



NANDHA ENGINEERING COLLEGE

(Autonomous)

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

Pitchandampalayam (P.O), Vaikkalmedu, Erode - Perundurai Road, Erode - 638 052

Phone : 04294 - 225585, 223711, 223722, 226393 Mobile : 73737 23722 Fax : 04294 - 224787

Website : www.nandhaengg.org

E.mail : info@nandhaengg.org

1.1.2. Details of courses where syllabus revision was carried out in B.E-Computer Science and Engineering R22-Curriculum

Course Code	Course Name	% of Change
22CSC12	Advanced Java Programming	30
22CSP08	Advanced Java Programming Laboratory	40
22CSC14	Principles of Compiler Design	10
22CSC15	Full Stack Development	90
22CSC16	Object Oriented Software Engineering	80
22CSP09	Full Stack Development Laboratory	100
22CSP10	Object Oriented Software Engineering Laboratory	0
22CSC17	Internet of Things and its Applications	60
22CSC18	Mobile Application Development	85
22CSP11	Internet of Things and its Applications Laboratory	0
22CSP12	Mobile Application Development Laboratory	40
22GED02	Internship / Industrial Training	100
22CSD01	Project Work-I	0
22CSX01	Deep Learning	100
22CSX02	Knowledge Engineering	100
22CSX03	Recommender Systems	100
22CSX04	Soft Computing	100
22CSX05	Computer vision	100
22CSX06	Ethics of AI	100
22CSX07	Business Intelligence	100
22CSX08	Robotic Process Automation	100
22CSX11	Pattern Recognition	100



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22CSX12	Text and Speech Analytics	100
22CSX13	Big Data Analytics	100
22CSX14	Health care Analytics	100
22CSX15	Predictive Analytics	100
22CSX16	Image and Video Analytics	100
22CSX17	Natural Language Processing	100
22CSX18	Augmented Reality / Virtual Reality	100
22CSX21	Fundamentals of Cryptography and Network Security	100
22CSX22	Ethical Hacking	100
22CSX23	Cloud Security	100
22CSX24	Information System Security Management	100
22CSX25	Social network security	100
22CSX26	Data Privacy and Protection	100
22CSX27	E-Commerce Security	100
22CSX28	Biometric Security	100
22CSX31	Industrial and medical IoT	100
22CSX32	Blockchain Technology	80
22CSX33	Beyond 5G & IoT Technologies	100
22CSX34	Programming for IoT Boards	100
22CSX35	Wireless Ad-Hoc and Sensor Networks	100
22CSX36	Wearable Computing	100
22CSX37	Fog and Edge computing	100
22CSX38	Image Processing	30
22CSX41	Cloud Computing	70
22CSX42	UI and UX Design	0
22CSX43	Devops	0
22CSX44	Principles of Programming Language	100
22CSX45	MEAN Stack Development	100
22CSX46	Social and Information Networks	100
22CSX47	Web Mining	100



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22CSX48	Multimedia data compression and storage	100
22CSX51	Agile Methodologies	25
22CSX52	Software Defined Networks	100
22CSX53	Software Project Management	60
22CSX54	Software Testing Tools and Techniques	85
22CSX55	Software Quality Assurance	90
22CSX56	Service Oriented Architecture	100
22CSX57	IT Operations	0
22CSX58	Product Life Cycle management	100
Average		80%



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NANDHA ENGINEERING COLLEGE

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



Curriculum and Syllabi

for

B.E – Computer Science and Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

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

July 2024

INSTITUTE VISION AND MISSION	
VISION	<ul style="list-style-type: none"> • To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	<ul style="list-style-type: none"> • 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	
VISION	To emerge as an eminent department in providing quality professionals, researchers, entrepreneurs with software skills and ethical values to cater to the changing needs of the industry and society.
MISSION	<ul style="list-style-type: none"> • To provide quality education to produce ethically strong Computer Science professionals with social responsibility • To impart the necessary domain skills to excel in solving real world problems. • To create a learner centric platform with ongoing development to fulfill the global computing demands.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	<p>The graduates of Computer Science and Engineering will be</p> <p>PEO1: Core Competency: Utilize and keep abreast of the latest trends in computer technology as professionals to satisfy the needs of the core industry and society.</p> <p>PEO2: Research, Innovation and Entrepreneurship: Apply recent tools, technologies and innovative ideas for leading successful careers in research/ entrepreneurship and to excel in solving real world problems.</p> <p>PEO3: Ethics, Human values and Life-long learning: Exhibit professional ethics in the industry and possess the necessary skills for working in multi-disciplinary areas with focus on life-long learning.</p>
PROGRAMME SPECIFIC OUTCOMES (PSO)	<p>The students of Computer Science and Engineering will be able to</p> <p>PSO 1: Conceptualize and use mathematical and algorithmic knowledge to find optimal solutions for engineering problems.</p> <p>PSO 2: Apply preeminent industry practices, techniques and tools for designing, developing and testing software systems.</p>

PROGRAM OUTCOMES:

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

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d	Investigation of Complex Problems	PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work.	PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j	Communication	PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k	Project Management and Finance	PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l	Lifelong Learning	PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the 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	2	3	3	3	2	2	2	2	3
2	3	3	3	3	3	3	3	2	3	3	2	2
3	3	2	2	2	2	3	2	3	3	3	3	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	3	1	1	1	2	2	2	2
2	3	3	3	3	3	3	3	3	3	3	3	3

Contribution

1: Reasonable

2: Significant

3: Strong

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REGULATIONS – 2022 **CHOICE BASED CREDIT SYSTEM**
B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER: I									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22MAN01	Induction Programme	MC	-	-	-	-	-	-
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra *	BSC	-	4	3	1	0	4
4	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
5	22ECC01	Basics of Electronics Engineering	ESC	-	3	3	0	0	3
6	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
7	22GYA01	தமிழர் மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
PRACTICAL									
8	22ECP01	Basics of Electronics Engineering Laboratory	ESC	-	4	0	0	4	2
9	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
10	22PYP01	Physics Laboratory *	BSC	-	2	0	0	2	1
Mandatory Non Credit Courses									
11	22MAN03	Yoga – I *	MC	-	1	0	0	1	0
TOTAL					29	15	1	13	22

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SEMESTER: II									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22EYA02	Professional Communication - II	HSMC	22EYA01	4	2	0	2	3
2	22MYB03	Statistics and Numerical Methods *	BSC	-	4	3	1	0	4
3	22CSC02	Data Structures using C *	ESC	22CSC01	3	3	0	0	3
4	22CSC03	Python Programming	ESC	-	3	3	0	0	3
5	22CSC04	Digital Principles and Computer Organization *	ESC	-	3	3	0	0	3
6	22GYA02	தமிழ்நுட்பம் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22CSP02	Data Structures Laboratory *	ESC	22CSP01	4	0	0	4	2
8	22CSP03	Python Programming Laboratory	ESC	-	4	0	0	4	2
9	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
10	22MAN02R	Soft/Analytical Skills – I**	MC	-	3	1	0	2	0
11	22MAN05	Yoga – II *	MC	-	1	0	0	1	0
TOTAL					34	16	1	17	23

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SEMESTER: III									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22MYB05	Discrete Mathematics	BSC	-	4	3	1	0	4
2	22CSC05	Algorithms	PCC	22CSC02	3	3	0	0	3
3	22CSC06	Computer Networks	PCC	-	3	3	0	0	3
4	22CSC07	Java Programming	PCC	-	3	3	0	0	3
5	22CSC08	Operating Systems	PCC	-	3	3	0	0	3
PRACTICAL									
6	22CSP04	Algorithms Laboratory	PCC	-	4	0	0	4	2
7	22CSP05	Computer Networks Laboratory	PCC	-	4	0	0	4	2
8	22CSP06	Java Programming Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN04R	Soft/Analytical Skills – II**	MC	-	3	1	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
TOTAL					32	17	1	14	22

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SEMESTER: IV									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CSC09	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
2	22CSC10	Theory of Computation	PCC	22MYB05	4	3	1	0	4
3	22CSC11	Database Management System	PCC	-	3	3	0	0	3
4	22CSC12	Advanced Java Programming **	PCC	22CSC07	3	3	0	0	3
5	22CSC13	Foundations of Data Science	PCC	-	5	3	0	2	4
6	22CYB07	Environmental Science and Engineering	BSC	-	3	3	0	0	3
PRACTICAL									
7	22CSP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
8	22CSP08	Advanced Java Programming Laboratory **	PCC	22CSP06	4	0	0	4	2
9	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
Mandatory Non Credit Courses									
10	22MAN07R	Soft/Analytical Skills – III**	MC	-	3	1	0	2	0
TOTAL					32	19	1	13	24

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SEMESTER: V									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CSC14	Principles of Compiler Design	PCC	22CSC10	4	3	1	0	4
2	22CSC15	Full Stack Development	PCC	-	3	3	0	0	3
3	22CSC16	Object Oriented Software Engineering	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	22CSP09	Full Stack Development Laboratory	PCC	-	4	0	0	4	2
8	22CSP10	Object Oriented Software Engineering Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN8R	Soft/Analytical Skills – IV**	MC	-	3	1	0	2	0
TOTAL					30	19	1	10	23

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SEMESTER: VI									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CSC17	Internet of Things and its Applications	PCC	-	3	3	0	0	3
2	22CSC18	Mobile Application Development	PCC	22CSC06	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	22CSP11	Internet of Things and its Applications Laboratory	PCC	-	4	0	0	4	2
8	22CSP12	Mobile Application Development Laboratory	PCC	-	4	0	0	4	2
TOTAL					26	18	0	8	22

