
Pipes/Filters -DOM – Events - Routing - Services – HTTP – Ajax– Template Driven Forms - Reactive Forms – Form Validation – Basic Animations.	

TEXT BOOK:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

REFERENCE:

1. https://www.javatpoint.com

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

22AIX46 - SOCIAL AND INFORMATION NETWORKS *(Common to 22CSX46,22ITX46,22CIX47,22CCX43)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• To determine the theories and methods for analyzing network data, understanding network formation, and applying network analysis to real-world problems.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply various techniques for analyzing and visualizing network data.	Ap	25%
CO2	Analyze the efficiency of different measurements and metrics of social network.	An	25%
CO3	Develop real-world applications of network analysis in various domains.	Ap	25%
CO4	Implement the solutions for problems in case studies related to social and information networks.	An	25%
CO5	Abide by the norms of professional ethics in information sharing in social networks.	Ap	Internal Assessment

UNIT I- INTRODUCTION TO SOCIAL AND INFORMATION NETWORKS	(9)
Overview of social and information networks - Basic terminology and concepts - Types of networks :Social networks, Information networks, Citation networks - Network Representations and Data Formats	
UNIT II – NETWORK STRUCTURE AND PROPERTIES AND MODELS	(9)
Degree distribution and Power loss – Clustering Co-efficients – Small World Phenomenon – Network Motifs and Patterns. Random Graphs – Scale Free Networks – Exponential Random Graphs – Preferential attachment Models	
UNIT III – INFORMATION DIFFUSION AND COMMUNITY DETECTION	(9)
Models of Information Diffusion – Influence Maximization – Contagion Models – Cascading behavior in networks – Community detection: Modularity and Community structure – Clustering algorithms : Louvain, Girvan-Newman – overlapping communities – Evaluation metrics for community detection	

UNIT IV – ALGORITHMIC ASPECTS OF NETWORK ANALYSIS	(9)
Network resilience and Robustness: Vulnerability of networks to nodes and edge removal – Resilience strategies – Robustness metrics – Cascading failures and network collapse. Algorithmic Aspects of Network Analysis: Centrality measures: Degree centrality and Betweenness centrality - Page Rank Algorithm - Network Embedding Techniques - Graph Neural Networks	
UNIT V – APPLICATIONS OF SOCIAL AND INFORMATION NETWORKS	(9)
Social media analysis – Recommender system – Epidemiology and disease spread modeling – Online advertising and viral marketing	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World" by David Easley and Jon Kleinberg, first edition,2010
2. "Network Science" by Albert-Laszlo Barabasi,first edition, 2016
3. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell, Second edition, O'Reilly Media , 2019

REFERENCES:

1. **"Social Network Analysis: Methods and Applications" by Stanley Wasserman and Katherine Faust**:
2. **"The Structure and Dynamics of Networks" by Mark Newman**,This book covers the fundamental principles of network theory, including network structure, dynamics, and applications in various fields.

Mapping of COs with POs / PSOs

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

22AIX47 - WEB MINING *(Common to 22CSX47,22ITX47,22CIX57,22CCX44)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To learn techniques for extracting knowledge from Web content as a basis for business decisions and applications.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key concepts of Web mining to discover useful information from the World-Wide Web and its usage patterns	Ap	25%
CO2	Analyse the data on web using crawlers and extract strutured data.	An	25%
CO3	Compare various methods of web data mining and its applications	Ap	25%
CO4	Demonstrate various pattern discovery and analysis techniques	An	25%
CO5	Ability to read and comprehend research articles related to the course.	An	Internal Assessment

UNIT I- INTRODUCTION -WEBSEARCH	**(9)**
Basic Concepts – Information Retrieval Models - Evaluation Measures – Text and Web Page Pre-processing – Inverted Index and its compression – Latent Sematic Indexing – Web Search – Meta-Searching and CombiningMultipleRankings–WebSpamming.	
UNIT II - WEBCRAWLING	**(9)**
BasicCrawlerAlgorithm–ImplementationIssues–UniversalCrawlers–FocusedCrawlers–TopicalCrawlers–Evaluation–CrawlerEthicsand Conflicts.	
UNIT III - STRUCTURED DATA EXTRACTION	**(9)**
Structured Data Extraction –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matchingand Tree Matching – Multiple Alignment – Building DOM Trees – Extraction Based on a Single List Page –IntroductiontoSchemaMatching–Pre-ProcessingforSchemaMatching-Schema–LevelMatch– DomainandInstance-Level Matching	
UNIT IV - WEBUSAGEMINING	**(9)**
WebUsageMining–ClickstreamAnalysis–LogFiles–DataCollectionandPre-Processing–DataModelingforWebUsageMining–TheBIRCHClusteringAlgorithm–AffinityAnalysisandtheAPrioriAlgorithm–DiscretizingtheNumericalVariable	

UNIT V – OPINION MINING	(9)
The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification –Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion SpamDetection.	

TEXT BOOKS :

1. Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)",Springer;2nd Edition2011forunitsI,II,III&V

2. ZdravkoMarkov,DanielT.Larose,"DataMiningtheWeb:UncoveringPatternsinWebContent,Structure,andUsage",JohnWiley& Sons, Inc.,2010for unit IV.

REFERENCES:

1 AnthonyScime,"WebMiningApplicationsandTechniques",IdeaGroupPub.,2005

Mapping of COs with POs / PSOs

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

22AIX48 - MULTIMEDIA DATA COMPRESSION AND STORAGE *(Common to 22CSX48,22ITX48,22CIX48,22CCX48)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• Apply data compression algorithms • Explain Multimedia Information Sharing

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply compression algorithms related to multimedia components such as text,speech,audio,image and video.	Ap	20%
CO2	Analyze the various image compression techniques and apply efficient technique for multimedia content	An	20%
CO3	Design a video using advanced video compression techniques and ensure efficient disk placement.	An	40%
CO4	Implement scheduling methods for request streams	An	20%
CO5	Submit a Multimedia presentation on assigned topics related to course	An	Internal Assessment

UNIT I- BASICS OF DATA COMPRESSION	**(9)**
MULTIMEDIA: Introduction-Uses of multimedia, Text, Images, Sound, Animation, Video—Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications	
UNIT II - IMAGE COMPRESSION	**(9)**
Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding	
UNIT III - VIDEO COMPRESSION	**(9)**
Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.	
UNIT IV - DATA PLACEMENT ON DISKS	**(9)**
Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.	
UNIT V – DISK SCHEDULING METHODS	**(9)**
Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams	

TEXT BOOKS:

1. 1.KhalidSayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

Mapping of COs with POs / PSOs

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

22AIX51 - AGILE METHODOLOGIES *(Common to 22CSX51,22CIX43)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Estimate in an incremental and iterative fashion using practical techniques • Apply agile principles to a range of decision possibilities.

Course Outcomes Students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the ethical considerations and team dynamics	An	20%
CO2	Apply scrum practices in project management	Ap	30%
CO3	Interpret and utilize agile metrics for informed decision-making	An	30%
CO4	Conduct Effective Requirements Engineering in Agile	An	20%
CO5	Apply agile testing practices to ensure high product quality.	Ap	Internal Assessment

UNIT I – AGILE METHODOLOGY	**(9)**
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values	
UNIT II - AGILE PROCESSES	**(9)**
Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.	
UNIT III - AGILITY AND KNOWLEDGE MANAGEMENT	**(9)**
Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM)	

UNIT IV - AGILITY AND REQUIREMENTS ENGINEERING	(9)
Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.	
UNIT V - AGILE TESTING	**(9)**
The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools : Jira	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints or Business Results", Prentice Hall, 2003
2. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson, 2002.
3. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009

REFERENCES:

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions, Springer-Verlag Berlin Heidelberg, 2010
2. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.

