NANDHA ENGINEERING COLLEGE

(Autonomous)

Affiliated to Anna University Chennai ✣ Approved by AICTE ✣ Accredited by NBA - New Delhi

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1.1.2 Details of the courses where the syllabus revision was carried out in

B.E - Computer Science and Engineering (IoT)

Course Code	Course Name	% of change
22CIC13	Embedded Systems	100%
22CIC14	Automata Theory and Compiler Design	100%
22CIC15	Full Stack Development	100%
22CIP09	Embedded Laboratory	100%
22CIP10	Full Stack Development Laboratory	100%
22CIC16	Mobile Application Development for IoT	100%
22CIC17	Computer Vision and Robotics	100%
22CIP11	Mobile Application Development for IoT Laboratory	100%
22CIP12	Computer Vision Lab	100%
22CIX01	Industrial and Medical IoT	100%
22CIX02	Block Chain Technology	100%
22CIX03	Beyond 5G and IoT Technologies	100%
22CIX04	Programming for IoT Boards	100%
22CIX05	Wearable Computing	100%
22CIX06	Fog and Edge Computing	100%
22CIX07	Wireless Ad-hoc and Sensor Networks	100%
22CIX08	Image Processing	100%
	Average	100%

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ERODE - 638052.

NANDHA ENGINEERING COLLEGE

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

Curriculum and Syllabi

for

B.E – Computer Science and Engineering (Internet of Things)[R22]

[CHOICE BASED CREDIT SYSTEM]

[This Curriculum and Syllabi are applicable to Students admitted in (2022-26) and (2023-2027) batches only]

JULY 2024

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

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

PROGRAM OUTCOMES:

At the end of a programme a students will be able to demonstrate ability to

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	**PO1**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	**PO2**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	**PO3**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d	Investigation of Complex Problems	**PO4**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	**PO5**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	**PO6**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	**PO7**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	**PO8**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work.	**PO9**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j	Communication	**PO10**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k	Project Management and Finance	**PO11**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l	Lifelong Learning	**PO12**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objectives and the outcomes is given in the following table

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

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

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

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS – 2022 **CHOICE BASED CREDIT SYSTEM**

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

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

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication - II	HSMC	22EYA01	4	2	0	2	3
2	22MYB03	Statistics and Numerical Methods*	BSC	-	4	3	1	0	4
3	22CIC01	Data Structures using C*	ESC	22CSC01	3	3	0	0	3
4	22CIC02	Python Programming	ESC	-	3	3	0	0	3
5	22CIC03	Digital Principles and Computer Organization	ESC	-	3	3	0	0	3
6	22GYA02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology*	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22CIP01	Data Structures Laboratory*	ESC	22CSP01	4	0	0	4	2
8	22CIP02	Python Programming Laboratory	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN04	Soft/Analytical Skills - II	MC	22MAN02	3	1	0	2	0
11	22MAN05	Yoga – II*	MC	-	1	0	0	1	0
				TOTAL	**32**	**16**	**1**	**17**	**23**

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
2	22CIC04	Algorithms	PCC	-	3	3	0	0	3
3	22CIC05	Internet of Things and its Applications	PCC	-	3	3	0	0	3
4	22CIC06	Java Programming	PCC	-	3	3	0	0	3
5	22CIC07	Operating Systems	PCC	-	3	3	0	0	3
PRACTICAL									
6	22CIP03	Algorithms Laboratory	PCC	-	4	0	0	4	2
7	22CIP04	Internet of Things and its Applications Laboratory	PCC	-	4	0	0	4	2
8	22CIP05	Java Programming Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN07[#] / 22MAN07R [##]	Soft/Analytical Skills - III	MC	22MAN04	3	1	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**32**	**17**	**1**	**14**	**22**

[#] **Applicable for (2022-2026) Batch only**

[##] **Applicable for (2023-2027) Batch only**

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC08	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
2	22CIC09	Computer Networks	PCC	-	3	3	0	0	3
3	22CIC10	Database Management System	PCC	-	3	3	0	0	3
4	22CIC11	Sensors and Actuator Devices	PCC	-	3	3	0	0	3
5	22CIC12	Privacy and Security in IoT	PCC	22CIC05	3	3	0	0	3
6	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3
PRACTICAL									
7	22CIP06	Computer Networks Laboratory	PCC	-	4	0	0	4	2
8	22CIP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
9	22CIP08	Sensors and Actuator Devices Lab	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN08[#]/ 22MAN08[##]	Soft/Analytical Skills - IV	MC	22MAN07	3	1	0	2	0
11	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
				TOTAL	**33**	**19**	**0**	**15**	**24**

[#] **Applicable for (2022-2026) Batch only**

[##] **Applicable for (2023-2027) Batch only**

SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC13	Embedded Systems	PCC	-	3	3	0	0	3
2	22CIC14	Automata Theory and Compiler Design	PCC	-	4	3	1	0	4
3	22CIC15	Full Stack Development	PCC	-	3	3	0	0	3
4	E1	Elective(PEC)	PEC	-	3	3	0	0	3
5	E2	Elective(PEC)	PEC	-	3	3	0	0	3
6	E3	Elective(OEC/PEC)	PEC/OEC	-	3	3	0	0	3
PRACTICAL									
7	22CIP09	Embedded Laboratory	PCC	-	4	0	0	4	2
8	22CIP10	Full Stack Development Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN10R	Communication and Quantitative Reasoning	MC	-	3	1	0	2	0
				TOTAL	**31**	**19**	**1**	**11**	**23**

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CIC16	Mobile Application Development for IoT	PCC	-	3	3	0	0	3
2	22CIC17	Computer Vision and Robotics	PCC	-	3	3	0	0	3
3	E4	Elective(PEC)	PEC	-	3	3	0	0	3
4	E5	Elective(PEC)	PEC	-	3	3	0	0	3
5	E6	Elective(OEC)	OEC	-	3	3	0	0	3
6	E7	Elective(OEC/PEC)	PEC/OEC	-	3	3	0	0	3
PRACTICAL									
7	22CIP11	Mobile Application Development for IoT Laboratory	PCC	-	4	0	0	4	2
8	22CIP12	Computer Vision Lab	PCC	-	4	0	0	4	2
				TOTAL	**30**	**19**	**0**	**11**	**22**

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	EM	Elective (Management)	HSMC	-	3	3	0	0	3
3	E8	Elective(PEC)	PEC	-	3	3	0	0	3
4	E9	Elective(OEC/PEC)	PEC/OEC	-	3	3	0	0	3
5	E10	Elective(OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
6	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
				TOTAL	**14**	**14**	**0**	**0**	**16**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22CID01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