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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	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	22CSD01	Project Work	EEC	-	20	0	0	20	10
TOTAL					20	0	0	20	10

(A) HS,BS, ES,EE and Mandatory Courses**(a) Humanities and Social Sciences including Management courses (HSMC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2.	22GYA01	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 தொழில்நுட்பமும் / 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 Science Courses (BSC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MYB01	Calculus and Linear Algebra	BSC	-	4	3	1	0	4
2.	22PYB01	Semiconductor Physics	BSC	-	3	3	0	0	3
3.	22PYP01	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 Science Courses (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.	22CSC02	Data structures Using C	ESC	22CSC01	3	3	0	0	3
6.	22CSC03	Python Programming	ESC	-	3	3	0	0	3
7.	22CSC04	Digital Principles and Computer Organization	ESC	-	3	3	0	0	3
8.	22CSP02	Data structures Laboratory	ESC	22CSP01	4	0	0	4	2
9.	22CSP03	Python Programming Laboratory	ESC	-	4	0	0	4	2
10.	22MEP01	Engineering Graphics Laboratory	ESC	-	4	0	0	4	2
(d) Employability Enhancement Courses (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.	22CSD01	Project Work	EEC	-	20	0	0	20	10

(e) Professional Core Courses (PCC)									
S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSC05	Algorithms	PCC	22CSC02	3	3	0	0	3
2.	22CSC06	Computer Networks	PCC	-	3	3	0	0	3
3.	22CSC07	Java Programming	PCC	-	3	3	0	0	3
4.	22CSC08	Operating Systems	PCC	-	3	3	0	0	3
5.	22CSP04	Algorithms Laboratory	PCC	-	4	0	0	4	2
6.	22CSP05	Computer Networks Laboratory	PCC	-	4	0	0	4	2
7.	22CSP06	Java Programming Laboratory	PCC	-	4	0	0	4	2
8.	22CSC09	Artificial Intelligence and Machine Learning	PCC	-	3	3	0	0	3
9.	22CSC10	Theory of Computation	PCC	22MYB05	4	3	1	0	4
10.	22CSC11	Database Management System	PCC	-	3	3	0	0	3
11.	22CSC12	Advanced Java Programming	PCC	22CSC07	3	3	0	0	3
12.	22CSC13	Foundations of Data Science	PCC	-	5	3	0	2	4
13.	22CSP07	Database Management System Laboratory	PCC	-	4	0	0	4	2
14.	22CSP08	Advanced Java Programming Laboratory	PCC	22CSP06	4	0	0	4	2
15.	22CSC14	Principles of Compiler Design	PCC	22CSC10	4	3	1	0	4
16.	22CSC15	Full Stack Development	PCC	-	3	3	0	0	3
17.	22CSC16	Object Oriented Software Engineering	PCC	-	3	3	0	0	3
18.	22CSP09	Full Stack Development Laboratory	PCC	-	4	0	0	4	2

19.	22CSP10	Object Oriented Software Engineering Laboratory	PCC	-	4	0	0	4	2
20.	22CSC17	Internet of Things and its Applications	PCC	-	3	3	0	0	3
21.	22CSC18	Mobile Application Development	PCC	22CSC06	3	3	0	0	3
22.	22CSP11	Internet of Things and its Applications Laboratory	PCC	-	4	0	0	4	2
23.	22CSP12	Mobile Application Development Laboratory	PCC	-	4	0	0	4	2

(f)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.	22MAN02R	Soft/Analytical Skills - I	MC	-	3	1	0	2	0
3.	22MAN03	Yoga - I	MC	-	1	0	0	1	0
4.	22MAN04R	Soft/Analytical Skills - II	MC	-	3	1	0	2	0
5.	22MAN05	Yoga - II	MC	-	1	0	0	1	0
6.	22MAN07R	Soft/Analytical Skills - III	MC	-	3	1	0	2	0
7.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
8.	22MAN08R	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0

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PROGRAMME ELECTIVE COURSES

VERTICAL I - MACHINE INTELLIGENCE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX01	Deep Learning	PEC	-	3	3	0	0	3
2.	22CSX02	Knowledge Engineering	PEC	-	3	3	0	0	3
3.	22CSX03	Recommender Systems	PEC	-	3	3	0	0	3
4.	22CSX04	Soft Computing	PEC	-	3	3	0	0	3
5.	22CSX05	Computer vision	PEC	-	3	3	0	0	3
6.	22CSX06	Ethics of AI	PEC	-	3	3	0	0	3
7.	22CSX07	Business Intelligence	PEC	-	3	3	0	0	3
8.	22CSX08	Robotic Process Automation	PEC	-	3	3	0	0	3

VERTICAL II - DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX11	Pattern Recognition	PEC	-	3	3	0	0	3
2.	22CSX12	Text and Speech Analytics	PEC	-	3	3	0	0	3
3.	22CSX13	Big Data Analytics	PEC	-	3	3	0	0	3
4.	22CSX14	Health care Analytics	PEC	-	3	3	0	0	3
5.	22CSX15	Predictive Analytics	PEC	-	3	3	0	0	3
6.	22CSX16	Image and Video Analytics	PEC	-	3	3	0	0	3
7.	22CSX17	Natural Language Processing	PEC	-	3	3	0	0	3
8.	22CSX18	Augmented Reality / Virtual Reality	PEC	-	3	3	0	0	3

VERTICAL III - CYBER SECURITY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX21	Fundamentals of Cryptography and Network Security	PEC	22CSC06	3	3	0	0	3
2.	22CSX22	Ethical Hacking	PEC	-	3	3	0	0	3
3.	22CSX23	Cloud Security	PEC	-	3	3	0	0	3

4.	22CSX24	Information Security Management	PEC	-	3	3	0	0	3
5.	22CSX25	Social network security	PEC	-	3	3	0	0	3
6.	22CSX26	Data Privacy and Protection	PEC	-	3	3	0	0	3
7.	22CSX27	E-Commerce Security	PEC	-	3	3	0	0	3
8.	22CSX28	Biometric Security	PEC	-	3	3	0	0	3

VERTICAL IV - INTERNET OF THINGS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX31	Industrial and medical IoT	PEC	-	3	3	0	0	3
2.	22CSX32	Blockchain Technology	PEC	-	3	3	0	0	3
3.	22CSX33	Beyond 5G & IoT Technologies	PEC	-	3	3	0	0	3
4.	22CSX34	Programming for IoT Boards	PEC	-	3	3	0	0	3
5.	22CSX35	Wireless Ad-Hoc and Sensor Networks	PEC	-	3	3	0	0	3
6.	22CSX36	Wearable Computing	PEC	-	3	3	0	0	3
7.	22CSX37	Fog and Edge computing	PEC	-	3	3	0	0	3
8.	22CSX38	Image Processing	PEC	-	3	3	0	0	3

VERTICAL V - WEB DEVELOPMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX41	Cloud Computing	PEC	-	3	3	0	0	3
2.	22CSX42	UI and UX Design	PEC	-	3	3	0	0	3
3.	22CSX43	Devops	PEC	-	3	3	0	0	3
4.	22CSX44	Principles of Programming Language	PEC	-	3	3	0	0	3
5.	22CSX45	MEAN Stack Development	PEC	-	3	3	0	0	3
6.	22CSX46	Social and Information Networks	PEC	-	3	3	0	0	3
7.	22CSX47	Web Mining	PEC	-	3	3	0	0	3
8.	22CSX48	Multimedia data compression and storage	PEC	-	3	3	0	0	3

VERTICAL VI - SOFTWARE DEVELOPMENT ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22CSX51	Agile Methodologies	PEC	-	3	3	0	0	3
2.	22CSX52	Software Defined Networks	PEC	-	3	3	0	0	3
3.	22CSX53	Software Project Management	PEC	-	3	3	0	0	3
4.	22CSX54	Software Testing Tools and Techniques	PEC	-	3	3	0	0	3
5.	22CSX55	Software Quality Assurance	PEC	-	3	3	0	0	3
6.	22CSX56	Service Oriented Architecture	PEC	-	3	3	0	0	3
7.	22CSX57	IT Operations	PEC	-	3	3	0	0	3
8.	22CSX58	Product Life Cycle Management	PEC	-	3	3	0	0	3

MANAGEMENT ELECTIVE

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

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	16	23	59	29	15	12	9	163
AICTE %	10%	14%	36%	18%	9%	7%	6%	

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



22CSC12–ADVANCED JAVA PROGRAMMING (Common to 22CCI4 and 22ITC13)					
		L	T	P	C
		3	0	0	3
PRE- REQUISITE : 22CSC07					
Course Objective:	Be able to put into use the advanced features of the Java language to build and compile robust enterprise grade applications				
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination		
The Students will be able to					
CO1	Apply the concepts of collections for high-performance implementations of data structures.	Ap	20%		
CO2	Analyze how to use HTML and CSS in front end design and JavaScript for responsive pages.	An	40%		
CO3	Design web applications based on client and server-side technologies and backend connectivity.	Ap	20%		
CO4	Demonstrates the benefits of XML in data sharing.	An	20%		
CO5	Implement mini projects for any given web application using advanced web development concepts.	An	Internal Assessment		

