ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS
HOSUR

B.E.COMPUTER SCIENCE AND ENGINEERING

REGULATION2022

(Choice Based Credit System)

CURRICULUM&SYLLABUS

ADHIYAMAAN COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai)

(Accredited by NAAC)

Dr.M.G.R Nagar,Hosur-635109,Tamilnadu,India
REGULATION 2022

CHOICE BASED CREDIT SYSTEM

B.E.-COMPUTER SCIENCE AND ENGINEERING

Vision

To mould young and fresh minds into challenging professionals with ethical values and shaping them with contemporary skills to contribute fully in current and future world demands**.**

Mission

To produce competent and quality professionals by imparting computer concepts and techniques to facilitate the students to work with modern tools, inventive technologies, innovative research capabilities and leadership abilities by inculcating the spirit of ethical values.

I. Programme Educational Objectives (PEOs)

PEO1: The graduates of the program will have sound knowledge in Mathematical, Scientific, and Engineering concepts necessary to formulate, analyse, design, and solve Engineering problems and to prepare them for higher learning, research, and industry.

PEO2: The graduates of the program will possess innovative skills to assess and apply the rapid changes in technology and to engage in research leading to novel solutions for human, social, and global competency**.**

PEO3: The graduates of the program will acquire knowledge and grab opportunities to work as teams in a multi-disciplinary environment, communicate ideas effectively with diverse audiences, and demonstrate leadership qualities with ethical values.

II. Programme Outcomes (POs)

PO1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences**.**

PO3 - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: 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.

PO5 - Modern tool usage: 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**.**

PO6 - The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - Communication: 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**.**

PO11 - Project management and finance: 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.

PO12 - Life-long learning: 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.

Programme Specific Outcomes (PSOs)

PSO1 - Professional Skills: An ability to interpret the fundamental concepts and methodology of computer systems. To enhance skills among students to synthesize data and technical ideas for software design and development.

PSO2 - Problem Solving Skills: The ability to understand the structure and development methodologies of software systems. Possess knowledge of software design processes using open-ended programming environments to deliver a quality product for business success**.**

PSO3 - Successful career and entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and a zest for higher studies.

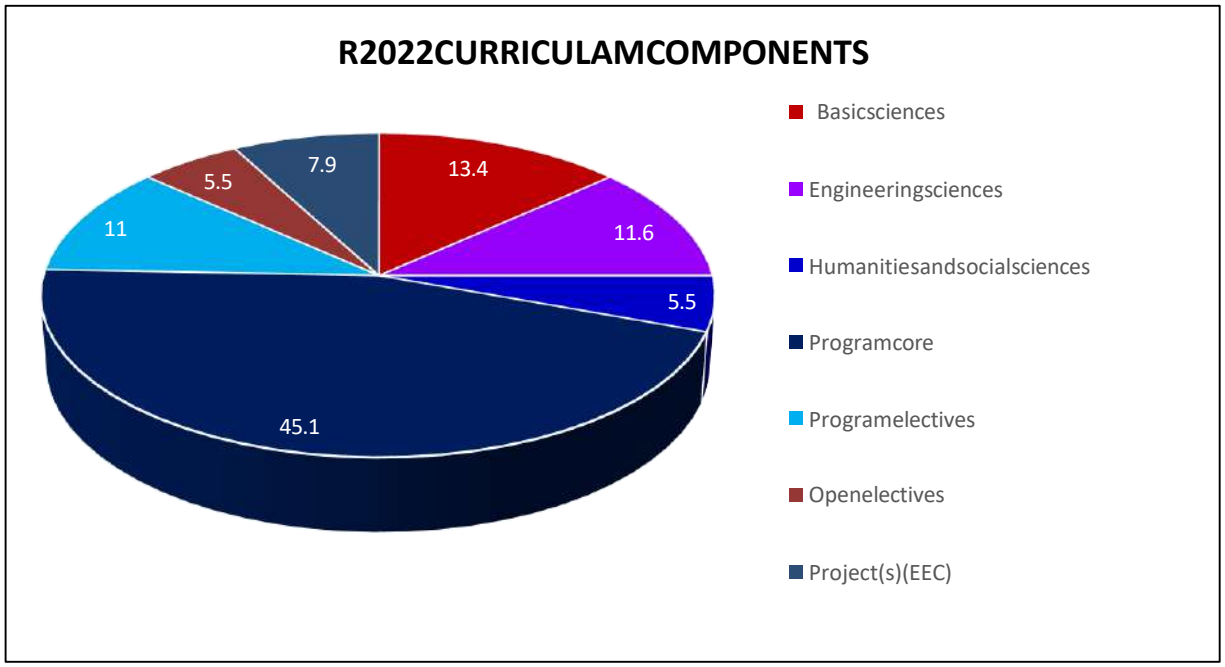
Correlation of PEO's with PO's and PSO's

	PO's												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
PEO1	3	2	2	1	2	1	3	2	2	1	3	1	1	1	2
PEO2	2	1	3	1	3	2	1	2	1	2	1	1	1	2	3
PEO3	2	2	3	2	3	1	1	3	2	2	3	1	1	2	1

ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS),HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING
COMPONENTS OF THE CURRICULUM
REGULATION 2022
Choice Based Credit System

Coursecomponent	Curriculum content (%of total number of credits of the program)	Total numberof contacthours	Total numberof credits
Basicsciences	13.4	60	22
Engineeringsciences	11.6	46	19
Humanitiesandsocialsciences	5.5	45	9
Programcore	45.1	840	74
Programelectives	11.0	270	18
Openelectives	5.5	135	9
Project(s)(EEC)	7.9	392	13
Totalnumberofcredits			164



ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS), HOSUR

B.E.COMPUTER SCIENCE AND ENGINEERING

REGULATION 2022

Choice Based Credit System

STRUCTURE OF THE CURRICULUM

Course Code	Course Title	Total Number of contact hours				Credit's
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
122ENI01	Professional English-I	2	0	2	45	3
122MAT02	Matrices and Calculus	3	1	0	60	4
122PHT03	Engineering Physics	2	0	0	45	2
122CYT04	Engineering Chemistry	2	0	0	45	2
122PPT05	Python Programming	3	0	0	45	3
122EET06	Basic Electrical Electronics and Instrumentation Engineering	3	0	0	45	3
122HST07	தமிழர்மரபு /Heritage of Tamils	1	0	0	45	1
122PHP08	Engineering Physics Laboratory	0	0	2	30	1
122PPP09	Python Programming Laboratory	0	0	2	30	1
222ENI01	Professional English-II (Embedded)	2	0	2	45	3
222MAT02	Probability and Statistics	3	1	0	60	4
222EST03	Environmental Science and Sustainability	2	0	0	45	2
222EGT04	Engineering Graphics	2	0	4	45	4
222PIT05	Physics for Information Science	2	0	0	45	2
222CPI06	Programming in C	3	0	2	45	4
222HST07	Tamils and Technology	1	0	0	45	1
222CYP08	Engineering Chemistry Laboratory	0	0	2	30	1
222EPP09	Engineering Practice Laboratory	0	0	2	30	1
322DMT01	Discrete Mathematics	3	1	0	60	4
322CST02	Digital Electronics	3	0	0	45	3
322CSI03	Foundations of Data Science	3	0	2	45	4
322CIT04	Object Oriented Programming	3	0	0	45	3
322CIT05	Data Structures	3	0	0	45	3
322CIT06	Computer Organization	3	0	0	45	3
322CIP07	OOPs Laboratory	0	0	2	30	1
322CIP08	Data Structures Laboratory	0	0	2	30	1
322GEV01	Professional Development	0	0	2	30	1
422CST01	Object Oriented Software Engineering	3	0	0	45	3
422CIT02	Design and Analysis of algorithm	3	0	0	45	3
422CIT03	Database Management System	3	0	0	45	3
422CIT04	Operating Systems	3	0	0	45	3
422CII05	Network Essentials	3	0	2	45	4
422CST06	Theory of Computation	3	0	0	45	3
422CIP07	Database Management System Laboratory	0	0	2	30	1
422CIP08	Operating Systems Laboratory	0	0	2	30	1
522CIT01	Artificial Intelligence and Machine Learning	3	0	0	45	3

522CSI02	Cryptography and Block Chain Technologies	3	0	2	45	4
522CST03	Compiler Design	3	0	0	45	3
522CIT04	Web Essentials	3	0	0	45	3
X22XXExx	Professional Elective-I	3	0	0	45	3
X22XXOxx	Open Elective-I	3	0	0	45	3
522MCTxx	Mandatory Course – I	1	0	0	45	1
522CIP07	Artificial Intelligence and Machine Learning Laboratory	0	0	2	30	1
522CIP08	Web Essentials Laboratory	0	0	2	30	1
522CSV09	Value Added Course	0	0	2	-	1
622CIT01	Full Stack Development	3	0	0	45	3
622CII02	Cloud Computing	3	0	2	45	4
622CST03	Mobile Application Development	3	0	0	45	3
622CSI04	Devops	3	0	2	45	4
X22XXExx	**Professional Elective–II**	3	0	0	45	3
X22XXOxx	**Open Elective-II**	3	0	0	45	3
622CIP07	Full Stack Development Laboratory	0	0	2	30	1
622CSP08	Mobile Application Development Laboratory	0	0	2	30	1
622CSP09	Internship	0	0	4	-	2
722CII01	ARVR and Meta verse	3	0	2	45	4
722CST02	Internet of Things	3	0	0	45	3
722CST03	**Human Values and Computing Ethics**	3	0	0	45	3
X22XXExx	**Professional Elective - III**	3	0	0	45	3
X22XXOxx	**Professional Elective - IV**	3	0	0	45	3
722BAOxx	**Management Elective**	3	0	0	45	3
722CSP07	Internet of Things Laboratory	0	0	2	30	1
722CSP08	Mini Project	0	0	4	30	2
X22XXExx	**Professional Elective - V**	3	0	0	45	3
X22XXExx	**Professional Elective - VI**	3	0	0	45	3
822CSP01	Project Work & Viva Voce	0	0	18	270	9

ADHIYAMAAN COLLEGE OF ENGINEERING (An Autonomous Institution), Hosur

B.E.COMPUTER SCIENCE AND ENGINEERING

REGULATION 2022-CURRICULUM

Choice Based Credit System

(Applicable to the students admitted from the Academic year 2022-2023 onwards)

SEMESTER – I

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
-	-	122IP001	Induction Programme	-	-	-	-	-	-	-
THEORY										
1	HS	122ENI01	Professional English-I	2	0	2	3	50	50	100
2	BS	122MAT02	Matrices and Calculus	3	1	0	4	40	60	100
3	BS	122PHT03	Engineering Physics	2	0	0	2	40	60	100
4	BS	122CYT04	Engineering Chemistry	2	0	0	2	40	60	100
5	ES	122PPT05	Python Programming	3	0	0	3	40	60	100
6	ES	122EET06	Basic Electrical Electronics and Instrumentation Engineering	3	0	0	3	40	60	100
7	HS	122HST07	தமிழர்மரபு /Heritage of Tamils	1	0	0	0	40	60	100
PRACTICALS										
7	BS	122PHP08	Engineering Physics Laboratory	0	0	2	1	60	40	100
8	ES	122PPP09	Python Programming Laboratory	0	0	2	1	60	40	100
TOTAL				**16**	**1**	**6**	**19**			

HOD

SEMESTER – II

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	HS	222ENI01	Professional English-II (Embedded)	2	0	2	3	50	50	100
2	BS	222MAT02	Probability and Statistics	3	1	0	4	40	60	100
3	BS	222EST03	Environmental Science and Sustainability	2	0	0	2	40	60	100
4	ES	222EGT04	Engineering Graphics	2	0	4	4	40	60	100
5	BS	222PIT05	Physics for Information Science	2	0	0	2	40	60	100
6	ES	222CPI06	Programming in C	3	0	2	4	50	50	100
7	HS	222HST07	Tamils and Technology	1	0	0	1	40	60	100
PRACTICALS										
7	BS	222CYP08	Engineering Chemistry Laboratory	0	0	2	1	60	40	100
8	ES	222EPP09	Engineering Practice Laboratory	0	0	2	1	60	40	100
TOTAL				**14**	**1**	**12**	**21**			

HOD

SEMESTER – III

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	BS	322DMT01	Discrete Mathematics	3	1	0	4	40	60	100
2	ES	322CST02	Digital Electronics	3	0	0	3	40	60	100
3	PC	322CSI03	Foundations of Data Science	3	0	2	4	50	50	100
4	PC	322CIT04	Object Oriented Programming	3	0	0	3	40	60	100
5	PC	322CIT05	Data Structures	3	0	0	3	40	60	100
6	PC	322CIT06	Computer Organization	3	0	0	3	40	60	100
PRACTICALS										
7	PC	322CIP07	OOPs Laboratory	0	0	2	1	60	40	100
8	PC	322CIP08	Data Structures Laboratory	0	0	2	1	60	40	100
9	EEC	322GEV01	Professional Development	0	0	2	1	100	-	100
TOTAL				**18**	**1**	**8**	**22**			

HOD

SEMESTER – IV

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	422CST01	Object Oriented Software Engineering	3	0	0	3	40	60	100
2	PC	422CIT02	Design and Analysis of Algorithm	3	0	0	3	40	60	100
3	PC	422CIT03	Database Management System	3	0	0	3	40	60	100
4	PC	422CIT04	Operating Systems	3	0	0	3	40	60	100
5	PC	422CII05	Network Essentials	3	0	2	4	50	50	100
6	PC	422CST06	Theory of Computation	3	0	0	3	40	60	100
PRACTICALS										
7	PC	422CIP07	Database Management System Laboratory	0	0	2	1	60	40	100
8	PC	422CIP08	Operating Systems Laboratory	0	0	2	1	60	40	100
9	EEC	422GEV02	Maths Solver	0	0	2	1	100	-	100
TOTAL				**18**	**0**	**8**	**21**			

HOD

SEMESTER – V

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	522CIT01	Artificial Intelligence and Machine Learning	3	0	0	3	40	60	100
2	PC	522CSI02	Cryptography and Block Chain Technologies	3	0	2	4	50	50	100
3	PC	522CST03	Compiler Design	3	0	0	3	40	60	100
4	PC	522CIT04	Web Essentials	3	0	0	3	40	60	100
5	PE	X22xxExx	Professional Elective-I	3	0	0	3	40	60	100
6	OE	X22xxoxx	Open Elective-I	3	0	0	3	40	60	100
7	MC	522MCTxx	Mandatory Course – I	1	0	0	1	100	-	100
PRACTICALS										
8	PC	522CIP07	Artificial Intelligence and Machine Learning Laboratory	0	0	2	1	60	40	100
9	PC	522CIP08	Web Essentials Laboratory	0	0	2	1	60	40	100
10	VAD	522CSV09	Value Added Course	0	0	2	1	100	-	100
TOTAL				**19**	**0**	**10**	**21**			

HOD

SEMESTER – VI

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	622CIT01	Full Stack Development	3	0	0	3	40	60	100
2	PC	622CII02	Cloud Computing	3	0	0	3	50	50	100
3	PC	622CST03	Mobile Application Development	3	0	0	3	40	60	100
4	PC	622CSI04	Devops	3	0	2	4	50	50	100
5	PE	X22XXExx	**Professional Elective – II**	3	0	0	3	40	60	100
6	OE	X22XXOxx	**Open Elective – II**	3	0	0	3	40	60	100
7	MC	X22MCTxx	**Mandatory Course - II**	3	0	0	1	40	60	100
PRACTICALS										
8	PC	622CIP07	Full Stack Development Laboratory	0	0	2	1	60	40	100
9	PC	622CSP08	Mobile Application Development Laboratory	0	0	2	1	60	40	100
10	EEC	622CSP09	Internship	0	0	4	2	100	-	100
TOTAL				**21**	**0**	**10**	**23**			

HOD

SEMESTER – VII

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	722CII01	ARVR and Meta verse	3	0	2	4	50	50	100
2	PC	722CST02	Internet of Things	3	0	0	3	40	60	100
3	HSMC	722CST03	**Human Values and Computing Ethics**	3	0	0	3	40	60	100
4	PE	X22XXExx	**Professional Elective - III**	3	0	0	3	40	60	100
5	PE	X22XXExx	**Professional Elective - IV**	3	0	0	3	40	60	100
6	HSMC	722BAOxx	**Management Elective**	3	0	0	3	40	60	100
PRACTICALS										
7	PC	722CSP07	Internet of Things Laboratory	0	0	2	1	60	40	100
8	EEC	722CSP08	Mini Project	0	0	4	2	60	40	100
TOTAL				**18**	**0**	**8**	**22**			

HOD

SEMESTER – VIII

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22XXExx	**Professional Elective - V**	3	0	0	3	40	60	100
2	PE	X22XXExx	**Professional Elective - VI**	3	0	0	3	40	60	100
PRACTICALS										
3	EEC	822CSP01	Project Work & Viva Voce	0	0	18	9	60	40	100
TOTAL				**6**	**0**	**18**	**15**			

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

Applicable to the students admitted from the Academic year (2022-2023 onwards)

LIST OF MANDATORY COURSES – I

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
1	MC	522MCT01	Indian Constitution	3	0	0	1	**100**	**-**	**100**
2	MC	522MCT02	Gender, Culture and Development	3	0	0	1	**100**	-	**100**
3	MC	522MCT03	Elements of Literature	3	0	0	1	**100**	-	**100**
4	MC	522MCT04	Introduction to women & gender Studies	3	0	0	1	**100**	-	**100**
5	MC	522MCT05	Disaster Management	3	0	0	1	**100**	-	**100**

LIST OFMANDATORY COURSES – II

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	MC	622MCT01	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	0	0	1	**100**	**-**	**100**
2	MC	622MCT02	History of Science and Technology in India	3	0	0	1	**100**	**-**	**100**
3	MC	622MCT03	Political and Economic Thought for a Humane Society	3	0	0	1	**100**	**-**	**100**
4	MC	622MCT04	State, Nation Building and Politics in India	3	0	0	1	**100**		**100**
5	MC	622MCT05	Industrial Safety	3	0	0	1	**100**	**-**	**100**

HOD

LIST OF ELECTIVE-MANAGEMENT (SEMESTER VII)

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	HSMC	722BAO01	Principles of Management	3	0	0	3	40	60	100
2	HSMC	722BAO02	Total Quality Management	3	0	0	3	40	60	100
3	HSMC	722BAO03	Human Resource Management	3	0	0	3	40	60	100
4	HSMC	722BAO04	Knowledge Management	3	0	0	3	40	60	100
5	HSMC	722BAO05	People Management	3	0	0	3	40	60	100
6	HSMC	722BAO06	Management Information System	3	0	0	3	40	60	100

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

Applicable to the students admitted from the Academic year (2022-2023 onwards)

PROFESSIONAL ELECTIVE COURSES- VERTICALS

VERTICAL 1: AI & DATA SCIENCE

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE01	Big Data Analytics	3	0	0	3	40	60	100
2	PE	X22CIE02	Exploratory Data Analysis	3	0	0	3	40	60	100
3	PE	X22CIE03	Recommender Systems	3	0	0	3	40	60	100
4	PE	X22CIE04	Text and Speech Analysis	3	0	0	3	40	60	100
5	PE	X22CIE05	Image and Video Analytics	3	0	0	3	40	60	100
6	PE	X22CIE06	Business Analytics	3	0	0	3	40	60	100
7	PE	X22CIE07	Cognitive Science	3	0	0	3	40	60	100

VERTICAL 2: FULL STACK DEVELOPMENT

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE08	C# & .NET	3	0	0	3	40	60	100
2	PE	X22CIE09	Advanced Scripting	3	0	0	3	40	60	100
3	PE	X22CIE10	UI and UX Design	3	0	0	3	40	60	100
4	PE	X22CIE11	Advanced Python Programming	3	0	0	3	40	60	100
5	PE	X22CIE12	Cloud Services and Management	3	0	0	3	40	60	100
6	PE	X22CIE13	Web Application Security	3	0	0	3	40	60	100
7	PE	X22CIE14	Software Testing and Automation	3	0	0	3	40	60	100

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AN AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

Applicable to the students admitted from the Academic year (2022-2023 onwards)

VERTICAL 3: CLOUD AND DATA CENTER TECHNOLOGIES

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CSE15	Data Warehousing	3	0	0	3	40	60	100
2	PE	X22CIE16	Virtualization	3	0	0	3	40	60	100
3	PE	X22CIE17	Cloud Services and Management	3	0	0	3	40	60	100
4	PE	X22CIE18	Storage Technologies	3	0	0	3	40	60	100
5	PE	X22CIE19	Software Defined Networks	3	0	0	3	40	60	100
6	PE	X22CIE20	Stream Processing	3	0	0	3	40	60	100
7	PE	X22CIE21	Security and Privacy in Cloud	3	0	0	3	40	60	100