(A) HSMC,BSC, and ESC Courses									
(a)Humanities and Management Sciences (HSMC)									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2.	22GYA01	தமிழர் மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
3.	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
4.	22GYA02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HSMC	-	1	1	0	0	1
5.	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
6.	EM	Elective - Management	HSMC	-	3	3	0	0	3

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

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

(d) Mandatory Non Credit Courses (MC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22MAN01	Induction Programme	MC	-	-	-	-	-	-
2.	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	22MAN02	3	1	0	2	0
5.	22MAN05	Yoga – II	MC	-	1	0	0	1	0
6.	22MAN07[#]/ 22MAN07R[##]	Soft/Analytical Skills - III	MC	22MAN04	3	1	0	2	0

7.	22MAN08[#]/ 22MAN08R[##]	Soft/Analytical Skills - IV	MC	22MAN07	3	1	0	2	0
8.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
9.	22MAN10R	Communication and Quantitative Reasoning	MC	-	3	1	0	2	0

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

		System Laboratory							
15.	22CIP08	Sensors and Actuator Devices Lab	PCC	-	4	0	0	4	2
16.	22CIC13	Embedded Systems	PCC	-	3	3	0	0	3
17.	22CIC14	Automata Theory and Compiler Design	PCC	-	3	3	0	0	3
18.	22CIC15	Full Stack Development	PCC	-	3	3	0	0	3
19.	22CIP09	Embedded Systems Laboratory	PCC	-	4	0	0	4	2
20.	22CIP10	Full Stack Development Laboratory	PCC	-	4	0	0	4	2
21.	22CIC16	Mobile Application Development for IoT	PCC	-	3	3	0	0	3
22.	22CIC17	Computer Vision and Robotics	PCC	-	3	3	0	0	3
23.	22CIP11	Mobile Application Development for IoT Laboratory	PCC	-	4	0	0	4	2
24.	22CIP12	Computer Vision Laboratory	PCC	-	4	0	0	4	2

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

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

7	22CIX27	Natural Language Processing	PSE	-	3	3	0	0	3
8	22CIX28	Augmented Reality and Virtual Reality	PSE	-	3	3	0	0	3
Vertical IV - Digital Forensics & Infosec Auditing									
1	22CIX31	Cryptography and network security	PSE	-	3	3	0	0	3
2	22CIX32	Ethical Hacking	PSE	-	3	3	0	0	3
3	22CIX33	Cyber Forensics	PSE	-	3	3	0	0	3
4	22CIX34	Social network security	PSE	-	3	3	0	0	3
5	22CIX35	Biometric Security	PSE	-	3	3	0	0	3
6	22CIX36	Cyber Physical System	PSE	-	3	3	0	0	3
7	22CIX37	Mobile Device Security	PSE	-	3	3	0	0	3
8	22CIX38	Intrusion Detection System	PSE	-	3	3	0	0	3
Vertical V – Web Development									
1	22CIX41	Design Thinking	PSE	-	3	3	0	0	3
2	22CIX42	Fundamentals of Data Science	PSE	-	3	3	0	0	3
3	22CIX43	Agile Methodologies	PSE	-	3	3	0	0	3
4	22CIX44	Cloud Computing	PSE	-	3	3	0	0	3
5	22CIX45	UI and UX design	PSE	-	3	3	0	0	3
6	22CIX46	DevOps	PSE	-	3	3	0	0	3
7	22CIX47	Social and information networks	PSE	-	3	3	0	0	3
8	22CIX48	Multimedia Data Compression and Storage	PSE	-	3	3	0	0	3
Vertical VI – Software Development Engineering									
1	22CIX51	Cloud Service Management	PSE	-	3	3	0	0	3
2	22CIX52	Software Testing Tools and Techniques	PSE	-	3	3	0	0	3
3	22CIX53	Software Quality Assurance	PSE	-	3	3	0	0	3
4	22CIX54	Software project management	PSE	-	3	3	0	0	3
5	22CIX55	IT Operations	PSE	-	3	3	0	0	3
6	22CIX56	Mean Stack Development	PSE	-	3	3	0	0	3

7	22CIX57	Web Mining	PSE	-	3	3	0	0	3
8	22CIX58	Product life cycle management	PSE	-	3	3	0	0	3

MANAGEMENT ELECTIVES									
1.	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
2.	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
3.	22GEA04	Professional Ethics and Human Values	HSMC	-	3	3	0	0	3
OPEN ELECTIVES									
1.	22CIZ01	Internet of Things and its applications	OEC	-	3	3	0	0	3
2.	22CIZ02	Sensors and Actuator devices	OEC	-	3	3	0	0	3
3.	22CIZ03	Industrial and Medical IoT	OEC	-	3	3	0	0	3
4.	22CIZ04	Wearable Computing	OEC	-	3	3	0	0	3

Minor degree courses Internet of Things									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22CIM01	Internet of Things	OEC	-	3	3	0	0	3
2	22CIM02	Fundamentals of Sensors and Actuators	OEC	-	3	3	0	0	3
3	22CIM03	IoT App Development	OEC	-	3	3	0	0	3
4	22CIM04	IoT for Industrial and Medical Applications	OEC	-	3	3	0	0	3
5	22CIM05	Wearable Computing	OEC	-	3	3	0	0	3
6	22CIM06	Fog and Edge Computing	OEC	-	3	3	0	0	3
7	22CIM07	Privacy and Security in IoT	OEC	-	3	3	0	0	3
8	22CIM08	Embedded Systems for IoT	OEC	-	3	3	0	0	3

CREDIT DISTRIBUTION

SEM	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	TOTAL
I	4	8		10				22
II	4	4		15				23
III		4	18					22
IV		3	21					24
V			14			9		23
VI			10			6	6	22
VII	5				2	3	6	16
VIII					10			10
TOTAL	13	19	63	25	12	18	12	162
R22 %	8.0	11.7	38.8	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+22+24+23+22+16+10) = 162 CREDITS

22CIC13 - EMBEDDED SYSTEMS				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To introduce students to various components of typical embedded systems viz., sensors and actuators, data converters, UART etc., and their interfacing. • To expose students to characteristics and various challenge of real time operating systems in terms of resources and deadline.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the challenges in designing an embedded system using various microcontrollers	An	40%
CO2	Make use of the working principle to interface embedded system components.	Ap	20%
CO3	Analyze the benefits and drawbacks of real –time scheduling and to recommend acceptable solution for specific challenges.	An	20%
CO4	Analyze the ideas behind serial communication technologies and their applications.	An	20%
CO5	Implement the embedded system in real world application.	Ap	Internal Assessment

UNIT I – INTRODUCTION	**(9)**
Overview of Embedded System - Design Challenge: Optimizing Design Merits - Embedded Processor Technology: Software and Hardware - Application of Specific Processors - Micro-controller architecture: 8051, PIC, and ARM.	
UNIT II - I/O INTERFACING TECHNIQUES	**(9)**
Introduction to memory - Memory interfacing: SRAM, DRAM and Flash Memory - A/D - D/A - Timer and counter - Watchdog timers: ATM Timeout using a Watchdog Timer - Encoder & Decoder – UART - Sensors and actuators interfacing.	
UNIT III - REAL TIME OPERATION SYSTEM	**(9)**
Classification and characteristics of Real – Time Tasks - features of real time operating system - issues and challenges in RTS - Real time task Scheduling : EDF- RMA and Hybrid schedulers - POSIX : RT and IEEE POSIX Standards.	