UNIT I - WRAPPER CLASSES AND COLLECTIONS	(9)
Wrapper Classes: Autoboxing, Unboxing and Cloneable Interface I/O Streams: Introduction to I/O, I/O Operations, Object Serialization Collection Framework: Introduction to Collection, List, Array Lists, Linked Lists, Sorting Lists, Using Iterators, Generics, Set, Map, HashMap, Sorted Maps, Using Custom Objects, Map	
UNIT II - HTML&CSS	(9)
HTML : Introduction to HTML and its elements, Basic Tags, Basic Elements, Formatting Tags, Layout tags and Semantic Tags, Tables, Forms and Frames, Style and div tags, Introduction to HTML5 CSS: Introduction to CSS, Styles and Style sheets, Formatting with CSS, Links and Lists, CSS Box Model, CSS3.	
UNIT III - JAVASCRIPT	(9)
JAVASCRIPT: Introduction to JavaScript, variables, Data Types, JS Functions, JS Strings, JS Events, JS Objects, Arrays, Event Handling JS Validations, JS Regular Expressions.	
UNIT IV - SERVLETS AND DATABASE CONNECTIVITY	(9)
SERVLETS: Introduction to Servlets, Servlet Lifecycle, Servlet-Get and Post Requests, Servlet Config and Servlet Context, Servlet-Cookies and Session Management. RDBMS / SQL / JDBC: Introduction to RDBMS, Oracle 11g Introduction, Select Statement, Restricting and Sorting Data, DML, DDL, Introduction to JDBC, Establishing Connection, Executing Query and Processing Results, Meta data & Prepared Statement, Using Callable Statement and Transactions.	

UNIT V - JSP and XML	(9)
JSP : overview-Basic JSP Architecture-Lifecycle-JSP in Eclipse-JSP scripting elements-Directives-Actions-Implicit objects XML : Introduction to XML, Document Type Definition, XML Namespaces, XML Schema, XSLT.	
TOTAL (L:45) : 45 PERIODS	
TEXT BOOKS:	
1. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill 2. "Web Technologies--A Computer Science Perspective", Jeffrey C.Jackson, Pearson Education, 2007	
REFERENCES:	
1. ThomasA. Powell,"TheComplete Reference HTML &CSS",New Riders, 5th ed., 2017. 2. SteveSuehring,"JavaScript– Step by Step", PHI, 2nd ed.,2011. 3. https://www.w3schools.com 4. https://www.tutorialspoint.com/jsp	

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



** Ratified by Twelfth Academic Council

22CSP08 – ADVANCED JAVA PROGRAMMING LABORATORY
(Common to 22CCP09 and 22ITP07)

	L	T	P	C
	0	0	4	2
PRE- REQUISITE : 22CSP06				
Course Objective:	To use advanced client and server-side technologies to develop a web application			
Course Outcomes				Cognitive Level
The Students will be able to				
CO1	Apply Advanced Java concepts to solve real-world problems.			Ap
CO2	Design and develop user-centric web applications focused on social and environmental issues.			C
CO3	Integrate front-end and back-end components effectively with databases and external services.			Ap
CO4	Use web designing and scripting technologies to develop web applications.			An
CO5	Demonstrate teamwork and problem-solving skills in project development.			An

LIST OF EXPERIMENTS

1. Practice programs on Java Collections Frameworks
2. Programs to convert primitive types to wrapper objects and vice versa
3. Programs with HTML and CSS
4. Programs with JavaScript.
5. Use JDBC connectivity and create Table, insert and update data.
6. Write a program in Java to create a Cookie and set the expiry time of the same.
7. Write a program in Java to create Servlet to count the number of visitors to a web page.
8. Write a program in Java to create a form and validate a password using Servlet.
9. Programs for creating web applications using JSP.
10. Programs on XML.

TOTAL (P:60) : 60 PERIODS

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



** Ratified by Twelfth Academic Council

22CSCI4 - PRINCIPLES OF COMPILER DESIGN

L	T	P	C
3	1	0	4

PRE-REQUISITE : NIL

Course Objective: Provide an in-depth view of how to transform source code into a Machine language that is easier to understand and to optimize.

Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The student will be able to			
CO1	Apply the fundamental concepts for the various phases of compiler design	Ap	20%
CO2	Analyze the syntax and semantic concepts of a compiler	An	20%
CO3	Design various types of parsers and address code generation	Ap	20%
CO4	Employ optimization techniques for the given intermediate code	Ap	20%
CO5	Apply suitable storage allocation technique to generate the target code	Ap	20%

UNIT I – INTRODUCTION AND LEXICAL ANALYSIS**(9)**

Introduction to Compiling- Compilers - Analysis of the source program - The phases - Cousins - The grouping of phases - Compiler construction tools. The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens - A language for specifying lexical analyzer.

UNIT II - SYNTAX ANALYSIS**(9)**

Syntax Analysis - The role of a parser - Context free grammar - Top down parsing– Recursive descent parsing, Predictive parsing - Bottom up parsing - Shift Reduce Parsing - Operator Precedence Parsing - LR parsers - SLR Parser, CLR Parser and LALR Parser.

UNIT III - INTERMEDIATE CODE GENERATION**(9)**

Intermediate languages - Declarations - Assignment statements - Boolean expressions - Case statements – Back patching - Procedure calls

UNIT IV - CODE OPTIMIZATION AND RUN TIME ENVIRONMENTS**(9)**

Introduction– Principal Sources of Optimization – Optimization of basic Blocks – DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis – **Runtime Environments – Source Language issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing, Error detection and recovery.**

UNIT V - CODE GENERATION	(9)
Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator – Peephole Optimization.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOK:
1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, “Compilers – Principles, Techniques, and Tools”, Pearson Education Asia, 2013.
REFERENCES:
1. Terence Halsey “Compiler Design: Principles, Techniques and Tools”, Larsen & Keller education, 2019. 2. C. N. Fisher and R. J. LeBlanc “Crafting a Compiler with C”, Pearson Education, 2011.

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

gla

22CSC15 - FULL STACK DEVELOPMENT
(Common to 22AIC15,22CIC15 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		Cognitive Level	Weightage of COs in End Semester Examination
The student will be able to			
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:
<ol style="list-style-type: none"> 1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasana 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:
<ol style="list-style-type: none"> 1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, "Bootstrap 4–Responsive Web Design" Packt Publishing (6 July 2017) 2. Adriaan de Jonge, Phil Dutton, "jQuery jQuery UI and jQuery Mobile - Recipes and Examples", Pearson Education India. 3. Thomas Powell, "Web Design: The Complete Reference" ,Osborne / McGraw-Hill 4. https://www.w3schools.com/

Mapping of 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

22CSC16 - OBJECT ORIENTED SOFTWARE ENGINEERING
(Common to 22ITX51)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective: Learn to apply object-oriented principles and software engineering methodologies to design and develop robust software solutions.

Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The student will be able to			
CO1	Apply object oriented and software engineering process for a given problem	Ap	20%
CO2	Analyze the system requirements, various design and testing techniques for a given system	An	30%
CO3	Design object oriented model for different phases of software development to a given scenario	Ap	30%
CO4	Design object solutions with patterns and architectural layers	An	20%
CO5	Document and present project deliverables	Ap	Internal Assessment

UNIT I – SOFTWARE PROCESS AND AGILE DEVELOPMENT

(9)

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study.

UNIT II - REQUIREMENTS ANALYSIS AND SPECIFICATION

(9)

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram- CASE TOOLS.

UNIT III - SOFTWARE DESIGN

(9)

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered – Client Server – Tiered Pipe and filter- User interface design- Case Study.

UNIT IV - OBJECT DESIGN

(9)

Preface to object orientation – Classes and Objects - Reusing pattern solutions –Overview of reuse concepts - Design patterns - Mapping models to code: Mapping concepts.

UNIT V - SOFTWARE TESTING AND MAINTENANCE	(9)
Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging – Program analysis – Symbolic execution – Model Checking-Case Study.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:
1. Bernd Bruegge & Allen H. Dutoit, “Object-Oriented Software Engineering”, 3rd edition, Pearson Education, 2014.
REFERENCES:
1. Roger S. Pressman, “Object-Oriented Software Engineering: An Agile Unified Methodology”, First Edition, Mc Graw-Hill International Edition, 2014.
2. Timothy C. Lethbridge, Robert Laganriere, “Object Oriented Software Engineering”, Tata McGraw-Hill, 6th ed., reprint, 2008.
3. Stephen Schach, “Object Oriented and Classical Software Engineering”, 6th edition, McGraw-Hill, 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		2	2			2	3	2			3
5														3
CO (W.A)	3	3	3		2	2			2	3	2			3

22CSP09- FULL STACK DEVELOPMENT LABORATORY
(Common to 22ITP10,22CIP10)

	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				Cognitive Level
The student will be able to				
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 cloundinary 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.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

Desktops with windows 7 and i3 Processor - 60 Nos

Software:

Microsoft Visual Studio Code, Node Js, React, jQuery, 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



22CSP10- OBJECT ORIENTED SOFTWARE ENGINEERING LABORATORY

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective: To Gain skills in creating, implementing, and presenting advanced software solutions through modern software engineering techniques and UML modeling.

Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The student will be able to			
CO1	Evaluate project management approaches as well as cost and schedule estimation strategies	An	15%
CO2	Perform formal analysis on specifications	An	15%
CO3	Conduct practical experiment to solve a given problem using Unified Modeling language	Ap	30%
CO4	Develop and debug the projects	Ap	20%
CO5	Generate test cases using testing strategies	Ap	20%

LIST OF EXPERIMENTS:

Prepare the following documents for the project and develop the software using software engineering methodology.