Mapping of COs with POs / PSOs

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

22AIX52 - SOFTWARE DEFINED NETWORKS *(Common to 22CSX52,22ITX52,22CCX52)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Gain knowledge in networking fundamentals and conceptual understanding of Software Defined Networks (SDN)				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the conventional network and SDN paradigm	An	20%
CO2	Analyze the flexibility and scalability of using SDN in terms of innovation and network management	An	20%
CO3	Apply troubleshooting on various components of SDN networks	Ap	20%
CO4	Evaluate the security challenges in SDN paradigm	An	20%
CO5	Evaluate the emerging SDN applications	Ap	20%

UNIT I – INTRODUCING SOFTWARE DEFINED NETWORKS	**(9)**
SDN Origins and Evolution – Introduction : SDN - Centralized and Distributed Control and Data Planes - The Genesis of SDN	
UNIT II - SOFTWARE DEFINED NETWORKS ABSTRACTIONS	**(9)**
How SDN Works - The Open flow Protocol - SDN Controllers: Introduction – General Concepts - VMware - Nicira - VMware/Nicira - Open Flow-Related - Mininet - NOX/POX- Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK	
UNIT III - PROGRAMMING SOFTWARE DEFINED NETWORKS	**(9)**
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing	
UNIT IV - SOFTWARE DEFINED NETWORKS APPLICATIONS AND USE CASES	**(9)**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System	
UNIT V - SOFTWARE DEFINED NETWORKS FUTURE AND PERSPECTIVES	**(9)**
SDN Open Source - SDN virtualization -SDN Futures - Final Thoughts and Conclusions	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. S. Azodolmolky, "Software Defined Networking with Open Flow", Packt Pub Ltd, Second Edition, October 2017
2. E. Banks, SDN Showdown: Examining the Differences between VMware's NSX and Cisco's ACI, Network World, January 6, 2014

REFERENCES:

1. Software Defined Networks "A Comprehensive Approach by Paul Goransson and Chuck Black", Morgan Kaufmann Publications, 2014
2. SDN "Software Defined Networks by Thomas D. Nadeau & Ken Gray", O'Reilly, 2013
3. Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013

Mapping of COs with POs / PSOs

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

22AIX53 - SOFTWARE PROJECT MANAGEMENT *(Common to 22CSX53,22CCX53,22CIX54,22ITX53)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide an insight into detailed project management activities including project evaluation, planning, estimation, monitoring and control activities especially for software projects.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply different techniques in monitoring and control of the project	Ap	30%
CO2	Apply project estimation and evaluation techniques to real world problems	Ap	20%
CO3	Plan, schedule and sequence the activities using various techniques	An	30%
CO4	Identify project risk, monitor and track project deadlines	An	20%
CO5	Managing people and organizing teams while developing a software project	Ap	Internal Assessment

UNIT I – SOFTWARE PROJECT MANAGEMENT	**(9)**
Project Definition – Importance – Activities – Overview of the project Planning – Software project economics – objectives – Project Life Cycle.	
UNIT II - PROJECT ESTIMATION AND EVALUATION	**(9)**
An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.	
UNIT III - ACTIVITY PLANNING AND SCHEDULING	**(9)**
Sequencing and scheduling activities – Objectives of planning – Forward pass and backward pass – Scheduling – PERT techniques – CRM.	
UNIT IV - RISK MANAGEMENT AND MONITORING	**(9)**
Creating Framework – Decision making – cost Monitoring – Types of Risk – Risk managing - Risk Planning and controlling.	

UNIT V - MANAGING TEAM PROJECT	(9)
Team structure – Project tracking - Managing the contract – change control – Team management – Communication – Software Configuration Management-Case Study: PMBOK , Agile Development	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management" – Sixth Edition, Tata McGraw Hill, New Delhi, 2017.
2. Pressman R S & Bruce R Maxhim, "Software Engineering - A Practitioner's Approach", Tata McGraw Hill- 9th Edition, 2023.

REFERENCES:

1. Robert K Wysocki "Effective Project Management, Traditional, Agile, Extreme, Hybrid", John Wiley & Sons Inc, 2019.
2. Hans-Bernd Kittlaus , Samuel A. Fricker, "Software Product Management: The ISPMA-Compliant Study Guide and Handbook",2018.
3. Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", 2017.

Mapping of COs with POs / PSOs

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

22AIX54 - SOFTWARE TESTING TOOLS AND TECHNIQUES *(Common to 22CSX54,22ITX54,22CIX52,22CCX54)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To equip students with the knowledge necessary to effectively utilize software testing tools and techniques in real-world software development environments.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of software testing fundamentals to a real-world problem	Ap	30%
CO2	Analyze various software testing levels	An	20%
CO3	Make use of structured and analytical testing approaches to ensure thorough testing	Ap	30%
CO4	Identify quality testing processes and tools in projects	An	20%
CO5	Use WinRunner tool to perform automated testing	Ap	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Introduction – The Testing process – Measurement of Testing - Basic Terminology Related to Software Testing - Testing Life Cycle – Principles of Testing – Limitations of Testing – Testing tools, techniques and metrics.	
UNIT II - LEVELS OF TESTING	**(9)**
Unit Testing – Integration Testing – System Testing – Acceptance Testing – Object Oriented Testing – Automated Testing.	
UNIT III - STRUCTURED AND ANALYTICAL TESTING	**(9)**
Structure-Based Testing: Introduction - Condition Coverage - Decision Condition Coverage - Modified Condition/Decision Coverage (MC/DC) - Multiple Condition Coverage - Path Testing - APT Testing; Analytical Techniques: Static Analysis - Dynamic Analysis.	
UNIT IV - QUALITY TESTING AND TOOLS	**(9)**
Quality Characteristics for technical testing: Security - Reliability - Efficiency – Maintainability - Portability - sample questionnaire; Test tools and Automation: Test automation project - Specific test tools: Fault Seeding and Fault Injection Tools – Performance Testing and Monitoring Tools – Tools for Web Testing.	

UNIT V - SOFTWARE TESTING TOOL	(9)
Need for Automated Testing Tool - Performance Testing Tools – WinRunner: Testing an application using WinRunner – Test Script Language (TSL) – GUI MAP File – Synchronization of Test Cases – Data-Driven Testing – Rapid Test Script Wizard – Mapping Custom Object to a Standard Classes – Checking GUI Objects. Silk Test: Architecture – Testing an Application Using Silk Test – The 4Test Scripting Language – Checkpoints – Data-Driven Test Cases.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Rajiv Chopra, Software Testing: A Self-Teaching Introduction, David Pallai, 2018.
2. Jamie L Mitchell, Rex Black, "Advanced Software Testing: Guide to the ISTQB Advanced Certification as an Advanced Technical Test Analyst", Second edition, Vol 3, 2015.

REFERENCES:

1. Dr.K.V.K.K Prasad, Software Testing Tools, Dream tech 2012.

Mapping of COs with POs / PSOs

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

22AIX55 - IT OPERATIONS *(Common to 22CSX57,22ITX57,22CIX55,22CCX55)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide knowledge on IT Operation Management and Service Management.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the fundamental components and processes involved in IT operations	**An**	30%
CO2	Analyze existing health and safety regulations applicable to IT operations environments	**An**	30%
CO3	Apply organizational theories to evaluate and improve the structure and efficiency of IT operations within an organization	**Ap**	20%
CO4	Analyze fundamental concepts and principles of information security in IT environments	**An**	20%
CO5	Develop strategies for leveraging Microsoft 365 to enhance productivity, collaboration, and efficiency within IT operations.	**Ap**	Internal Assessment

UNIT I – IT OPERATIONS	**(9)**
IT Operation Definition - Roles & Responsibilities of IT Operations - IT Monitoring - IT operations Management - Responsibilities of IT operations Management. IT Service Management: IT Service Management Best Practices - The Service Life Cycle(Service Strategy - Service Design - Service Transition - Service Operation - Continual Service Improvement) Functions of IT Service Management (Incident Management, Event Management, Request fulfillment, Problem Management, Change Management, Availability Management - The Service Desk) - Escalation & Governance Management.	
UNIT II - HEALTHY SAFE AND SECURE WORKING ENVIRONMENT & ETIQUETTE	**(9)**
Health and Safety Essentials - Control and Management Systems - Facilities Management and Ergonomics - Managing Equipment - Managing Material. Etiquette: Professionalism in Relationships - First Impressions - Conducting Yourself in a Working Environment - Make Your Work Place Healthy - Dinning Etiquette - Elevator Etiquette - Cafeteria Etiquette - Meeting Etiquette - Telephone Etiquette - Dealing with Difficult People and Conflicting Situations.	