UNIT IV - EMBEDDED NETWORKING PROTOCOLS	(9)
Serial Protocols : Inter Integrated Circuits (I^2C) and Controllers Area Network - Embedded Ethernet Controller - RS232 – Bluetooth - ZigBee - Wi-Fi.	
UNIT V - APPLICATION OF EMBEDDED SYSTEM AND CASE STUDIES	**(9)**
Introduction to embedded system application using case studies : Role in Agriculture sector, Automotive electronics, Consumer Electronics, Industrial controls, Embedded system for Adaptive Cruise Control (ACC), Study of Embedded system for Smart Card.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Vahid, Frank, and Tony D. Givargis. Embedded system design: a unified hardware/software introduction. John Wiley & Sons, 2001.
2. RajKamal. Embedded Systems-SoC, IoT, AI and Real-Time Systems. McGraw-Hill Education, 2020.

REFERENCES:

1. Marilyn Wolf, Computer as Components – Principles of Embedded Computing System Design, Fourth Edition, Morgan Kaufman Publishers, 2016.

Mapping of COs with POs / PSOs

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

22CIC14 – AUTOMATA THEORY AND COMPILER DESIGN (Common to 22CCC13)				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE-REQUISITE: NIL

Course Objective:	To understand the various phases of compiler design and design context free grammar of any language, various parsing techniques, the intermediate code generation and implement the code generator.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design minimized automata for regular expression.	Ap	20%
CO2	Construct parsing table using different parsers. SLR, CLR, LALR and Shift reduce parsing.	Ap	20%
CO3	Generate intermediate code for the expression.	E	20%
CO4	Apply the code optimization techniques to generate machine code.	Ap	20%
CO5	Demonstrate the construction of automata using JFLAP and present the compiler construction process with a sample code	Ap	20%

UNIT I - INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS	**(9)**
Introduction – Translators - Compilation and Interpretation - Language processors - The Phases of Compiler – Compiler Construction Tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA.	
UNIT II – CONTEXT FREE GRAMMAR AND PUSHDOWN AUTOMATA	**(9)**
Types of Grammar - Chomsky's hierarchy of languages – Context Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and CNF and GNF – Push Down Automata (PDA) : Definition – Moves – Instantaneous descriptions – Languages of push down automata – Equivalence of pushdown automata and CFG - CFG to PDA - PDA to CFG – Deterministic Pushdown Automata.	
UNIT III – SYNTAX ANALYSIS	**(9)**
Role of Parser – Types of Parsing - Top down parser and Bottom up parser - Recursive Descent Parser - LL(1) - LR(0) Item Construction of SLR Parsing Table – CLR(1) - LALR Parser - Error Handling and Recovery in Syntax Analyzer.	

UNIT IV - IMPLEMENTATION OF THREE ADDRESS CODE	(9)
Intermediate Representation: Translation to Syntax Trees and DAGs.- Syntax-Directed Translation Schemes for Code Generation - Assignment and Boolean Operators & Control flow – Backpatching - Procedural calls.	
UNIT V – CODE OPTIMIZATION & CODE GENERATION	**(9)**
Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks - Issues in the Design of a Code Generator - Basic Blocks and Flow Graphs; Representation of Flow Graphs, Loops- A Simple Code Generator.	
TOTAL (L:45, T:15) : 60 PERIODS	

TEXTBOOKS:

1. J.E .Hopcroft, R.Motwani and J.D Ullman, Introduction to Automata Theory, Languages and computations, Second Edition, Pearson Education, 2003.
2. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, Elements of the theory of computation, Second Edition,PHI, 2003.
2. J.Martin, Introduction to Languages and the theory of computation, Third Edition, TMH, 2003.
3. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence Based Approach, Morgan Kaufmann Publishers, 2002.

Mapping of COs with POs / PSOs

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

22CIC15 - FULL STACK DEVELOPMENT *(COMMON TO 22CSC15,22AIC15 AND 22ITC17)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	To provide students with a solid foundation in the front-end and back-end web development fundamentals, integrate with databases and external services, and apply best practices in web development

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

UNIT I - BASICS OF MERN STACK	(9)
MERN Introduction-MERN Components - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js npm.	
UNIT II – BOOTSTRAP AND NODE JS BASICS	(9)
Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS.Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter.	
UNIT III - NODE JS EXPRESS	(9)
Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON- Express - Routing - Handler Function – Middleware-Rest API.	

UNIT IV - MONGODB	(9)
MongoDB - MongoDB Basics - Documents -Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB.	
UNIT V - REACT	(9)
React Introduction – State - Lifecycle methods - Hooks – useState, useEffect, useContext - Event handling - Forms – controlled components, submission, validation.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22CIP09 - EMBEDDED SYSTEM LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• Provide a comprehensive understanding of embedded systems and their application in IoT • Equip students with the knowledge and skills to effectively implement and manage a range of IoT communication protocols.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Utilise the knowledge of embedded systems and their range of uses in the Internet of Things environment.	Ap
CO2	Interfacing the various kind of embedded system components with Internet of Things.	An
CO3	Apply embedded programming techniques to solve real-world problems	Ap
CO4	Develop an integrated hardware and software solutions for embedded systems to ensuring functionality and efficiency.	Ap
CO5	Design a various IoT communication protocols to enable seamless device connectivity and data exchange within IoT networks.	Ap

LIST OF EXPERIMENTS :

1. Monitoring a machinery vibration using vibration sensors
2. Interfacing an MQ-2 Gas Sensor with an LED
3. Interfacing an ADXL345 Accelerometer with ARM
4. Interfacing soil moisture sensor with ARM
5. Implementing a program to heartbeat sensor and ARM
6. Interfacing UART for LED Control between IoT and PC
7. Application to transmit & receive a character through RS232 and Bluetooth low energy Communication
8. Interfacing GSM Module with IoT and Sending Sensor Data to Cloud
9. Interfacing ESP8266(WIFI Module) with IoT for HTTP Communication
10. Implement Zigbee interface for Data Transmission with IoT