1. Problem Analysis and Project Planning - study of the problem, Identify project scope, Objectives, and Infrastructure.
2. Software Requirement Analysis - Phases/ modules of the project, Identify deliverables.
3. Data Modeling - use work products, data dictionary and UML diagrams.
4. Software Development and Debugging.
5. Software Testing - Prepare test plan, perform validation testing, coverage analysis, develop test case hierarchy, Site check and site monitor.

LIST OF PROJECTS:

1. Passport automation system.
2. Book bank.
3. Exam Registration and result system.
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Expert System for Medical Diagnosis System
8. Credit card processing.
9. Payroll System.
10. Student Information System.

SOFTWARE TOOLS:

1. Rational Suite 30 user License
2. Open Source Alternatives: ArgoUML, VisualParadigm
3. Eclipse IDE and JUnit, Selenium, Figma
4. PCs 30

TOTAL (P:60) : 60 PERIODS**Mapping of COs with POs / PSOs**

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



22CSC17- INTERNET OF THINGS AND ITS APPLICATIONS
(Common to 22AIC14, 22CIC05 and 22ITC16)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objectives:

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

Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The student will be able to			
CO1	Identify various characteristics and deployment levels of IoT.	Ap	30%
CO2	Analyze the concepts of M2M and IoT architecture.	An	20%
CO3	Implement Various IoT communication protocols like MQTT, CoAP, and HTTP in developing IoT applications.	Ap	20%
CO4	Analyze the functioning of arduino boards and various communications technologies to use with it.	An	30%
CO5	Perform in a team to build automation, agriculture and various real time applications using arduino.	Ap	Internal Assessment

UNIT I – INTRODUCTION TO INTERNET OF THINGS

(9)

Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems-Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates – Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.

UNIT II - M2M AND IOT ARCHITECTURE

(9)

Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model.

UNIT III - IOT PROTOCOLS

(9)

PHY/MAC Layer: 3GPP MTC, IEEE 802.15 – Wireless HART- Z-Wave, BLE- Zigbee - DASH7 – Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP-DCCP-Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.

UNIT IV - PROGRAMMING USING ARDUINO	(9)
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial(UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101- Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming- Case Studies.	
UNIT V - APPLICATIONS OF IOT	(9)
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
<ol style="list-style-type: none"> 1. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019. 2. Arshdeep Bahga, Vijay Madiseti, "Internet of Things-A hands-on approach", Universities Press, 2015. 3. Veneri,Giacomo and Antonio capasso “Hands on Industrial Internet of things: create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packet Publishing,Ltd,2018.
REFERENCES:
<ol style="list-style-type: none"> 1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

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



22CSC18 - MOBILE APPLICATION DEVELOPMENT (Common to 22ITC18,22CCX51)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objective:		To design and develop mobile apps, integrate services like APIs and databases, to ensure usability and security and to prepare apps for deployment on app stores, focusing on practical skills and industry standards.			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination		
The student will be able to					
CO1	Analyze and identify the computing requirements appropriate to a real world problem	An	20%		
CO2	Design an Android application using layout, UI components	Ap	20%		
CO3	Portray and implement the ethical responsibilities in mobile application development using modern tools	Ap	20%		
CO4	Develop a fully functional native mobile app by applying industry's best practices	Ap	20%		
CO5	Present their projects and compile thorough reports, demonstrating teamwork and reflective learning.	C	Internal assessment		
UNIT I – MOBILE PLATFORM AND APPLICATIONS					(9)
Mobile Device Operating Systems - Special Constraints & Requirements - Commercial Mobile Operating Systems - Software Development Kit: iOS, Android, BlackBerry, Windows Phone - MCommerce - Structure - Pros & Cons - Mobile Payment System - Security Issues.					
UNIT II - INTRODUCTION TO ANDROID					(9)
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.					
UNIT III - ANDROID APPLICATION DESIGN ESSENTIALS					(9)
Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions. - Activity Lifecycle - Navigation					
UNIT IV - ANDROID USER INTERFACE DESIGN & MULTIMEDIA					(9)
User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures.					
UNIT V - ANDROID APIS					(9)
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World – Error Handling – Case studies					
TOTAL (L:45) : 45 PERIODS					

TEXT BOOKS:

1. Prasanth Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi-2012 (UNIT – 1)
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd edition, Pearson Education, 2011 (UNIT 2 – 5)

REFERENCES:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010.
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.

Mapping of COs with POs / PSOs

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



22CSPI I- INTERNET OF THINGS AND ITS APPLICATIONS LABORATORY
(Common to 22ITP09 ,22AIP10 and 22CIP04)

	L	T	P	C
	0	0	4	2
PRE-REQUISITE : NIL				
Course Objective:	To equip students with comprehensive knowledge and hands on experience in designing and developing IoT systems and applications.			
Course Outcomes			Cognitive Level	
The student will be able to				
CO1	Apply the knowledge of controlling sensors using arduino.		Ap	
CO2	Analyze the given Aduino program to build practical IoT solutions.		An	
CO3	Apply Arduino programming techniques to use various sesnors and actuators.		Ap	
CO4	Design IoT based system for given application and specifications.		An	
CO5	Implement a mini-project to demonstrate the given problem using suitable sensors with Arduino development board.		C	

LIST OF EXPERIMENTS

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:

Hardware:

WiFi UNIT or ESP 8266 UNIT 33, Connecting cable or USB cable 33, Ultrasonic sensor 33, Jumper wires 33, Vibration sensor 33, Touch Sensor 33, Temperature and humidity sensor 33, Raspberry pi 33, HDMI 33, Micro USB power input 33, Breadboard 33, Resistor (47K/IW) 33, LED 33, Arduino Uno 33, 16 x 2 LCD display 33, ACS712 Voltage sensor 33, 9/12V Battery 33, Center tapped transformer (230/6-0-6V) 33 , Diode (IN4007) 33, Opto-coupler 33

Software:

OS – Windows / UNIX Clone 33
Computer with Arduino IDE software 33

TOTAL (P:60) : 60 PERIODS

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

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22CSP12- MOBILE APPLICATION DEVELOPMENT LABORATORY (Common to 22ITPI I)					
		L	T	P	C
		0	0	4	2
PRE-REQUISITE : NIL					
Course Objective:		To provide hands-on experience in designing, developing, testing, and deploying mobile apps.			
Course Outcomes				Cognitive Level	
The student will be able to					
CO1	Analyze and identify the computing requirements appropriate to a real world problem			An	
CO2	Design an Android application using layout, UI components using event listeners			C	
CO3	Develop Android application with data storage			C	
CO4	Develop a native mobile app			C	
CO5	Utilize RSS feeds and integrate into web applications			Ap	

LIST OF EXPERIMENTS :	
<ol style="list-style-type: none"> 1. Develop an application that uses GUI components, Font and Colors. 2. Develop an application that uses Layout Managers. 3. Develop an application that uses event listeners. 4. Develop an application that uses adapters, Toast. 5. Develop an application that makes use of databases. 6. Develop an application that makes use of RSS Feed. 7. Implement an application that implements Multi threading. 8. Develop a native application that uses Camera and writes the image to the storage. 9. Develop a basic SMS receiver application. 10. Implement an application that creates an alert upon receiving a message. 	
HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:	
Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development, Tools with appropriate emulators and debuggers - 33 Nos.	
TOTAL (P:60) : 60 PERIODS	

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												2
2			3											2
3			3		3	3		3					2	2
4			3						3				2	3
5	3									3	3	3	2	3
CO (W.A)	3	3	3		3	3		3	3	3	3	3	2	2.4

gla

22GEA01 - UNIVERSAL HUMAN VALUES <i>(Common to all Branches)</i>				
	L	T	P	C
	2	0	0	2
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> • To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living 			
Course Outcomes The student will be able to		Cognitive Level	Weightage of COs in End Semester Examination	
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession.	E	Internal Assessment	
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap		
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An		
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap		
CO5	Apply the understanding of ethical conduct to formulate the strategy for 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).	

22GED02 – INTERNSHIP / INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	0	2
PRE-REQUISITE : NIL					
Course Objectives:	<ul style="list-style-type: none"> To obtain a broad understanding of the emerging technologies in Industry To gain knowledge about I/O models. 				
Course Outcomes					Cognitive Level
The Student will be able to					
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 project/product that can make their life comfortable.				An
CO4	Prepare a business plan for a commercial venture of the proposed project/product together with complying to relevant norms.				Ap
CO5	Identify the community that shall benefit from the project /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 project/product to make their life comfortable and convert new ideas into project/product .

Every student is required to complete 4 to 6 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		2												
4							2	3			2			
5						2			2					2
CO (W.A)		2				2	2	3	2	3	2			2

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22CSD01- PROJECT WORK - I					
		L	T	P	C
		0	0	20	10
PRE-REQUISITE : NIL					
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination		
The Student will be able to					
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 (External)		
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

gla

22CSX01 - DEEP LEARNING <i>(Common to 22AIC13,22CIX13 and 22ITX01)</i>				
	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 auto encoders 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, August 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									
4	3												3	
5					3				3	3				
CO (W.A)	3	3	3		3				3	3			3	3



22CSX02 - KNOWLEDGE ENGINEERING (Common to 22AIX01,22CCX21 and 22ITX02)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	To implement various techniques for knowledge acquisition and representation.			
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination	
CO1	Apply knowledge representation with production rules.	Ap	20%	
CO2	Implement SLD derivations with horn clauses.	An	20%	
CO3	Apply reasoning with inheritance network and default logic.	Ap	20%	
CO4	Apply subjective probability with actions and planning.	Ap	20%	
CO5	Perform object oriented representation using frames	Ap	20%	

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

TEXT BOOKS:

1. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, First Edition, 2016.