UNIT III - ITIL	(9)
Introduction – Understanding ITIL Guiding Principles in an Organization–Optimize and Automate – Four Dimensions of Service Management – Key Activities of the Service Value Chain	
UNIT IV - IT INFRASTRUCTURE & INFORMATION SECURITY	**(9)**
Definition - Components of IT Infrastructure (Hardware, Software, Network) - Types of IT infrastructure (Traditional, Cloud, Hyperconverged)- Risk, Response and Recovery: Risk Management and Information Security - The Risk Management Process - Business Continuity Management - Backing Up Data and Applications - Incident Handling - Recovery From a Disaster.	
UNIT V - AMS & TOOLS	**(9)**
Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies	
	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. John Sansbury, Ernest Brewster, Aidan Lawes, Richard Griffiths, "IT Service Management :Support for your ITSM Foundation Exam",March 2016.
2. Elearn ,"Managing Health, Safety and Working Environment ",Revised Edition(Management Extra), 1st Edition, 2017 .
3. Vivek Bindra ,"Everything About Corporate Etiquette" , Bloomsbury India,2015.
4. AXELOS, "ITIL: Foundation ITIL 4 Edition", 2019
5. David Kim, Michael G. Solomon,"Fundamentals of Information Systems Security", Jones & Bartlett Learning, 3rd Edition.
6. https://docs.microsoft.com/en-us/learn/m365

Mapping of COs with POs / PSOs

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

22AIX56 - SOFTWARE QUALITY ASSURANCE *(Common to 22CSX55,22ITX55,22CIX53,22CCX56)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Acquire knowledge of software quality assurance principles, practices and standards				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the common challenges which affect software quality	An	20%
CO2	Apply the knowledge of SQA Components and Project Life Cycle	Ap	20%
CO3	Establish Software Quality Infrastructure through implementation of modern Engineering and IT tools	An	20%
CO4	Classify the various metrics used in quality management	An	20%
CO5	Apply SQA Standards, Certifications and Assessments	Ap	20%

UNIT I – INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	**(9)**
Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall"s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.	
UNIT II - SQA COMPONENTS AND PROJECT LIFE CYCLE	**(9)**
Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.	
UNIT III - SOFTWARE QUALITY INFRASTRUCTURE	**(9)**
Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.	
UNIT IV - SOFTWARE QUALITY MANAGEMENT & METRICS	**(9)**
Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.	

UNIT V - SQA STANDARDS, CERTIFICATIONS & ASSESSMENTS	(9)
Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

REFERENCES:

1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thomson Computer Press, 1997.

Mapping of COs with POs / PSOs

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

22AIX57 - SERVICE ORIENTED ARCHITECTURE *(Common to 22CSX56,22ITX56,22CCX57)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To learn service-oriented analysis and design for developing SOA based application				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply XPath and XQuery to navigate and query XML documents efficiently	**Ap**	30%
CO2	Apply SOA principles and technologies to analyze real-world case studies across different industries.	**Ap**	30%
CO3	Analyze the impact of SOA on business process automation and agility	**An**	20%
CO4	Design service models and business process flows adhering to SOA principles and industry standards.	**Ap**	20%
CO5	Implement and demonstrate SOA-based applications using Microservices Architecture.	**An**	Internal Assessment

UNIT I – XML	**(9)**
XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery	
UNIT II - EXPLORING SOA	**(9)**
SOA Fundamentals: Evolution of SOA – SOA – Characteristics of SOA – Concept of a service in SOA – Basic SOA architecture -Web Services Introduction - Protocols: SOAP-REST – Web Security - Enterprise Software models - IBM on Demand operating environment.	
UNIT III - SOA PRINCIPLES AND DESIGN	**(9)**
Business centric SOA and its benefits – Principles of Service Orientation-SOA layers-SOA Patterns -Basic modeling building blocks –Service models for legacy application integration and enterprise integration – Enterprise solution assets (ESA).	
UNIT IV - BUILDING SOA BASED APPLICATIONS	**(9)**
Introduction to SAAS-Microservices Architecture-SOA Limitations - WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE.	

UNIT V - SERVICE ORIENTED ANALYSIS AND DESIGN	(9)
SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design – Case Study	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Thomas Erl; Service Oriented Architecture Concepts Technology & Design; Pearson Education Limited; 2015.

REFERENCES:

1. Mark Endrei, Jenny Ang, Ali Arsanjani, Sook Chua, Philippe Comte, Pål Krogdahl, Min Luo, Tony Newling – "Patterns: ServiceOriented Architecture and Web Services", 2004.
2. Mark D. Hansen "SOA Using Java™ Web Services", 2007.
3. Thomas Erl PHI "SOA Design Pattern", 2009.
4. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian "SOA with REST: principles, patterns & constraints for building enterprise solutions with REST", 2013.

Mapping of COs with POs / PSOs

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

22AIX58 - PRODUCT LIFE CYCLE MANAGEMENT *(Common to 22CSX58,22ITX58,22CIX58,22CCX58)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To comprehend the foundations, implementation, business benefits, integration with product management strategy, and application in service-related industries				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Product Life Cycle Management **(**PLM) and integrate with lifecycle phases	Ap	30%
CO2	Analyze global impacts of PLM on product development	An	20%
CO3	Examine PLM deployment stages for decision-making	An	30%
CO4	Interpret and use PLM strategies for enhancing productization	An	20%
CO5	Develop a project using Scrum	Ap	Internal Assessment

UNIT I – INTRODUCTION TO PRODUCT LIFECYCLE MANAGEMENT	**(9)**
Introduction to PLM, Fundamentals of PLM- Objective of PLM - Activities of PLM - Joined-up and Holistic Approach - Generic Product Lifecycle Phases, PLM Grid, Components of PLM Grid, Why PLM, How PLM.	
UNIT II - COMPLEX AND CHANGING ENVIRONMENT	**(9)**
Changes and Interconnections, Macroeconomic and Geopolitical Changes, Environmental and Social Changes, Corporate Changes, Technological Changes, Product Changes, The Result and the Requirements.	
UNIT III - PLM DEPLOYMENT AND BUSINESS BENEFITS	**(9)**
Deployment Stages of PLM, PLM maturity model, Realization stage of the project, Accomplishing change, Business benefits of a PLM system - Factors leading to PLM, Benefits of the PLM system, Improving the productivity of labour, Costs of quality, PLM and data warehousing as a tool to support decision-making.	
UNIT IV - SERVICE INDUSTRY AND PLM	**(9)**
Introduction to service, Further productization, Making a service, PLM in service business - PLM challenges in service business, Services modularized, Making items out of product functions, IT specifically variable product.	

UNIT V - PRODUCT AND PRODUCT MANAGEMENT STRATEGY AS A PART OF BUSINESS STRATEGY	(9)
Product lifecycle management as a business strategy tool, From changes in the business environment to product strategy, Making a product strategy, Product management strategy, Time to market, Time to react, Time to volume, Time to service, Electronic business and PLM, Case Study: Scrum Framework	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", Springer Publisher, 2011 (2nd Edition).
2. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", Springer Publisher, 2008 (3rd Edition).