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE22	Ethical Hacking	3	0	0	3	40	60	100
2	PE	X22CIE23	Digital Forensics	3	0	0	3	40	60	100
3	PE	X22CIE24	Cyber Security	3	0	0	3	40	60	100
4	PE	X22CIE21	Security and Privacy in Cloud	3	0	0	3	40	60	100
5	PE	X22CIE26	Social Network Security	3	0	0	3	40	60	100
6	PE	X22CSE27	Crypto Currency	3	0	0	3	40	60	100
7	PE	X22CSE28	Network Security	3	0	0	3	40	60	100

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

Applicable to the students admitted from the Academic year (2022-2023 onwards)

VERTICAL 5: CREATIVE MEDIA

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE29	Multimedia and Animation	3	0	0	3	40	60	100
2	PE	X22CIE30	Multimedia Data Compression and Storage	3	0	0	3	40	60	100
3	PE	X22CSE31	Human computer interaction	3	0	0	3	40	60	100
4	PE	X22CIE32	Visual Effects	3	0	0	3	40	60	100
5	PE	X22CIE33	Game Development	3	0	0	3	40	60	100
6	PE	X22CIE34	Video Creation and Editing	3	0	0	3	40	60	100
7	PE	X22CSE35	Image and video Analytics	3	0	0	3	40	60	100

VERTICAL 6: EMERGING TECHNOLOGIES

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE01	Big Data Analytics	3	0	0	3	40	60	100
2	PE	X22CSE37	Neural Networks and deep learning	3	0	0	3	40	60	100
3	PE	X22CIE24	Cyber Security	3	0	0	3	40	60	100
4	PE	X22CSE39	Robotics process Automation	3	0	0	3	40	60	100
5	PE	X22CIE10	UI and UX Design	3	0	0	3	40	60	100
6	PE	X22CSE05	Digital Marketing	3	0	0	3	40	60	100
7	PE	X22CIE42	Design Thinking	3	0	0	3	40	60	100

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

Applicable to the students admitted from the Academic year (2022-2023 onwards)

S.No	Semester	Credits
1	I	19
2	II	21
3	III	22
4	IV	21
5	V	21
6	VI	23
7	VII	22
8	VIII	15
Total		**164**

HOD

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR

B.E. COMPUTER SCIENCE AND ENGINEERING

R2022-CURRICULUM

Choice Based Credit System

SDG IMPLEMENTATION INITIATIVE

COURSES INTRODUCED	RELATED TO SDG
222EST03 - Environmental Science and Sustainability	SDG 11
322GEV01 - Professional Development	SDG 8
Human Values and Ethics	SDG 5, SDG 8, SDG 10, SDG 12
Introduction to Women and Gender Studies	SDG 5, SDG 10
For all Courses	SDG 4

HOD

SEMESTER – III

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	BS	322DMT01	Discrete Mathematics	3	1	0	4	40	60	100
2	ES	322CST02	Digital Electronics	3	0	0	3	40	60	100
3	PC	322CSI03	Foundations of Data Science	3	0	2	4	50	50	100
4	PC	322CIT04	Object Oriented Programming	3	0	0	3	40	60	100
5	PC	322CIT05	Data Structures	3	0	0	3	40	60	100
6	PC	322CIT06	Computer Organization	3	0	0	3	40	60	100
PRACTICALS										
7	PC	322CIP07	OOPs Laboratory	0	0	2	1	60	40	100
8	PC	322CIP08	Data Structures Laboratory	0	0	2	1	60	40	100
9	EEC	322GEV01	Professional Development	0	0	2	1	100	-	100
TOTAL				**18**	**1**	**8**	**22**			

322DMT01 DISCRETE MATHEMATICS 3 1 0 4 1 0 0

COURCE OBJECTIVES:

- To master combinatorics which deals with the counting principles.
- To identify the basic properties of graph and model simple applications.
- To understand the concept of logic and hence to construct valid mathematical arguments.
- To expose the basic properties and concepts of algebraic structures.
- To introduce the concept of Lattices and Boolean algebra.

UNIT I COMBINATORICS 9+3

Mathematical Induction – The basics of Counting Principle - The Pigeonhole principle - Permutations and Combinations – Recurrence relations- Solving linear recurrence relations - Generating functions – Inclusion and exclusion principle.

UNIT II GRAPHS 9+3

Graphs – preliminaries - Types of graphs – properties – walks, trials and paths – Isomorphism of graphs – Matrix representations of graphs - Connectivity of a graph – Bipartite graphs - Euler and Hamilton graphs - Coloring of graphs - Chromatic number of a graph.

UNIT III LOGICS AND PROOFS 9+3

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested Quantifiers – Rules of inference - introduction to proofs – proof methods and strategy.

UNIT IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids – Groups-Subgroups and homomorphism's – Cosets and Lagrange's theorem – Rings & Fields (basic definitions and problems): Elementary properties of Rings-Isomorphism-Types of Rings-Sub Rings-Homomorphism of rings - Fields of quotients of an integral domain.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering – Posets – Lattices as Posets – Properties of Lattices-Lattices as algebraic systems – Sub lattices – direct product and Homomorphism – Some special lattices – Boolean algebra.

TOTAL = 45 + 15 = 60 PERIODS

COURSE OUTCOMES:

CO 1: Demonstrate the applications of basic concepts of an algorithm and counting principles in combinatorial mathematics.

CO 2: Acquaint with the graph theory concepts which serves as the base for the real time applications in network analysis.

CO 3: Expertise the knowledge of logics helps to verify the correctness of computer programs and to draw conclusions from scientific experiments.

CO 4: Internalize the abstract algebraic structures which provide the ability to deal the theory of sequential machines, formal languages and syntactic analysis.

CO 5: Apply the concept of Lattices and Boolean algebra.

TEXT BOOKS:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Seventh edition, Special Indian edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2011.
2. T. Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2006.

REFERENCES:

1. Trembly J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, thirtieth re-print 2007.
2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, 2007.
3. Thomas Koshy, ``Discrete Mathematics with Applications", Elsevier Publications, 2006.
4. Herstein. I .N., "Topics in Algebra", Second Edition, Wiley India Pvt. Ltd., 2006.
5. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications Inc., First edition, 2016.

CO's-PO's & PSO's MAPPING

322DMT01 DISCRETE MATHEMATICS															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	2	2	2	1	-	-	-	-	-	-	2	2	2	-
CO2	3	3	1	2	1	-	-	-	-	-	-	2	2	2	-
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	2	2	2	-
CO5	3	2	2	1	1	-	-	-	-	-	-	2	2	2	-
AVG	3	2	2	2	1	-	-	-	-	-	-	2	2	2	-

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CST02	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Minimize the Boolean expression and identify the various operations of Logic gates
- Design and analyze of various combinational circuits
- Design various sequential circuits like counters, registers, etc
- Understand the concept of memories and programmable logic devices.
- Design and analyze synchronous and asynchronous sequential circuits

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES 9

Review of binary number systems - Binary arithmetic – Binary codes – Boolean algebra and theorems- Boolean functions – Simplifications of Boolean functions using Karnaugh map and tabulation methods – Logic gates

UNIT II COMBINATIONAL CIRCUITS 9

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor - Serial Adder/Subtractor - Binary Multiplier – Binary Divider - Multiplexer/ DE multiplexer – decoder - encoder – code converters - Magnitude Comparator.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip-flops - SR, JK, D, T, and Master-Slave –Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, – Counters, shift registers - Shift counters

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Stable and Unstable states, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

TOAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Solve and implement various Boolean expression with minimized logic gates

CO2: Implement the various combinational circuits for real time applications

CO3: Design and analyze various synchronous sequential circuits like counters, registers, etc.

CO4: Implement asynchronous sequential circuits

CO5: Demonstrate the concept of memories and I/O.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 5th Edition, 2013
2. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006

REFERENCES:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
2. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merril publishing company,1982.
4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition,2007.

CO's-PO's & PSO's MAPPING

322CST02 DIGITAL ELECTRONICS															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	2	3	3	1	2	1	-	-	-	-	1	3	2	2
CO2	3-	2	3	3	1	2	1	-	-	-	-	1	3-	2	2
CO3	3	2	3	3	1	2	1	-	-	-	-	1	3	2	2
CO4	3	2	3	3	1	2	1	-	-	-	-	1	3	2	2
CO5	3	2	3	3	1	2	1	-	-	-	-	1	3	2	2
AVG	3	2	3	3	1	2	1	-	-	-	-	1	3	2	2

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CSI03 **FOUNDATIONS OF DATA SCIENCE** **L T P C**
3 0 2 4

COURSE OBJECTIVES:

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION **9**

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - **Machine Learning – Applications for machine learning in data science – The Modeling process**

UNIT II DESCRIBING DATA **9**

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III DESCRIBING RELATIONSHIPS **9**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING **9**

Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

Unit V DATA VISUALIZATION **9**

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

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Stats models and Pandas packages.
2. Working with NumPy arrays
3. Working with Pandas data frames
   Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
4. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b. Bivariate analysis: Linear and logistic regression modeling
   c. Multiple Regression analysis
   d. Also compare the results of the above analysis for the two data sets.
5. Apply and explore various plotting functions on UCI data sets.
   a. Normal curves
   b. Density and contour plots
   c. Correlation and scatter plots
   d. Histograms
   e. Three-dimensional plotting
6. Visualizing Geographic Data with Basemap

COURSE OUTCOMES:

CO1: Gain knowledge on data science process

CO2: Understand different types of data description for data science process

CO3: Explore the relationships between data using correlation and regression techniques

CO4: Perform Data Wrangling using Python Libraries

CO5: Apply visualization Libraries in Python to interpret and explore data

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES:

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

CO's-PO's & PSO's MAPPING:

322CSI03 FOUNDATIONS OF DATA SCIENCE															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2
CO2	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2
CO3	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2
CO4	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2
CO5	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2
AVG	3	3	2	3	1	1	-	-	1	1	1	1	2	2	2

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CIT04 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To design and build Graphical User Interface Application using JAVAFX

UNIT – I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments

UNIT – II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT - III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.
Introduction to Collection Framework: Array List **–** Map – Set.

UNIT- IV I/O, GENERICS, AND DATABASE CONNECTIVITY 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Accessing database using JDBC - Applet Architecture- Applet Lifecycle-Simple Applet.

UNIT- V STRING HANDLING AND EVENT HANDLING 9

Strings: Basic String class, methods and String Buffer Class, JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane, Menus.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Apply the concepts of classes and objects to solve simple problems

CO2: Develop programs using inheritance, packages and interfaces

CO3: Make use of exception handling mechanisms and multithreaded model to solve real

CO4: Build Java applications with I/O packages, Collections and generics concepts using Database connectivity

CO5: Integrate the concepts of event handling and JavaFX components for developing GUI based applications.

TEXT BOOKS:

1.Herbert Schildt, "Java: The Complete Reference", 13th Edition, McGraw Hill Education, New Delhi, 2019

2.Herbert Schildt, "Introducing JavaFX 8 Programming",1stEdition, McGraw Hill Education, New Delhi, 2015

REFERENCES:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall.

2.PaulDeitel HarveyDeitel, Java - How to Program, PrenticeHall;9th edition, 2011.

3.Cay Horstmann BIG JAVA,4th Edition, JohnWileySons,2009

4.NicholasS.Williams, Professional Java for Web Applications, Wrox Press,2014

5.T. Budd (2009), An Introduction to Object Oriented Programming, Addison Wesley Longman, 2002.

6.E. Balagurusamy. "Programming with JAVA" A primer, Tata McGraw Hill Publication company, sixth edition, 2019.

CO's-PO's & PSO's MAPPING

322CIT04 OBJECT ORIENTED PROGRAMMING															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	1	1	3	1	3	1	1	1	3	2	2	2	3	1	2
CO2	2	1	3	2	1	1	1	1	2	1	1	3	3	3	2
CO3	3	3	1	2	2	1	1	1	3	2	1	2	3	1	3
CO4	3	1	2	2	2	-	-	-	1	2	1	3	3	1	1
CO5	1	1	2	3	2	-	-	-	3	2	1	2	3	3	3
AVG	2	1	2	2	2	1	1	1	2	2	1	2	3	2	2

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CIT05	DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURCE OBJECTIVES:

- Understand the need and fundamental concepts of List ADT.
- Acquire knowledge in Stack and Queue data structures.
- Learn Trees, graph data structure to solve problems.
- Familiar with Sorting, Searching and Hashing algorithms.

PREREQUISITES: Programming in C

UNIT I LINEAR DATA STRUCTURES – LIST 6

Introduction-Abstract Data Types - The List ADT - Array based Implementation - Linked List Implementation- Doubly Linked List - Circular Linked List - Applications of Linked List - Polynomial Operations- Multi lists

UNIT II LINEAR DATA STRUCTURES – STACKS AND QUEUES 9

The Stack ADT - Array Implementation - Linked List Implementation - Applications of Stack - Balancing Symbols - Postfix Expressions - Infix to Postfix Conversion - The Queue ADT - Array Implementation - Linked List Implementation - Circular Queue - Application of Queue- BFS-Printer Queue.

UNIT III NON LINEAR DATA STRUCTURES – TREES 10

Preliminaries - Binary Trees - Array Implementation - Linked List Implementation - Tree Traversals - Expression Trees - Binary Search Tree - Operations on Binary Search Tree – AVL Trees - Heaps - Binary Heaps - Operations of Heaps -Binomial Queues - B-Tree -B^+ Trees.

UNIT IV NON LINEAR DATA STRUCTURES –GRAPHS 10

Representation of Graphs –Breadth First Traversal- Depth First Traversal - Bi-connectivity – Cut vertex – Euler circuits– Topological Sorting– Application of Graphs - Shortest Path Algorithm: Floyd Warshall - Bellman Ford - Dijkstra's Algorithm -Minimum Spanning Trees: Prim's Algorithm - Kruskal's Algorithm.

UNIT - V SEARCHING, SORTING AND HASH TECHNIQUES 10

Searching: Linear Search - Binary Search. **Sorting:** Insertion Sort - Selection Sort - Shell Sort - Bubble Sort - Quick Sort - Merge Sort - Radix Sort. **Hashing**: Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

TOTAL: 45 PERIODS

COURCE OUTCMES:

CO1: Implement List ADT to solve real time problems.

CO2: Develop applications using Stack and Queues data structures.

CO3: Design and Implement applications on trees.

CO4: Implement graph data structure for solving problems.

CO5: Develop various Sorting, Searching and Hashing algorithms to small and large data.

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, McGraw Hill/ MIT Press, 2022.

2.Data Structures and Algorithms in Java, An Indian Adaptation 2022by Michael T.Goodrich; Roberto Tamassia; Michael H. Goldwasser; Subhasish Banerjee , 6 edition, wiley– 21 June

3.Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second edition, Pearson Education, January 2020

REFERENCES:

1.Data Structures and Algorithms Made Easy in Java, Narasimha Karumanchi(Author)- 16 December 2011

2.Data Structures, Algorithm, and Software Principles in C, Thomas A Standish, Addison –Wesley 2017

3. Problem Solving in Data Structures & Algorithms Using Java Book by Hemant Jain October2016

CO's-PO's & PSO's MAPPING

322CIT05- DATA STRUCTURES															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	2	1	3	3	3	2	2	-	-	-	2	-	-	3
CO2	3	2	1	3	3	3	2	2	-	-	-	2	-	-	3
CO3	3	2	1	3	3	3	2	2	-	-	-	2	-	-	3
CO4	3	2	1	3	3	2	3	2	-	-	-	2	-	-	3
CO5	3	2	1	3	3	2	3	2	-	-	-	2	-	-	3
AVG	3	2	1	3	3	3	2	2	-	-	-	2	-	-	3

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CIT06	COMPUTER ORGANIZATIONL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To have insight into the basic structure of computers.
- To understand the design and implementation of ALU.
- To comprehend the importance of the memory and I/O communication.
- To familiarize basic concepts of Parallelism.

PREREQUISITES: NIL

UNIT-I BASIC STRUCTURE OF COMPUTER SYSTEM 9

Functional Units of a Digital Computer: Von Neumann Architecture – Basic operational concepts – Bus structures – Memory Locations and Addresses – Instructions and instruction sequencing - Addressing modes –**RISC and CISC -** Basic I / O Operations.

UNIT-II COMPUTER ARITHMETIC AND CONTROL UNIT 9

Number Representation and Arithmetic Operations **-** Addition and Subtraction of Signed Numbers – Multiplication of Positive Numbers – Signed Operand Multiplication– Integer Division - Floating Point Numbers and operations - Control Units - Fundamental concepts – Instruction Execution– Hardwired control – Micro programmed control.

UNIT-III PIPELINING 9

Basic concepts – Data hazards – Instruction hazards - Unconditional branches – Conditional branches – Branch Prediction – Influence on instruction sets – Data path and control considerations - Super Scalar Operations-Performance considerations- **Pipeline optimization techniques: Compiler techniques for improving performance**.

UNIT-IV MEMORY & I/O ORGANIZATION 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories –**cache size vs. block size-mapping functions**- Performance Considerations of Cache memory - Virtual memory - Accessing I/O devices – Interrupts – Direct Memory Access – Interface circuits – Standard I/O Interfaces: USB, Fire wire.

UNIT-V PARALLELISM 9

ILP – Concepts & Challenges – Compiler Techniques – Reducing branch costs – Dynamic scheduling - Parallel Processing and Performance- Hardware Multithreading – Flynn's Classification (SISD, MIMD, SIMD, SPMD) **-** Vector (SIMD) Processing - Shared-Memory Multiprocessors -Cache Coherence - Message-Passing Multi computers - Parallel Programming for Multiprocessors - Performance Modeling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand basic operational concepts of computers, ALU and Instructions.

CO2: Demonstrate arithmetic and control unit operations using different methods

CO3: Analyse the Hazard classifications and Pipeline concepts

CO4: Illustrate the various memory mechanisms and I/O Interfaces

CO5: Understand Instruction Level Parallelism and Multiprocessor architectures.

TEXT BOOKS:

1.Carl Hamacher, ZvonkoVranesic and Safwat Zaky&NaraigManjikian- "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2021.

2.John L. Hennessey and David A. Patterson, - "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Sixth Edition, 2017.

REFERENCE BOOKS:

1.David A. Patterson and John L. Hennessy, - "Computer Organization and Design: The Hardware /Software interface", sixth Edition, Elsevier, 2021.

2. William Stallings, - "Computer Organization and Architecture – Designing for Performance"11th Edition, Pearson Education, 2019.

CO's-PO's & PSO's MAPPING

322CIT06 COMPUTER ORGANIZATION															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	2	3	1	2	1	1	1	3	2	2	1	3	3	2
CO2	3	2	3	1	2	1	1	1	2	1	1	1	3	3	2
CO3	3	2	3	1	2	1	1	1	3	2	1	1	3	3	2
CO4	3	2	3	1	2	-	-	-	1	2	1	1	3	3	2
CO5	3	2	3	1	2	-	-	-	3	2	1	1	3	3	2
AVG	3	2	3	1	2	1	1	1	2	2	1	1	3	3	2

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CIP07	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

LIST OF EXPERIMENTS:

1. Implement class, method and static member.
2. Implement Inheritance (overriding).
3. Implement packages and interfaces.
4. Implement method and constructor overloading.
5. Implement exception handling and creation of user defined exceptions.
6. Write a java program that implements a multi-threaded application
7. Implement collection class (Array list, Map, Set).
8. Write a program to perform file operations.
9. Implement string handling functions.
10. Develop an application using Java concepts, JavaFX controls, layouts and menus with Database Connectivity.

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- **Software:** JDK 18.0
- **Hardware:** Standalone desktops – 30 Nos

COURSE OUTCOMES:

CO1: Design and develop java programs using object-oriented programming concepts

CO2: Develop simple applications using object-oriented concepts such aspackage, exceptions.

CO3: Implement multithreading, and generics concepts

CO4: Create GUIs and event driven programming applications for real world problems

CO5: Implement and deploy web applications using Java.

CO's-PO's & PSO's MAPPING

322CIP07-OBJECT ORIENTED PROGRAMMING LABORATORY															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3
CO2	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3
CO3	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3
CO4	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3
CO5	3	3	2	2	1	-	-	-	2	-	-	3	3	3	3
AVG	3	3	2.8	2	1.8	-	-	-	2	-	-	3	3	3	3

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322CIP08	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate array and list implementation of linear data structure algorithms.
- To implement the applications using stack.
- To implement Binary search tree, AVL tree algorithms and Heap algorithm.
- To implement Dijkstra's, Prim's and krushkal algorithm.
- To implement Sorting, Searching and hashing algorithms.

LIST OF EXERCISES:

1. Array implementation & linked list of Singly, Doubly and Circular Linked List
2. Array implementation of Stack and Queue.
3. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
4. Implementation of Binary Search Trees
5. Implementation of Tree Traversal
6. Implementation of Heaps using Priority Queues
7. Implementation of Dijkstra's Algorithm, Prim's Algorithm and krushkal Algorithm
8. Implementation of Linear Search and Binary Search
9. Implementation of Insertion Sort, Selection Sort, Quick sort, Merge Sort
10. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- **Software:** TURBO C++ (1.0)
- **Hardware:** Standalone desktops – 30 Nos

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Implement Linear data structures algorithm.