REFERENCES:

1. John F. Sowa, "Knowledge Representation: Logical, Philosophical, and Computational Foundations", Brooks/Cole, Thomson Learning, 2000
2. Ela Kumar, "Knowledge Engineering", I K International Publisher House, 2018.

Mapping of COs with POs / PSOs

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



22CSX03 - RECOMMENDER SYSTEMS <i>(Common to 22AIX02,22ITX03 and 22CIX14)</i>				
	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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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 Systems 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



22CSX04 - SOFT COMPUTING (Common to 22ITX04 and 22AIX03)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objective:		To learn and understand soft computing concepts and Fuzzy inference systems.			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination		
The Student will be able to					
CO1	Make use of the soft computing concepts along with its architecture	Ap	20%		
CO2	Apply the techniques of back propagation network along with its parameter tuning.	Ap	20%		
CO3	Interpret the fuzzy logics to solve the neural network problems	Ap	20%		
CO4	Utilize the genetic algorithm techniques to obtain the optimized solution	Ap	20%		
CO5	Illustrate the working of hybrid soft computing and to solve real world problems	An	20%		

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

UNIT V – HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS**9**

Hybrid systems-Neural networks ,fuzzy logic and genetic algorithms hybrids-GA Based Weight Determination –Fuzzy backpropagation networks-Simplified fuzzy ARTMAP-Fuzzy associative memories-Soft computing tools-Fuzzy constrains-Fuzzy logic controller.

TOTAL (L:45) = 45 PERIODS**TEXT BOOKS**

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

REFERENCE

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

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



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



22CSX06 - ETHICS OF AI <i>(Common to 22ITX06,22AIX06 and 22CIX17)</i>				
	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	
147 Page	Approved by Twelfth Academic Council

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. Paula Boddington ,”Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms)” , 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



22CSX07 - BUSINESS INTELLIGENCE <i>(Common to 22ITX07,22AIX07 and 22CCX28)</i>				L	T	P	C
				3	0	0	3
PRE-REQUISITE : NIL							
Course Objective:		To understand the effect of Business Intelligence (BI) on an organization					
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination				
CO1	Use of the knowledge of Business Intelligence in solving problems.	U	20%				
CO2	Apply the concepts of Data visualization and Visual analytics.	Ap	20%				
CO3	Able to apply data mining tools.	Ap	20%				
CO4	Demonstrate the text analytics, text mining and sentiment analysis.	An	20%				
CO5	Develop web mining.	C	20%				

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

UNIT IV – TEXT ANALYTICS, TEXT MINING AND SENTIMENT ANALYSIS	9
Text analytics and Text mining concepts and definition – Text Mining Applications - Text mining process – Text mining tools – Sentiment analysis overview – Sentiment analysis applications – Sentiment analysis process, Sentiment Analysis and Speech Analytics.	
UNIT V – WEB MINING	9
Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis- Social Media Definitions and Concepts- Social Media Analytics.	
TOTAL = 45 PERIODS	

TEXT BOOKS
1. Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence and Analytics”, Pearson 10th edition, 2018
REFERENCES
1. Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence, Analytics, and Data Science: A Managerial Perspective”, 4th Edition, Pearson, 2017
2. David Loshin Morgan, Kaufman, ”Business Intelligence: The Savvy Manager”s Guidell”, Second Edition, 2012.

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



22CSX08 - ROBOTICS PROCESS AUTOMATION <i>(Common to 22ITX08,22AIX08, 22CIX18 and 22CCX38)</i>				
	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. M.P.Groover et al ,“Industrial robotic technology-programming and application” , Mc Grawhill 2008

REFERENCES:

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

Mapping of COs with POs / PSOs

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



22CSX11 - PATTERN RECOGNITION <i>(Common to 22ITX11,22AIX11,22CCX24 and 22CIX21)</i>						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE : NIL						
Course Objectives:		<ul style="list-style-type: none"> • 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
<ol style="list-style-type: none"> 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
<ol style="list-style-type: none"> 1. Sergios Theodoridis and Konstantinos Koutroumbas, "Machine Learning: A Bayesian and Optimization Perspective", Academic Press,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



22CSX12 - TEXT AND SPEECH ANALYTICS (Common to 22ITX12, 22AIX12 and 22CIX22)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> 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	Ap	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	Ap	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 BOOKS**

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

REFERENCES

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

Mapping of COs with POs / PSOs

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



22CSX13 - BIG DATA ANALYTICS (Common to 22ITX13,22CIX12,22AIC16 and 22CCX25)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> ● 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



22CSX14 - HEALTH CARE ANALYTICS <i>(Common to 22ITX14,22AIX14,22CIX24 and 22CCX26)</i>				
	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



22CSX15 - PREDICTIVE ANALYTICS <i>(Common to 22ITX15,22AIX15 and 22CIX25)</i>				
	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



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



22CSX17 - NATURAL LANGUAGE PROCESSING (Common to 22ITX17,22AIX17 and 22CIX27)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objective:	To learn and understand syntactic and semantic elements of NLP and knowledge representation and interface.				
Course Outcomes The Students 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. Christopher D. Manning and Hinrich Schuetze ,“Foundations of Statistical Natural Language Processing”, 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



22CSX18 - AUGUMENTED REALITY AND VIRTUAL REALITY (Common to 22ITX18,22AIX18 and 22CIX28)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE :NIL					
Course Objective:		To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies.			
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Apply principles of virtual reality and commercial VR technologies.	Ap	30%		
CO2	Analyze the classic components of a VR system through hands-on experimentation and simulation.	An	20%		
CO3	Make use of diverse modeling techniques with real-world sensor data.	Ap	30%		
CO4	Evaluate the solution to enhance VR user experience and safety in diverse fields.	E	20%		
CO5	Create VR applications by utilizing VR programming tools.	C	Internal Assessment		

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

UNIT V -VR PROGRAMMING**(9)**

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

TOTAL (L: 45) = 45 PERIODS**TEXT BOOK:**

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

REFERENCES:

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



22CSX21 - FUNDAMENTALS OF CRYPTOGRAPHY AND NETWORK SECURITY (Common to 22ITX21)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : 22CSC06					
Course Objective:	To understand basics of Cryptography and Network Security and to learn about how to maintain the Confidentiality, Integrity and Availability of a Data.				
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Interpret the basic principles of cryptography and general cryptanalysis	Ap	20%		
CO2	Classify the encryption techniques and identify the use of public key encryption, digital signatures, and key establishment.	An	20%		
CO3	Design a model for achieving Data Integrity using key management techniques and authentication.	Ap	20%		
CO4	Describe how trust can be demonstrated in the underlying protocols of modern systems and evaluate the security techniques	An	40%		
CO5	Apply security practices for real time applications.	Ap	Internal Assessment		

UNIT I - INTRODUCTION TO CRYPTOGRAPHY	(9)
Introduction to Cryptography, Security Threats, Vulnerability, Services, Mechanisms and attacks – the OSI security architecture – Network Security model- Conventional Encryption Model- CIA model - Classical Cryptography: Dimensions of Cryptography, - Classical Encryption techniques (Symmetric cipher, Substitution techniques, transposition techniques, Steganography).	
UNIT II - SYMMETRIC AND ASYMMETRIC CIPHERS	(9)
Block Ciphers (DES, AES): Feistel Cipher Structure, Simplified DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations- Public-Key Cryptography: Principles of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange.	
UNIT III – CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS	(9)
Hash and MAC Algorithms: Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures	
UNIT IV - MUTUAL TRUST AND USER AUTHENTICATION	(9)
Key Management and Key Distribution: Symmetric Key distribution using symmetric and asymmetric encryption – Distribution of Public keys – x.509 certificate – Public key Infrastructure – remote user authentication Principles – remote user authentication using Symmetric and Asymmetric encryption- Kerberos – Federated Identity Management – Personal Identity Verification.	

UNIT V - SECURITY IN NETWORKS**(9)**

IP Security and Key Management-Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web and System Security-Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

TOTAL (L:45) = 45 PERIODS**TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, India, 2015.
2. Charles P. Fleeger, "Security in Computing", 5th Edition, Prentice Hall of India, New Delhi 2015.