REFERENCES:

1. Uthayan Elagovan, "Product Lifecycle Management (PLM): A Digital Journey Using Industrial Internet of Things (IIoT)" , July 2020.
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, "Implementing and Integrating ProductData Management and Software Configuration Management", Art ech House Publishers, 2003

Mapping of COs with POs / PSOs

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

22GEA02 - PRINCIPLES OF MANAGEMENT				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To provide with a foundational understanding of management concepts and practices. • To equip students with the knowledge and skills necessary to manage and lead organizations effectively, understanding both theoretical frameworks and practical applications in management. • To learn about various planning tools and decision-making processes crucial for organizational success. • To gain insights into human resource management functions. • To study effective communication strategies and the impact of information technology on communication and how effective control can lead to improved productivity and organizational performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key management theories and practices to real-world business scenarios, demonstrating the ability to implement management functions.	Ap	20%
CO2	Analyze human resource management practices, evaluating how recruitment, training, performance appraisal, and employee relations contribute to organizational success.	An	30%
CO3	Evaluate strategic decisions and their impacts on organizational performance,the effectiveness of communication strategies and the use of information technology in facilitating efficient and effective communication within organizations.	E	30%
CO4	Create comprehensive strategic plans and organizational policies and design control systems to ensure continuous improvement in productivity and organizational performance.	C	20%
CO5	Engage in independent study as a member of a team and develop higher-order thinking skills that are crucial for effective management and leadership in complex organizational settings with assignments or case studies.	Ap	Internal Assessment

UNIT I -INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**(9)**
Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers -managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization-Organization culture and Environment - Current trends and issues in Management.	
UNIT II -PLANNING	**(9)**
Nature and purpose of planning - planning process - types of planning - objectives - setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.	

UNIT III -ORGANISING	(9)
Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization -delegation of authority - centralization and decentralization -Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management	
UNIT IV - DIRECTING	**(9)**
Foundations of individual and group behaviour - motivation -motivation theories - motivational techniques - job satisfaction - job enrichment - leadership - types and theories of leadership -communication - process of communication - barrier in communication - effective communication -communication and IT.	
UNIT V - CONTROLLING	**(9)**
System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance -direct and preventive control -reporting.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrichand Mark V. Cannice"Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018.

REFERENCES:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Robert Kreitner&MamataMohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

Mapping of COs with POs / PSOs

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

22GEA03 - TOTAL QUALITY MANAGEMENT

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To Recognize the importance of quality councils and strategic planning in TQM. • To Explore the elements and historical development of TQM. • To Foster employee involvement through motivation, empowerment, teamwork, and recognition. • To Implement continuous process improvement methods like Juran's Trilogy, PDSA Cycle, 5S, and Kaizen. • To Conduct quality audits and understand the introduction to other ISO standards like ISO 14000, IATF 16949, TL 9000, IEC 17025, ISO 18000, ISO 20000, ISO 22000, and ISO 21001.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	30%
CO2	Apply continuous process improvement methodologies such as Juran's Trilogy, PDSA Cycle, 5S, and Kaizen.	Ap	20%
CO3	Apply various quality tools and techniques in both manufacturing and service industry.	Ap	20%
CO4	Develop strong supplier partnerships and understand supplier selection,rating, and relationship development.	An	20%
CO5	choose appropriate quality standards and implement them in the respective industry App.	E	10%

UNIT – I QUALITY CONCEPTS AND PRINCIPLES	**(9)**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.	
UNIT – II TQM-PRINCIPLES AND STRATEGIES	**(9)**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.	
UNIT – III CONTROL CHARTS FOR PROCESS CONTROL	**(9)**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study- Introduction to Six Sigma.	

UNIT – IV TQM-MODERN TOOLS	(9)
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.	
UNIT – V QUALITY SYSTEMS	**(9)**
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, UrdhwareshеHemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1. SubburajRamasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3. David Goetsch& Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8thEdition,Pearson, 2017.

Mapping of COs with POs / PSOs

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

22GEA04 - PROFESSIONAL ETHICS				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To Familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To Foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To Encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	30%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	30%
CO3	Analyze the importance of ethics in professional practice.	An	20%
CO4	Develop the ability to make informed and ethical decisions in engineering practice.	An	10%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	10%

UNIT I: INTRODUCTION TO PROFESSIONAL ETHICS	**(9)**
Definition and Importance of Ethics,Ethical Theories and Principles,Ethics vs. Morals vs. Values, Role of Ethics in Engineering.	
UNIT II: PROFESSIONAL RESPONSIBILITY AND CODES OF CONDUCT	**(9)**
Professional Responsibility and Accountability, Codes of Conduct in Engineering (e.g., IEEE, NSPE),Conflicts of Interest and Whistleblowing, Case Studies.	
UNIT III: ETHICAL DECISION-MAKING AND PROBLEM-SOLVING	**(9)**
Ethical Decision-Making Models,Tools and Frameworks for Ethical Analysis,Resolving Ethical Dilemmas,Case Studies	
UNIT IV: LEGAL AND REGULATORY ASPECTS	**(9)**
Legal Frameworks Governing Engineering Practice, Intellectual Property Rights, Health, Safety, and Environmental Regulations, Case Studies.	

UNIT V: SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	(9)
Social Responsibility of Engineers, Sustainable Engineering Practices, Impact of Engineering on Society and Environment,Case Studies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins,"Engineering Ethics: Concepts and Cases" 6th edition, 2018.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering" 5thEdition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. SenthilKumar,"Professional Ethics and Human Values",Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

Mapping of COs with POs / PSOs

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

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	

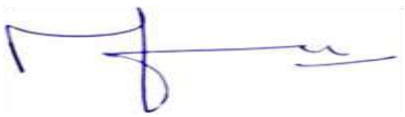
TEXT BOOKS:

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	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3							3	3		3		
2		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		2		3	3	3	3		



22AIZ01 –FUNDAMENTALS OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To impart a structured understanding of the fundamental principles, methods and applications of Artificial Intelligence(AI) and Machine Learning (ML), with a focus on problem-solving techniques			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Make use of the AI agents to formulate real world problems	Ap	20%
CO2	Apply search algorithms to find optimal solutions.	Ap	20%
CO3	Apply various reasoning techniques to solve logical problems.	Ap	20%
CO4	Implement custom supervised learning solutions to address complex, real-world challenges	Ap	20%
CO5	Develop end-to-end unsupervised learning solutions for practical applications	Ap	20%

UNIT I –INTRODUCTION	(9)
Definition – The foundations of Artificial Intelligence(AI) – History of AI – Agents and Environments –The concept of rationality - Nature of Environments – Structure of Agents –Introduction to Machine Learning – Big Data – Deep Learning.	
UNIT II - PROBLEM-SOLVING	(9)
Solving problems by searching: Agents – Search Algorithms – Uninformed Search strategies - Informed (Heuristic) Search Strategies - Greedy best-first search - A* search - Heuristic Functions - Generating heuristics from relaxed problems - Generating heuristics from sub-problems: Pattern databases. Adversarial Search and Games: Game Theory - Optimal Decisions in Games.	
UNIT III - KNOWLEDGE, REASONING, AND PLANNING	(9)
Logical Agents: Logic - Propositional Logic - Agents Based on Propositional Logic - Syntax and Semantics of First-Order Logic - Propositional vs. First-Order Inference - Forward and Backward Chaining - Basic Probability Notation - Bayes' Rule and Its Use - Naive Bayes Models - Representing Knowledge in an Uncertain Domain - The Semantics of Bayesian Networks.	

UNIT IV - 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 - Support vector machine, Decision Tree, Random forests	
UNIT V –UNSUPERVISED LEARNING AND NEURAL NETWORKS	(9)
Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization. Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization - stochastic gradient descent - ReLU, hyperparameter tuning.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Stuart Russel, Peter Norvig., "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson Education, 2022.

REFERENCES:

1. Saptarsi Goswami,Amit Kumar Das, et al. "AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), Pearson Education, 2024.
2. Lavika Goel, "Artificial Intelligence: Concepts and Applications", Wiley, 2021.
3. Tom M.Mitchell, "Machine Learning", Tata McGraw Hill, 2017.