CO2: Build applications using stack and queue data Structure

CO3: Design Tree data structures and develop application using it.

CO4: Apply different graph algorithms to find shortest path

CO5: Develop the various searching, sorting algorithms and Hash techniques

CO's-PO's & PSO's MAPPING

322CIP08 DATA STRUCTURES LABORATORY															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	1	2	2	1	-	-	-	-	2	1	2	2	2	2	3
CO2	3	3	1	1	-	-	-	-	1	1	1	3	1	2	2
CO3	2	1	3	1	-	-	-	-	1	1	2	3	3	3	3
CO4	3	1	3	3	-	-	-	-	1	2	3	3	2	1	2
CO5	3	2	1	1	2	-	-	-	3	3	3	1	3	1	3
AVG	2	2	2	1	2	-	-	-	2	2	2	2	2	2	3

3-High, 2 Moderate, 1-Low, "- "-No Correlation

322GEV01	PROFESSIONAL DEVELOPMENT LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the preventability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, preventability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: **10 PERIODS**

1. Create and format a document Working with tables.
2. Working with Bullets and Lists.
3. Working with styles, shapes, smart art, charts.
4. Inserting objects, charts and importing objects from other office tools.
5. Make a custom cover page in Microsoft Word.
6. Creating and Using document templates.
7. Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments.
8. Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes.
9. Working with document protection and security Inspect document for accessibility

MS EXCEL: **10 PERIODS**

1. Create worksheets, insert and format data
2. Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, and Convert Data
3. Sort and filter data
4. Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae
5. Create and Work with different types of charts
6. Use pivot tables and power pivot to summarize and analyse data Perform data analysis using own formulae and functions
7. Combine data from multiple worksheets using own formulae and built-in functions to generate results
8. Export data and sheets to other file formats
9. Working with macros, Index Match and offset function
10. Protecting data and Securing the workbook

MS POWERPOINT: **10 PERIODS**

1. Select slide templates, layout and themes
2. Formatting slide content and using bullets and numbering Insert and format images, smart art, tables, charts
3. Using Slide master, notes and handout master Working with animation and transitions Organize and Group slides
4. Import or create and use media objects: audio, video, animation
5. Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements

CO2: Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

CO3: Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

CO's-PO's & PSO's MAPPING

322GEV01 PROFESSIONAL DEVELOPMENT															
CO/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	3	-	-	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	-		2	-	3	-	-	-	-	3	-	1	-
AVG	**1**	**2**	-	-	**0.6**	-	**2**	-	-	-	-	**3**		**0.6**	-

3-High, 2 Moderate, 1-Low, '- '-No Correlation

422CST01	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand Software Engineering Lifecycle Models
- To Perform software requirements analysis
- To understand various design patterns
- To understand software testing and testing tools
- To work on project management concepts and its activities

Prerequisite: Nil

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 – Petri nets -Introduction to OOAD with OO Basics- Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram

UNIT III: DESIGN PROCESS AND PATTERNS **9**

Software Design-Design Process-Design Concepts-Coupling-Cohesion-Design Patterns - Creational - Factory Method - Structural - Bridge - Adapter - Behavioral- Strategy-Observer-Applying GoF -Design Patterns-Mapping Design to Code.

UNIT IV: SOFTWARE TESTING **9**

Software Testing Fundamentals - Internal and External Views of Testing - White box Testing - Basis Path Testing - Control Structure Testing - Black Box Testing - Regression Testing - Unit Testing - Integration Testing - User Acceptance Testing - Validation Testing - System Testing - Case Study : Software testing tool – Selenium.

UNIT V: PROJECT MANAGEMENT **9**

Software Project Management- Software Project Management principles- Software Configuration Management - Project Scheduling- Case Study

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand and Compare various software process models

CO2: Perform formal analysis on specifications and use UML diagrams for analysis

CO3: Illustrate design activities and design patterns

CO4: Apply various software testing techniques to ensure the quality and reliability of Software

CO5: Develop software projects based on Project management Activities

TEXT BOOKS:

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.
2. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, Mc Graw-Hill International Edition, 2014.

REFERENCE BOOKS:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
3. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016
4. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
5. Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 2010.
6. Unmesh Gundecha, Selenium Web Driver 3 Practical Guide: End-to-End Automation Testing for Web and Mobile Browsers with Selenium Web Driver, Second Edition,2018

CO's-PO's & PSO's MAPPING

422CST01-OBJECT ORIENTED SOFTWARE ENGINEERING															
CO's / PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3
CO2	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3
CO3	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3
CO4	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3
CO5	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3
AVG	2	3	2	2	3	-	-	-	2	1	2	3	2	3	3

3- High, 2- Moderate, 1-Low, '-'-No Correlation

422CIT02	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To illustrate brute force and divide and conquer design techniques.
- To explain dynamic programming and greedy techniques for solving various problems.
- To apply iterative improvement technique to solve optimization problems
- To examine the limitations of algorithmic power and handling it in different problems.

UNIT I: INTRODUCTION **8**

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

UNIT II: BRUTE FORCE AND DIVIDE AND CONQUER **10**

Brute Force – String Matching - Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Multiplication of Large Integers and Stassen's Matrix /Multiplication – Closest-Pair and Convex - Hull Problems. Decrease and Conquer: - Topological Sorting-Transform and Conquer: Presorting – Heaps and Heap Sort.

UNIT III: DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE **10**

Dynamic programming – Principle of optimality - Coin changing problem – Wars hall's and Floyd's algorithms Optimal Binary Search Trees - Multi stage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra's algorithm - Huffman Trees and codes - 0/1 Knapsack problem.

UNIT IV: ITERATIVE IMPROVEMENT **8**

Linear programming problem-The Simplex Method-Ford Fulkerson algorithm for Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem-Analysis of Gale Shaply algorithms-local search heuristics

UNIT V: LIMITATIONS OF ALGORITHM POWER **9**

Lower - Bound Arguments - P, NP, NP- Complete and NP Hard Problems. Backtracking – N- Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Traveling Salesman Problem - Approximation Algorithms for NP- Hard Problems – Traveling Salesman problem – Knapsack problem.

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Analyze the efficiency of recursive and non-recursive algorithms mathematically

CO2: Analyze the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques

CO3: Implement and analyze the problems using dynamic programming and greedy algorithmic techniques.

CO4: Solve the problems using iterative improvement techniques for optimization.

CO5: Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

TEXT BOOKS:

1. 1.Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, Published by Pearson (July 14, 2021) © 2012

July 14, 2021) © 201

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2022.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2022.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.

CO's-PO's & PSO's MAPPING

CO's / PO's	422CIT02- DESIGN AND ANALYSIS OF ALGORITHMS														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2
CO 2	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2
CO 3	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2
CO 4	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2
CO 5	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2
AVG	3	3	3	2	1	-	-	-	-	-	-	3	3	2	2

3- High, 2 -Moderate, 1-Low, '-'- No Correlation

422CIT03	DATA BASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

UNIT I: RELATIONAL DATABASES **10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II: DATABASE DESIGN **8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III: TRANSACTIONS **9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

UNIT IV: IMPLEMENTATION TECHNIQUES **9**

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

UNIT V: ADVANCED STORAGE OPTIMIZATION & SECURITY TECHNIQUES **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing, and Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Construct SQL Queries using relational algebra
CO2: Design database using ER model and normalize the database
CO3: Construct queries to handle transaction processing and maintain consistency of the database
CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

TEXT BOOKS:

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

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006

CO's-PO's & PSO's MAPPING

422CIT03 -DATABASE MANAGEMENT SYSTEM															
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	3	3	2	-	-	-	-	-	3	3	3	3
CO2	2	2	1	3	2	2	-	-	-	-	-	3	3	3	3
CO3	2	3	1	3	2	2	-	-	-	-	-	3	3	3	3
CO4	2	3	1	2	3	2	-	-	-	-	-	3	3	3	3
CO5	2	2	1	3	2	2	-	-	-	-	-	3	3	3	3
Avg.	2	2.4	1	2.8	2.4	2	-	-	-	-	-	3	2	1	2.6

3- High, 2 -Moderate, 1-Low, '-'-No Correlation

422CIT04	OPERATING SYSTEM S	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system
- Introduce basic Unix commands, system call interface for process management, intercrosses communication and I/O in Unix

Prerequisites: Computer Organization and Architecture

UNIT I: OPERATING SYSTEM **9**

Introduction, Structures - Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

UNIT II: CPU SCHEDULING **10**

Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management- fork, exit, wait, waitpid, exec Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

UNIT III: PROCESS MANAGEMENT AND SYNCHRONIZATION **9**

The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT IV: MEMORY MANAGEMENT AND VIRTUAL MEMORY **9**

Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT V: FILE SYSTEM, VIRTUAL MACHINES AND MOBILE OS **8**

Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management, Virtual Machines – History, Benefits and Features, Mobile OS - iOS and Android

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1 Gain extensive knowledge about OS and OS structures

CO2 Apply the concepts of process management and scheduling algorithms

CO3 Illustrate process synchronization and methods of dead lock handling

CO4 Compare and contrast various memory management schemes, functionality of file systems

CO5 Explore OS protection and security mechanism

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”,10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7 th Edition, Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

CO’s-PO’s & PSO’s MAPPING

422CIT04- OPERATING SYSTEMS															
CO’s /PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	-	-	-	-	-	-	3	3	3	2
CO2	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	1	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	1	3	-	-	-	-	-	-	3	3	3	2
CO5	3	1	1	1	2	-	-	-	-	-	-	3	3	3	2
AVG	3	1.8	1.8	1.2	2.6	-	-	-	-	-	-	3	3	3	2

3- High, 2 Moderate, 1-Low, ‘-‘No Correlation

422CII05	NETWORK ESSENTIALS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the basics of networking
- To brief about network simulation and communication
- To describe about Network addressing
- To understand the services of transport and application layer
- To know about the configuration of network security and troubleshooting

UNIT I: BASICS OF NETWORKING AND SIMULATION b **8**

Basics of Network Communication - Network Types, Data Transmission, Bandwidth and Throughput - Clients and Servers, Network Components- Network Structure. Online Connections – Wireless Networks, Local Network connections, Network documentation. **Network Simulation using Wire shark**: Wire shark Network Simulator, The Wire shark User Interface, Wire shark Network Configuration

UNIT II: PHYSICAL AND DATA LINK LAYER **10**

Physical Topologies and Network Standards- OSI and TCP/IP models-Error Detection and Correction: Types of Errors–Redundancy– LRC – CRC –Checksum- Data Link Control: Flow and Error Control Protocols: Stop and wait – Stop and wait ARQ - Go Back-N ARQ – Selective repeat ARQ- Sliding window – HDLC.

UNIT III: NETWORK ADDRESSING **10**

Process of encapsulation and Ethernet framing -Network communication at the access layer - Broadcast Containment, Routing between networks – Routing table -IPv4 Addressing – Binary conversion, IPv4 Address structure, Classful IPv4 Addressing, Public and Private IPv4 Addresses, Unicast, Broadcast, and Multicast Addresses -Static and Dynamic Addressing, DHCPv4 Configuration. IPv4 and IPv6 Address Management - Network Boundaries, Network Address Translation, IPv4 Issues, IPv6 Features

UNIT IV: TRANSPORT LAYER **9**

Transport Layer Services - The Client Server Relationship, TCP and UDP, Port Numbers. Process to process delivery –User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control Techniques– Congestion Management-Congestion Prevention Policies -Quality of services (QoS) – Techniques to improve QoS - Integrated Services - Differentiated Services.

UNIT V: APPLICATION LAYER **8**

Domain Name Space (DNS) – SMTP – POP3 – WWW - FTP – HTTP – SNMP – SSO- Streaming audio and video. **Case Study**: Cisco Switches: Switch Boot Process, Cisco Routers, Router Boot Process - Cisco IOS Command Line- IOS Navigation, navigation of Cisco IOS to configure network devices - Building a Small Cisco Network - Basic Switch Configuration, Initial Router Settings, and Switch to router connection

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand the basic layers and its functions in computer networks.

CO2: Explore various flow and error control protocols in data link layer.

CO3: Describe the functions of Network Layer and different addressing mechanisms

CO4: Analyze flow control and congestion control algorithm for QoS at end to end level.

CO5: Explore the features and working of various application layer protocols.

Text Books:

1. Jeffrey S. Beasley, Networking Essentials, 6th edition Published by Pearson IT Certification (December 9,2021) © 2022.
2. Jeffrey S. Beasley, Networking Essentials: A CompTIA Network+ N10-007 Textbook (Pearson It Cybersecurity Curriculum) Paperback – Import, 19 April 2018.
3. Networking Essentials Companion Guide, Cisco Networking Academy, Published Mar 10, 2022 by CiscoPress.
4. A. S. Tanenbaum, "Computer Networks", Prentice-Hall of India 2008, 4th Edition.
5. Stallings, "Data and Computer Communications", Pearson Education 2012, 7th Edition.

LAB EXPERIMENTS:

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and trace route. Capture ping and trace route PDUs using a wire shark and examine.
2. Write a HTTP web client program to download a web page using TCP sockets
3. Applications using TCP sockets like: Echo client and echo server Chat File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Simulation of Congestion Control Algorithms using NS.
7. Simulation of Distance Vector/ Link State Routing algorithm.
8. Do the following using NS3 Simulator
    a. Simulate to Find the Number of Packets Dropped
    b. Simulate to Find the Number of Packets Dropped by TCP/UDP
    c. Simulate to Find the Number of Packets Dropped due to Congestion
    d. Simulate to Compare Data Rate& Throughput.
    e. Simulate to Plot Congestion for Different Source/Destination
    f. Simulate to Determine the Performance with respect to Transmission of Packets

Total Hours: 30

Programming Languages to be used: C/Python/Java

CO's-PO's & PSO's MAPPING

422CIT05- NETWORK ESSENTIALS															
CO's /PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2
CO2	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2
CO3	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2
CO4	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2
CO5	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2
AVG	3	2	2	2	2	-	-	-	-	-	-	1	3	2	2

3- High, 2 -Moderate, 1-Low, '-'-No Correlation

422CIT06	THEORY OF COMPUTATION	L P T C 3 0 0 3

COURSE OBJECTIVES:

- To understand foundations of computation including automata theory.
- To construct models of regular expressions and languages.
- To design context free grammar and push down automata.
- To understand Turing machines and their capability.
- To understand Undesirability and NP class problems.

UNIT I: INTRODUCTION TO AUTOMATA **9**

Need for automata theory - Introduction to formal proof- Finite Automata – Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA) – Finite automata with Epsilon transitions–Equivalence of DFA`s and NFA`s - Applications of finite state automata- Equivalence of NFAs with and without ε-moves- Conversion of NFA into DFA – Minimization of DFAs.

UNIT II: REGULAR EXPRESSIONS AND LANGUAGES **9**

Regular languages - Regular Expressions – Finite automata and regular expressions – Properties of regular sets–Properties of Regular Language: Proving languages not to be Regular (Pumping Lemma for Regular Language), Closure properties of Regular Language.

UNIT III: CONTEXT FREE LANGUAGES AND PUSH DOWN AUTOMATA **9**

Context Free Grammar (CFG) – Derivation trees – Ambiguity-Normal Forms, Chomsky Normal Form (CNF) and Griebach Normal Form (GNF)– Introduction to Push Down Automata (PDA) – PDA definition – Equivalence of PDA and Context Free Grammar – CFG to PDA-PDA to CFG-Deterministic pushdown automata – Properties of Context Free Languages.

UNIT IV: TURING MACHINES **9**

Church-Turing thesis: Turing machines - Language of a TM, TM as accepters and deciders. Programming techniques for TM -Storage in state, multiple tracks, and subroutines. Variants of Turing Machines- Encoding of a TM-Universal Turing machine.

UNIT V: DECIDABILITY AND REDUCIBILITY **9**

Decidability: Decidable languages Halting problem: Diagonalization Method-Halting Problem is Undecidable- Reducibility: Undecidable problems from Language theory –Rice theorem and Properties of RE Languages - A simple Undecidable problem: Post's Correspondence Problem (PCP) –Modified PCP-MPCP to PCP- Undesirability of PCP.

Total Hours: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Construct automata, regular expression for any pattern.

CO2: Design grammars and Automata (recognizers) for different language classes.

CO3: Write Context free grammar for any construct.

CO4: Design turing machines for any language and propose computation solutions using turing machines

CO5: Derive whether a problem is decidable or not.

TEXT BOOKS:

1. John E. Hopcroft and Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", third edition, Pearson Education, New Delhi, 2020.
2. John C. Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011.
3. Rajendra Kumar, "Theory of Automata Languages and Computation", first edition Tata McGrawHill Education Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

1. S.N.Sivanadam, M.Janaki Meena, "Theory of Computation", I.K.International Publishing HousePvt. Ltd, ISBN: 9789380026206, 2009.
2. Michael Sipser , "Introduction to the Theory of Computation", third edition, PWS Publications, Boston, 2021.
3. Harry R. Lewis, Chris H Papadimitriou, "Elements of the Theory of Computation", SecondEdition, 2015 PHI / Pearson Education, New Delhi, 1997.
4. Peter Linz, "An Introduction to Formal Language and Automata", sixth edition, Narosa Publishers, New Delhi, 2016.

CO's-PO's & PSO's MAPPING

422CIT06- THEORY OF COMPUTATION															
CO's / PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
CO5	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
AVG	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3

3- High, 2- Moderate, 1-Low, '-' - No Correlation

422CIP07 DATABASE MANAGEMENT SYSTEM LABORATORY L T P C

0 0 2 1

COURSE OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

LIST OF EXPERIMENTS:

1. Create a database table, add constraints (primary key, unique, check, not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above mentioned features
13. Case Study using any of the real life database applications from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – E-Mall

e) Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), and functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings.

Total: 45 Periods

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1 Create databases with different types of key constraints.

CO2 Construct simple and complex SQL queries using DML and DCL commands.

CO3 Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.

CO4 Create an XML database and validate with meta-data (XML schema).

CO5 Create and manipulate data using NOSQL database

CO's-PO's & PSO's MAPPING

422CIP07- DATABASE MANAGEMENT SYSTEM LABORATORY															
CO's/ PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO2	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO3	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO4	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO5	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
AVG.	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3

3- High, 2 -Moderate, 1-Low, '-'-No Correlation

422CIP08 **OPERATING SYSTEMS LABORATORY** **L T P C**
0 0 2 3

COURSE OBJECTIVES:

- To provide an understanding of the design aspects of operating system concepts through simulation
- To introduce basic Unix commands, system call interface for process management, Inter process communication and I/O in Unix
- To Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.

Pre-Requisites: Programming in C LIST

OF EXPERIMENTS:

1. Write C programs to simulate the following CPU Scheduling algorithms
   a) FCFS b) SJF c) Round Robin d) priority
2. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, font, seek, stat, opendir, readdir)
3. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.
4. Write a C program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.
5. Write C programs to illustrate the following IPC mechanisms
   a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write C programs to simulate the following memory management techniques
   a) Paging b) Segmentation
7. Write C programs to simulate Page replacement policies
   a) FCFS b) LRU c) Optimal

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Implement basic services and functionalities of operating system using system call.

CO2: Implement various CPU scheduling algorithm.

CO3: Simulate Producer Consumer problem for process synchronization

CO4: Implement memory management and file allocation techniques algorithms.

CO5: Build disk scheduling algorithms.

CO's- PO's & PSO's MAPPING

422CIP08- OPERTAING SYSTEMS LABORATORY															
CO's / PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO2	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO3	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO4	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
CO5	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3
AVG	3	3	2	2	2	-	-	-	2	-	-	3	3	3	3

3-High, 2 -Moderate, 1-Low, '-'-No Correlation

SEMESTER – V

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	522CIT01	Artificial Intelligence and Machine Learning	3	0	0	3	40	60	100
2	PC	522CSI02	Cryptography and Block Chain Technologies	3	0	2	4	50	50	100
3	PC	522CST03	Compiler Design	3	0	0	3	40	60	100
4	PC	522CIT04	Web Essentials	3	0	0	3	40	60	100
5	PE	X22XXExx	Professional Elective-I	3	0	0	3	40	60	100
6	OE	X22XXOxx	Open Elective-I	3	0	0	3	40	60	100
7	MC	X22MCTxx	Mandatory Course – I	1	0	0	1	100		100
PRACTICALS										
8	PC	522CIP07	Artificial Intelligence and Machine Learning Laboratory	0	0	2	1	60	40	100
9	PC	522CIP08	Web Essentials Laboratory	0	0	2	1	60	40	100
10	VAD	522CSV09	Value Added Course	0	0	2	1	100		100
TOTAL				**19**	**0**	**10**	**21**			

HOD

522CIT01	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the Characteristics of Intelligent Agents
- To solve problems using various Search Strategies & Knowledge Representation Scheme
- To understand the basic concepts learning and hypothesis
- TohaveathoroughunderstandingofthewidelyusedMachinelearningalgorithms

UNIT–I INTRODUCTION TO AI **9**

Introduction – Definition - Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem solving Methods - Search Strategies: **Informed -Uninformed - Heuristics**- Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation -Backtracking Search.