TOTAL (P:60) = 60 PERIODS

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

22CIP10 - FULL STACK DEVELOPMENT LABORATORY (Common to 22CSP09 AND 22ITP10)				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	To develop full stack applications with clear understanding of user interface, business logic and data storage.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Install and develop programs using React JS.	Ap
CO2	Make use of multiple node js modules to implement the application.	An
CO3	Develop responsive and dynamic web pages	C
CO4	Develop responsive and mobile supported applications	C
CO5	Perform database operations using MongoDB and aware of recent technologies in Full Stack through self-learning.	An

LIST OF EXPERIMENTS :

1. Build a Basic React APP that display custom message from users
2. Create a Login form using React JS
3. Write a program to upload Single/Multiple images to cloudinary using Node JS
4. Write a program to create router using Node.js with Express
5. Design a program to create Single Responsive Page using Bootstrap
6. Implement Create and Read Operations in MongoDB.
7. Implement Update and Delete Operations in MongoDB.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs

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

22MAN10R - COMMUNICATION AND QUANTITATIVE REASONING				
	L	T	P	C
	1	0	2	0

PRE-REQUISITE : NIL

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

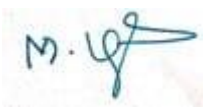
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns,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

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

REFERENCES:

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

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



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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22CIC17 - COMPUTER VISION AND ROBOTICS				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				

Course Objective:	• To understand the Fundamental Concepts Related To sources, shadows and shading. • To understand the Geometry of Multiple Views.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement fundamental image processing techniques required for computer vision.	An	20%
CO2	Implement boundary tracking techniques.	An	20%
CO3	Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections	Ap	20%
CO4	Apply 3D vision techniques and Implement motion related techniques.	Ap	20%
CO5	Develop applications using computer vision techniques	Ap	20%

UNIT I - FUNDAMENTALS OF IMAGING: FROM LIGHT MEASUREMENT TO COLOR REPRESENTATION	(9)
CAMERAS: Pinhole Cameras. Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases. Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models. Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	
UNIT II - ADVANCED IMAGE PROCESSING: FILTERS, EDGE DETECTION, AND TEXTURE ANALYSIS	**(9)**
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates. Edge Detection: Noise, Estimating Derivatives, Detecting Edges. Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	
UNIT III - MULTI-VIEW GEOMETRY AND SEGMENTATION TECHNIQUES IN IMAGING	**(9)**
The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras Segmentation by Clustering: Segmentation, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	

UNIT IV - MODEL-BASED SEGMENTATION AND TRACKING TECHNIQUES	(9)
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice. Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples	
UNIT V - GEOMETRIC CAMERA MODELS AND CALIBRATION	**(9)**
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations. Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

Mapping of COs with POs / PSOs

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

22CIP09-MOBILE APPLICATION DEVELOPMENT FOR IoT LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To explore various Hybrid App Development Platforms. • To acquire the knowledge of app releases and publishing an app to the play store.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Demonstrate the configuration of Android Software Development tools.	Ap
CO2	Design and develop Mobile Applications using Android and Kotlin.	An
CO3	Develop a complex android application by using APIs, Libraries, and message handling techniques.	Ap
CO4	Construct the mobile application using a hybrid framework or SDK release.	An
CO5	Publish the mobile application on Google Play Store.	C

LIST OF EXPERIMENTS :

1. Install Android Studio and Configure Latest Android SDKs and Android Virtual Devices.
2. Create an application that takes the name from a text box and shows "hello message" along with the name entered in the text box, when the user clicks the OK button.
3. Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout).
4. Design a complete Student Management Application using Android and provide effective navigation between various Activities.
5. Design a mobile IoT APP for a smart home.
6. Design a mobile IoT App for Agriculture motor control from a remote location.
7. Design a mobile IoT APP for home protection which monitors for intruders and sends a message to your phone immediately and also sends an email.
8. Design a Green leaf disease detection using Rasberry Pi.
9. Develop an Android Application that stores Student Details into the hosting server and retrieve student details from the server.
10. Prepare and Publish Your Android Apps in Google Play Store.

TOTAL (P:60) = 60 PERIODS

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

22CIP12 - COMPUTER VISION LABORATORY				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To Make students acquainted with practical aspects of computing with images. • To Improve quality of image by applying enhancement techniques. • To understand Feature Extraction algorithms.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Understand the basic image processing techniques and enhance images by adjusting contrast	Ap
CO2	Detects edges using various kernels using transformation	Ap
CO3	Apply histogram processing, convert between various color spaces.	Ap
CO4	Partition dataset by classification and clustering	An
CO5	Comprehend computer vision systems for real world problems.	An

LIST OF EXPERIMENTS :

1. Implement basic image operations
   a. Loading and displaying an image.
   b. Color formats
   c. Image enhancement.
2. Implement smoothing filters on an image using
   a.Gaussian filter
   b. Median filter
   c. Mean Filter
3. Demonstrate fourier Transformations
4. Implement histogram calculation and equalization for the given image.
5. Implement morphological operations like dilation, erosion, opening and closing on the given image
6. Implement edge detection on images using any two edge detection masks.
7. Detection of motion from structure.
8. Implement texture extraction of a given image.
9. Implement object detection like recognizing pedestrians.
10. Implement face recognition of an image using K-Means clustering.
11. Implement dimensionality reduction using PCA for the given images.
12. Demonstrate model based reconstruction using tensor flow.

TOTAL (P:60) = 60 PERIODS

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

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

PRE-REQUISITE : NIL

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

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

UNIT I- INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL-ENCOMPASSING RESOLUTION	**(6)**
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II- RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	**(6)**
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	

UNIT III- UNDERSTANDING HUMAN BEING	(6)
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	
UNIT IV- Understanding Nature and Existence	**(6)**
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V- Understanding Human Conduct, All-encompassing Resolution and Holistic Way of Living	**(6)**
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOK:

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

REFERENCES:

1. IvanIllich,1974, Energy& Equity, The Trinity Press, Worcester, and Harper Collins ,USA
2. E.F. Schumacher,1973, Smallis Beautiful: a studyofeconomicsasifpeoplemattered, Blond& Briggs,Britain.
3. Sussan George, 1976,Howthe Other Half Dies, Penguin Press. Reprinted1986,1991
4. DonellaH.Meadows,DennisL.Meadows,JorgenRanders,WilliamW.BehrensIII,1972, LimitstoGrowth–ClubofRome'sreport,UniverseBooks.
5. ANagraj,1998,JeevanVidyaEkParichay,DivyaPathSansthan,Amarkantak.
6. PLDhar,RRGaur,1990,ScienceandHumanism,CommonwealthPublishers.
7. ANTripathy,2003,HumanValues,NewAgeInternationalPublishers
8. EGSeebauer&RobertL.Berry,2000,FundamentalsofEthicsforScientists&Engineers, OxfordUniversityPress
9. MGovindrajran,SNatrajan&V.S.SenthilKumar,EngineeringEthics(includingHumanValues), Eastern EconomyEdition, Prentice HallofIndia Ltd.
10. SubhasPalekar,2000,HowtopracticeNaturalFarming,Pracheen(Vaidik)KrishiTantraShodh,Amravati
11. BPBanerjee,2005,FoundationsofEthicsandManagement,ExcelBooks
12. BLBajpai,2004,IndianEthosandModernManagement,NewRoyalBookCo.,Lucknow. Reprinted2008.