Mapping of COs with POs / PSOs

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

22AIZ02 – INTRODUCTION TO BUSINESS ANALYTICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on various analytical methods for achieving Business Intelligence.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply and perform the business data modelling and its analytics	Ap	20%
CO2	Perform the business analytics and data Visualization using spreadsheet	Ap	20%
CO3	Summarize data using descriptive Statistics	Ap	20%
CO4	Interpret the inference on results and use regression models for prediction	An	20%
CO5	Apply various Forecasting Techniques on time series data	Ap	20%

UNIT I – INTRODUCTION	(9)
Business Analytics - Evaluation of Business analytics – scope of business analytics - Data for Business Analytics: Data set and Database - Big data-Metrics and Data classification - Data reliability and validity - Models in business analytics - problem solving with analytics	
UNIT II - BUSINESS ANALYTICS ON SPREADSHEET AND VISUALIZATION	(9)
Basic excel skills - Excel function - using excel lookup function for specific application - using excel lookup functions for database queries - spreadsheet Add-ins for business analytics - Data Visualization: Tools and Software - Creating Charts in Microsoft Excel - Excel Data Visualization Tools	
UNIT III - DESCRIPTIVE STATISTICS	(9)
Populations and samples - Measures of location - Measures of dispersion - Measures of shape - Excel descriptive statistic tool - Descriptive statistic for grouped data - Descriptive statistic for Categorical data-statistical thinking in business decisions	
UNIT IV - STATISTICAL INFERENCE AND REGRESSION MODELS	(9)
Objectives – HypothesisTesting-Hypothesis-Testing Procedure- One-Sample Hypothesis Tests. Trendlines: Modeling Relationships - Trends in Data – Regression Analysis: Simple Linear Regression : Finding the Best-Fitting Regression Line – Multiple linear regression	

UNIT V - FORECASTING TECHNIQUES	(9)
Qualitative and judgemental Forecasting-statistical forecasting model - forecasting models for stationary timeseries-forecasting models for time series with linear trend – forecasting time series with seasonality - selecting appropriate time series based forecasting models-regression forecasting with causal variables.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. James R. Evans. "Business Analytics", 2 nd Edition, Pearson, 2017.

REFERENCES:

1. U Dinesh Kumar. "Business Analytics: The Science of Data - Driven Decision Making", 1st Edition, Wiley, 2017.
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016.
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 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	3										
4	3													
5	3	3		3										3
CO (W.A)	3	3	3	3									3	3

22AIZ03-FUNDAMENTALS OF NEURAL NETWORKS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:

- To understand the basics of neural networks.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	To gain knowledge of basic neural networks.	Ap	20%
CO2	To understand the radial basis function networks and restricted Boltzmann machines	Ap	20%
CO3	To acquire the skills of recurrent neural networks and convolution neural networks	Ap	20%
CO4	To analyze the graph neural networks and deep reinforcement learning	An	20%
CO5	To develop knowledge about advanced topics of neural networks	Ap	20%

UNIT I –INTRODUCTION TO NEURAL NETWORKS	**9**
Single Computational Layer: The Perceptron, Multilayer Neural Networks, The Importance of Nonlinearity, Advanced Architectures and Structured Data, Two Notable Benchmarks, Backpropagation Algorithm-The Computational Graph Abstraction, Back propagation in Computational Graphs, Backpropagation in Neural Networks, The Vector-Centric View of Back propagation	
UNIT II – RADIAL BASIS FUNCTION NETWORKS AND RESTRICTED BOLTZMANN MACHINES	**9**
Radial Basis Function Networks -Training an RBF Network, Variations and Special Cases of RBF Networks , Relationship with Kernel Methods, Restricted Boltzmann Machines - Hopfield Networks, The Boltzmann Machine, Restricted Boltzmann Machines, Applications of Restricted Boltzmann Machines, Using RBMs beyond Binary Data Types, Stacking Restricted Boltzmann Machines	
UNIT III – RECURRENT NEURAL NETWORKS AND CONVOLUTIONAL NEURAL NETWORKS	**9**
The Architecture of Recurrent Neural Networks, The Challenges of Training Recurrent Networks, Echo-State Networks, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRUs), Applications of Recurrent Neural Networks, Convolutional Neural Networks-The Basic Structure of a Convolutional Network, Training a Convolutional Network, Visualization and Unsupervised Learning, Applications of Convolutional Networks	

UNIT IV – GRAPH NEURAL NETWORKS AND DEEP REINFORCEMENT LEARNING	9
Node Embeddings with Conventional Architectures, Graph Neural Networks: The General Framework, Backpropagation in Graph Neural Networks, Applications of Graph Neural Networks, Deep Reinforcement Learning-Stateless Algorithms: Multi-Armed Bandits, The Basic Framework of Reinforcement Learning, Monte Carlo Sampling, Bootstrapping for Value Function Learning, Policy Gradient Methods, Monte Carlo Tree Search, Practical Challenges Associated with Safety	
UNIT V – ADVANCED TOPIC	**9**
Attention Mechanisms-Recurrent Models of Visual Attention, Attention Mechanisms for Image Captioning, Soft Image Attention with Spatial Transformer, Attention Mechanisms for Machine Translation, Transformer Networks, Vision Transformer (ViT), Attention Mechanisms in Graphs, , Neural Turing Machines, Adversarial Deep Learning, Generative Adversarial Networks (GANs), Competitive Learning, Limitations of Neural Networks	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charu C. Aggarwal, Neural Networks and DeepLearning Springer Publications, 2nd edition, 2023

REFERENCES

1. Stone, James. (2019). —Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning‖, Sebtel Press, United States, 2019
2. Ian Good fellow, Yoshua Bengio, Aaron Courville, —Deep Learning", MIT Press, 2016
3. Vance, William , —Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science‖ (Hardcover - 2020), Joining the dotstv Limited
4. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), —Deep Learning Applications‖, Volume 3,Springer Publications 2022
5. Charu C. Aggarwal, ‖Neural Networks and Deep Learning: A Textbook", Springer International 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	2	2			2					1		3	3
2	3	1									1		2	2
3	3	1				1							3	2
4	3	1	1										2	2
5	3	3	1								1		3	3
CO (W.A)	3	2	1			1					1		3	2

22AIZ04 – INTRODUCTION TO ROBOTICS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To build a basic knowledge of robotic process and control.

	Course Outcomes The students will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Actuators and grippers for various real time applications	Ap	20%
CO2	Apply various elements of robots like sensors, motors and transformations to find distance and vision.	Ap	20%
CO3	Apply kinematics and manipulator design.	Ap	20%
CO4	Analyze dynamics and robotic linear controllers.	An	20%
CO5	Apply various nonlinear and force controllers in robotics.	Ap	20%

UNIT I – INTRODUCTION AND ACTUATORS	(9)
Introduction, brief history, robots, Robot usage, Robot Subsystems, classification of robot, industrial applications, Electric Actuators, Hydraulic Actuators, Pneumatic Actuators, Selection of Motors, Grippers.	
UNIT II - SENSORS, VISION AND TRANSFORMATIONS	(9)
Sensor Classifi cation, Internal Sensors, External Sensors, Vision, Signal Conditioning, Sensor Selection, Robot Architecture, Pose of a Rigid Body, Coordinate Transformation, Denavit and Hartenberg (DH) Parameters, A Variant of DH Parameters, DH Parametrization of Euler angles.	
UNIT III –KINEMATICS, STATICS AND MANIPULATOR DESIGN	(9)
Forward Position Analysis, Inverse Position Analysis, Velocity Analysis: The Jacobian Matrix, Link Velocities, Forces and Moments Balance, Recursive Calculations, Equivalent Joint Torques, Role of Jacobian in Statics, Manipulator Design, Functional Requirements of a Robot	