UNIT– II KNOWLEDGE REPRESENTATION **9**

Propositional Logic - First Order Logic: Syntax and Semantics – Extensions & Notational variations – Using First Order Logic – Logical agents of Wumpus world - Knowledge Engineering – General ontology – Inference in First order Logic: Inference Rules involving quantifiers – Forward and Backward Chaining – Resolution – Completeness of Resolution – Case Study: Basics of Prolog

UNIT-III INTRODUCTION TO ML **9**

Learning – Types of Machine Learning– Supervised Learning – The Brain and the Neuron –Design a Learning System –Issues in Machine Learning–Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version paces and the Candidate Elimination Algorithm– Perceptron–Linear Reparability - Linear Regression.

UNIT-IV LINEAR MODELS **9**

Multi-layer Perception – Going Forwards – Going Backwards: Back Propagation Error– Multi-layer Perception in Practice–ExamplesofusingtheMLP–Overview–DerivingBack-Propagation–Radial Basis Functions and Splines–Concepts–RBF Network–Curse of Dimensionality–Inter polations and Basis Functions –Support Vector Machines

UNIT-V TREEAND UNSUPERVISED LEARNING MODELS **9**

Learning with Trees–Decision Trees–Constructing Decision Trees–Classification and Regression Trees– Ensemble Learning–Boosting–Bagging–Different ways to Combine Classifiers–Nearest Neighbor Methods–Unsupervised Learning–Kmeans Algorithms –Vector Quantization– Self Organizing Feature Map. Applications of AI and ML – Future of AI – Ethics in AI.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Understand various problem solving approaches for AI problems
CO2: Utilize various Knowledge Representation Techniques in solving complex real-life problems
CO3: Apply the learning concepts and derive hypothesis for a real world problem
CO4: Develop model using supervised learning techniques
CO5: Select the suitable machine learning strategy to real-world applications.

TEXTBOOK:

1. Stuart J Russell and Peter Norvig," Artificial Intelligence - A Modern Approach", Third Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2015.
2. Stephen Mars land, —Machine Learning– n Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.

Reference Books:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Barlett Publishers, Inc., First Edition 2008.
2. Stuart Russell (Author), Peter Norvig, Artificial Intelligence: A Modern Approach, Global Edition Paperback – 13 May 2021
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth edition, Springer, 2003.
5. Eaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill Education, 2008.
6. SaikatDutt (Author), Subramanian Chandramouli (Author), Amit Kumar Das, Machine Learning, First Edition Paperback Pearson – 1 October 2018
7. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
8. Jason Bell,—Machine learning– Hands on for Developers and Technical Professionals, First Edition,Wiley,2014

COs-PO's & PSO's MAPPING

522CIT01-- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
AVG	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3

1–Low 2-Medium, 3-High,"-"- No Correlation

522CSI02	CRYPTOGRAPHY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To learn the fundamentals of Cryptography.
- To comprehend the Mathematical Foundations of Security Principles.
- To describe the principles of Public Key Cryptosystem, Hash Function, Key Management and Internet Security.
- To understand the basics of Block chain
- To learn the components of Ethereum and Smart Contracts.

UNIT-I SYMMETRIC KEYENCRYPTION 9

Computer Security Concepts– The OSI Security Architecture– Security Attacks –Security Services and Mechanisms – A Model for Network Security – Classical Encryption Techniques – Block Ciphers and the Data Encryption Standard–Block Cipher Operation–Advanced Encryption Standard: AES Structure, AES Transformation Function.

UNIT-II NUMBER THEORY AND PUBLIC KEY ENCRYPTION 10

Basic Concepts in Number Theory: Prime Numbers–Modular Arithmetic–The Euclidean Algorithm–Fermat's and Euler's Theorem – Testing for Primality – The Chinese Remainder Theorem – Public Key Cryptography –Diffie-Hellman Key Exchange and RSA – Cryptographic Hash Functions: Applications, Secure Hash Algorithm(SHA)–Digital Signature :DSS, RSA, and Elgamal Digital Signature.

UNIT-III KEY MANAGEMENT AND INTERNET SECURITY 9

Key Management and Distribution – Authentication Applications: Kerberos – Biometrics – Electronic Mail Security: PGP, S/MIME–IP Security Overview.

UNIT-IV INTRODUCTION OF BLOCKCHAIN 8

Introduction–Origin of Block chain–Block chain Solution–Components of Block chain–Block in a Block chain – The Technology and the Future – Decentralization and Distribution – Types of Block chain – Consensus Protocol.

UNIT-V ETHEREUM AND SMART CONTRACTS 8

Introduction – Code Is Law and Ethereum Classic – Ethereum Components – Mining Works in Ethereum –Merkle Patricia Tree – Architecture of Ethereum – Workflow of Ethereum – Smart Contracts – Characteristics of a Smart Contract – Types of Smart Contracts – Types of Oracles – Smart Contracts in Ethereum– Smart Contracts in Industry-Solidity Programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand the fundamentals of network security and apply the symmetric encryption techniques to convert plaintext to cipher text.

CO2: Understand number theory concepts and use them in public key encryption.

CO3: Apply key management and authentication techniques to provide secure communication.

CO4: Understand Block chain's fundamental components.

CO5: Implement Block chain applications using the Ethereum platform.

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security," Seventh Edition, Prentice Hall, New Delhi, 2017.
2. Subramanian, Chandramouli& George A., Asha & K.A., Abhilash & Karthikeyan, Meena. 2020."BLOCKCHAIN TECHNOLOGY," Universities Press (India) Pvt. Ltd., First edition, ISBN- 10: 9389211638, ISBN-13:978-9389211634.

REFERENCES:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing," Fifth Edition, Prentice Hall, 2018.
2. Arun, Jai Singh & Cuomo, Jerry & Gaur, Nitin. 2019. "Block chain for Business," Pearson Education, First Edition, and ISBN-10:938958888X, ISBN-13:978-9389588880.
3. Tulajadas Choudhry, Ambadas&SarfarzAriff, Arshad & M.R. Sham., 2020. "Block chain for Enterprise Application Developers," Wiley, First edition, ISBN-10: 8126599960, ISBN-13: 978-8126599967.

Lab Experiments:

1. Write a code to implement AES Encryption And Decryption
2. Implement Diffie–Hellman Algorithm and RSA Algorithm
3. Implement Digital Signature Using RSA and SHA Algorithm
4. Creating Merkle tree
5. Creation of Block
6. Block chain Implementation
7. Write a program to understand the solidity variables and arrays with regards to fixed length array and dynamic array.
8. Deploy a Smart Contract for Marks Management System using solidity.

Programming Languages to be used: Java

TOTAL: 30 PERIODS

CO's-PO's & PSO'S MAPPING

522CSI02-CRYPTOGRAPHY AND BLOCK CHAIN TECHNOLOGIES															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1
CO2	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1
CO3	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1
CO4	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1
CO5	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1
AVG	3	3	3	1	2	3	-	-	-	-	-	-	3	3	1

3-High 2-Moderate 1-Low '- '– No Correlation

		L	T	P	C
522CST03	**COMPILER DESIGN**	**3**	**0**	**0**	**3**

PREREQUISITES: Theory of Computation.

COURSE OBJECTIVES

- To understand the phases of compiler**.**
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment
- To Perceive the various storage allocation techniques
- To Acquaint how to generate and optimize the code

UNIT-I INTRODUCTION TO COMPILER & LEXICAL ANALYSIS 9

Introduction – The Phases of Compiler – Lexical Analysis: Role of lexical analyzer – Input Buffering – Specification ofTokens–RecognitionofTokens– Finite Automata – Regular Expression to FA (Direct Method) – Minimizing DFA – Lex Tool.

UNIT-II SYNTAX ANALYSIS 11

Role of the parser –Context-Free Grammar – **Top Down Parsing:** Recursive Descent Parser - Predictive Parser – LL(1)Parser – **Bottom Up Parsing:** Shift Reduce Parser –Operator Precedence Parser - LR Parser – LR (0) Item - Construction of SLR Parsing Table – CLR Parser- Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer - YACC tool.

UNIT-III SYNTAX DIRECTED TRANSLATION & INTERMEDIATE CODE GENERATION 9

Syntax Directed Definitions: Construction of Syntax Trees– Bottom-Up Evaluation of S- Attribute Definitions–L-Attributed Definitions -Specification of a simple type Checker - Equivalence of Type Expressions - Type Conversions. Intermediate Languages: Three Address Code, Types and Declarations, Assignment Statements, Arrays, Boolean Expressions and back patching.

UNIT-IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8

Runtime Environments: Source language issues – Storage organization – **Storage Allocation Strategies**: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables - Dynamic Storage Allocation– **Code generation:** Issues in the Design of a code generator – Instruction Costs - Basic Blocks and Flow graphs - Design of a simple Code Generator.

UNIT-V CODE OPTIMIZATION 8

Principal Sources of Optimization – Peep-hole optimization **–** DAG **-** Optimization of Basic Blocks - Global Data Flow Analysis – Constant Propagation-Partial Redundancy Elimination-loops in Flow Graphs-Case Study: LLVM Compiler.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO 1: Design a lexical analyzer for a sample language and learn to use the LEX tool.

CO2: Apply different parsing algorithms to develop a parser and learn to use YACC tool.

CO3: Construct the intermediate code representation and generation.

CO4: Apply knowledge of run-time environments to debug and optimize programs during execution.

CO5: Apply the optimization technique to generate optimized code.

TEXTBOOK

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, —Compilers: Principles, Techniques and Tools, Second Edition, PearsonEducation, 2014(reprint).

REFERENCES

1. Randy Allen, Ken Kennedy, and Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, “Advanced Compiler Design Implementation”, First Edition Elsevier Science India,MorganKaufmannPublishers,2008
3. JeanPaulTremblay, Paul G Seren son, “The Theory and Practice of Compiler Writing", McGraw Hill, New Delhi, 2007.
4. DickGrone, HenriEBal, CerielJ HJacobs and Keen Gangendoen, Modern Compiler Design”, John Wiley, New Delhi, 2009.
5. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

CO’s-PO’s&PSO’S MAPPING

522CST03-COMPILER DESIGN															
CO’s/PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	-	-	-	3	3	1	3	2	3	2
CO2	3	3	3	3	3	-	-	-	3	2	3	2	2	1	2
CO3	3	3	2	2	3	-	-	-	3	1	1	1	2	2	3
CO4	3	2	2	1	1	-	-	-	2	3	2	3	1	2	1
CO5	3	3	3	2	1	-	-	-	2	1	1	3	2	1	2
AVG	3	2.8	2.6	2.2	1.8	-	-	-	2.6	2	1.6	2.4	1.8	1.8	2

1 – Low 2 - Medium, 3-High, “-“- No Correlation

522CIT04	WEB ESSENTIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

UNIT-I WEBSITE BASICS, HTML5, CSS3 and WEB3.0 9

Web Essentials: Introduction to web 3.0 – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework

UNIT-II CLIENT SIDE PROGRAMMING 9

Java Script: Introduction to JavaScript: Basic Syntax-variables and data types-statements-operators-literals- functions-objects-arrays-JSON introduction – Syntax – Function Files

UNIT-III DOM MANIPULATION and EVENT HANDLING in WEBDEVELOPMENT 9

Introduction to the DOM–Intrinsic Event Handling-Modifying Elements-The Document Tree-Node objects-The Document Node-Element Nodes-Text Nodes-DOM Event Handling-The event object and Event Listeners-Mouse Events-Event Propagation-Properties of Window

UNIT-IV SERVER- SIDE PROGRAMMING 9

Introduction to JSP: JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session tracking, connecting to database in JSP.

UNIT-V PHP AND WEB SERVICES 9

An introduction to PHP – PHP Variables – Program control – Built-in functions – Form Validation –XML: Basic XML – Document Type Definition – XML Schema – Basics of web services-components of web services-SOAP and restful web services

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Construct a basic website using HTML and Cascading Style Sheets

CO2: Develop web pages using Java script with event-handling mechanism

CO3: Develop server-side programs using JSP

CO4: To build dynamic and interactive web applications.

CO5: Constructs webpage's in PHP and represent data in XML format.

TEXTBOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS&HTML5"ThirdEdition, O'Reilly Publishers, 2014.
2. Deitel and Deitel and Nie to, Internet and World Wide Web-How to Program, Prentice Hall, 5th Edition, 2012.
3. Web3.0:The Internet of Value" by Alex Tap Scott, published by Tap Scott Group in 2021

REFERENCES:

1. James F.Kurose,"Computer Networking: Atop-Down Approach", Sixth Edition,PearsonEducation,2012
2. Web RTC APIs:and RTC WEB Protocols of the HTML5 Real-Time Web, September 4,2012
3. Steven Holzener,"PHP–The Complete Reference",1st Edition,Mc-GrawHill,2017
4. Fritz Schneider,ThomasPowell,"JavaScript–TheCompleteReference",3rdEdition,Mc-Graw Hill Publishers, 2017
5. Bates, "Developing Web Applications",WileyPublishers,2006

CO'S-PO'S & PSO'S MAPPING

522CIT04-WEB ESSENTIALS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	-	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	-	3	3	3	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22MEE17	ROBOTICS PROCESS AND INDUSTRIAL AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the various parts of robots and fields of robotics.
- To get knowledge in automation and sensor.
- To understand and analyze the kinematics and inverse path planning.
- To learn the robot programming methods and language.
- To study some industrial applications of the robot.
-

UNIT I INTRODUCTION TO ROBOTICS **9**

Definitions, Types of Robots, Grippers, Representing Position and Orientation, Representing Pose in 2-Dimensions, Representing Orientation in 3-Dimensions, Hydraulic, pneumatic and electric drives-Application of Robots

UNIT II UI AUTOMATION AND SENSOR **9**

The key components of the UI Path Studio user interface (UI) - steps of the process to be built based on the business needs- using Arguments in Studio- UI Automation with the Classic Design Experience – Robotic sensors: Torque sensors –touch sensors- proximity sensors-light sensors- elements of wrist sensors- fiber optic and tactile sensors-image processing and analysis.

UNIT III ROBOT ARM KINEMATICS AND PATH PLANNING **9**

Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Debugging in Studio-Debugging features - remote debugging - overview of the debugging features Handler-Different types of exceptions.

UNIT IV ROBOT PROGRAMMING AND LANGUAGES **9**

Robot languages and classification-Methods of Robot programming – lead through programming methods – robot program as a path in space – motion interpolation – weight, signal and delay commands – Branching capabilities –– Robot programming examples for pick and place application using VAL-ARC welding program-point to point path robot and to protruding in a pallet object-MCL Language

UNIT V RPA TESTING AND INDUSTRIAL APPLICATIONS **9**

RPA testing in the overall automation process and features for testing, Causes that affect the robot stability and how they can be tackled- Robots in manufacturing and non-manufacturing application – field robotics- Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Knowing the various parts of robots and fields of robotics.

CO2: Providing knowledge in automation and sensors.

CO3: Understanding and analyze the kinematics and path planning.

CO4: Learning the robot programming methods and language.

CO5: Reviewing some industrial applications of the robot.

TEXT BOOKS:

1. Fu, K.S., Gonzalez RC., and Lee C.S.G., "Robotics control, sensing, vision and intelligence," McGraw Hill, 1987.
2. Mikell P. Groover, Milchel Wein Roger Nagel and Nicholas G. Ordy, "Industrial Robotics, Technology, Programming and Applications", McGraw Hill, Last Print, 2005.

REFERENCES:

1. Deb.S.R, "Robotics Technology and Flexible Machine Design", Tata McGraw Hill, 2005.
2. Jankai Raman "Robotics and Image processing", Tata McGraw Hill, 1995
3. Ganesh S.Hegde "A text book on Industrial Robotics". Laxmi Publictions, 2006.
4. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo "Robot modeling, planning and control", 2011.

CO'S-PO'S & PSO'S MAPPING

X22MEE17-ROBOTICS PROCESS AND INDUSTRIAL AUTOMATION															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	-	2	1	-	2	-	2	-	-	1	2	-	1
CO2	1	-	-		1	-	2	-		-	-	1	2	-	1
CO3	2	-	-		1	-		-		-	-	-	-	-	1
CO4	2	1	-	1	1	-		-	1	-	1	-	-	-	1
CO5	1	2	-	2	1	-	2	-		-	1	-	-	-	1
AVG	1.4	1.6	-		1		2		1.5		1	1	2	1	1

1–Low 2-Medium, 3-High, "-"- No Correlation

522CIP07	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- Familiar with basic principles of AI toward problem solving, and learning
- Understand and Practice ML algorithms

List of Experiments:

1. Implementation of Uninformed search algorithm (BFS,DFS)
2. Implementation of Informed Search algorithm
3. Implement Candidate Elimination algorithm
4. Implement linear regression
5. Implement Back-propagation algorithm
6. Implement Support Vector Machine algorithm
7. Implement Decision Tree algorithm
8. Implement k-Nearest Neighbors algorithm
9. Implement K- Means Clustering algorithm

Recommended Projects: Students shall select any <u>one project</u> from the following:

1. **Predictive Text Generator - Students will develop a text generator using models that can predict the next word in a sentence based on previous words.**
2. **AI Chabot -This project focuses on creating a Chabot that can understand and respond to user queries using natural language processing**
3. Voice-Activated System - This project involves creating a system capable of recognizing spoken words and converting them into actions or responses.
4. **Recommendation System - Build a recommendation engine that suggests products or content to users based on their past behavior and preferences.**
5. **Disease Prediction Using Machine Learning**
6. Fake News Detection using Machine Learning
7. Sentiment analysis with Twitter /Face book data
8. Handwritten Digit Recognition using Neural Network

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On success full completion of the course the students will be able to

CO1: Apply different searching algorithms

CO2: Choose hypothesis to solve real world problem.

CO3: Evaluate neural network models

CO4: Solve different classification and clustering problems

CO5: Select suitable Machine learning model for any problem.

COs-PO's & PSO's MAPPING

522CIP07-- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
AVG	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3

1–Low 2-Medium, 3-High, "-"-No Correlation

522CIP08	WEB ESSENTIALS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To be familiar with web page design using HTML and style sheets.
- To use JavaScript to access and utilize web services for dynamic content.
- To create dynamic web pages using server-side scripting.

List of Experiments

1. Design a webpage for your college containing descriptions of courses, departments, faculties, library, etc.
2. Create a web page and use inline, embedded, and external CSS to style various elements. Experiment with CSS3 features like background images, border images, colors, and shadows.
3. Create a student registration form for job applications and validate the form fields using JavaScript.
4. Create a quiz program with adaptive questions along with statistical variations using JavaScript
5. Design a JSP to insert the details of the users who register through the registration page and store the details in to the database.
6. Implement Event Handling in the Web Pages.
7. Create a simple widget (e.g., weather, stock ticker) using JSON data fetched from an API.
8. JDBC connectivity to retrieve bank customers' transaction details.
9. Develop a PHP program to validate the fields of the Registration page

Recommended projects: Students shall select any **one project** from the following:

- Personal Portfolio Website
- Weather Forecast App
- E-commerce Product Page
- Interactive Learning Management System
- Expense Tracker
- Online Job Portal
- Online Feedback Form
- Social Media Networking Site

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Design webpage's using HTML and style sheets.

CO2: Construct client-side validation using scripting languages.

CO3: Implement basic validation techniques to improve forms using JavaScript.

CO4: Create a database connectivity solution using JSP.

CO5: Develop and implement applications using web technology.

Software Requirements Operating System: Linux/Windows
Programming Language&IDE: HTML5, JDK1.7, PHP and Notepad++.
Server: ApacheTomcatServer/XAMPP/LAMP Backend: MySQL / SQLite

CO'S-PO'S & PSO'S MAPPING

522CIP08-WEB ESSENTIALS LABORATORY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	-	-	-	-	-	-	3	3	3	2
CO2	3	1	2	2	2	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	2	2	-	-	-	-	-	-	3	3	3	2
CO5	3	2	2	2	2	-	-	-	-	-	-	3	3	3	2
AVG	3	2	2	2	2	-	-	-	-	-	-	3	3	3	2

1– Low2-Medium, 3-High, "-"- No Correlation

SEMESTER – VI

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	622CIT01	Full Stack Development	3	0	0	3	40	60	100
2	PC	622CII02	Cloud Computing	3	0	2	4	40	60	100
3	PC	622CST03	Mobile Application Development	3	0	0	3	40	60	100
4	PC	622CSI04	Devops	3	0	2	4	50	50	100
5	PE	X22XXExx	**Professional Elective – II**	3	0	0	3	40	60	100
6	OE	X22XXOxx	**Open Elective – II**	3	0	0	3	40	60	100
7	MC	X22MCTxx	**Mandatory Course - II**	3	0	0	1	40	60	100
PRACTICALS										
8	PC	622CIP07	Full Stack Development Laboratory	0	0	2	1	60	40	100
9	PC	622CSP08	Mobile Application Development Laboratory	0	0	2	1	60	40	100
10	EEC	EEC	Internship	0	0	4	2	60	40	100
TOTAL				**21**	**0**	**10**	**23**			

HOD

		L	T	P	C
622CIT01	**FULL STACK DEVELOPMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the basics and design Principles.
- To present idea, information, product and service on websites.
- To know how to apply programming principles to construct websites.
- To develop fully working web based project on Full Stack.