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

22GED02 – INTERNSHIP / INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	0	2
PRE-REQUISITE : NIL					
Course Objective:	• To obtain a broad understanding of the emerging technologies in Industry • To gain knowledge about I/O models.				
Course Outcomes The Student will be able to		**Cognitive Level**			
CO1	Engage in Industrial activity which is a community service.	U			
CO2	Prepare the project report, three minute video and the poster of the work.	Ap			
CO3	Identify and specify an engineering product that can make their life comfortable.	An			
CO4	Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms.	Ap			
CO5	Identify the community that shall benefit from the product.	E			

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

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

- Successful completion of Internships/ Value Added Programs/Training Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute.
- Participation in Inter-Institute innovation related competitions like Hackathons.
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests

- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

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

22CID01- PROJECT WORK					
		L	**T**	**P**	**C**
		0	**0**	**20**	**10**
PRE-REQUISITE : NIL					
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem.	Ap	20 % - First Review (Internal)		
CO2	Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment	Ap, E	20 % - Second Review (Internal)		
CO3	Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project, design, implement, analyze and interpret results of the implemented project	Ap, An, C	20 % - Third Review (Internal)		
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE format of the work and effective oral communication through presentation of the project work and demonstration of the project.	E	20 % - Final Review (External)		
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work (leading to start-up/ product/ research paper/ patent)	Ap, An	20 % - Final Review (External)		

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide.

The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make

presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations
TOTAL (P: 300) = 300 PERIODS

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

1 . Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.

2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

UNIT I- OVERVIEW OF 5G WIRELESS COMMUNICATIONS	**(9)**
Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.	
UNIT II- WAVEFORM DESIGN FOR 5G & BEYOND	**(9)**
Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multicarriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods.	

UNIT III - 5G ARCHITECTURE AND 5G NEXTGEN CORE NETWORK	(9)
5G Architecture: Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements	
UNIT IV - MASSIVE MIMO SYSTEMS	**(9)**
Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming.	
UNIT V - V2X COMMUNICATIONS AND NOVEL ASPECTS IN TERAHERTZ WIRELESS COMMUNICATIONS	**(9)**
Vehicle-to-Vehicle (V2V) Communications, Vehicle-to-Infrastructure (V2I) Communications, Vehicle-to-Pedestrian (V2P) Communication, Self-driving Vehicles & its challenges, Vehicle-to-Network (V2N) Communications. Overview, potential spectral windows at THz frequencies, Terahertz wave propagation characteristics, opportunities & challenges, application	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

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

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

PRE-REQUISITE : NIL

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

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

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

UNIT V – CONNECTING TO THE CLOUD	(9)
Smart IoT systems- DHT11 data logger with thinkspeak server-ultrasonic sensor data logger-air quality monitoring system-landslide detection and disaster management system-smart motion detector and upload image to gmail.com.	
TEXT BOOKS :	
1. Rajesh singh, Anitha Gehlot, Lovi raj gupta, Bhupendra singh and MahendranSwain "Internet of things with Raspberry Pi and Arduino" CRC Press 2020.	
REFERENCES:	
1. Sai Yamanoor, Srihari Yamanoor " Python programming with Raspberry Pi" Packet Publishing Ltd, Ist edition, 2017. 2. Wolfram Donat "Learn raspberry Pi programming in python" A Press 2014.	

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

UNIT-I INTRODUCTION TO WEARABLE SYSTEMS	**(9)**
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems- Wearable ground reaction force sensor.	
UNIT-II SIGNAL PROCESSING	**(9)**
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation**.**	

UNIT-III WIRELESS HEALTH SYSTEM	(9)
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.	
UNIT-IV SMART TEXTILE	**(9)**
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study- smart fabric for monitoring biological parameters - ECG, respiration.	
UNIT-V APPLICATIONS OF WEARABLE COMPUTING	**(9)**
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22CIX06– FOG AND EDGE COMPUTING (Common to 22CSX37,22ITX37,22AIX37 and 22CCX37)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To introduce IoT enabling technologies and its opportunities. • To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing.				

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

UNIT I- INTERNET OF THINGS (IOT) AND NEW COMPUTING PARADIGMS	**(9)**
Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges	
UNIT II - CHALLENGES IN FEDERATING EDGE RESOURCES	**(9)**
Introduction –the networking challenge - the management challenge- Miscellaneous challenges - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics.	
UNIT III – OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING	**(9)**
Introduction- Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing – optimization Techniques.	

UNIT IV – MIDDLEWARE FOR FOG AND EDGE COMPUTING	(9)
Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Fog Data Management - Smart Building - Predictive Analysis with FogTorch .	
UNIT V – APPLICATIONS OF FOG AND EDGE COMPUTING	**(9)**
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog.	

TEXT BOOKS :

1. Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.

REFERENCES:

1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2ndedition, CreateSpace Independent Publishing Platform, USA
2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India

Mapping of COs with POs / PSOs

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

22CIX07 – WIRELESS AD-HOC AND SENSOR NETWORKS (Common to 22CSX35,22ITX35 and 22CCX32)				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• Understand the design issues in ad hoc and sensor networks. • Learn the different types of MAC protocols

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understanding the concepts, network architectures and applications of ad hoc and wireless sensor networks	U	20%
CO2	Understanding the working of MAC Protocols for ad hoc networks	U	20%
CO3	Understanding the working of Routing Protocols for ad hoc networks	U	20%
CO4	Analyze the protocol design issues of ad hoc and sensor networks	An	20%
CO5	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues	Ap	20%

UNIT I- FUNDAMENTALS OF WIRELESSS COMMUNICATION TECHNOLOGY	**(9)**
Introduction – Spectrum Allocation-characteristics of wireless channel-modulation techniques-multiple accesss techniques-wireless internet- mobile IP.	
UNIT II – AD-HOC WIRELESS NETWORK AND MAC PROTOCOLS	**(9)**
Cellular and Ad hoc wireless networks-Applications- Issues in Ad-Hoc wireless network. MAC Protocols: Issues-classifications-other MAC Protocols.	
UNIT III – ROUTING PROTOCOLS FOR AD-HOC WIRELESS NETWORKS	**(9)**
Introduction- Issues in designing a routing protocol-classifications of routing protocols-table driven routing protocol-on-demand routing protocol-hybrid routing protocols-routing protocols with efficient flooding mechanisms.	
UNIT IV – TRANSPORT LAYER PROTOCOLS	**(9)**
Design goals of transport layer protocols-TCP over Ad-hoc wireless networks-other transport layer protocols-Security in Ad-hoc wireless networks-network security attacks-key management-secure routing in in Ad-hoc wireless networks.	