UNIT IV –DYNAMICS, LINEAR CONTROL	(9)
Inertia Properties, Euler–Lagrange Formulation, Newton—Euler Formulation, Recursive Newton—Euler Algorithm, Dynamic Algorithms, Control Techniques, Dynamic Systems, Transfer Function and State-Space Representation, A Robotic Joint, Selection of PID Controller Gains, State-feedback Control, Joint Controllers.	
UNIT V - NONLINEAR AND FORCE CONTROLS	(9)
Control of a Moving Block, Multivariable Robot Contro, Stability of Multi-DOF Robot, Linearized Control, (PD) Position Control, (Inverse Dynamics) Control, Feedforward Control, Robust Control, Adaptive Control, Cartesian Control, Force Control, Hybrid Control, Motion Planning.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. S K Saha,‖Introduction to Robotics‖McGraw Hill Education-2nd edition - 2014.
2. Saeed B.Nikku, Introduction to Robotics, analysis, control and applications Wiley-India 2nd edition-2011

REFERENCES:

1. Industrial robotic technology-programming and application‖ by M.P.Groover et al, McGrawhill 2008.
2. Robotics technology and flexible automation‖ by S.R. Deb, TMH2009
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	3												3	
2	3												3	
3	3													
4		3												
5	3													3
CO (W.A)	3	3											3	3

22CSM01- DATA SCIENCE FOR ENGINEERS (common to AI&DS &CSE)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objective:	• To master modern data engineering principles with emphasis on optimization and security.				
Course Objectives The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	To apply data science concepts.	Ap	20%		
CO2	To analyze data using descriptive statistics techniques	An	20%		
CO3	To apply Statistical Inference Skills	Ap	20%		
CO4	To analyze and build Regression and Correlation Models	Ap & An	20%		
CO5	To develop data science solutions using machine learning models	Ap	20%		

UNIT I- INTRODUCTION	**(9)**
Introduction– Data Science - Data Science and Other Fields - The Relationship between Data Science and Information Science -Computational Thinking - Issues of Ethics, Bias, and Privacy in Data Science - facets of data - Data Types - Data Collection - Data Preprocessing: Cleaning, Integration, Transformation, Reduction and Discretization	
UNIT II - DESCRIPTIVE STATISTICS	**(9)**
Descriptive Statistics-Data Preparation-Exploratory Data Analysis-Summarizing the Data .Data DistributionsOutlier Treatment-Measuring Asymmetry-Continuous Distribution-Kernel Density-	
UNIT III - STATISTICAL INFERENCE	**(9)**
Statistical Inference: The Frequentist Approach -Measuring the Variability in Estimates-Point Estimates-Confidence Intervals-Hypothesis Testing-Testing Hypotheses Using Confidence Intervals-Testing Hypotheses Using p-Values	
UNIT IV - REGRESSION AND CORRELATION	**(9)**
Linear Regression -Simple Linear RegressionMultiple Linear Regression and Polynomial Regression -Logistic Regression ,Correlation:Multiple Correlation - Partial Correlation.	

UNIT V- MACHINE LEARNING MODELS	(9)
Supervised Learning: Support Vector Machines, Random Forest-Unsupervised Learning: Clustering, Network Analysis: Social Network Analysis, Centrality, Ego Networks, Community Detection, Recommendation Systems: Content based Filtering, Collaborative Filtering, Hybrid Recommenders, Modeling and Evaluating Recommendations.	
TOTAL(L:45)=45 PERIODS	

TEXT BOOKS

1. Chirag Shah, "A Hands-On Introduction to Data Science", 1st Edition, Kindle Edition, 2020 (Unit I)
2. Laura Igual • Santi Seguí "Introduction to Data Science A Python Approach to Concepts, Techniques and Applications 2017 (Units II,III,IV,V)

REFERENCES:

1. Joel Grus, "Data Science from the Scratch", O'Reilly, 2015
2. Frank Kane, "Hands-On Data Science and Python Machine Learning", First edition, Packt Publication, 2017

Mapping of COs with POs / PSOs

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

22CSM02 - FUNDAMENTALS OF DATA ENGINEERING (common to AI&DS &CSE)					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objective:	• To master modern data engineering principles with emphasis on optimization and security.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply core principles of data engineering to design and implement data pipelines.	Ap	20%
CO2	Analyze and develop complex data models and architect efficient data warehouses.	An	20%
CO3	Implement and optimize data processing and transformation workflows using modern techniques.	Ap	20%
CO4	Analyze and enforce data governance in data Engineering	An	20%
CO5	Ensuring security and ethical compliance using case studies	An	20%

UNIT I- INTRODUCTION TO DATA ENGINEERING	**(9)**
Introduction to Data Engineering - Role of a Data Engineer - Data Engineering Lifecycle - Overview of Data Ecosystems and Tools - Data Integration and Data Pipelines	
UNIT II - DATA MODELING AND WAREHOUSING	**(9)**
Introduction to Data Modeling - Conceptual, Logical, and Physical Data Models - Relational vs. Non-relational Data Models - Data Warehousing Concepts - Design and Architecture of Data Warehouses - ELT (Extract, Load, Transform) Processes - Dimensional Modeling and Star Schemas	
UNIT III - DATA PROCESSING AND TRANSFORMATION	**(9)**
Introduction to Data Processing - Stream Processing with Apache Kafka - Data Cleaning and Transformation Techniques - Data Orchestration with Apache Airflow - Optimizing Data Workflows	
UNIT IV - DATA GOVERNANCE	**(9)**
Introduction to Data Governance - Data Quality and Data Lineage- Data Governance Frameworks and Best Practices using Case Studies.	
UNIT V -SECURITY AND ETHICS	**(9)**
Data Security and Indian Privacy law Personal Data Protection Bill (PDPB) - Ethical Considerations in Data Engineering - Case Studies and Industry Standards	

TOTAL(L:45)=45 PERIODS

TEXT BOOKS:

1. Joe Reis and Matt Housley, "Fundamentals of Data Engineering", Published by O'Reilly Media, Inc., July, 2022.
2. Bill Chambers and Matei Zaharia "Spark: The Definitive Guide Big Data Processing Made Simple", Published by O'Reilly Media, Inc., 2018.

REFERENCES:

1. Martin Kleppmann, "Designing Data-Intensive Applications - The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly Media, Inc. in March 2017.
2. Paul Crickard, "Data Engineering with Python", Packt Publishing Ltd., October 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							2		
4				3			1							
5						3		3		2				
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**		**2**		**2**		

22CSM03 - DATA ANALYSIS AND VISUALIZATION (common to AI&DS &CSE)				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

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

Course Outcomes The Students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the data for different industry needs.	Ap	20%
CO2	Analyze and design solutions for geographical datasets using tool/packages.	An	20%
CO3	Analyze and visualize the tools for data Analysis.	An	20%
CO4	Apply and analyze univariate and bivariate using tables.	Ap	20%
CO5	Apply time series analysis for respective industry.	Ap	20%

UNIT I – INTRODUCTION TO DATA ANALYSIS	**(9)**
Introduction Exploratory Data Analysis– Understanding the various levels of data – Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook- Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels	
UNIT II – GETTING STARTED WITH PANDAS	**(9)**
Arrays and vectorized conputation, Introduction to pandas Data Structures – Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques- Data Cleaning and Preparation, Handling Missing Data, String Manipulation.	
UNIT III - 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.	
UNIT IV - UNIVARIATE & BIVARIATE ANALYSIS	**(9)**
Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread – Bivariate Analysis: Relationships between Two Variables - Percentage Tables Transformations.	

UNIT V - TIME SERIES ANALYSIS	(9)
Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Function	
TOTAL(L:45)=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)
4. Ben Fry," Visualizing Data: Exploring and Explaining Data with the Processing Environment", O'Reilly Media, 2008.
5. C Ware, "Information Visualization: Perception for Design", 3rd Edition. Morgan Kaufmann, 2012

REFERENCES:

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.
4. Alexandru C. Telea, "Data Visualization: Principles and Practice. A K Peters/CRC Press, 1st edition, 2007, ISBN 1568813066.