Mapping of COs with POs / PSOs

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



22CSX22 – ETHICAL HACKING <i>(Common to 22ITX22, 22CIX32 and 22CCCI4)</i>						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE : NIL						
Course Objectives :		<ul style="list-style-type: none"> • 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		Cognitive Level	Weightage of COs in End Semester Examination			
The student will be able to						
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%			

UNIT I - INTRODUCTION	(9)
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	
UNIT II - NETWORK AND COMPUTER ATTACKS	(9)
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	
UNIT III - FOOT PRINTING AND SOCIAL ENGINEERING	(9)
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	

UNIT IV - PORT SCANNING**(9)**

Introduction to Port Scanning- Types of Port Scans - Port-Scanning Tools – Nmap- Unicornscan — Nessus and OpenVAS-Ping Sweeps - Fping - Hoping-Crafting IP Packets

UNIT V - DESKTOP AND SERVER OS 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) :45 PERIODS**TEXT BOOKS:**

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	2.2		3	3			3	3				3	3



22CSX23 – CLOUD SECURITY <i>(Common to 22ITX23, 22AIX23 and 22CCX04)</i>				L	T	P	C
				3	0	0	3
PRE-REQUISITE : NIL							
Course Objectives :		<ul style="list-style-type: none"> • To introduce the fundamental concepts and architecture of cloud computing. • To understand and address security concerns, risks, and legal aspects. • To explore data security strategies and best practices for securing data in the cloud • To evaluate security criteria for building and managing private clouds and selecting external cloud service providers. • To assess and evaluate cloud security through comprehensive frameworks 					
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination				
The student will be able to							
CO1	Analyze various the concepts of cloud computing, policy and compliance in cloud environment.	An	20%				
CO2	Develop and implement secure cloud architectures, security patterns, and strategies for secure cloud operations.	Ap	20%				
CO3	Apply key strategies and best practices for managing cloud data security risks and monitoring security controls	Ap	20%				
CO4	Apply the fundamental concepts in infrastructure security facilities in cloud computing.	Ap	20%				
CO5	Implement security operations activities and architectures for efficient and secure cloud management	Ap	20%				

UNIT I - INTRODUCTION	(9)
Introduction to Cloud computing and security: Understanding cloud computing – The IT foundation for Cloud. An historical view: Roots of Cloud computing – A brief primer on architecture. Security architecture: Cloud computing architecture – Cloud reference architecture – Control over security in the cloud model – Making sense of cloud deployment – Making sense of services models – Real- world cloud usage scenarios.	
UNIT II - SECURING THE CLOUD	(9)
Security concerns – Risk issues and legal aspects – Security concerns –Assessing risk tolerance in Cloud Computing–Legal and regulatory issues–Securing the Cloud: Architecture–Security patterns and architectural element – Cloud security architecture –Planning key strategies for secure operation.	
UNIT III - CLOUD DATA SECURITY	(9)
Securing the cloud: Data security – Overview of data security in Cloud Computing. Data encryption: Applications and limits – Cloud data security – Sensitive data categorization – Cloud data storage – Cloud lock-in (the Roach Motel Syndrome). Securing the cloud: Key strategies and Best practices–Overall strategy–Effectively managing risk –Overview of security controls –The limits of security controls – Best practices – Security monitoring.	

UNIT IV - SECURITY CRITERIA	(9)
Security criteria: Building an internal cloud – Private clouds – Motivation and overview – Security criteria for ensuring a private cloud – Security criteria – Selecting an external cloud provider – Selecting a CSP – Overview of assurance – Selecting a CSP – Overview of risks – Selecting a CSP	
UNIT V – EVALUATING CLOUD SECURITY	(9)
Security criteria – Evaluating cloud security – An information security framework – Evaluating cloud security – Checklists for evaluating cloud security – Metrics for the checklists – Operating a cloud – Architecture to efficient and secure operations – Security operations activities.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

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

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



22CSX24 - INFORMATION SYSTEM SECURITY MANAGEMENT <i>(Common to 22ITX24 and 22CCX16)</i>					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: NIL					
Course Objective:	To focus on the strategies and practices required to protect information systems and manage security effectively within an organization.				
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Apply theoretical knowledge to practical problems, demonstrating the ability to develop and implement security solutions based on frameworks.	Ap	20%		
CO2	Analyze and explore the information security controls	An	20%		
CO3	Assess and evaluate the risk management practices of information security.	Ap	20%		
CO4	Identify the disasters and recovering from them with appropriate decisions.	An	20%		
CO5	Apply various recovery strategies, such as data backup and restoration, alternative site arrangements, and failover solutions, to ensure effective recovery.	Ap	20%		

UNIT I - INFORMATION SECURITY PRINCIPLES AND FRAMEWORK

(9)

Information Security- Assets and Types - Threat, Vulnerability, Risk and Impact - Information Security Policy Concepts - Need for Information Security. Organization and Responsibilities: Organizational Policy, Standards and Procedures - Information Security Governance - Information Assurance Programme Implementation - Security Incident Management - Legal Framework: Security Standards and Procedures.

UNIT II - SECURITY LIFE CYCLE AND CONTROLS

(9)

Information Security Life Cycle - Testing, Audit, Review and Controls - Systems Development and Support - General Controls - People Security - User Access Controls - Technical Security - Protection from Malicious Software - Physical Security - Different Uses of Controls.

UNIT III - SECURITY MANAGEMENT MODELS AND PERFORMANCE MEASUREMENT

(9)

Blueprints - Frameworks and Security Models - Security Architecture Models - Various Access Control Models - Information Security Performance Measurement.

UNIT IV - RISK ASSESSMENT & RISK MANAGEMENT

(9)

Threats and its Categories - Vulnerabilities and its Categories - Risk - Calculation of Overall Risk – Risk Identification - Risk Analysis - Risk Evaluation - Risk Control - Risk Termination - Risk Reduction – Risk Transfer - Risk Tolerance - Overall Risk Assessment. Risk Management Framework and Process – Managing Risk - Risk Treatment- Alternative Risk Management Methodologies.

UNIT V -DISASTER RECOVERY AND BUSINESS CONTINUITY MANAGEMENT	(9)
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Disaster Recovery Process and policy - Relationship between Disaster Recovery and Business Continuity Management - Resilience and Redundancy - Approaches to Writing and Implementing Plans - Need for Documentation - Maintenance and Testing.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Andy Taylor, David Alexander, Amanda Finch and David Sutton, "Information Security Principles", 2020, Third Edition, BCS, United Kingdom.
2. Michael E. Whitman and Herbert J. Mattord, "Management of Information Security", 2018, Sixth Edition, Cengage Learning, United States of America.

REFERENCES:

1. Calder, A., and Watkins, S. G., "Information security risk management for ISO27001/ISO27002", 2018, Third Edition, IT Governance Ltd, United States of America.
2. Susanto, H., and Almunawar, M. N., "Information security management systems: A novel framework and software as a tool for compliance with information security standards", 2018, First Edition, Apple Academic Press, New York.

Mapping of COs with POs / PSOs

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

22CSX25- SOCIAL NETWORK SECURITY (Common to 22ITX25, 22CIX34, 22AIX21 and 22CCX02)						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE: NIL						
Course Objective:		To focus on understanding and addressing security issues related to social networking platforms, including protecting user privacy, preventing cyber threats, and managing data security.				
Course Outcomes			Cognitive Level	Weightage of COs in End Semester Examination		
The Student will be able to						
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)
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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)
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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. Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

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

Mapping of COs with POs / PSOs

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



22CSX26 - DATA PRIVACY AND PROTECTION (Common to 22ITX26, 22AIX24 and 22CCX06)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE: NIL					
Course Objective:		To provide students with a comprehensive understanding of how to safeguard personal and sensitive data from unauthorized access, breaches, and misuse.			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination		
The student will be able to					
CO1	Apply knowledge on fundamental principles of Data privacy.	Ap	20%		
CO2	To design and development of data preservation by using data mining.	An	20%		
CO3	Ability to assess privacy risks associated with Privacy regulations.	Ap	20%		
CO4	Analyses various approaches in data security by using tools.	An	20%		
CO5	Apply security on storage and database.	Ap	20%		

UNIT I – INTRODUCTION TO DATA PRIVACY	(9)
Data Privacy and its Importance - Need for Sharing Data - Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Introduction to Anonymization Design Principles - Nature of Data in the Enterprise Static Data Anonymization on Multidimensional Data: Introduction - 36 Classification of Privacy Preserving Methods - Classification of Data in a Multidimensional Data Set - Group-Based Anonymization.	
UNIT II - PRIVACY PRESERVING DATA MINING	(9)
Introduction - Privacy Preserving Graph Data - Privacy Preserving Time Series Data - Privacy Preservation of Longitudinal Data - Privacy Preservation of Transaction Data - Static Data Anonymization: Threats to Anonymized Data-Threats to Data Structures-Threats by Anonymization Techniques.	
UNIT III – PRIVACY REGULATIONS	(9)
Introduction - UK Data Protection Act 1998. - Federal Act of Data Protection of Switzerland 1992 - Payment Card Industry Data Security Standard (PCI DSS)- The Health Insurance Portability and accountability Act of 1996(HIPAA): Effects of Protection-Anonymization Considerations- Anonymization Design for HIPAA - Explicit Identifiers - Quasi-Identifiers - Sensitive Data. – Anonymization Design Checklist.	
UNIT IV - DATA SECURITY	(9)
Securing Unstructured Data: Structured Databases. Unstructured Data – At Rest ,in Transit and in Use – Approaches to secure Unstructured Data–Newer Approaches to Secure Unstructured Data. Information Rights Management: Overview–IRM Technology Details – Getting Started with IRM. Encryption: History of Encryption – Symmetric Key Cryptography – Public Key Cryptography	

UNIT V - CONTEMPORARY ISSUES**(9)**

Storage Security: Evolution – Modern Storage Security – Risk Remediation – Best Practices. Database Security: General Concepts – Database Security Layers – Database-Level Security – Database Backup and Recovery – Database Auditing and Monitoring

TOTAL (L:45) = 45 PERIODS**TEXTBOOK:**

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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