UNIT V – WIRELESS SENSOR NETWORKS	(9)
Sensor network architecture-data dissemination-data gathering-MAC protocols for sensor networks-Location discovery-Quality of a sensor network-evolving standards.	

TEXT BOOKS :

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Dargie, Waltenegus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.

REFERENCES:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

Mapping of COs with POs / PSOs

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

22CIX08-IMAGE PROCESSING (Common to 22CSX38,22ITX38 and 22CCX35)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide the basic knowledge on image processing concepts. • To develop the ability to apprehend and implement various image processing algorithms.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understand different components of image processing system	U	20%
CO2	Describe various image transforms, enhancement techniques using various processing methods	U	20%
CO3	Illustrate the compression and segmentation techniques on a given image	Ap	40%
CO4	Demonstrate the filtering and restoration of images(pixels) with examples	Ap	20%
CO5	Illustrate the various schemes for image representation and detection techniques with examples	An	20%

UNIT-I DIGITAL IMAGE FUNDAMENTALS	**(9)**
Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.	
UNIT-II IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN	**(9)**
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering, Implementation.	
UNIT-III IMAGE RESTORATION	**(9)**
Image Restoration: A Model of the Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and Multi resolution Processing: Multi resolution	

Expansions, Wavelet Transforms in one Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.	
UNIT-IV IMAGE COMPRESSION & SEGMENTATION	**(9)**
Image Compression: Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	
UNIT-V REPRESENTATION AND DESCRIPTION	**(9)**
Various schemes for representation-chain codes-polygonal approximation-signatures –boundry segments- boundary descriptors: shape numbers-fourier descriptors and regional descriptors-topological descriptors-texture-moments of two dimentional functions.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:
1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Prentice Hall India/Pearson Education.
REFERENCES:
1. A.K.Jain, Fundamentals of Digital Image Processing. Prentice Hall India. 2. Madhuri.A.Joshi, Digital Image Processing, PHI. 3. Sonka, Image Processing, Analysis and Machine Vision. Cengage Publications.

Mapping of COs with POs / PSOs

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

22CIX11 - EXPLORATION AND VISUALIZATION OF DATA

L	T	P	C
3	0	0	3

PRER-EQUISITE : NIL

Course Objective:

- To implement data visualization using Matplotlib.
- To perform univariate, bivariate and multi variate data exploration and analysis.

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

TOTAL : 45 PERIODS

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Mapping of COs with POs / PSOs

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

22CIX12 - BIG DATA ANALYTICS (Common to 22CSX13,22ITX13,22AIC16 and 22CCX25)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	● Acquire a deep understanding of big data and NoSQL. ● Develop expertise in map reduce analytics using Hadoop and related tools ● Explore the Hadoop related tools for Big Data Analytics.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

22CIX13 - DEEP LEARNING (Common to 22CSX01,22ITX01 and 22AIC13)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To understand and apply deep learning techniques to support real-time applications.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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", 1 st Edition, MIT Press, USA, 2018.
2. Josh Patterson and Adam Gibson,"Deep Learning–A Practitioner"s Approach",1st Edition,O"ReillySeries,August2017.

Mapping of COs with POs / PSOs

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

22CIX14 - RECOMMENDER SYSTEMS (Common to 22CSX03,22ITX03 and 22AIX02)				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To learn the significance of machine learning algorithms for Recommender systems.

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

UNIT I – INTRODUCTION	**(9)**
Introduction - Recommender Systems Function - Data and Knowledge Sources - Recommendation Techniques - Application and Evaluation - Applications of recommendation systems - Issues with recommender system.	

UNIT II – CONTENT-BASED RECOMMENDATION	**(9)**
High level architecture of content-based systems - Advantages and drawbacks of content based filtering- Item Representation - Learning User Profiles and Filtering - Trends and Future Research - Neighborhood-based Recommendation - Components of Neighborhood Methods.	

UNIT III – COLLABORATIVE FILTERING	**(9)**
Preliminaries: Baseline predictors - The Netflix data - Implicit feedback - Matrix factorization models - Neighborhood models - Enriching neighborhood models - Between neighborhood and factorization - Constraint-based Recommenders.	

UNIT IV – CONTEXT-AWARE RECOMMENDER SYSTEMS	(9)
Context in Recommender Systems - Paradigms for Incorporating Context in Recommender Systems - Combining Multiple Approaches – Case Studies - Additional Issues in Context-Aware Recommender Systems- Evaluating Recommender Systems: Experimental Settings - Recommendation System Properties.	
UNIT V – IPVT, MATCHING RECOMMENDATION TECHNOLOGIES	**(9)**
IPTV Architecture - Recommender System Architecture- Recommender Algorithms- Recommender Services – System Evaluation - Knowledge Sources – Domain - Knowledge Sources - Mapping Domains to Technologies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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 BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22CIX16 - COMPUTER VISION (Common to 22CSX05,22ITX05,22AIC05 and 22CCX23)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To impart knowledge and understanding about the application of algorithms and techniques used to interpret and analyze visual data from the world.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply 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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret features of 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 BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply advanced probabilistic models and decision theory concepts to optimize inference.	Ap	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**

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

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

UNIT I –INTRODUCTION	**9**
Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF mode	
UNIT II –TEXT CLASSIFICATION	**9**
Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Deep Learning models for text classification– Recurrent Neural Networks (RNN) – Transformers –Text summarization and Topic Models	
UNIT III – QUESTION ANSWERING AND DIALOGUE SYSTEMS	**9**
Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems –– evaluating dialogue systems	

UNIT IV – TEXT-TO-SPEECH SYNTHESIS	9
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional ResponsibilityRoboethics Taxonomy.	
UNIT V – AUTOMATIC SPEECH RECOGNITION	**9**
Named Entity Recognition (NER)-Coreference resolution-Text coherence and cohesion-Advanced sentiment analysis-Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems	
TOTAL= 45 PERIODS	

TEXT BOOK:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22CIX23 - TIME SERIES ANALYSIS AND FORECASTING (Common to 22AIX13)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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 BOOK:

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

REFERENCE:

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

Mapping of COs with POs / PSOs

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

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

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

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

UNIT IV – HEALTHCARE AND DEEP LEARNING	(9)
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.	
UNIT V – CASE STUDIES	**(9)**
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE :NIL