Mapping of COs with POs / PSOs

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

22CSM04 - MACHINE LEARNING FOR DATA SCIENCE

(common to AI&DS &CSE)				
	L	T	P	C
	3	0	0	3

PREREQUISITE :NIL

Course Objective:	• To equip students with basic knowledge essential for data-driven decision-making using Machine Learning and Data Science

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply TensorFlow to process data, explore learning types, and develop models.	Ap	20%
CO2	Build, execute, and visualize computational graphs for machine learning tasks.	Ap	20%
CO3	Utilize model to optimize complexity and estimate predictive uncertainty.	Ap	20%
CO4	Apply the techniques for data analysis, classification, and feature extraction.	Ap	20%
CO5	Make use of the techniques to transform data.	Ap	20%

UNIT I –INTRODUCTION	**(9)**
A machine-learning odyssey: Machine-learning fundamentals –Data representation and features - - Types of learning - TensorFlow - The TensorFlow system architecture and API.	
UNIT II –ESSENTIALS OF TENSORFLOW	**(9)**
TensorFlow essentials: Ensuring that TensorFlow works - Representing tensors - Creating operators - Executing operators within sessions - Understanding code as a graph - Writing code in Jupyter - Using variables - Saving and loading variables - Visualizing data using TensorBoard	
UNIT III – GENERALIZATION	**(9)**
Classification and Regression – Generalization-Overfitting and Underfitting: Relation of Model Complexity to Dataset Size. - Uncertainty Estimates from Classifiers: The Decision Function- Predicting Probabilities- Uncertainty in Multiclass Classification.	
UNIT IV – SUPERVISED LEARNING AND UNSUPERVISED LEARNING	**(9)**
Supervised Machine Learning Algorithms: Some Sample Datasets-k-Nearest Neighbors-Linear Models-Naive Bayes Classifiers-Decision Trees -Types of Unsupervised Learning - Challenges in Unsupervised Learning - Dimensionality Reduction-Feature Extraction	

UNIT V – PREPROCESSING	(9)
Preprocessing and Scaling: Different Kinds of Preprocessing-Applying Data Transformations-Scaling Training and Test Data the Same Way-The Effect of Preprocessing on Supervised Learning	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Chris Mattmann, "Machine Learningwith TensorFlow", Manning Publications Co, 2nd Edition, 2020.
2. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists",O'Reilly Media, 1st Edition, 2016.
3. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 3rd Edition, 2023

REFERENCES:

1. Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, RadislavVaisman,"Data Science and Machine Learning",Chapman & Hall/CRC Press, 1st Edition, 2024.
2. Wes McKinney,"Python for Data Analysis", 3rd Edition, O'Reilly Media, 2022.
3. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani ,"An Introduction to Statistical Learning with Applications in Python", Springer, 1st Edition, 2023.
4. Chris Albon, "Machine Learning with Python Cookbook", O'Reilly Media, 2nd 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				3									
2			3											
3			3		3						2			
4					3				3		2	3		
5						3			3					
CO (W.A)	3		3		3	3			3		2	3		

22CSM05 - NOSQL DATABASES (common to AI&DS &CSE)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Students will understand NoSQL database types, data management, consistency, scaling, and real-world applications in areas like e-commerce, content management, and analytics.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of different NoSQL databases by explaining their types, architectures, and use cases.	Ap	20%
CO2	Analyze and compare RDBMS with NoSQL databases based on structure, scalability, and performance.	Ap	20%
CO3	Apply performance tuning techniques to Document-oriented NoSQL databases for optimized data retrieval and storage.	Ap	20%
CO4	Analyze the performance tuning methods for Key-Value Pair NoSQL databases to enhance efficiency	An	20%
CO5	Apply various NoSQL development tools to implement and manage different types of NoSQL databases effectively.	An	20%

UNIT I - INTRODUCTION TO NOSQL CONCEPTS	**(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 - Significance of NoSQL databases in modern applications.	
UNIT II - RELATIONAL AND NoSQL DATABASES MODELS DEPLOYMENT	**(9)**
Comparison of relational databases to new NoSQL stores – MongoDB – Cassandra – HBASE - Neo4j use and deployment - Application - RDBMS - Challenges NoSQL approach - Key-Value and Document Data Models - Column-Family Stores - Aggregate-Oriented Databases - Replication and sharding - MapReduce on databases - Distribution Models - Single Server - Sharding - Master-Slave Replication - Peer-to-Peer Replication - Combining Sharding and Replication.	

UNIT III - NoSQL DOCUMENT AND KEY-VALUE DATABASES	(9)
NoSQL Key/Value databases using MongoDB - Document Databases - Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling - Suitable Use Cases, Event Logging - Content Management Systems - Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.	
UNIT IV - ARCHITECTURE AND APPLICATIONS OF COLUMN-ORIENTED NoSQL DATABASES	**(9)**
Column- oriented NoSQL databases using Apache HBASE - Column-oriented NoSQL databases using Apache Cassandra - Architecture of HBASE - Column-Family Data Store Features - Consistency, Transactions, Availability - Query Features, Scaling, Suitable Use Cases - Event Logging, Content Management Systems - Blogging Platforms - Counters - Expiring Usage.	
UNIT V - NOSQL KEY-VALUE DATABASES	**(9)**
NoSQL Key/Value databases using Riak - Key-Value Databases - Key-Value Store - Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases - Storing Session Information - User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data - Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Sadalage, P. & Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019.

REFERENCES:

1. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, "The Design and Implementation of Modern Column- Oriented Database Systems", Now Publishers, 2013.
2. Guy Harrison," Next Generation Database: NoSQL and big data", Apress, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2			3									
2	3	3			3									
3	3	3			3						2	3		
4	3	3		2	3						2	3		
5	3	3		3	3						2	3		
CO (W.A)	**3**	**2.8**		**2.5**	**3**						**2**	**3**		

22CSM06 - SECURITY AND PRIVACY IN DATA SCIENCE (common to AI&DS &CSE)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	• To equip students with the knowledge and skills required to manage effective security and privacy measures in data science practices, ensuring data protection and compliance.			

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply cryptographic techniques to secure sensitive data in transit and at rest.	Ap	20%
CO2	Analyze legal frameworks governing data privacy, including GDPR, CCPA, and HIPAA, and their implications for data handling.	An	20%
CO3	Apply homomorphic encryption techniques to perform computations on encrypted data.	Ap	20%
CO4	Analyze various authentication models, including passwords, biometrics, and two-factor authentication.	An	20%
CO5	Evaluate ethical implications of AI-driven decision-making processes in relation to privacy concerns.	An	20%

UNIT I - INTRODUCTION TO DATA SECURITY AND PRIVACY	**(9)**
Importance of data science concepts - Privacy and Security Concepts: Definitions and distinctions between security and privacy - Threats and Attacks: Common security threats (e.g., data breaches) - Legal and Ethical Aspects: Overview of data privacy laws - Principles of Data Privacy: Anonymization, pseudonymization, data minimization.	
UNIT II - CRYPTOGRAPHY AND DATA PROTECTION TECHNIQUES	**(9)**
Cryptographic Techniques: Symmetric vs. asymmetric encryption, hashing algorithms (SHA, AES) - Public Key Infrastructure (PKI): Use of keys and certificate authorities - Data Encryption: Encrypting sensitive data in transit and at rest -Secure Communication: Implementing secure channels (SSL/TLS) - Digital Signatures and Authentication: Methods for verifying data integrity.	
UNIT III – PRIVACY-PRESERVING MACHINE LEARNING	**(9)**
Challenges in Machine Learning: Privacy risks in training data - Differential Privacy: Techniques to maintain individual privacy in aggregate statistics - Secure Multi-Party Computation: Collaborative computations without exposing sensitive data - Federated Learning: Decentralized approach to safeguard user privacy - Homomorphic Encryption: Performing computations on encrypted data.	
UNIT IV – DATA ACCESS CONTROL AND AUTHENTICATION	**(9)**

Authentication Models: Mechanisms (passwords, biometrics, two-factor authentication) - Authorization Models: Role-Based Access Control (RBAC), Attribute-Based Access Control (ABAC) - Identity Management: Identity and Access Management (IAM) systems - Secure Data Sharing: Safe practices for sharing data with third parties - Audit and Monitoring: Techniques for monitoring access.	
UNIT V – REAL-WORLD APPLICATIONS AND CASE STUDIES	**9**
Case Studies of Data Breaches: Analysis of breaches (Equifax, Facebook) - Data Security in Cloud Computing: Cloud-specific security challenges - Security in Big Data and IoT: Addressing privacy issues in large-scale data systems - Privacy and Ethics in AI: Ethical implications of AI-driven data usage - Best Practices: Secure data science practices.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Bhavani Thuraisingham, Murat Kantarcioglu, Latifur Khan,"Secure Data Science - Integrating Cyber Security and Data Science" ,CRC Press,1st Edition,2022.
2. Nataraj Venkataramanan, Ashwin Shriram, "Data Privacy Principles and Practice", CRC Press, 1st Edition, 2016.
3. Gerardus Blokdyk, "Data Security And Privacy A Complete Guide", 2023 Edition.