22CSX27- E-COMMERCE SECURITY <i>(Common to 22ITX27 and 22CCX05)</i>				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE: NIL				
Course Objective:	To focus on understanding and implementing security measures to protect online transactions and digital business operations.			
Course Outcomes The student will be able to		Cognitive Level	Weightage of COs in End Semester Examination	
CO1	Analysis the historical context, benefits, drawbacks, and societal implications.	An	20%	
CO2	Acquire knowledge of key e-commerce technologies such as symmetric and asymmetric encryption, SSL	Ap	20%	
CO3	Conduct investigation about the diverse security threats inherent in e-commerce	Ap	20%	
CO4	Design and develop e-commerce security policies, including privacy protection, security infrastructure implementation	An	20%	
CO5	Gain insight into the various threats faced by e-business	An	20%	

UNIT I - INTRODUCTION	(9)
Introduction to e-Commerce -The Background of e-Commerce-Delimitation-Advantages and Disadvantages of e-Commerce-Advantages of e-Commerce to Consumers-Benefits to Society- e-Commerce Disadvantages	
UNIT II - E-COMMERCE TECHNOLOGIES	(9)
Symmetric Encryption – Asymmetric Encryption- Secure Socket Layer – Digital Signature- Electronic Certificates - Wise Cards-Electronic Money – Characteristics of e-Commerce Technologies	
UNIT III – SECURITY THREATS TO E-COMMERCE	(9)
Client Dangers-Communication Channel Perils-Server Risks-Security Necessities and Security Approach- Authentication--Privacy-Approval- Integrity	
UNIT IV – SECURITY POLICY	(9)
Privacy-Security Infrastructure-Solution for Trust-Four Trusting Convictions-Seven Basic Factors at Influence Trust -Secure Trading for Electronic Businesses Makes Trust-Solutions for Security -Testing E-Commerce Security	
UNIT V - E-BUSINESS THREATS AND SOLUTIONS	(9)
E-Business Threats- Authentication Attacks-Respect ability Attacks- Secrecy Attacks-Infection-Trojan Horse-Worms-e-Business Solutions	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOK:
1. Tavares, Joao Manuel R.S, “Handbook of e-business security”, LCCN 2018013131 ISBN 9781138571303,2019.
REFERENCES:
1. Mehdi Khosrow-pour, “E-commerce Security: Advice from Experts”, Idea Group Inc(IGI),2004
2. Ronggang Zhang , Lijuan Fang , Xiaoping He , Chuan Wei, “The Whole Process of E-commerce Security Management System”,February2023

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



22CSX28- BIOMETRIC SECURITY (Common to 22ITX28,22CIX35,22CCX03 and 22AIX22)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE: NIL				
Course Objectives:	To provide students with a comprehensive understanding of biometric security systems, covering their design, implementation, evaluation, and applications in various security contexts.			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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, 1st Edition, 2018.
2. Ravindra Das, "The Science of Biometrics Security Technology for Identity Verification", Taylor and Francis, 1st Edition, 2018.

Mapping of Cos with POs/PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3								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



22CSX31-INDUSTRIAL AND MEDICAL IOT <i>(Common to 22ITX31,22AIX31,22CIX01 and 22CCX31)</i>				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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 INDUSTRIAL 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:
<ol style="list-style-type: none"> 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. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.
REFERENCES:
<ol style="list-style-type: none"> Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, 1st Edition, Apress, 2017 About Ella Hassanien, Nilanjan Dey and Sureeka 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

22CSX32-BLOCKCHAIN TECHNOLOGY <i>(Common to 22ITX32, 22AIX32 and 22CIX02)</i>						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE : NIL						
Course Objectives:		<ul style="list-style-type: none"> • To impart knowledge of distributed ledgers in business • To acquire knowledge in emerging concepts using blockchain 				
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination			
The Student will be able to						
CO1	Apply the principles of blockchain technology to articulate their significance.	Ap	20%			
CO2	Evaluate the effectiveness of different consensus algorithms in specific blockchain applications.	An	20%			
CO3	Evaluate their impact on security and privacy in digital transactions.	An	20%			
CO4	Implement a strategic plan for integrating specific distributed ledger technologies into a business environment, considering operational efficiency, security, and regulatory compliance.	Ap	20%			
CO5	Apply appropriate techniques to manage trust-based business networks, considering societal, environmental, economic, and global perspectives.	Ap	20%			

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

UNIT V -BLOCKCHAIN DEVELOPMENT TOOLS AND FRAMEWORKS	(9)
Compilers: Solidity Compiler – 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:
<ol style="list-style-type: none"> 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 Edition, 2018.
REFERENCES:
<ol style="list-style-type: none"> 1. Don, Alex Tapscott, “Blockchain Revolution”, Portfolio Penguin 2016. 2. William Mougayar, “Business Blockchain Promise, Practice and Application of the Next Internet Technology”, John Wiley & Sons 2016.

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

22CSX33-BEYOND 5G AND IOT TECHNOLOGIES <i>(Common to 22ITX33,22AIX33,22CIX03 and 22CCX33)</i>				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> • 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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:
<ol style="list-style-type: none"> 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, KanZheng, 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:
<ol style="list-style-type: none"> 1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK, 2017. 2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" 1st Edition, John Wiley & Sons, 2015.

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



22CSX34 – PROGRAMMING FOR IoT BOARDS (Common to 22ITX34,22AIX34,22CIX04 and 22CCX34)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> • 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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.

TOTAL (L:45) = 45 PERIODS**TEXT BOOKS :**

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

REFERENCES:

1. Sai Yamanoor, Sri hari Yamanoor “ Python programming with Raspberry Pi” Packet Publishing Ltd, 1st edition, 2017.
2. Wolfram Donat “Learn raspberry Pi programming in python” A Press 2014.

Mapping of COs with POs / PSOs

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



22CSX35 – WIRELESS AD-HOC AND SENSOR NETWORKS (Common to 22ITX35,22CIX07 and 22CCX32)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> Understand the design issues in ad hoc and sensor networks. Learn the different types of MAC protocols 			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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 WIRELESS COMMUNICATION TECHNOLOGY	(9)
Introduction –Spectrum Allocation-characteristics of wireless channel-modulation techniques-multiple access 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 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.

TOTAL (L:45) = 45 PERIODS**TEXT BOOKS :**

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

REFERENCES:

1. Carlos De MoraisCordeiro, 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

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



22CSX36-WEARABLE COMPUTING (Common to 22ITX36,22AIX36,22CIX05 and 22CCX36)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> • 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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. Edward Sazonov, Sergey G. Togov "Wearable Sensors: Fundamentals, Implementation and Applications" , Elsevier ,2014
REFERENCES:
1. Subhas Chandra Mukhopadhyay “,Wearable Sensors: Fundamentals, Implementation, and Applications” 2. Robert Matthews and Alberto Piaggese, "Wearable Sensors: Fundamentals, Implementation, and Applications" 3. Mehmet R. Yuce."Wearable Sensors and Systems “.

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



22CSX37– FOG AND EDGE COMPUTING <i>(Common to 22ITX37,22AIX37,22CIX06 and 22CCX37)</i>				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objectives:	<ul style="list-style-type: none"> • 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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.

TOTAL (L:45) = 45 PERIODS**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, 2nd Edition, Create Space Independent Publishing Platform, USA
2. Ovidiu Vermesan, Peter Friess, “Internet of Things –From Research and Innovation to Market Deployment”, 2014, 1st edition, River Publishers, India

Mapping of COs with POs / PSOs

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



22CSX38-IMAGE PROCESSING (Common to 22ITX38,22CIX08 and 22CCX35)						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE : NIL						
Course Objectives:		<ul style="list-style-type: none"> • To provide the basic knowledge on image processing concepts. • To develop the ability to apprehend and implement various image processing algorithms. 				
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination			
The Student will be able to						
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,Smoothingfrequency-domainFilters,SharpeningFrequency-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 Multire solution Processing: Multire solution 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 dimensional 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														
COs	Pos												PSOs	
	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

22CSX41-CLOUD COMPUTING <i>(Common to 22ITC15,22AIX41 and 22CIX44)</i>		L	T	P	C
		3	0	0	3
PRE-REQUISITE :NIL					
Course Objectives:	Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges				
Course Outcomes		Cognitive Level		Weightage of COs in End Semester Examination	
The Student will be able to					
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:
<ol style="list-style-type: none"> 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:
<ol style="list-style-type: none"> 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

22CSX42- UI AND UX DESIGN (Common to 22ITX42,22AIX42,22CIX45 and 22CCX41)				
	L	T	P	C
	3	0	0	3

PRE-REQUISITE :NIL			
Course Objectives:	To understand fundamental concepts of UI/UX design and to develop real time applications.		
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The Student will be able to			
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.	
TOTAL (L:45) : 45 PERIODS	

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" 3rd Edition , 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", 3rd Edition, 2015.
4. <https://www.nngroup.com/articles/>
5. [https://www.interaction-design.org/literature.](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



22CSX43-DEVOPS (Common to 22ITX43,22AIX43,22CIX46 and 22CCX46)					
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL					
Course Objectives:	To introduce DevOps terminology, definition & concepts, version control tools and configuration management.				
Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination		
CO1	Analyze different actions performed through Version control tools like Git	An	20%		
CO2	Apply Jenkins for Continuous Integration and Continuous Testing and Continuous Deployment by building automating test cases using Maven & Gradle.	Ap	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	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:
<ol style="list-style-type: none"> 1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, 2nd Edition, Kindle Edition, 2016. 2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014
REFERENCES:
<ol style="list-style-type: none"> 1. Hands-On Azure Devops: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni 2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, 1st Edition, 2015. 3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, 2nd Edition, 2016. 4. MariotTsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, 2nd Edition, 2019. 5. https://www.jenkins.io/user-handbook.pdf 6. 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

gla

22CSX44-PRINCIPLES OF PROGRAMMING LANGUAGES (Common to 22ITX44,22AIX44 and 22CCX47)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE :NIL				
Course Objective:	To understand design concepts for programming languages			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
CO1	Apply programming languages for problem solving.	Ap	20%	
CO2	Analyze object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog.	Ap	40%	
CO3	Design a solution for given problem using programming languages structures	An	20%	
CO4	Demonstrate the different functionalities of programming languages.	<u>An</u>	20%	
CO5	Make an Oral presentation related to course.	Ap	Internal Assessment	

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

UNIT V – FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES**(9)**

Introduction to lambda calculus – fundamentals of functional programming languages -Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages.