UNIT- I GETTING STARTED WITH ANGULAR 9

Understanding the basic web Development Framework-Getting Started with Angular – Features of Angular - Angular Development Environment Setup - Angular application setup – Elements in Angular - Angular Components - Creating Components - Modules in Angular - Basics of Angular Modules –Front end Security (Content Security Policy(CSP))[Hands-on Exercises for Web Application Development Using Capstone Project]

UNIT- II ANGULAR BUILDING BLOCK – 1 9

Angular Templates – Template basics – Elements of Templates – Change Detection - Directives in Angular –Types of Directives - Component Directives – Structural Directives – Attribute Directives - Data Binding – Types of Data Binding – Property Binding – Attribute binding - Pipes – Built-in- Pipes- Custom Pipes - Nested Components - [Hands-on Exercises for Web Application Development Using Capstone Project]

UNIT- III ANGULAR BUILDING BLOCK – 2 9

Forms in Angular – Types of Forms – Model Driven Forms – Reactive Forms – Dependency Injection – Angular Services –Services basics – Communication with different backend services using Angular – Angular Routing – Route Guards – Asynchronous Routing – Nested Routing - Angular Capstone Projects [Hands-on Exercises for Web Application Development Using Capstone Project]

UNIT -IV NODE.JS AND EXPRESS.JS 9

Node.js: Importance of Node.js - Create a web server in Node.js - Node Package Manager - Modular programming in Node.js - Restarting Node Application - File Operations. Implementing HTTP services in Node.js. Express.js: Express Development Environment - defining a route - Handling Routes - Route and Query Parameters – Middleware - Chaining of Middleware's - Types of Middleware's - connecting to MongoDB with Mongoose - Validation Types and Defaults – Models - CRUD Operations - API Development - Session Management – Cookies – Securing Express Application - Helmet Middleware - Using a Template Engine Middleware - Stylus CSS Pre-processor. Back end Security **(**Cross –Site Request Forgery Protection (CSRF))

UNIT -V MONGO DB **9**

Mongo DB: Introduction Module Overview- Document Database Overview- Understanding JSON- MongoDB Structure and Architecture- MongoDB Remote Management- Installing MongoDB on the local computer (Mac or Windows)- Introduction to MongoDB Cloud- Create MongoDB Atlas Cluster- GUI tools Overview- Install and Configure MongoDB Compass- Introduction to the MongoDB Shell- MongoDB Shell JavaScript Engine- MongoDB Shell JavaScript Syntax- Introduction to the MongoDB Data Types- Introduction to the CRUD Operations on documents- Create and Delete Databases and Collections- Introduction to MongoDB Queries. Simple Applications.

. **TOTAL: 45 PERIODS**

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Define component-based application using Angular Components

CO2: Describe component-based application using Angular Templates and Directives

CO3: Develop Angular forms and bind them with model data using data binding.

CO4: Analyse Node.js and identify when to use, create and run Node.js.

CO5: Design schema using advanced queries.

TEXT BOOKS

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

2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, A press, 2019.

REFERENCE BOOKS

1.Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018

2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018

3. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp

4. https://www.coursera.org/specializations/full-stack-react

5. https://www.udemy.com/course/the-full-stack-web-development

COs-PO's & PSO's MAPPING

622CIT01-FULL STACK DEVELOPMENT															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	-	2	-		-	-	2	1	3	1	1	-
CO2	1	2	1	1	-	-		-	-	-	3	-	3	2	1
CO3	2	2	-	3	1	-		-	-	2	2	2	1	2	1
CO4	-	1	2	2	2	-		-	-	3	3	1	3	2	1
CO5	3	-	2	1	2	-		-	-	1	1	3	-	2	1
AVG	1.8	1.2	1.4	1.6	1.4	-		-	-	1.6	2	1.8	1.8	2	1

1–Low 2-Medium, 3-High,"-"- No Correlation

622CII02	CLOUD COMPUTING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the principles of Cloud Architecture, Models and Infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure and Cloud deployment environments.
- To understand the Cloud Platforms in Industry and Software Environments.
- To learn about the security issues in the cloud environment.

UNIT-I INTRODUCTION ABOUT CLOUD ARCHITECTURE MODEL **9**

Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model-NIST Cloud Computing Reference Architecture – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS,PaaS, SaaS –AWS Cloud Infrastructure: Architectural Design of Compute and Storage Clouds -- Design Challenges.

UNIT-II VIRTUALIZATION **9**

Virtualization - Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques– Pros and Cons of Virtualization - Implementation Levels of Virtualization - Virtualization Types: Full Virtualization -- Para Virtualization -- Hardware Virtualization - Tools and Mechanisms: Xen, VMware, Microsoft Hyper-V.

UNIT-III CLOUD COMPUTING MECHANISM **9**

Cloud Infrastructure Mechanism: Cloud Storage-Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3-Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT-IV CLOUD INDUSTRIAL PLATFORMS AND SOFTWARE ENVIRONMENTS **9**

Cloud Platforms in Industry: Amazon Web Service - Google cloud Platform - Microsoft Azure; Cloud Software Environments -Hadoop –Map Reduce -Eucalyptus –Open Nebula, Open Stack;

UNIT-V SECURITY IN THE CLOUD **9**

Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, IAM Challenges - IAM Architecture and Practice, MFA, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images. VM migration attack – hyper jacking; Data Security and Storage, Zero-Trust Security Model.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand the architecture of Cloud computing stack
CO2: Apply the concept of Virtualization and its techniques.
CO3: Identify the architecture, storage, infrastructure and delivery models of cloud computing
CO4: Analyse the Cloud platforms in industry and Software Environments.
CO5: Understand the necessity and approaches for cloud security.

TEXT BOOK:

1. Thomas Erl, Zaigham Mahood, Ricardo uttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, 2014.
2. Rittinghouse, John. and James F. Ransome – Cloud Computing: Implementation, Management and Security. CRC Press, 2017.

REFERENCE BOOKS:

1. Toby Velte, Anthony Velte, Robert C. Elsenpeter, - Cloud Computing, A Practical Approach Tata McGraw-Hill Edition, 2010.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, - Mastering Cloud Computing, Tata McGraw-Hill, 2013.
3. Arshdeep Bahga, Vijay Madisetti, - Cloud Computing: A Hands- On Approach‖, Universities Press, 2014.
4. Tom White, - Hadoop: The Definitive Guide, O'Reilly Media, 4th Edition, 2015.
5. James E Smith and Ravi Nair, -Virtual Machines, Elsevier, 2005.
6. John Rittinghouse and James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.
7. Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2010.

COs-PO's & PSO's MAPPING

622CII02- CLOUD COMPUTING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
AVG	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3

1–Low 2-Medium, 3-High, "-"- No Correlation

LIST OF EXPERIMENTS:

1. **EC2 creation [4 hours]**

- Concepts [2 hours] - AWS Global Infra - Regions & Availability Zones, EC2 – AMI , Instance type , SSH, SSH Keys, Linux commands, Web Server
- Hands-On [2 hour]
- Create an instance in the US-East-1 (N. Virginia) region with an Ubuntu OS and install Nginx for making them web servers.
- Change the default website with a page displaying the message: "Hello World"

2. **EBS creation [2 hours]**
   - Concepts [1 hour] - Elastic Block Storage , Volume Types, Volume Creation, Volume Snapshot, Volume Attachment
   - Hands-On [1 hour]
   - Launch a Linux EC2 instance.
   - Create an EBS volume with 20 GB of storage and attach it to the created EC2 instance.
   - Resize the attached volume and make sure it reflects in the connected instance.
3. **EFS creation [2 hours]**
   - Concepts [1 hour] - Shared File System, Difference between Block Storage (EBS) vs Shared File System (EFS), creating, mounting and accessing EFS.
   - Hands-On [1 hour]
   - Create an EFS and connect it to 3 different EC2 instances. Make sure that all instances have different operating systems. For instance, Ubuntu, Red Hat Linux and Amazon Linux
4. **S3 Bucket creation [2 hours]**
   - Concepts [1 hour] - Object Storage, Bucket , Bucket Properties, creation and data transfer.

   Hands-On [1 hour]
   - Create an S3 Bucket for file storage.
   - Upload 5 objects with different file extensions.
5. **VPC creation [6 hours]**
   - Concepts [4 hour] - Network, IP Address, Subnet, Subnet Mask, CIDR, VPC, VPC scope, VPC creation, Subnet creation, Public vs Private Subnet, Internet Gateway, NAT Gateway
   - Hands-On [2 hour]
   - Create a VPC with 120.0.0.0/16 CIDR block.
   - Create 1 public subnet 2 private subnets and make sure you connect a NAT gateway

   for internet connectivity to a private subnet.
6. **IAM users & roles [2 hours]**
   - Concept [1 hour] - Identity & Access Management in AWS, Users, groups, permissions, policies, roles, role assignment, assume role
   - Hands-On [1 hour]Create IAM policy to restrict access to EC2 only.
   - Create a new role and assign this IAM policy.
   - Create a new user with console access and assign this role to user.
   - Assume this role without sign out and check

7. RDS creation [2 hours]

- Concept [1 hour] – AWS Relational Database Service, Database Engines, Database Instance, Storage , Creation and access
- Hands-On [1 hour]
- Create a new EC2 instance or use an existing one
- Create a RDS MySQL DB Instance & provide access to EC2. o Access MySQL DB from EC2 instance and perform SQL tasks.

8. CASE STUDY: [6 hours]

Problem: You are tasked to deploy a 3-tier web application on AWS. The application should consist of a web server, an application server, and a database.
Deployment Steps:

1. Create an AWS Account:
    - Sign up for an AWS account and create an IAM user with appropriate permissions.
2. Create a VPC:
    - Create a VPC with public and private subnets.
    - Configure internet gateway and route tables.
3. Launch EC2 Instances:
    - Launch two EC2 instances: one for the web server and one for the application server.
    - Attach EBS volumes to both instances for storage.
    - Configure security groups to allow necessary traffic.
4. Deploy the Web Server:
    - Install and configure a web server (e.g., Nginx, Apache) on the web server instance.
    - Configure the web server to serve static content and forward dynamic requests to the application server.
5. Deploy the Application Server:
    Install and configure the application server (e.g., Node.js, Python) on the application server instance.
    - Deploy the application code to the instance.
    - Configure the application server to connect to the database.
6. Create an RDS Database:
    - Create an RDS instance for the database.
    - Configure database parameters, security groups, and backups.
    - Grant database access to the application server.
7. Connect the Components:
    - Configure the application server to connect to the database.
    - Configure the web server to forward requests to the application server.
8. Test and Deploy:
    - Test the application thoroughly to ensure it functions as expected.
    - Deploy the application to production.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Software: AWS, Ubuntu, MySQL, HTML, Python/ Node.js
Hardware: Standalone desktops 30 Nos

Total: 30 Hours

622CST03	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

Prerequisites: Java Programming

COURSE OBJECTIVE(S):

- To learn the characteristics of mobile applications.
- To learn about the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

UNIT-I GETTING STARTED WITH MOBILITY 9

Mobility landscape, Mobile platforms – Apple iPhone Platform- Google Android Platform – Eclipse Simulator, Mobile apps development, setting up the mobile app development environment along with an emulator –Mobile payment System- Security issues- Case Study on Mobile App development.

UNIT-II BUILDING BLOCKS OF MOBILE APPS – I 9

App user interface designing – mobile UI resources (Layout, UI elements, Drawable Menu), Activity-states and life cycle, interaction amongst activities-Event handling- App functionality beyond user interface - Threads, A Sync task, Services – states and lifecycle, Notifications.

UNIT-III BUILDING BLOCKS OF MOBILE APPS – II 9

Broadcast receivers, Telephony and SMS APIs , Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet).- Firebase and admob-Service Content Provider.

UNIT-IV SPRUCING UP MOBILE APPS 9

Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, Embedded Systems-IOT Nodes-Smart gadgets (smart watches, fitness trackers, and smart home devices) – Accessibility in mobile Apps- using the camera to take and process pictures.

UNIT-V TESTING MOBILE APPS AND TAKING APPS TO MARKET 9

Debugging mobile apps, Mobile Automation Testing, Mobile Cloud Testing, App Security Testing, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, Monkey Talk, Deploying Android Application to the world**,** Versioning, signing and packaging mobile apps, distributing apps on mobile market place.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Familiarize with Mobile apps development aspects.

CO2: Design and implement the user interfaces for mobile applications

CO3: Develop useful mobile applications using Google Android and Eclipse simulator.

CO4: Develop mobile applications using graphics and animation and smart gadgets

CO5: Perform testing, signing, packaging and distribution of mobile apps

TEXT BOOK:

1.Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition, Wiley India, (2013).

2.Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd,2010

REFERENCE BOOKS:

1. Barry Burd, "Android Application Development All in one for Dummies", First Edition, Wiley India, (2011)

2. Lauren Darcey, Shane Conder, "Teach Yourself Android Application Development in 24 Hours", Second Edition, Wiley India, (2012)

3."Inclusive Design for a Digital World: Designing with Accessibility in Mind" by Regine M. Gilbert

4."Embedded Systems: Introduction to Arm Cortex-M Microcontrollers" by Jonathan W. Valvano

COs-PO's & PSO's MAPPING

622CST03-MOBILE APPLICATION DEVELOPMENT															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	3	2	3	2	-	-	-	-	2	3	2	1	3
CO2	3	2	-	2	-	2	-	-	-	-	2	3	2	1	3
CO3	3	1	2	2	1	2	-	-	-	-	2	3	2	2	3
CO4	2	1	3	2	-	2	-	-	-	-	2	3	2	1	3
CO5	3	1	3	2	1	2	-	-	-	-	2	3	2	-	3
AVG	3	1	2	2	1	2	-	-	-	-	2	3	2	1	3

1–Low 2-Medium, 3-High, "-"- No Correlation

DEVOPS **L T P C**

622CSI04 **3 0 2 4**

COURSE OBJECTIVES:

- Understand and implement DevOps principles.
- Learn CI/CD pipelines concepts and related tools.
- Learn infrastructure management using IaC.
- Build expertise configuration management and monitoring systems.
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT- I : INTRODUCTION TO DEVOPS **6**

Introduction to DevOps - Core Principles-Automation, Continuous Improvement, Collaboration-DevOps Lifecycle-Develop, Build, Test, Release, Deploy, Monitor.

UNIT- II: VERSION CONTROL AND CI/CD **12**

Introduction to Version Control - Types of Version Control Systems-Centralized, Distributed - Git Concepts-Repositories, Commits, Branches, Merging - Git Commands - Continuous Integration (CI) - CI Pipeline Stages-Build, Test, Deploy - Continuous Delivery (CD)-Release Strategies, Automated Deployments - CI/CD Tools-Jenkins, GitHub Actions

UNIT -III: INFRASTRUCTURE AS CODE (IAC) **9**

Introduction to Infrastructure as Code (IaC) - Declarative vs. Imperative IaC - Versioning Infrastructure Code - IaC Tools-Terraform, Cloud-specific IaC Tools - Terraform Core Concepts - Providers, Resources, State Management - Terraform Commands - Init, Plan, Apply, Destroy

.

UNIT -IV: CONTAINERS AND ORCHESTRATION **9**

Introduction to Containers - Docker Concepts-Docker Images, Containers,Dockerfile - Building and Managing Containers - Container Orchestration - Container Orchestration with Kubernetes - Kubernetes Architecture - Kubernetes Operations

UNIT -V: CONFIGURATION MANAGEMENT AND MONITORING **9**

Introduction to Configuration Management - Configuration Management Tools- Ansible, Chef, Puppet - Automating Server Configuration-Desired State Configuration, Idempotency - Monitoring and Logging - Monitoring Tools- Prometheus, Grafana, ELK Stack

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Understand and implement core DevOps principles and practices.

CO2: Manage version control and CI/CD pipelines.

CO3: Automate infrastructure deployment using Terraform and IaC tools.

CO4: Build, deploy, and orchestrate containerized applications using Docker and Kubernetes.

CO5: Monitor applications and manage configurations with Ansible, Prometheus, and Grafana.

TEXT BOOK:

1."The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations", Gene Kim, Patrick Debois, John Willis, and Jez Humble, IT Revolution Press, 2016.

REFERENCE BOOKS:

1. “Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation”, Jez Humble, David Farley, 2017
2. “Terraform: Up & Running: Writing Infrastructure as Code”, Yevgeniy Brikman, O'Reilly, 2019
3. “Kubernetes: Up and Running: Dive Into the Future of Infrastructure”**,** Brendan Burn, Joe Beda & Kelsey Hightower, O'Reilly, 2017
4. “Ansible for DevOps: Server and Configuration Management for Humans”, Jeff Geerling, 2015

LAB EXPERIMENTS:

1. Provision a Virtual Machine (VM) in AWS/Azure using Terraform
2. Provision a Virtual Machine (VM) in AWS with Cloud Formation / Azure with ARM
3. Use Ansible to configure the VM and install Nginx
4. Create a CI pipeline using Jenkins with stages for code checkout, build and test
5. Deploy a sample application inside the VM using Jenkins (CD Pipeline)
6. Run a container using pre-build docker image
7. Build and Run a Custom Docker Image
8. Implement Logging and Monitoring with Prometheus and Grafana

TOTAL: 30 Hours

COs-PO’s & PSO’s MAPPING

622CSI04-DEVOPS															
CO’s/PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2	1	1	-	-	-	3	3	3	2	2	2
CO2	3	2	1	2	1	1	-	-	-	3	3	3	2	2	2
CO3	3	2	1	3	1	1	-	-	-	3	3	3	2	2	2
CO4	3	2	1	3	1	1	-	-	-	3	3	3	2	2	2
CO5	3	2	1	3	1	1	-	-	-	3	3	3	2	2	2
AVG	3	1.8	1	2.6	1	1	-	-	-	3	3	3	2	2	2

1–Low 2-Medium, 3-High, “-“- No Correlation

622CSE05	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- The primary objective of this module is to examine and explore the role and importance of
- Digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT-I: INTRODUCTION TO ONLINE MARKET **9**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT- II: SEARCH ENGINE OPTIMISATION **9**

Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT –III: E- MAIL MARKETING **9**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-

UNIT- IV: MEDIA MARKETING **9**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand Conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influence Marketing.

UNIT- V: DIGITAL TRANSFORMATION **9**

Digital Transformation & Channel Attribution- Analytic- Ad-words, Email, Mobile, Social Media, Web Analytic - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45 HOURS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOK

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN- 10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st Edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN:8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South- Western ,Cengage Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill

COs-PO's & PSO's MAPPING

622CSE05-DIGITAL MARKETING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	3	-	-	-	-	1	2	3	3	3	3
CO2	2	2	2	2	3	-	-	-	-	1	2	3	3	3	3
CO3	1	1	1	3	2	-	-	-	-	1	2	1	3	2	1
CO4	3	3	2	3	1	-	-	-	-	1	3	3	2	3	2
CO5	2	2	1	2	3	-	-	-	-	2	3	2	1	2	1
AVG	2.2	2.2	1.6	2	2.4	-	-	-	-	1.2	2.4	2.4	2.4	2.6	2

1–Low 2-Medium, 3-High,"-"- No Correlation

		L	T	P	C
622CIP07	**FULL STACK DEVELOPMENT LAB**	**0**	**0**	**2**	**1**

OBJECTIVES

- To develop full stack applications with clear understanding of user interface, business logic and data Storage.
- To design and develop user interface screens for a given scenario
- To develop the functionalities as web components as per the requirements
- To implement the database according to the functional requirements
- To integrate the user interface with the functionalities and data storage

LIST OF EXPERIMENTS:

1. Create a basic Angular Application which Demonstrates About the parent and child components.
2. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4. Design a following static web pages required for online book store website

   Home page

   Login page

   Catalogue page

   Cart page

   Registration page
5. Develop a Angular JS application that displays a list of shopping items and allow user to add and remove items from the list using directives and controllers
6. Write a program to create a simple calculator Application using React JS
7. Write a program to create a voting application using React JS.
8. Write a server side program for manipulating mongo DB from Node.js
9. Develop a project using Angular, Node. js, Express .js and Mongo DB from .This has to be CRUD Application for managing items(e.g., a task manager or inventory app) and emphasis on integrating Security Practices.

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Design full stack applications with clear understanding of user interface, business logic and data Storage

CO2: Design and develop user interface screens

CO3: Implement the functional requirements using appropriate tool

CO4: Design database based on the requirements

CO5: Develop all the necessary components of the application.