REFERENCES:

1. William Stallings, "Cryptography and Network Security: Principles and Practice" ,Pearson Education, 2017.
2. J. Morris Chang, Di Zhuang and G. Dumindu Samaraweera, "Privacy-Preserving Machine Learning", Manning, 2023.
3. Mike Loukides, Hilary Mason, DJ Patil, "Ethics and Data Science", O'Reilly Media-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											
2		3		2		2		3						
3	3													
4		3	3											
5						3		3		2				
CO (W.A)	**3**	**3**	**3**	**2**		**3**		**3**		**2**				

22CSM07 - CLOUD COMPUTING FOR DATA SCIENCE (common to AI&DS &CSE)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To provide students with an in-depth understanding of Google Cloud Platform (GCP) and its services for data science, enabling them to apply cloud computing tools to data storage, analysis, machine learning, and optimization for solving real-world data science problems.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key Google Cloud Platform services (e.g., BigQuery, Cloud Storage, AI Platform) for data science workflows.	Ap	20%
CO2	Utilize cloud storage and databases (Google Cloud Storage, BigQuery, Cloud Bigtable) to manage and analyze large datasets.	Ap	20%
CO3	Implement data processing and analytics workflows using GCP services like Cloud Dataproc, Dataflow, and BigQuery for efficient data handling and analysis.	Ap	20%
CO4	Develop and deploy machine learning models on Google AI Platform using tools like TensorFlow, AutoML, and TPUs for real-time data analysis and predictions.	An	20%
CO5	Optimize and manage cloud-based resources, performance, and costs using GCP tools like Kubernetes Engine, BigQuery optimization, and Cloud Functions.	An	20%

UNIT I - INTRODUCTION TO GOOGLE CLOUD PLATFORM FOR DATA SCIENCES	**(9)**
Introduction to key GCP services: BigQuery, Google Cloud Storage, Google Cloud Dataproc, Google AI Platform - Setting up and managing GCP environment for data science - Benefits of cloud computing in data science applications - Introduction to GCP Console and basic navigation.	
UNIT II - DATA STORAGE AND MANAGEMENT ON GCP	**(9)**
Google Cloud Storage (GCS): Object storage for datasets and files - Using BigQuery for large-scale data analytics and SQL queries - Cloud Bigtable and Cloud Datastore: NoSQL data management options - Data import/export techniques and integration between GCP storage services - Best practices for data security and access control on GCP.	

UNIT III - DATA ANALYTICS AND PROCESSING IN GCP	(9)
Introduction to Cloud Dataproc for distributed data processing with Apache Hadoop and Spark - Stream and batch data processing using Cloud Dataflow - Advanced data analytics with BigQuery - Data analysis using Google Cloud Datalab and data visualization.	
UNIT IV - MACHINE LEARNING AND AI SERVICES ON GCP	**(9)**
Introduction to Google AI Platform and machine learning workflows - Training machine learning models using Google Cloud ML Engine - AutoML for automatic model selection and training - Using TPUs for accelerating model training - Deploying models to production using AI Platform.	
UNIT V – SCALABILITY, COST MANAGEMENT, AND OPTIMIZATION IN GCP	**(9)**
Scaling data processing and machine learning models using Google Kubernetes Engine (GKE)- Optimizing performance in BigQuery with partitioning, clustering, and query optimization - Managing and controlling costs using Google Cloud Billing, Budgets, and Cost Alerts - Automating workflows using Cloud Functions and Cloud Run - Performance and cost optimization strategies for cloud workloads	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Valliappa Lakshmanan," Data Science on the Google Cloud Platform ", Published by Shroff/O'Reilly, 1st Edition,2018.

REFERENCES:

1. Ian Alexander," Data Science for Business with Google Cloud Platform", Published by Eagar, 1st Edition 2020.
2. Adnan Masood, Shafiqur Rehman , " Google Cloud Platform for Data Engineering ", published by O'Reilly Media, 1st Edition, 2018

Mapping of COs with POs / PSOs

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

22CSM08 - BUSINESS INTELLIGENCE FOR DECISION MAKING (common to AI&DS &CSE)					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	● To know the basic principles of business intelligence system and derive inferences for decision making.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of Business Intelligence, analytics, and decision support systems to analyze real-world business problems	Ap	20%
CO2	Implement business reporting and visual analytics techniques to monitor and evaluate business performance	Ap	20%
CO3	Evaluate the effectiveness of various models in predicting future trends and behaviors based on historical data.	An	20%
CO4	Analyze the effectiveness of various models in prescribing future trends and behaviors based on historical data.	An	20%
CO5	Formulate decision making problems and Strategies.	An	20%

UNIT I –BUSINESS INTELLIGENCE	**(9)**
An Overview of Business Intelligence, Analytics, and Decision Support- A Framework for Business Intelligence-Foundations and Technologies for Decision Making-Decision Making: The Intelligence Phase-The Design Phase-The Choice Phase-The Implementation Phase.	
UNIT II - DESCRIPTIVE ANALYTICS	**(9)**
Data Integration and the Extraction Transformation and Load(ETL) Processes, Business Reporting, Visual Analytics and Business Performance Management-Different Types of Charts and Graphs-The Emergence of Data Visualization and Visual Analytics.	
UNIT III - PREDICTIVE ANALYTICS	**(9)**
Techniques for Predictive Modeling -Text Analytics-Text Mining-Sentiment Analysis-Web Analytics, Web Mining-Social Analytics.	

UNIT IV – PRESCRIPTIVE ANALYTICS	(9)
Introduction-Prescriptive Modeling - Nonlinear Optimization - Continuation of Marketing/Planning - Prescriptive Step in the BA Analysis - Case Background Review -Prescriptive Analysis .	
UNIT V – DECISION MAKING	**(9)**
Introduction - Decision Theory Model Elements - Types of Decision Environments - Decision-Making Under Certainty - Decision Making Under Risk - Decision-Making under Uncertainty - Expected Value of Perfect Information- Sequential Decisions and Decision Trees .	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Efraim Turban,Ramesh Sharda, Dursun Delen, "Busines Intelligence and Analytics for Decision Support Systems", 10 th Edition Pearson, 2018.
2. Marc J Schniederjans Dara G. Schniederjans, Chirstoper M Sterkey, "Business Analytics principles, Concepts and Applications", 2nd edition, Pearson FT Press,2014.

REFERENCES:

1. Carlo Vercells, "Business Intelligence :Data Mining and Optimization for Decision Making", 1st Edition, Wiley Publications,2009.
2. David Loshin Morgan, Kaufman, "Business Intelligence :The Savvy Managers Guide", 2nd Edition, 2012.
3. Cindi Howson, "Successful Business Intelligence :Secrets to Making BI a Killer App", McGraw-Hill,2014.

Mapping of COs with POs / PSOs

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