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

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

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

UNIT IV – PREDICTIVE MODELLING	9
Decision Trees-Logistic Regression-Neural Network Model-K-Nearest Neighbors-Naive Bayes - Regression Models- Linear Regression-Building Neural Networks using XLMiner-Other Regression Algorithms	
UNIT V – TEXT MINING	**9**
Motivation for Text Mining-A Predictive modeling approach to Text Mining-Structured vs. Unstructured data-Why Text mining is hard-Data Preparation steps-Text mining features-Modeling with Text mining features-Regular Expressions - Web mining - Text Mining vs. Web Mining - Case studies:-Survey Analysis	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

PRE-REQUISITE : NIL

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

22CIX28 - AUGUMENTED REALITY AND VIRTUAL REALITY (Common to 22CSX16,22ITX18 and 22AIX18)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	• To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply 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**

22CIX31 – CRYPTOGRAPHY AND NETWORK SECURITY (Common to 22CCC12)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: NIL					
Course Objective:	• To equip students with a thorough understanding of the principles and practices of securing digital information.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply number theory concepts in the implementation of cryptographic algorithms	Ap	20%
CO2	Analyze block cipher algorithms in terms of security and efficiency.	An	20%
CO3	Apply Public Key Cryptography in Real-World Scenarios use public key cryptography to secure data and communications in various real-world applications.	Ap	20%
CO4	Analyze common hash algorithms such as MD5, SHA-1, and SHA-2.	An	20%
CO5	Analyze the functioning and security protocols such as SSL/TLS, HTTPS, and IPsec.	An	20%

UNIT I-INTRODUCTION AND NUMBER THEORY	**(9)**
Computer security concepts - OSI security architecture – Security attacks – Security services – Security mechanism – Model for network security– Classical encryption techniques: substitution techniques, transposition techniques, Rotor machine, steganography– Finite Fields and Number Theory: Divisibility and Division algorithm–Euclid's algorithm-Modular arithmetic-Groups, Rings, Fields – Finite fields– Polynomial Arithmetic–Prime numbers-Fermat's and Euler's theorem- Testing for primarily-The Chinese remainder theorem-Discrete logarithms.	
UNIT II-BLOCK CIPHERS AND ENCRYPTION STANDARDS	**(9)**
Block cipher and Data Encryption Standard–Advanced Encryption Standards: Finite field arithmetic–AES structure–AES transformation functions–AES key expansion–AES implementation-Block cipher operation : Multiple Encryption and triple DES - Electronic Codebook - Cipher Block Chaining Mode - Cipher Feedback Mode – Output Feedback Mode-Counter Mode–Pseudo random Number Generation-Stream cipher–RC4.	
UNIT III- PUBLIC KEY CRYPTOGRAPHY	**(9)**
Public key cryptography: Principles of public key cryptosystems-The RSA algorithm - Diffie Hellman Key exchange- El Gamal cryptosystem - Elliptic curve arithmetic - Elliptic curve cryptography –	

Pseudorandom Number Generation Based on an Asymmetric Cipher.	
UNIT IV -MESSAGE AUTHENTICATION AND DIGITAL SIGNATURES	**(9)**
Cryptographic Hash Function s- Message Authentication Code – Digital signature – Key management and distribution – user authentication.	
UNITV– NETWORK AND INTERNET SECURITY	**(9)**
Transport level security-Wireless network security-Electronic Mail security: PGP,S/MIME– IP security – Intruders –Malicious software–Firewalls.	
TOTAL :45 PERIODS	

TEXT BOOKS:

1. David Cielen, Arno D.B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. RobertS. Witte and JohnS. Witte, "Statistics", EleventhEdition, WileyPublications, 2017. (Units II and III).
3. Jake Vander Plas,"PythonDataScienceHandbook",O'Reilly,2016.(Units IV and V)

REFERENCE:

1. Allen B.Downey, "Think Stats :Exploratory Data AnalysisinPython",GreenTeaPress,2014.

Mapping of COs with POs / PSOs

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

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

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

UNITI-INTRODUCTION

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

UNITII-NETWORK AND COMPUTER ATTACKS

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

UNITIII-FOOT PRINTING AND SOCIAL ENGINEERING

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

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

TEXTBOOKS:

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

REFERENCES:

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

2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.

Mapping of Cos with POs /PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	3
2		3		3									3	3
3				3	3								3	3
4		3			3								3	3
5		2						3	3				3	3
CO (W.A)	**3**	**2.7**		**3**	**3**			**3**	**3**				**3**	**3**

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

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

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

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

UNIT III – NETWORK FORENSICS	**(9)**
Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip – off – Micro – read – Challenges –iOS operating system.	

UNIT IV – CLOUD FORENSICS DATA	(9)
Cloud forensics: Cloud computing model – Server – side forensics – Client – side forensics – Challenges – Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis –Tools – Challenges –Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics – Log Forensics – Content analysis – File metadata forensics	
UNIT V - BITCOIN FORENSICS	**(9)**
Email sand email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components – Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

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

REFERENCES:

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

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

3.Kenneth C. Brancik— Insider Computer Fraud Auerbach Publications Taylor & amp; Francis Group –2008.

Mapping of COs with POs / PSOs

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

22CIX34 - SOCIAL NETWORK SECURITY (Common to 22CSX25,22ITX25,22AIX25 and 22CCX02)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To focuses on understanding and addressing security issues related to social networking platforms, including protecting user privacy, preventing cyber threats, and managing data security.				

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

UNIT I - INTRODUCTION	**(9)**
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web – Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.	

UNIT II - MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	**(9)**
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.	

UNIT III - EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	**(9)**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting community's social network infrastructures and communities - Decentralized online social networks - multi-relational characterization of dynamic social network communities.