COs-PO's & PSO's MAPPING

622CIP07-FULL STACK DEVELOPMENT LABORATORY														
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	3	1	1	1	2	1	1	1	2	2	1
CO2	3	3	3	2	3	1	1	1	2	1	1	1	2	2	1
CO3	3	3	3	3	3	1	1	1	2	1	1	1	2	2	1
CO4	3	3	3	3	3	2	1	1	1	1	2	1	1	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	1	2	2	1
AVG	3	3	3	2	3	1	1	1	1	1	1	1	2	2	1

1–Low 2-Medium, 3-High, "-"-No Correlation

622CSP08	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		3	0	2	1

COURSE OBJECTIVE(S):

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Can able to draw basic graphical primitive on the mobile application and EV Charging station Locator.

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colors
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a mobile application to send an email.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop a mobile Application "Voice-to-Text with External Audio Input Devices"
7. Implement an application that creates an alert upon receiving a message.
8. Develop a mobile app that connects to a wearable fitness tracker or a heart rate monitor via Bluetooth.
9. Design a mobile app to "Capturing and Processing Audio with External Microphones"
10. Electric Vehicle (EV) Charging Station Locator

- Scenario: The growth of EVs has increased the need for charging infrastructure.

Exercise:

- Build an app that helps users locate EV charging stations nearby.
- Use maps APIs (e.g., Google Maps or OpenStreetMap) for navigation.
- Add features like real-time availability, pricing, and booking options.

TOTAL: 45 HOURS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Design and Implement various mobile applications using emulators.

CO2: Develop a mobile app that integrates with external audio input devices (e.g., microphones, audio interfaces) to capture high-quality voice input.

CO3: Develop an app using basic graphical primitives and databases.

CO4: Develop a mobile app that interfaces with external Bluetooth devices, such as wearable fitness trackers or heart rate monitors.

CO5: Design and develop user Interfaces for the Android platform.

LIST OF EQUIPMENTS:

- Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development
- Tools with appropriate emulators and debuggers.
- Google Speech-to-Text API (or an equivalent like IBM Watson or AWS Transcribe)
- Bluetooth headset or smart speaker with microphone support.

COs-PO's & PSO's MAPPING

622CSP08-MOBILE APPLICATION DEVELOPMENT LABORATORY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	-	-	3	1	3	2	2	3	2
CO2	2	2	3	2	2	-	-	-	1	2	3	3	2	1	2
CO3	3	3	2	1	1	-	-	-	1	1	1	3	2	3	3
CO4	1	3	3	3	1	-	-	-	1	1	3	2	3	1	3
CO5	3	2	1	1	1	-	-	-	2	2	3	1	3	1	2
AVG	2	3	2	2	1	-	-	-	2	1	3	2	2	2	2

1–Low 2-Medium, 3-High,"-"- No Correlation

SEMESTER – VII

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PC	722CII01	ARVR And Meta Verse	3	0	2	4	50	50	100
2	PC	722CST02	Internet of Things	3	0	0	3	40	60	100
3	HSMC	722CST03	**Human Values And Computing Ethics**	3	0	0	3	40	60	100
4	PE	X22XXExx	**Professional Elective - III**	3	0	0	3	40	60	100
5	PE	X22XXExx	**Professional Elective - IV**	3	0	0	3	40	60	100
6	HSMC	722BAOxx	**Management Elective**	3	0	0	3	40	60	100
PRACTICALS										
7	PC	722CSP07	Internet of Things Laboratory	0	0	2	1	60	40	100
8	EEC	722CSP08	Mini Project	0	0	4	2	60	40	100
TOTAL				**18**	**0**	**8**	**22**			

HOD

722CII01	ARVR AND META VERSE	L	T	P	C
		2	0	2	4

COURSEOBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT-I FUNDAMENTALS OF AR VR 7

Fundamental AR VR concepts and characteristics, Nature of virtuality, introduced to AR VR hardware and software, AR VR applications across different industries, Introduction to Metaverse, Digital twin, Web3.0, NFT, Block chain & Crypto currencies.

UNIT-II INTERACTIVE MEDIA DEVELOPMENT 6

Taxonomy of Interactive Applications - immersive nature of AR VR technology - creative storytelling - gaming industry applications - concept for game - building a prototype – Consider Graphic styles and optimization - communication and collaboration – Digital distribution – google play – iOS Store – Mac store.

UNIT-III FUNDAMENTALS FOR REALTIME SCRIPTING (C#) 6

Introduction to Variables, Conditions, Loops, Patterns, - Scope of variables – OOPS in Real-time environments – Setting IDE – Scripting vs Programming – Enumeration – Memory management – Program states – Handing exceptions – Device considerations – Input systems – Hardware and Haptics feedback.

UNIT-IV LEVEL DESIGN FOR AR VRUSING UNITY 6

Basic concepts of Level designing, Level mapping – Level creation techniques – Grey boxing techniques, Focus on the layout and composition – Prioritize assets based on block out – Accessing Unity asset store – importing FBX assets – Building a level for VR/AR, Level Optimization.

UNIT-V SOLUTION DESIGN FOR AR VR 5

Design process – mood board – design specification document – technical project management – AR architecture & frameworks – AR Kit – Ar core – Vuforia – VR architecture & frameworks – HTC – Windows Mixed reality – Oculus – XR and definition – XR over cloud – Emerging trends in AR VR MR.

TOTAL: 30 PERIODS.

TOTAL: 30 PERIODS.

PRACTICAL EXERCISES:

1. Install Unity and set up a basic AR/VR development environment with necessary packages and configurations.
2. Design and develop a simple 3D AR/VR prototype using Unity that demonstrates basic spatial interaction and environment rendering.
3. Write a C# script in Unity that enables a 3D object to change its colour when clicked by the user in an AR or VR environment.
4. Develop optimized real-time C# code using best practices in memory management, event-driven updates, and performance tuning for AR/VR applications in Unity.
5. Develop Level design within considerations of Unity Real-time rendering concepts.
6. Build an AR application that displays a 3D object (e.g., cube or custom model) on a printed image marker using Vu foria SDK in Unity.
7. Design, Develop & Deploy AR or VR application in devices after building design flow that reflects user experiences.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand the basic concepts of AR and VR
CO2: Identify and describe various tools and technologies used in AR/VR systems.
CO3: Illustrate the working principles of AR/VR-related sensor devices.
CO4: Design 3D models and environments using appropriate modeling techniques.
CO5: Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016.
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003.

REFERENCES:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications.
2. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
3. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Meging Real and Virtual
4. Worlds”, 2005.

CO'S-PO'S & PSO'S MAPPING

722CII01- ARVR AND META VERSE															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	0	3	-	-	-	2	3	1	2	2	1	2
CO2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
CO3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
CO4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
CO5	3	3	3	3	3	-	-	-	3	2	3	3	3	3	3
AVG	3	2.6	2.4	2	3	-	-	-	2.8	2.2	1.8	2.6	2.8	1.8	2.2

1–Low2-Medium, 3-High, "-" - No Correlation

722CST02	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I INTRODUCTION to IoT 8

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT 10

Design Methodology - Embedded computing logic - Microcontroller, System on Chips – IoT system building blocks – **ESP32Microcontroller–Features, specifications, GPIO Programming**- Raspberry Pi – Interfaces and Raspberry Pi with Python Programming-IOT Connectivity and communications.

UNIT IV DATA ANALYTICS AND IOT PLATFORMS 10

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics-**Introduction to cloud storage models and communication APIs for IoT**-**Xively Cloud for IoT – Designing a RESTful Web API –Google cloud for IoT**

UNIT V IoT APPLICATIONS ANDCASE STUDIES 8

Cisco IoT system - IBM Watson IoT platform – **IoT Application Domains**-**Developing IoT ecosystem** - CASE STUDIES: **Smart Cities**, Smart Lighting, Smart Parking -and Smart Traffic Control-**Home Automation**

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course, the student should be able to:

CO1: Explain the concept of IoT.

CO2: Analyze various protocols for IoT.

CO3: Design a PoC of an IoT system using Rasperry Pi/Arduino

CO4: Apply data analytics and use cloud offerings relzated to IoT.

CO5: Analyze applications of IoT in real time scenario

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Olivier she sent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michael's, Florien (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

WEBSITES

https://www.arduino.cc/

https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

CO'S-PO'S & PSO'S MAPPING

722CST02-INTERNET OF THINGS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	3	-	-	-	3	3	2	1	2	1	3
CO2	2	2	3	3	3	-	-	-	3	2	1	1	2	2	1
CO3	1	2	2	3	3	-	-	-	1	2	1	2	1	1	3
CO4	1	2	3	3	3	-	-	-	2	2	2	3	2	2	2
CO5	3	2	2	2	3	-	-	-	2	1	1	3	3	2	1
AVG	2	1.8	2.4	2.6	3	-	-	-	2.2	2	1.4	2	2	1.6	2

1–Low 2-Medium, 3-High, "-"- No Correlation

722CST03	HUMAN VALUES AND COMPUTING ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students' minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES 9

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement. Reading Text: Excerpts from John Stuart Mills' On Liberty

UNIT II SECULAR VALUES 9

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani

UNIT III SCIENTIFIC VALUES 9

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper. Reading Text: Excerpt from the Scientific Temper by Antony Michaelis R

UNIT IV ETHICS IN COMPUTING 9

Ethics – Importance of Ethics in Computing – Moral Theories in Ethical Decision Making – Divine Command Theory – Social Contract Theory – Working Through Ethical Dilemmas – Frameworks for ethical analysis – Challenges in Applying Ethics to Technology – Case study : whistleblowing in the tech industry

UNIT V ETHICAL INITIATIVES IN AI 9

Introduction to Ethical Issues in AI –Ethical harms and concerns – Ethical issues in artificial intelligence – Societal Issues Concerning the Application of Artificial Intelligence – Ethical issues in AI Applications in Medicine – AI's decision-making role in Industries – National and International Strategies on AI – Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization –International ethical initiatives .

TOTAL: 45 PERIODS

REFERENCES:

1. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3. Ethics for the Information Age, Michael J. Quinn, Pearson Education, ISBN: 978-0134296548 (7th Edition) 2020.
4. AI Ethics: A Textbook , Paula Boddington , pringer Nature Singapore (Part of the *Artificial Intelligence: Foundations, Theory, and Algorithms* series) , April 2024
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

COURSE OUTCOMES

On successful completion of the course the students will be able to

CO1: Identify the importance of democratic, secular and scientific values in harmonious functioning of social life

CO2: Demonstrate democratic and scientific values in personal and professional life.

CO3: Apply rational thinking to analyze and resolve social issues

CO4: Understand and apply ethical principles and moral theories to solve real-life computing problems

CO5: Apply ethical principles to identify and assess concerns in real-world AI applications.

CO'S-PO'S & PSO'S MAPPING

722CST03-HUMAN VALUES AND COMPUTING ETHICS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	2	3	2	1	1	-	1	-	-	2
CO2	1	-	-	-	-	2		2	2	1	-	1	-	-	2
CO3	-	2	-	-	-	3	2	3	2	-	-	2	-	-	1
CO4	2	2	-	1	2	2	2	3		1	-	2	-	-	1
CO5	2	2	2	2	3	3	2	3	1	1	-	2	-	-	3
AVG	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**1**	**-**	**2**	**-**	**-**	**2**

1–Low 2-Medium, 3-High, "-"- No Correlation

X22BAO01	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting Objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization Structure – Types – Line and staff authority – Departmentalization – delegation of authority –Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behavior– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of Computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of Managerial functions like planning, organizing, staffing, leading & controlling.

CO2: Have same basic knowledge on international aspect of management.

CO3: Ability to understand management concept of organizing.

CO4: Ability to understand management concept of directing.

CO5: Ability to understand management concept of controlling.

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.

2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.

2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.

3. Tripathy PC and Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

CO'S-PO'S & PSO'S MAPPING

X22BAO01- PRINCIPLES OF MANAGEMENT															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	1	-	-	2	-	-	1	-	2	-	1	1	-	-	2
CO4	-	1	1	1	2	-	-	1	2	-	--	-	1	1	1
CO5	1	-	-	-	1	1	-	-	-	3	-	1	1	-	1
AVG	1.66	1	1	1.5	1.5	1	1	1	2	3	1	1	1	1	1.25

1–Low 2-Medium, 3-High, "- "- No Correlation

722CSP07	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To implement the concepts of IoT.
- To interface different platforms like Arduino and Raspberry pi
- To design and implement the related applications.
- To learn how to analysis the data in IoT.

LIST OF EXPERIMENT:

1. LED Blinking using **ESP32**
2. **Working with GPIO**
3. LED Blinking using Raspberry Pi
4. Interfacing DHT11 and Soil Moisture Sensors with Raspberry Pi
5. Interfacing Ultrasonic Sensor (HC-SR04) with Raspberry Pi for Distance Measurement
6. Uploading DHT11 Sensor Data from Raspberry Pi to Thing Speak Cloud
7. Monitoring SPO2 and Heart Rate using Arduino and MAX30100 Sensor
8. Motion Tracking using MPU6050 Sensor and Cloud Logging
9. Barometric Pressure and Altitude Measurement using BMP Sensor with Arduino
10. Weather Station using Raspberry Pi with DHT11, BMP Sensor, and ThingSpeakIntegration

Mini Project of Building Complete IoT System

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- **Software:**Python, AWS IoT
- **Hardware:**Arduino and Raspberry Pi

COURSE OUTCOMES:

On successful completion the students will be able to

CO1: Demonstrate basic programming and control using Arduino and Raspberry Pi.

CO2: Operate analog and digital sensors using microcontroller and microprocessor platforms.

CO3: Implement real-time monitoring using sensor data for health and environment applications.

CO4: Uploadandanalyze sensor data using cloud platforms like Thing Speak for IoT applications.

CO5: Designanddevelop an integrated IoT-based weather monitoring system with cloud connectivity.

CO's-PO's & PSO's MAPPING

722CSP07-INTERNET OF THINGS LABORATORY														
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	2	-	2	-	-	-	-	-	-	2	2	3
CO2	2	3	2	2	-	2	-	-	-	-	-	-	1	2	2
CO3	2	3	2	2	-	1	-	-	-	-	-	-	3	3	3
CO4	2	3	2	2	-	1	-	-	-	-	-	-	2	2	2
CO5	2	3	2	2	-	1	-	-	-	-	-	-	3	2	3
AVG	2.1	3	2.1	2	-	1.5	-	-	-	-	-	-	2	2	3

3-High, 2 Moderate, 1-Low, '- 'No Correlation

722CSP08 **MINI PROJECT** **L TP C**
0 02 1

COURSE OBJECTIVES:

- To identify societal or real world problems that require computerization
- To suggest creative solutions to societal problems
- To explore possible alternative solutions
- To estimate risk and develop a prototype

The course aims to prompt students to identify mini-projects that foster creativity, innovation, and tackle societal challenges. These projects can be application-focused and completed within a short duration. Students are expected to conduct independent or group research on approved domains and problems. Each student selects a topic aligned with their specialization and follows a prescribed methodology. Students are required to complete their projects and present either a working model or a prototype. At the end of the semester, students prepare a comprehensive report. This report includes problem identification, literature review or related work, methodology, findings, discussions, conclusion, and references, adhering strictly to university formatting guidelines. The students will be evaluated based on the report and viva-voce examination by a panel of examiners.

1. Internal - Assessment
    a. First Review
        i. Block Diagram of the proposed solution for a societal / creative problem
        ii. New Contribution in terms of modifications to existing algorithm or suggestion of new ones
        iii. Detailed Design of each module
        iv. Evaluation Metrics
    b. Second Review
        i. Implementation - Justifying pros and Cons
        ii. Coding - highlighting what has been reused and what is being written
    c. Third Review
        i. Test cases and Test Runs
        ii. Performance Evaluation based on Metrics
        iii. Project Documentation
2. External-Assessment
        Presentation, Viva-Voce, Report submission.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the project, the student will be able to

CO1: Gain Domain knowledge and technical skill set required for solving industry /research problems

CO2: Provide solution architecture, module level designs, algorithms

CO3: Identify the methodology suitable for the proposed solution

CO4: Implement, test and deploy the solution as prototype or working model

CO5: Prepare detailed technical report, demonstrate and present the work

CO'S-PO'S & PSO'S MAPPING

722CSP08- MINI PROJECT															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	1	1	-	3	2	2	3	3	3	3
CO2	3	3	3	2	3	1	1	-	3	2	2	3	3	3	3
CO3	3	3	3	2	2	1	1	-	3	3	3	2	3	3	3
CO4	3	3	3	2	3	1	1	-	3	3	3	2	3	3	3
CO5	3	3	3	2	3	2	1	2	3	3	2	2	3	3	3
AVG	3	3	3	2	2.8	1.2	1	0.4	3	2.6	2.4	2.4	3	3	3

1–Low 2-Medium, 3-High, "- "- No Correlation

SEMESTER – VIII

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22XXExx	**Professional Elective - V**	3	0	0	3	40	60	100
2	PE	X22XXExx	**Professional Elective - VI**	3	0	0	3	40	60	100
PRACTICALS										
3	EEC	822CSP01	Project Work & Viva Voce	0	0	18	9	60	40	100
TOTAL				**6**	**0**	**18**	**15**			

822CSP01 **PROJECT WORK AND VIVA-VOCE** **L T P C**

0 0 16 9

COURSE OBJECTIVES:

- To identify societal or real world problems that require computerization
- To suggest creative solutions to societal problems
- To explore possible alternative solutions
- To estimate risk and develop a prototype

The primary objective of this course is to stimulate students to identify projects aimed at exploring variables that foster creativity and innovation, while also addressing societal problems or challenges. The projects may be application-focused or research-driven. Students are expected to engage in independent or group research focused on domains and associated problems approved by the Department. Each student is empowered to select a topic relevant to their specialization within the program, and subsequently, to pursue the work on the chosen topic in accordance with a formulated methodology. At the end of the semester, subsequent to fulfilling the requirements to the contentment of the supervisor and the members of the panel, it is requisite to prepare a comprehensive report. This report should encompass a precise description of the identified problem, an exhaustive review of relevant literature within the area of study, a delineation of the methodology employed in conducting the research, an exposition of the findings and subsequent discussions, a succinct conclusion, and a comprehensive list of references. This report must adhere strictly to the formatting guidelines stipulated by the University and be submitted to the Head of the department The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

1. Internal - Assessment
    a. First Review
        i. Block Diagram of the proposed solution for a societal / creative problem
        ii. New Contribution in terms of modifications to existing algorithm or suggestion of new ones
        iii. Detailed Design of each module
        Iv. Evaluation Metrics
    b. Second Review
        i. Implementation - Justifying pros and Cons
        Ii. Coding - highlighting what has been reused and what is being written
    c. Third Review
        i. Test cases and Test Runs
        ii. Performance Evaluation based on Metrics
        Iii. Project Documentation
2. External-Assessment
        Presentation, Viva-Voce, Report submission.

TOTAL: 240 PERIODS

COURSE OUTCOMES:

At the end of the project, the student will be able to

CO1: Gain Domain knowledge and technical skill set required for solving industry /research problems

CO2: Provide solution architecture, module level designs, algorithms

CO3: Identify the methodology suitable for the proposed solution

CO4: Implement, test and deploy the solution for the target platform

CO5: Prepare detailed technical report, demonstrate and present the work

CO'S-PO'S & PSO'S MAPPING

822CSP01- PROJECT WORK AND VIVA-VOCE															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	1	1	-	3	2	2	3	3	3	3
CO2	3	3	3	2	3	1	1	-	3	2	2	3	3	3	3
CO3	3	3	3	2	2	1	1	-	3	3	3	2	3	3	3
CO4	3	3	3	2	3	1	1	-	3	3	3	2	3	3	3
CO5	3	3	3	2	3	2	1	2	3	3	2	2	3	3	3
AVG	3	3	3	2	2.8	1.2	1	0.4	3	2.6	2.4	2.4	3	3	3

3– High 2 - Moderate 1- Low '-'- No Correlation

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE COURSES- VERTICALS

VERTICAL 1: AI & DATA SCIENCE

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE01	Big Data Analytics	3	0	0	3	40	60	100
2	PE	X22CIE02	**Exploratory Data Analysis**	3	0	0	3	40	60	100
3	PE	X22CIE03	Recommender Systems	3	0	0	3	40	60	100
4	PE	X22CIE04	Text and Speech Analysis	3	0	0	3	40	60	100
5	PE	X22CIE05	Image and Video Analytics	3	0	0	3	40	60	100
6	PE	X22CIE06	Business Analytics	3	0	0	3	40	60	100
7	PE	X22CIE07	**Cognitive Science**	3	0	0	3	40	60	100

722CIE01	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE(S):

- Understand the terminologies, analytics and processing concepts of Big Data**.**
- Learn various Big Data Analytic techniques.
- Explore the Data Streams processing concepts.
- Familiarize with Hadoop Ecosystem, HIVE, and PIG Framework.
- Exposure to Data Analytics with Spark.