TOTAL(L:45) = 45 PERIODS**TEXT BOOKS:**

1. Robert W. Segesta, “Concepts of Programming Languages”, 12th Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, “Programming Language Pragmatics”, 4th Edition, Elsevier, 2018.
3. Jeffrey D. Ullman, “Elements of programming”, 2nd Edition, Pearson, 1997.
4. W. F. Clocksin and C. S. Mellish, “Programming in Prolog: Using the ISO Standard”, 5th Edition, Springer, 2003.

REFERENCES:

1. Ghezzi, “Programming Languages”, 3rd Edition, John Wiley, 2008
2. John C. Mitchell, “Concepts in Programming Language”, Cambridge University Press, 2004
3. Lutz M, “Programming Python”, SPD/O’reilly, 4th Edition, 2015.
4. Allen Tucker, Robert Noonan, “Programming Languages: Principles and Paradigms”, Tata McGraw Hill, 2nd Edition, 2007.

Mapping of COs with POs / PSOs

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



22CSX45- MEAN STACK DEVELOPMENT <i>(Common to 22ITX45,22AIX45,22CIX56 and 22CCX45)</i>				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	To build complex web application with using minimum code.			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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.

TOTAL(L:45) = 45 PERIODS**TEXT BOOK:**

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

REFERENCES:

2. <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



22CSX46-SOCIAL AND INFORMATION NETWORKS (Common to 22ITX46,22AIX46,22CIX47 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. David Easley and Jon Kleinberg , "Networks, Crowds, and Markets: Reasoning About a Highly Connected World" , 1st Edition, 2010
2. Albert-Laszlo Barabasi , "Network Science" , 1st Edition, 2016
3. Matthew A. Russell , "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" , 2nd Edition, O'Reilly Media , 2019

REFERENCES:

1. Stanley Wasserman and Katherine Faust: , "Social Network Analysis: Methods and Applications"
2. Mark Newman , "The Structure and Dynamics of Networks", 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



22CSX47-WEB MINING (Common to 22ITX47,22AIX47,22CIX57 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		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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 structured 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 Semantic Indexing – Web Search – Meta-Searching and Combining Multiple Rankings–Web Spamming.	
UNIT II - WEBCRAWLING	(9)
BasicCrawlerAlgorithm–ImplementationIssues–UniversalCrawlers–FocusedCrawlers–TopicalCrawlers–Evaluation–CrawlerEthicsand Conflicts.	
UNIT III - STRUCTURED DATA EXTRACTION	(9)
Structured Data Extraction –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matching and Tree Matching – Multiple Alignment – Building DOM Trees – Extraction Based on a Single List Page –Introduction to Schema Matching–Pre-Processing for Schema Matching–Schema–Level Match– Domain and Instance-Level Matching	
UNIT IV – WEB USAGE MINING	(9)
WebUsageMining–ClickstreamAnalysis–LogFiles–DataCollectionandPre-Processing DataModelingforWebUsageMining–TheBIRCHClusteringAlgorithm–AffinityAnalysisandtheAPrioriAlgorithm–DiscretizingtheNumericalVariable	

UNIT V – OPINION MINING	(9)
The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification –Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion Spam Detection.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:
<ol style="list-style-type: none"> 1. Bing Liu, “ Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)”,Springer, 2nd Edition 2011 for units I,II,III&V 2. Dravko Markov, Daniel T.Larose, “Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage”, John Wiley& Sons, Inc.,2010 for unit IV.
REFERENCES:
<ol style="list-style-type: none"> 1. Anthony Scime, “Web Mining Applications and Techniques”,IdeaGroupPublication,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

22CSX48-MULTIMEDIA DATA COMPRESSION AND STORAGE (Common to 22ITX48,22AIX48,22CIX48 and 22CCX48)				
		L	T	P
		3	0	0
PRE-REQUISITE :NIL				
Course Objective:	<ul style="list-style-type: none"> Apply data compression algorithms Explain Multimedia Information Sharing 			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
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 Lossy Compression– 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

TOTAL(L:45) = 45 PERIODS**TEXT BOOKS:**

1. Khalid Sayood," 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



22CSX51-AGILE METHODOLOGIES (Common to 22AIX51 and 22CIX43)						
			L	T	P	C
			3	0	0	3
PRE-REQUISITE : NIL						
Course Objectives:		<ul style="list-style-type: none"> Estimate in an incremental and iterative fashion using practical techniques Apply agile principles to a range of decision possibilities. 				
Course Outcomes			Cognitive Level	Weightage of COs in End Semester Examination		
Students will be able to						
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:
<ol style="list-style-type: none"> 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:
<ol style="list-style-type: none"> 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



22CSX52-SOFTWARE DEFINED NETWORKS (Common to 22ITX52,22AIX52 and 22CCX52)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	Gain knowledge in networking fundamentals and conceptual understanding of Software Defined Networks (SDN)			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The students will be able to				
CO1	Analyze the conventional network and SDN paradigm	An	20%	
CO2	Analyze the flexibility and scalability of using SDN in terms of innovation and network management	An	20%	
CO3	Apply troubleshooting on various components of SDN networks	Ap	20%	
CO4	Analyze the security challenges in SDN paradigm	An	20%	
CO5	Evaluate the emerging SDN applications	Ap	20%	

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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



22CSX53-SOFTWARE PROJECT MANAGEMENT
(Common to 22ITX53,22AIX53,22CCX53 and 22CIX54)

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" , 6th Edition, Tata McGraw Hill, New Delhi, 2017.
2. Pressman R S & Bruce R Maxhim, "Software Engineering - A Practitioner's Approach", 9th Edition, Tata McGraw Hill, 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 ISPMMA-Compliant Study Guide and Handbook",2018.
3. Gopaldaswamy 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



22CSX54-SOFTWARE TESTING TOOLS AND TECHNIQUES
(Common to 22ITX54,22AIX54,22CIX52 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.
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Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination
The students will be able to			
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:
<ol style="list-style-type: none"> 1. Rajiv Chopra, “Software Testing: A Self-Teaching Introduction”, David Pallai- Mercury Learning and Information Publisher, 2018. 2. Jamie L Mitchell, Rex Black, “Advanced Software Testing: Guide to the ISTQB Advanced Certification as an Advanced Technical Test Analyst”, 2nd Edition, Vol 3, 2015.
REFERENCES:
<ol style="list-style-type: none"> 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



22CSX55-SOFTWARE QUALITY ASSURANCE <i>(Common to 22ITX55,22AIX56,22CIX53 and 22CCX56)</i>					
		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		Cognitive Level	Weightage of COs in End Semester Examination		
The Student will be able to					
CO1	Analyze the common challenges which affect software quality	An	20%		
CO2	Apply the knowledge of SQA Components and Project Life Cycle	Ap	20%		
CO3	Establish Software Quality Infrastructure through implementation of modern Engineering and IT tools	An	20%		
CO4	Analyze the various metrics used in quality management	An	20%		
CO5	Apply SQA Standards, Certifications and Assessments	Ap	20%		

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

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

TEXT BOOK:
1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.
REFERENCES:
1. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997. 2. Mordechai Ben-Menachem, “Software Quality: Producing Practical Consistent Software”, International Thomson Computer Press, 1997.

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

22CSX56-SERVICE ORIENTED ARCHITECTURE (Common to 22ITX56,22AIX57 and 22CCX57)				
	L	T	P	C
	3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	To learn service-oriented analysis and design for developing SOA based application			
Course Outcomes		Cognitive Level	Weightage of COs in End Semester Examination	
The Student will be able to				
CO1	Apply XPath and XQuery to navigate and query XML documents efficiently	Ap	30%	
CO2	Apply SOA principles and technologies to analyze real-world case studies across different industries.	Ap	30%	
CO3	Analyze the impact of SOA on business process automation and agility	An	20%	
CO4	Design service models and business process flows adhering to SOA principles and industry standards.	Ap	20%	
CO5	Implement and demonstrate SOA-based applications using Microservices Architecture.	An	Internal Assessment	

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

UNIT V - SERVICE ORIENTED ANALYSIS AND DESIGN**(9)**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design – Case Study

TOTAL (L:45) : 45 PERIODS**TEXT BOOK:**

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

REFERENCES:

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

Mapping of COs with POs / PSOs

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



22CSX57-IT OPERATIONS (Common to 22ITX57,22CIX55,22AIX55 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 - Dining 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



22CSX58-PRODUCT LIFE CYCLE MANAGEMENT
(Common to 22ITX58,22AIX58,22CIX58 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		Cognitive Level	Weightage of COs in End Semester Examination
The students will be able to			
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", 2nd Edition ,Springer Publisher, 2011.
2. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", 3rd Edition, Springer Publisher 2008

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