UNIT IV - PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES **(9)**

Understanding and predicting human behaviour for social communities - User data management – Inference and Distribution – Enabling new human experiences-Reality Mining-Context- Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT - V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS **(9)**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover Networks-Community welfare - Collaboration networks - Co-Citation networks.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**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**

22CIX35 - BIOMETRIC SECURITY (Common to 22CSX28,22ITX28,22AIX22 and 22CCX03)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• To provide students with a comprehensive understanding of biometric security systems, covering their design, implementation, evaluation, and applications in various security contexts.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the 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

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

PRE-REQUISITE : NIL

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

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

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

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

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

UNIT I - INTRODUCTION	**(9)**

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

1. Stephen Northcutt, Judy Novak: "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook ", Prentice Hall, 2001.
3. Rafeeq Rehman: "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall, 2003

Mapping of COs with POs / PSOs

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

22CIX41 DESIGN THINKING (Common to 22ITC08)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To expose the student with state-of-the-art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design thinking and its different phases for business process.	Ap	20%
CO2	Empathize with user situations and be able to define clear problem statement	An	20%
CO3	Create prototypes for clear understanding of the problem statement and Use the different ideation methods.	Ap	20%
CO4	Implement Plan through engage and evolve phase that will deliver/achieve the Big Idea/solution deduced from earlier phases	An	40%
CO5	Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches	C	Internal Assessment

UNIT I – Introduction to design thinking	**(9)**
Introduction – Need for design thinking – Design and Business – The Design Process –– Phases in design thinking process – Five stage mode- Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.	
UNIT II - Empathize phase	**(9)**
Visualization – Mind Mapping – Empathize – Empathize with the users - Steps in empathize phase – Developing empathy towards people –Observations – Need Finding – User Personas.	
UNIT-III Ideate phase and Prototype phase	**(9)**
What is ideation – Need for ideation – Uses of ideation – Ideation Methods- Brainstorming-Rules for brainstorming -Ideation games - Six Thinking Hats –Doodling – Use of doodling in expressing creative ideas- Idea refinement. Prototyping- Guidelines for prototyping –Types of prototyping- Importance of prototyping in design thinking.	
UNIT IV – Engage phase	**(9)**
Assumption Testing-Rapid Prototyping – Engage – Story telling – Characteristics of good stories – Reaching users through stories-Storyboarding-Characteristics of good stories-Value proposition-Guidelines to write value proposition	

UNIT V – Evolve phase	(9)
Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems– Quick Wins Agile Methodology – Complementing agile with design thinking	
TOTAL= 45 PERIODS	

TEXT BOOKS:

1. Lee Chong Hwa "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 1st Edition, 2017
2. Eli Woolery, Design Thinking Handbook, Invision, 2019
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires, 1stEdition, HarperCollins, 2009

REFERENCE:

1. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014

Mapping of COs with POs / PSOs

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

22CIX42 - FUNDAMENTALS OF DATA SCIENCE (Common to 22ITC10)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	To provide insights from data using data science concepts in python				
Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**		
CO1	Apply the fundamental knowledge of data science to solve real time problem	Ap	20		
CO2	Analyze and visualize data for knowledge representation.	An	20		
CO3	Demonstrate proficiency in data analysis	Ap	30		
CO4	Conduct experiments of data science concepts in python	An	30		
CO5	Develop solutions for real world problems with standard datasets using data science tools	C	Internal Assessment		

UNIT I - INTRODUCTION	**(9)**
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data	
UNIT II - DESCRIBING DATA	**(9)**
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores	
UNIT III - DESCRIBING RELATIONSHIPS	**(9)**
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.	

UNIT IV - PYTHON LIBRARIES FOR DATA WRANGLING	(9)
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.	
UNIT V - DATA VISUALIZATION	**(9)**
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III) 69
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)

REFERENCE:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Mapping of COs with POs / PSOs

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

22CIX43 - AGILE METHODOLOGIES (Common to 22CSX51 and 22AIX51)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE : NIL					
Course Objective:	• Estimate in an incremental and iterative fashion using practical techniques • Apply agile principles to a range of decision possibilities.				

Course Outcomes Students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply UI design concepts for building user Applications.	Ap	20%
CO2	Demonstrate UI Design of any product or application.	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. 5. https://www.interaction-design.org/literature.

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

22CIX47 - SOCIAL AND INFORMATION NETWORKS (Common to 22CSX46,22ITX46,22AIX46 and 22CCX43)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	To determine the theories and methods for analyzing network data, understanding network formation, and applying network analysis to real-world problems.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply various techniques for analyzing and visualizing network data.	Ap	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**

22CIX48 - MULTIMEDIA DATA COMPRESSION AND STORAGE (Common to 22CSX48,22ITX48,22AIX48 and 22CCX48)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE-REQUISITE :NIL					
Course Objective:	• Apply data compression algorithms • Explain Multimedia Information Sharing				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply compression algorithms related to multimedia components such as text,speech,audio,image and video.	Ap	20%
CO2	Analyze the various image compression techniques and apply efficient technique for multimedia content	An	20%
CO3	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

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

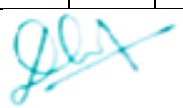
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Cloud Service Management terminology, definition & concepts and predict benefits of cloud service management with traditional IT service management.	Ap	20%
CO2	Analyze strategies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

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

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

Mapping of COs with POs / PSOs

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



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

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of software testing fundamentals to a real-world problem	Ap	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.

REFERENCE:

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

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	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**

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

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply 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 BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the fundamental components and processes involved in IT operations	An	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**

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Node JS and NOSQL concepts for front end and back-end design	Ap	40%
CO2	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**

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key concepts of Web mining to discover useful information from the World-Wide Web and its usage patterns	Ap	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 – WEB CRAWLING	**(9)**
BasicCrawlerAlgorithm–ImplementationIssues–UniversalCrawlers–FocusedCrawlers–TopicalCrawlers–Evaluation–CrawlerEthicsand Conflicts.	
UNIT III - STRUCTURED DATA EXTRACTION	**(9)**
Structured Data Extraction –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matchingand Tree Matching – Multiple Alignment – Building DOM Trees –Extraction Based on a Single List Page –IntroductiontoSchemaMatching–Pre-ProcessingforSchemaMatching- Schema–LevelMatch– DomainandInstance-Level Matching	
UNIT IV – WEB USAGE MINING	**(9)**
Web Usage Mining–Click stream Analysis–Log Files–Data Collection and Pre-Processing–Data Modeling for Web Usage Mining–The BIRCH Clustering Algorithm–Affinity Analysis and the A Priori Algorithm–Discretizing the Numerical Variable	

UNIT V – OPINION MINING	(9)
The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification –Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion SpamDetection.	
TEXT BOOKS : 1. Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)",Springer;2nd Edition2011for unitsI,II,III&V 2. Zdravko Markov, DanielT.Larose, "Data Mining the Web: Uncovering Patternsin Web Content, Structure, and Usage", JohnWiley& Sons, Inc.,2010 for unit IV.	
REFERENCE: 1. Anthony Scime,"Web Mining Applications and Techniques",IdeaGroupPub.,2005	

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

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

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply Product Life Cycle Management **(**PLM) and integrate with lifecycle phases	Ap	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 Weihrich and Mark V. Cannice "Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018.

REFERENCES:

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

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

22GEA03- TOTAL QUALITY MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	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, Urdhwareshe Hemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

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

Mapping of COs with POs / PSOs

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

22GEA04- PROFESSIONAL ETHICS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To Familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To Foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To Encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	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" 5th Edition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. Senthil Kumar,"Professional Ethics and Human Values",Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

Mapping of COs with POs / PSOs

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