Prerequisites: Fundamentals of Machine Learning

UNIT-I INTRODUCTION TO BIG DATA 8

Concepts and Terminologies – Big Data Characteristics – Types of Data – Big Data Analytics Lifecycle –**Big Data Analytics: Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools**- Big Data Processing Concepts: Parallel Data – Distributed Data –Batch Mode – Real Time Mode.

UNIT-II BIG DATA ANALYTICS TECHNIQUES 9

Quantitative Analysis – Qualitative Analysis – Statistical Analysis: A/B Testing – Correlation – **Regression –Linear Regression – Polynomial Regression – Multivariate Regression** - Machine Learning: Classification – Clustering – Outlier Detection – Filtering – Semantic Analysis – Visual Analysis – Heat Maps – Time Series Plots – Network Graph – Spatial Data Mapping**– Reinforcement Learning.**

UNIT-III STREAM MEMORY 9

Introduction to Stream Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Ones in a Window – Decaying Window **– Case Studies: – Real Time Sentimental Analysis-**Stock Market Predictions-Using Graph Analytics for Big Data: Graph Analytics.

UNIT-IV BIGDATA FRAMEWORKS 10

Pig: Introduction to Pig - The Anatomy of Pig - Pig on Hadoop - Pig Philosophy - Use Case for Pig: ETL Processing Data Types in Pig - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - User-Defined Functions (UDF).Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase: Basics, Concepts, Clients, Example, Hbase versus RDBMS. Big SQL: Introduction

UNIT-V SPARK FOR BIG DATA ANALYTICS 9

Introduction to Data Analysis with Spark- Functional Programming Basics – Parallel Programming using Resilient Distributed Datasets – Spark SQL -Data Analysis Operations - Spark RDD – Characteristics -Transform and Action Commands – Data Frame Operations-Spark for ETL -Analytics Reporting and Data Visualization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Discuss the challenges of big data, its analytics and processing concepts.

CO2: Apply analytics for various big data-based problems.

CO3: Identify the appropriate solution to data streams related problems.

CO4: Excel on big data applications using big data frameworks.

CO5: Apply Machine Learning Techniques using Spark.

TEXT BOOKS:

1. Thomas Erl, WajidKhattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers & Techniques" ,Prentice Hall, 2016
2. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", Wiley India Private Limited, Second Edition, 2019.

REFERENCE BOOKS:

1. David Loshin, Morgan Kaufman, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No SQL, and Graph", Elsevier Publishers, 2013.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Tom White, "Hadoop the Definitive Guide", O'Reilly Publishers, 4th Edition, 2015.
4. Edward Capriolo, Dean Wampler, Jason Ruther glen, "Programming Hive", O'Reilly Publishers, 2012.
5. Tim Hawkins, Eelco Plugge, Peter Membrey, David How's, "The Definitive Guide to MongoDB: A complete guide to dealing with Big Data using MongoDB", Third Edition, press Publishers, 3rdEdition, 2015.
6. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

CO'S-PO'S & PSO'S MAPPING

X22CIE01- BIG DATA ANALYTICS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	2	2	3	1	1	3	3
CO2	3	3	2	3	2	-	-	-	2	2	3	3	2	3	2
CO3	3	3	3	2	3	-	-	-	2	2	1	2	2	3	3
CO4	2	3	3	3	3	-	-	-	2	2	3	2	3	3	2
CO5	3	3	3	3	3	-	-	-	3	1	3	2	3	2	3
AVG	2.8	3	2.8	2.8	2.8	-	-	-	2.2	1.8	2.6	2	2.2	2.8	2.6

1–Low 2-Medium, 3-High, "- "- No Correlation

522CIE03 **RECOMMENDER SYSTEMS** **L T P C**

3 0 0 3

UNIT I INTRODUCTION **9**

Basic taxonomy of recommender systems - Data mining methods for recommender systems - Recommender system functions - Understanding ratings - Applications of recommendation systems - Issues with recommender system.

UNIT II COLLABORATIVE FILTERING **9**

Nearest-neighbours collaborative filtering (CF). User-based and item-based CF, comparison, Components of neighbourhood methods Hybrid recommender systems. Attacks on collaborative recommender systems.

UNIT III CONTENT-BASED RECOMMENDATION **9**

High-level architecture of content-based systems - Advantages and drawbacks of content- based filtering, Item profiles - Discovering features of documents - Obtaining item features from tags - Representing item profiles - Methods for learning user profiles - Similarity based retrieval - Classification algorithms.

UNIT IV KNOWLEDGE- BASED RECOMMENDATION **9**

Knowledge representation and reasoning – Constraint-based recommenders – Case-based recommenders - Hybrid approaches: Opportunities for hybridization - Monolithic hybridization design - Parallelized hybridization design - Pipelined hybridization design.

UNIT V EVALUATING RECOMMENDER SYSTEM **9**

Introduction - Evaluation designs - Evaluation on historical datasets - Community-Based Web Search - Social Tagging Recommenders Systems - Trust and Recommendations.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Develop an understanding of recommender systems and data mining techniques used.

CO2: Apply collaborative filtering techniques and addressing attacks on collaborative recommender systems.

CO3: Design content-based recommender systems using similarity retrieval or classification algorithms.

CO4: Employ knowledge representation and reasoning in recommender systems and opportunities for hybridization.

CO5: Evaluate and improve recommender systems for real-time application.

TEXT BOOKS:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

2. C.C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

REFERENCE BOOKS:

1. F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.
2. Schutze, Hinrich, Christopher D. Manning, and Prabhakar Raghavan. Introduction to information retrieval. Cambridge University Press, 2008.
3. Leskovec, Jure, Anand Rajaraman, and Jeffrey David Ullman. Mining of massive data sets. Second Edition, Dreamtech Press, 2016.
4. T.V. Geetha and S. Sendhilkumar, Machine Learning: Concepts, Techniques and Applications, First Edition, CRC Press, Taylor and Francis, 2023

CO's-PO & PSO's MAPPING:

522CIE03- RECOMMENDER SYSTEMS															
CO's/ PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	3	-	-	1	1	1	1	3	1	2	1
CO2	2	2	2	3	3	-	-	1	3	1	3	2	2	2	1
CO3	2	2	2	3	2	-	-	1	3	1	1	2	2	2	1
CO4	2	2	2	3	2	-	-	1	1	1	3	1	3	2	1
CO5	2	2	2	3	2	-	-	1	1	1	3	1	3	2	1
AVG	2	2	2	3	2.4	-	-	1	1.8	1	2.2	1.8	2.2	2	1

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE04	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure- Text Pre-processing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – Fast Text model – Overview of Deep Learning models – RNN – Transformers – Overview of 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

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, Wave Net and other deep learning-based TTS systems

UNIT V AUTOMATIC SPEECH RECOGNITION 9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems- Speech recognition architecture-Connectionist temporal classification-ASR Evolution-TTS

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Explain existing and emerging deep learning architectures for text and speech processing
CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation
CO3: Explain coreference and coherence for text processing
CO4: Build question-answering systems, chatbots and dialogue systems
CO5: Apply deep learning models for building speech recognition and text-to-speech systems

TEXTBOOK

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.

CO'S-PO'S & PSO'S MAPPING

X22CIE04- TEXT AND SPEECH ANALYSIS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	3	-	-	-	1	2	1	2	1	1	1
CO2	3	1	2	1	3	-	-	-	2	2	1	3	3	2	1
CO3	2	2	1	3	1	-	-	-	3	3	1	2	3	3	1
CO4	2	1	1	1	2	-	-	-	2	1	2	2	3	1	1
CO5	1	3	2	2	1	-	-	-	3	2	1	1	2	3	1
AVG	2.2	1.8	1.8	1.6	2	-	-	-	2.2	2	1.2	2	2.4	2	1

1–Low 2-Medium, 3-High, "- "- No Correlation

X22CIE05	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms
- To elaborate on the video analytics techniques.

UNIT -I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT- II IMAGE PRE-PROCESSING 9

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 multisperalct images - Local pre-processing in the frequency domain - Line detection by local preprocessing 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-R-CNN-Faster R-CNN-You Only Look Once (YOLO)-Salient Features-Loss Functions-YOLO architectures

UNIT- IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition Deep Face solution by Facebook-Face Net for Face Recognition- Implementation using Face Net Gesture Recognition.

UNIT- V VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem Rest Net Architecture-Rest Net and skip connections-Inception Network-Google Net architecture Improvement in Inception v2-Video Analytics-Rest Net and Inception v3. 3

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basics of image processing techniques for computer vision and video analysis.
CO2: Explain the techniques used for image pre-processing.
CO3: Develop various object detection techniques.
CO4: Understand the various face recognition mechanisms.
CO5: Elaborate on deep learning-based video analytics

TEXT BOOK:

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

REFERENCES:

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

CO'S-PO'S & PSO'S MAPPING

X22CIE05-IMAGE AND VIDEO ANALYTICS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	3	-	-	-	3	3	2	1	2	1	3
CO2	2	2	3	3	3	-	-	-	3	2	1	1	2	2	1
CO3	1	2	2	3	3	-	-	-	1	2	1	2	1	1	3
CO4	1	2	3	3	3	-	-	-	2	2	2	3	2	2	2
CO5	3	2	2	2	3	-	-	-	2	1	1	3	3	2	1
AVG	2	1.8	2.4	2.6	3	-	-	-	2.2	2	1.4	2	2	1.6	2

1–Low 2-Medium, 3-High, "- "- No Correlation

522CIE06	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the business analytics for decision making
- To apply the appropriate analytics and generate solutions
- To Model and analyse the business situation using descriptive analytics.
- To understand business operation and guiding future strategic decisions.
- To analyse the business situation using Prescriptive analytics.

UNIT I - INTRODUCTION TO BUSINESS ANALYTICS (BA) **9**

Business Analytics - Terminologies, Process, Importance, Relationship with Organizational Decision Making, Analytics in Decision Making, BA for Competitive Advantage

UNIT II: MANAGEING RESOURCES FOR BUSINESS ANALYTICS **9**

Managing BA Personnel, Data and Technology. Organizational Structures aligning BA. Managing Information Policy, data quality and change in BA.

UNIT III: DESCRIPTIVE ANALYTICS **9**

Introduction to Descriptive analytics – Visualizing, and Exploring Data - Descriptive Statistics - Sampling and Estimation - Probability Distribution for Descriptive Analytics - Analysis of Descriptive analytics

UNIT IV: PREDICTIVE ANALYTICS **9**

Introduction to Predictive analytics - Logic and Data Driven Models - Predictive Analysis Modeling and Procedure – Data Mining for Predictive analytics. Analysis of Predictive analytics.

UNIT V: PRESCRITIVE ANALYTICS **9**

Introduction to Prescriptive analytics - Prescriptive Modeling - Non Linear Optimisation – Demonstrating Business Performance Improvement

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand the role of Business Analytics in decision making

CO2: Identify the appropriate tool for the analytics scenario

CO3: Apply the tools and generate solutions

CO4: Analyse the business operations

CO5: Implement the model and improve the business performance.

TEXTBOOKS:

1. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014
2. Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.

REFERENCE BOOKS:

1. James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed, 2012.
2. Arun, Jai Singh & Cuomo, Jerry & Gaur, Nitin. 2019. "Block chain for Business," Pearson Education, First edition, ISBN-10: 938958888X, ISBN-13: 978-9389588880.

CO's-PO's & PSO's MAPPING

CO's/ PO's	522CIE06 - BUSINESS ANALYTICS														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1
CO2	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1
CO3	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1
CO4	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1
CO5	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1
AVG	3	3	3	3	2	3	3	3	-	-	1	3	3	3	1

3- High 2-Moderate 1-Low '-'– No Correlation

VERTICAL 2: FULL STACK DEVELOPMENT

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE08	C# & .NET	3	0	0	3	40	60	100
2	PE	X22CIE09	Advanced Scripting	3	0	0	3	40	60	100
3	PE	X22CIE10	UI and UX Design	3	0	0	3	40	60	100
4	PE	X22CIE11	Advanced Python Programming	3	0	0	3	40	60	100
5	PE	X22CIE12	Cloud Services and Management	3	0	0	3	40	60	100
6	PE	X22CIE13	Web Application Security	3	0	0	3	40	60	100
7	PE	X22CIE14	Software Testing and Automation	3	0	0	3	40	60	100

HOD

522CIE07	CLOUD SERVICES AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts**.**
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world Problems

UNIT I: CLOUD SERVICE MANAGEMENT FUNDAMENTALS **9**

Cloud Ecosystem, the Essential Characteristics, Basics of Information Technology ServiceManagement and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II: CLOUD SERVICES STRATEGY **9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driverfor Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, and Cloud Service Architecture

UNIT III: CLOUD SERVICE MANAGEMENT **9**

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealingwith Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service CapacityPlanning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service OperationsManagement.

UNIT IV: CLOUD SERVICE ECONOMICS **9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscriptionbased Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V: CLOUD SERVICE GOVERNANCE & VALUE **9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, CloudGovernance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, BalancedScorecard, Total Cost of Ownership

TOTAL:45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO 1: Understand the Service Management Fundamentals and Strategies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.

CO3: Identify the Services of Cloud Technologies and Select Appropriate Tools for Cloud Service Economics.

CO4: Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO5: Evaluate and optimize Cloud Governance for efficiency and effectiveness.

TEXTBOOK

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era byEnamulHaque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing.
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya,Christian Vechhiola, S.ThamaraiSelvi

CO's-PO & PSO's MAPPING:

522CIE07- CLOUD SERVICES AND MANAGEMENT															
CO's/ PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	1	-	-	-	2	1	3	2	2	1	3
CO2	3	1	2	3	2	-	-	-	1	2	3	1	2	2	2
CO3	1	1	3	1	3	-	-	-	3	3	1	1	3	2	1
CO4	1	1	1	2	3	-	-	-	2	3	3	1	1	1	1
CO5	1	3	3	2	2	-	-	-	1	3	3	2	1	3	2
AVG	1.8	1.8	2	1.8	2.2	-	-	-	1.8	2.4	2.2	1.4	1.8	1.8	1.8

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE08 **C# AND.NET PROGRAMMIN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn basic programming in C# and understand object-oriented programming concepts.
- To enhance skills in writing Windows applications using ADO.NET and ASP.NET.
- To study advanced concepts in data connectivity, WPF, WCF, and WWF using C# and .NET 4.5.
- To implement mobile applications using the .NET Compact Framework.
- To understand the working of base class libraries and manipulate data using XML.

UNIT I C# LANGUAGE BASICS **9**

.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers

UNIT II C# ADVANCED FEATURES **9**

Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and RegularExpressions-Generics-Collections-MemoryManagementandPointers- Errors and Exceptions - Reflection

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION **9**

Diagnostics -Tasks, Threads and Synchronization - .Net Security - Localization - Manipulating XML- SAX and DOM - Manipulating files and the Registry- Transactions - ADO.NET- Peer-to- Peer Networking - PNRP - Building P2P Applications - Windows Presentation Foundation (WPF).

UNIT IV WINDOW BASED APPLICATIONS, WCF AND WWF **9**

Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)-Introduction to Web Services -.Net Remoting -Windows Service -Windows Workflow Foundation (WWF) - Activities – Workflows

UNIT V .NET FRAMEWORK AND COMPACT FRAME WORK **9**

Assemblies - Shared assemblies - Custom Hosting with CLR Objects – App domains - Core XAML -Bubbling and Tunneling Events-Reading and Writing XAML -.Net Compact Framework-Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Write various applications using C# language in the .NET Framework.

CO2: Develop distributed applications using the .NET Framework.

CO3: Create mobile applications using the .NET Compact Framework.

CO4: Develop Windows and web applications using WPF, ASP.NET, WCF, and WWF.

CO5: Test and deploy applications using .NET and Compact Framework with performance and debugging tools.

TEXTBOOKS:

1.Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, Professional C# 2012 and .NET 4.5, Wiley, 2012.

2. Harsh Bhasin, Programming in C#, Oxford University Press, 2014.

REFERENCES:

1. Ian Griffiths, Mathew Adams, Jesse Liberty, *Programming C# 4.0*, O'Reilly, Fourth Edition, 2010.
2. Andrew Troelsen, *Pro C# 5.0 and the .NET 4.5 Framework*, Apress Publication, 2012.
3. Andy Wigley, Daniel Moth, Peter Foot, *Mobile Development Handbook*, Microsoft Press, 2011.**CO'S-**

CO'S-PO'S&PSO'SMAPPING

X22CIE08-C# AND .NET PROGRAMMING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	-	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	-	3	3	3	2

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE09	ADVANCED SCRIPTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Demonstrates an in depth understanding of tools and scripting languages necessary fordesign and development of applications.
- Explores the nature of scripting and provides skills in scripting language design.
- Learn to write simple scripts to automate system using appropriate languages.
- Conceive basics of text processing, client and server level scripting and GUI programming.

UNIT I INTRODUCTION TO SCRIPTING AND PERL 9

Scripts and Programs - Origin of Scripting - Characteristics of Scripting Languages - Uses of Scripting Languages - Web Scripting. Perl backgrounder- Perl overview - Perl parsing rules - Variables and Data - Statements and Control structures –Subroutines - Packages - Modules - Working with Files - Data Manipulation.

UNIT II INTRODUCTION TO PHP 9

Introduction - Programming in web environment - variables – constants - data types - operators - Statements - Functions - Arrays – OOP: Classes and Objects-Constructor- Inheritance-Overloading and overriding - String Manipulation and regular expressions - File handling and data storage.

UNIT III PHP and MySQL 9

Setting up webpages to communicate with PHP – Handling Form Controls -PHP and MySQL database - PHP Connectivity - Sending and receiving E-mails - Debugging and error handling - PHP Frameworks: Codeignter – Laravel.

UNIT IV OOC AND DB INTEGRATION IN PYTHON 9

Python Basics - Introduction to OOC – Classes and Instances – Static and Class Methods – Composition – Inheritance – Built-in Functions – Integrated Web Applications in Python - Python and MySQL Database Integration: Connect Database – Create and Insert Operations – Parameter Passing – Retrieving data from Database. Case Study on SciPy, Django, Open CV.

UNIT V INTRODUCTION TO RUBY 9

Introduction to Ruby - Core Programming Elements – Conditional Structures – Loop Structures – Arrays – Using Objects - Defining Classes and Creating Objects - Object Inheritance – File Input/Output.

TOTAL: 45 HOURS

COURSE OUTCOMES:

CO1: Apply Perl scripts in application development and data analysis
CO2: Apply various operators and control statements to implement program logic.
CO3: Develop Web based application using PHP and MySQL
CO4: Design and implement short and efficient Python scripts for longer constructs.
CO5: Illustrate Ruby scripts in application development

TEXT BOOKS:

1. Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2012.
2. Steve Suehring, "PHP6& MySQL Bible", John Wiley Publishing Inc., Reprint 2010.
3. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2010.
4. Ophir Frieder, Gideon Frieder and David Grossman, "Computer Science ProgrammingBasics with Ruby", First Edition, O'Reilly, 2013.

REFERENCES:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2012.
2. Tom Christiansen, Jon Orwant, Larry Wall, Brian Foy, "Programming Perl", 4th Edition,O'Reilly Media, 2012.
3. Steven Holzner, "PHP: The Complete Reference", 2nd Edition,
4. Tata McGraw-HillPublishing Company Limited, Indian Reprint 2010.
5. Paul Barry, "Head First Python", O'Reilly Media, 2010.
6. Garrett Grolemund, "Hands-On Programming with R", Paperback Edition, O'ReillyMedia, 2016.
7. Colin Gillespie and Robin Lovelace, "Efficient R Programming", First Release, O'Reilly,2016.

CO'S-PO'S & PSO'S MAPPING

X22CIE09-ADVANCED SCRIPTING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	-	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	-	3	3	3	2

1–Low 2-Medium, 3-High, "- "-No Correlation

X22CIE10	UI AND UX DESIGN	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES:

- To provide a sound knowledge in UI& UX
- To understand the importance of user interface design principles
- To Illustrate web interface design and Mobile interface design
- To explore the various Tools used in UI&UX
- To Create a wire frame and prototype

UNIT-I FOUNDATIONS OF DESIGN **9**

Introduction: Introduction about UX - Five Main Ingredients of UX - Three "What's" of User Perspective - Pyramid of UX Impact - UI vs. UX Design - Core Stages of Design Thinking- Divergent and Convergent Thinking –Brainstorming and Game storming-Observational Empathy- Behavior Basics: Psychology versus Culture - User Psychology - Experience - Conscious Vs Subconscious Experience - Emotions - Gain and Loss – Motivations. **Case Study: Exploring various UI Interaction Patterns.**

UNIT-II USER INTERFACE DESIGN **9**

Designing Behavior: Designing with Intention - Rewards and Punishments - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. **Basic Visual Design Principles:** Visual Weight - Contrast - Depth and Size - Color. Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - One Long Page or a Few Short Pages - Input Types - Labels and Instructions - Buttons - Adaptive and Responsive Design - Touch versus Mouse. **Case Study: Explore an interface with proper UI Style Guides, Invent a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)**

UNIT-III WEB INTERFACE & MOBILE INTERFACE DESIGN **9**

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Patterns: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Case Study: Make use of a Responsive layout for a societal application; Criticize a Design Thinking Process for a new product.

UNIT-IV WIREFRAMING, PROTOTYPING AND TESTING **9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wire framing – CreatingWireflows-BuildingaPrototype-BuildingHigh-FidelityMockups-esigningEfficientlywithTools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods – Synthesizing Test Findings - Prototype Iteration. **Case Study: Prioritize a Wire Flow diagram for application using open source software, Utilize a popular tool to build a prototype and perform usability testing and identify improvements.**

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 **Case Study: Estimate end to end user research, creating personas, ideation process (User stories, Scenarios),Flow diagrams, Flow Mapping.**

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Build UI Interface for user Applications

CO2: Evaluate UX design of any product or application

CO3: Design web and mobile interface for product development

CO4: Create Wire frame and Prototype

CO5: Implement Sketching principles

TEXTBOOKS

1. Joel Marsh, "UX for Beginners", O'Reilly,2022
2. Xia Jiajia, "UI UX Design", O"Reilly, Art power International, 2016.
3. Brian Fling, "Mobile Design and Development", O"Reilly Media Inc., 1st Edition, 2009.

REFERENCES

1. JeniferTidwell,CharlesBrewer,AynneValencia,"DesigningInterface"3rdEdition,O'Reilly2020
2. SteveSchoger,AdamWathan"RefactoringUI",2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile", Third Edition,2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

CO'S-PO'S & PSO'S MAPPING

X22CIE10- UI AND UX DESIGN															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	2	-	-	-	3	3	3	2	3	3	2
CO2	2	3	2	3	3	-	-	-	2	2	3	3	2	2	3
CO3	2	3	3	3	3	-	-	-	3	2	2	3	2	3	3
CO4	2	2	3	3	3	-	-	-	3	2	2	3	3	3	3
CO5	2	2	3	3	3	-	-	-	3	2	2	2	3	2	2
AVG	2	2	3	3	3	-	-	-	3	2	2	3	3	2	3

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE11	ADVANCED PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the basics of core python concepts
- To develop Python programs with conditionals and loops.
- To define Python data structures with concurrent programming.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

Prerequisite: Nil

UNIT I FUNDAMENTALS OF CORE PYTHON CONCEPTS **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language)- Python interpreter and interactive mode; Exception Handling - OOP in Python (classes, inheritance, special methods) **Illustrative programs:** Task Management System, Towers of Hanoi.

UNIT II CONTROL STATEMENTS AND FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope- Strings: string slices, immutability, string functions and methods, string module; Arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search

UNIT III PYTHON DATA STRUCTURES WITH FUNCTIONAL & CONCURRENT PROGRAMMING **9**

Collections module (named tuple, deque, Counter, defaultdict)- Sets, Frozen sets - Custom data structures (linked lists, trees)- Heap and priority queue (heapq) Lambda, map, filter, reduce- Iterators and generators-Closures and decorators (chained, parameterized)- Multithreading vs Multiprocessing-AsyncIO and asynchronous programming

Illustrative programs: Word Frequency Counter using Counter, Write a generator function for Fibonacci sequence up to n terms.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages. Illustrative programs: word count, copy file. Case Study: Python Libraries (NumPy, Pandas, Matplotlib, Pygmy)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Apply advanced object-oriented programming concepts such as inheritance and develop algorithmic solutions.
CO2: Develop Python programs with conditionals and loops
CO3: Apply Python's built-in modules and Construct and use closures and decorators
CO4: Represent compound data using Python lists, tuples, dictionaries.
CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised andupdated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. John V Guttag, —Introduction to Computation and Programming Using Python'', Revisedand expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning,2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: AnIntroduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

CO'S-PO'S & PSO'S MAPPING

X22CIE11 ADVANCED PYTHON PROGRAMMING															
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	2	2	-	-	-	-	-		-	1	2	-	-
CO3	3	-	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	-		2	-	-	-	-	-	2	-	1	-	-	-
CO5	-	2	3		-	-	-	-	-	-	-	-	-	-	1
AVG	2	1	2	2	-	-	-	-	-	0.4	-	0.4	0.4	1	0.2

3-High, 2 Moderate, 1-Low, '- 'No Correlation

X22CIE13 **WEB APPLICATION SECURITY** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

TOTAL :45 PERIODS

COURSE OUTCOMES:

CO1: Understanding the basic concepts of web application security and the need for it
CO2: Be acquainted with the process for secure development and deployment of web applications
CO3: Acquire the skill to design and develop Secure Web Applications that use Secure APIs
CO4: Be able to get the importance of carrying out vulnerability assessment and penetration testing
CO5: Acquire the skill to think like a hacker and to use hackers tool sets

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2.Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3.Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1.Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2.Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3.Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4.Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5.Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

CO'S-PO'S & PSO'S MAPPING

X22CIE13- WEB APPLICATION SECURITY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	2	1	3	-	-	-	-	-	-	1	-	-	-
CO2	2	1	2	1	3	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	2	3	-	-	-	-	-	-	1	-	-	-
CO4	1	2	1	1	2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	2	-	-	-	-	-	-	1	-	-	-
AVG	1.2	1.6	1.6	1.4	2.6	-	-	-	-	-	-	0.6	-	-	-

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE14	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I FOUNDATIONS OF SOFTWARE TESTING AUTOMATION 9

Software Testing: Motivation, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, Terminologies and Processes, Software Test Automation: JUnit as an example , Benefits and Challenges of Automation Testing, Types of Automation Testing-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II TEST PLANNING AND AUTOMATION TESTING TOOLS 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics, Criteria for Selecting Automation Tools, Popular Tools (Selenium, QTP/UFT, Test Complete, Appium, JUnit, TestNG), Open Source vs Commercial Tools.

UNIT III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modelling a Test Design Process, Modelling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 9

Test Design Techniques, Risk-Based Testing, Test Metrics and Measurement, Test Management, Performance Testing and Tuning, Security Testing, Usability and Accessibility Testing, Automation Framework Design, Advanced API Testing, Behaviour-Driven Development (BDD) & Test-Driven Development (TDD), Exploratory Testing and Session-Based Testing, Testing in Agile and DevOps, AI and Machine Learning in Testing

UNIT V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports, Mobile Automation Testing, API Automation Testing, Case Studies and Hands-On Projects

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO 1: Understand the basic concepts of software testing and the need for software testing.
CO 2: Design Test planning and different activities involved in test planning.
CO 3: Design effective test cases that can uncover critical defects in the application
CO 4: Carry out advanced types of testing.
CO 5: Automate the software testing using Selenium and Testing.

TEXTBOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012.

2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018.

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams publishing.
Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group
3. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packet Publishing.
4. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
5. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packet Publishing.
6. Varun Menon, Testing Beginner's Guide, 2013, Packet Publishing. Edition, 2016.

CO’S-PO’S & PSO’S MAPPING

X22CIE14 - SOFTWARE TESTING AND AUTOMATION															
CO’s/PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	2	-	-	-	3	3	2	1	2	2	1
CO2	2	3	1	2	1	-	-	-	1	2	1	1	2	2	1
CO3	2	2	1	2	1	-	-	-	2	2	1	1	2	2	1
CO4	2	1	3	1	1	-	-	-	3	1	1	1	2	2	1
CO5	2	2	2	1	1	-	-	-	1	2	1	1	2	2	1
AVG	2	2	2	2	1	-	-	-	2	2	1	1	2	2	1

1–Low 2-Medium, 3-High, “- “-No Correlation

VERTICAL 3: CLOUD AND DATA CENTER TECHNOLOGIES									
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Marks**		
							CA	**EA**	**TOT**
THEORY									
PE	X22CSE15	Data Warehousing	3	0	0	3	40	60	100
PE	X22CIE16	**Virtualization**	3	0	0	3	40	60	100
PE	X22CIE17	Cloud Services and Management	3	0	0	3	40	60	100
PE	X22CIE18	Storage Technologies	3	0	0	3	40	60	100
PE	X22CIE19	**Software Defined Networks**	3	0	0	3	40	60	100
PE	X22CIE20	Stream Processing	3	0	0	3	40	60	100
PE	X22CIE21	Security and Privacy in Cloud	3	0	0	3	40	60	100

		L	T	P	C
X22CIE07	**CLOUD SERVICES AND MANAGEMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts**.**
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world Problems

UNIT I: CLOUD SERVICE MANAGEMENT FUNDAMENTALS **9**

Cloud Ecosystem, the Essential Characteristics, Basics of Information Technology ServiceManagement and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II: CLOUD SERVICES STRATEGY **9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driverfor Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, and Cloud Service Architecture

UNIT III: CLOUD SERVICE MANAGEMENT **9**

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealingwith Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service CapacityPlanning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service OperationsManagement.

UNIT IV: CLOUD SERVICE ECONOMICS **9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscriptionbased Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V: CLOUD SERVICE GOVERNANCE & VALUE **9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, CloudGovernance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, BalancedScorecard, Total Cost of Ownership

TOTAL:45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO 1: Understand the Service Management Fundamentals and Strategies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.

CO3: Identify the Services of Cloud Technologies and Select Appropriate Tools for Cloud Service Economics.

CO4: Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO5: Evaluate and optimize Cloud Governance for efficiency and effectiveness.

TEXTBOOK

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era byEnamulHaque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini,Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing.
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya,Christian Vechhiola, S.ThamaraiSelvi

CO's-PO & PSO's MAPPING:

X22CIE07- CLOUD SERVICES AND MANAGEMENT															
CO's/ PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	1	-	-	-	2	1	3	2	2	1	3
CO2	3	1	2	3	2	-	-	-	1	2	3	1	2	2	2
CO3	1	1	3	1	3	-	-	-	3	3	1	1	3	2	1
CO4	1	1	1	2	3	-	-	-	2	3	3	1	1	1	1
CO5	1	3	3	2	2	-	-	-	1	3	3	2	1	3	2
AVG	1.8	1.8	2	1.8	2.2	-	-	-	1.8	2.4	2.2	1.4	1.8	1.8	1.8

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE15 **DATA WAREHOUSING** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To know the details of data warehouse Architecture
- To understand the OLAP Technology
- To understand the partitioning strategy
- To differentiate various schema
- To understand the roles of process manager & system manager

UNIT I INTRODUCTION TO DATA WAREHOUSE **9**

Data warehouse Introduction - Data warehouse components- operational database Vs datawarehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture – AutonomousData Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

UNIT II ETL AND OLAP TECHNOLOGY **9**

ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling -Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP – OnlineTransaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAPVs HOLAP.

UNIT III META DATA, DATA MART AND PARTITION STRATEGY **9**

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges forMeta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing DataMarts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting– Horizontal Partition

UNIT IV DIMENSIONAL MODELING AND SCHEMA **9**

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflakeschema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition – ProcessArchitecture- Types of Data Base Parallelism – Data warehouse Tools

UNIT V SYSTEM & PROCESS MANAGERS **9**

Data Warehousing System Managers: System Configuration Manager- System SchedulingManager - System Event Manager - System Database Manager - System Backup RecoveryManager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- QueryManager – Tuning – Testing**CASE STUDY: Data Warehouse for the Ministry of commerce, Data Warehousing in Hewlett Packard**

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Design data warehouse architecture for various Problems

CO2: Apply the OLAP Technology

CO3: Analyse the partitioning strategy

CO4: Critically analyze the differentiation of various schema for given problem

CO5: Frame roles of process manager & system manager

TEXT BOOKS

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

REFERENCES

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.

2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

CO's-PO's & PSO's MAPPING

X22CIE15- DATA WAREHOUSING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	0	3	-	-	-	2	3	1	2	2	1	2
CO2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
CO3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
CO4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
CO5	3	3	3	3	3	-	-	-	3	2	3	3	3	3	3
AVG	3	2.6	2.4	2	3	-	-	-	2.8	2.2	1.8	2.6	2.8	1.8	2.2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE18	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I: STORAGE SYSTEMS **9**

Introduction to Information Storage: Digital data and its types, Information storage, key characteristics of data center, and the evolution of computing platforms. Information Lifecycle Management is also introduced. Third Platform Technologies: Cloud computing and its essential characteristics, cloud services, and cloud deployment models are discussed, along with big data analytics, social networking, and mobile computing. The characteristics of third platform infrastructure and the imperatives for third platform transformation are highlighted. Data Center Environment: This section covers the building blocks of a data center, compute systems and compute virtualization, and the concept of the software-defined data center.

UNIT II: INTELLIGENT STORAGE SYSTEMS AND RAID **9**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture.

UNIT III: STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION **10**

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV: BACKUP, ARCHIVE AND REPLICATION **9**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data de duplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V: SECURING STORAGE INFRASTRUCTURE **8**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
CO2: Illustrate the usage of advanced intelligent storage systems and RAID.
CO3: Interpret various storage networking architectures - SAN, Including storage subsystems and Virtualization.
CO4: Examine the different role in providing disaster recovery and remote replication technologies.
CO5: Infer the security needs and security measures to be employed in information storage management.

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuga Nathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein , Storage Networks Explained, Second Edition, Wiley, 2009'

REFERENCE BOOKS:

1. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice) Reilly, 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.
3. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill, 2013.
4. Rittenhouse, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing - A Practical Approach, Tata McGraw Hill, 2009.

CO's-PO & PSO's MAPPING:

X22CIE18- STORAGE TECHNOLOGIES															
CO's/ PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	3	3	-	-	-	1	1	1	3	1	2	1
CO2	3	1	2	3	3	-	-	-	3	2	3	2	2	3	1
CO3	1	1	3	2	2	-	-	-	3	1	1	2	2	3	3
CO4	3	2	1	2	2	-	-	-	1	1	3	1	3	2	1
CO5	1	3	2	1	2	-	-	-	1	2	3	1	3	2	1
AVG	1.8	1.8	1.8	2.2	2.4	-	-	-	1.8	1.4	2.2	1.8	2.2	2.4	1.4

3-High 2-Moderate 1-Low '-'– No Correlation

X22CIE20	STEAM PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning.
- To explore the different supervised learning techniques including ensemble methods.
- To learn different aspects of unsupervised learning and reinforcement learning.
- To learn the role of probabilistic methods for machine learning.
- To understand the applications of Machine Learning.

UNIT I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III UNSUPERVISED AND REINFORCEMENT LEARNING 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many-to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming jData, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

CO1: Understand the applicability and utility of different streaming algorithms.
CO2: Describe and apply current research trends in data-stream processing.
CO3: Analyze the suitability of stream mining algorithms for data stream systems.
CO4: Program and build stream processing systems, services and applications.
CO5: Solve problems in real-world applications that process data streams

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCE BOOKS:

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

CO'S-PO'S & PSO'S MAPPING

X22CIE20-STEAM PROCESSING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	2	3	-	-	-		-	3	3	3	2
CO2	3	3	2	-	2	3	-	-	-	-	-	3	3	3	2
CO3	3	3	2	3	2	3	-	-	-	-	-	3	3	3	2
CO4	3	3	2	2	1	3	-	-	-	-	-	2	3	3	2
CO5	3	3	2	3	1	3	-	-	-	-	-	3	3	3	2
AVG	3	3	2	2.6	1.6	3	-	-	-	-	-	2.8	-	3	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE21	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I: FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II: SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III: ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

UNIT IV: CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V: MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the cloud concepts and fundamentals.

CO2: Explain the security challenges in the cloud.

CO3: Define cloud policy and Identity and Access Management.

CO4: Understand various risks and audit and monitoring mechanisms in the cloud.

CO5: Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:

1. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing", Wiley 2013.
2. Dave shackleford, "Virtualization Security ‖, SYBEX a Wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy‖, OREILLY 2011.

REFERENCE BOOKS:

1. Mark C. Chu-Carroll "Code in the Cloud‖, CRC Press, 2011.
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi.

CO'S-PO'S & PSO'S MAPPING

X22CIE21 - SECURITY AND PRIVACY IN CLOUD															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	2	-	-	-	1	1	1	3	3	1	2
CO2	1	3	2	3	1	-	-	-	2	2	3	2	3	1	2
CO3	3	2	2	3	2	-	-	-	3	1	1	2	2	3	1
CO4	2	1	2	3	3	-	-	-	3	2	3	3	2	3	2
CO5	2	2	2	-	3	-	-	-	2	3	3	2	2	3	2
AVG	2.2	2.2	2.2	2	2.2	-	-	-	2.2	1.8	2.2	2.4	2.4	2.2	1.8

1–Low 2-Medium, 3-High, "- "-No Correlation

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE22	Ethical Hacking	3	0	0	3	40	60	100
2	PE	X22CIE23	Digital Forensics	3	0	0	3	40	60	100
3	PE	X22CIE24	Cyber Security	3	0	0	3	40	60	100
4	PE	X22CIE21	**Security and Privacy in Cloud**	3	0	0	3	40	60	100
5	PE	X22CIE26	Social Network Security	3	0	0	3	40	60	100
6	PE	X22CSE27	Crypto Currency	3	0	0	3	40	60	100
7	PE	X22CSE28	Network Security	3	0	0	3	40	60	100

X22CIE22	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of computer-based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.
- To have insight into the basic structure of computers.

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 Addressing. - Network and Computer Attacks - Malware - Protecting Against Malware Attacks. - Intruder Attacks - Addressing Physical Security

UNIT-II: FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS **9**

Foot printing Concepts - Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Foot printing through Social Engineering - Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT-III: ENUMERATION AND VULNERABILITY ANALYSIS **9**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT-IV: SYSTEM HACKING **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT-V: PARALLELISM **9**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To express knowledge on basics of computer-based vulnerabilities
CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.
CO3: To demonstrate the enumeration and vulnerability analysis methods
CO4: To gain knowledge on hacking options available in Web and wireless applications.
CO5: To acquire knowledge on the options for network protection.

TEXTBOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014.

CO'S-PO'S & PSO'S MAPPING

X22CIE22- ETHICAL HACKING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	2	1	-	-	-	1	2	2	1	1	1	3
CO2	1	2	1	2	1	-	-	-	2	2	1	1	1	2	2
CO3	2	2	3	3	1	-	-	-	1	2	1	2	2	3	1
CO4	2	1	1	2	1	-	-	-	1	3	3	3	3	2	1
CO5	2	3	1	1	2	-	-	-	2	1	1	1	1	1	3
AVG	1.8	2	1.8	2	1.2	-	-	-	1.4	2	1.6	1.6	1.6	2	2

3-High, 2- Medium, 1- Low "- "- No Correlation

X22CIE23	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamental principles and challenges involved in Digital Forensic.
- Apply scientific methods and investigative techniques.
- Gain a thorough understanding of digital evidence handling and investigation concepts.
- Comprehend the basics of Digital Forensics.
- Apply digital forensic techniques in various network environments.

UNIT -I DIGITAL FORENSICS 9

Foundations of Digital Forensics - Digital Evidence - Increasing Awareness of Digital Evidence -Digital Forensics: Past, Present, and Future - Principles and Challenges of Digital Forensics – Digital Forensics Research - Language of Computer Crime Investigation.

UNIT- II DIGITAL INVESTIGATIONS 9

Conducting Digital Investigations - Digital Investigation Process Models - Scaffolding for Digital Investigations - Applying the Scientific Method in Digital Investigations - Fundamental Principles - Preparing to Handle Digital Crime Scenes – Surveying and Preserving the Digital Crime Scene - Equivocal Forensic Analysis – Victimology - Crime Scene Characteristics.

UNIT -III DIGITAL EVIDENCE 9

Violent Crime and Digital Evidence - Digital Evidence as Alibi - Investigating an Alibi – Time and Location as Alibi - Investigating Computer Intrusions - Forensic Preservation of Volatile Data - Investigation of Malicious Computer Programs – Cyber stalking.

UNIT- IV COMPUTER BASICS FOR DIGITAL INVESTIGATORS 9

Basic Operation of Computers - Representation of Data - File Systems and Location of Data Dealing with Password Protection and Encryption - Applying Forensic Science to Computers – Digital Evidence on Windows Systems - Digital Evidence on UNIX Systems..

UNIT- V FORENSIC SCIENCE ON NETWORKS 9

Digital Evidence on the Internet - Online Anonymity and Self-Protection - E-mail Forgery and Tracking - Usenet Forgery and Tracking - Digital Evidence on Physical and Data-Link Layers – Digital Evidence at the Network and Transport Layers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basic foundations and Challenges in Digital Forensics
CO2: Applying Scientific methods in Digital Investigation
CO3: Understanding various investigation concepts in Digital Evidence
CO4: Understand the basics of Digital Forensic
CO5: Applying Forensics in various Networks

TEXT BOOK:

1. Eoghan Casey, "Digital Evidence and Computer Crime Forensic Science, Computers and The Internet", Third Edition, Elsevier, 2011
2 Kevin Mandia, Chris Prosise, Matt Pepe, —Incident Response and Computer Forensics —, Tata McGraw -Hill, New Delhi, 2006.
3 Nelson Phillips and Enfinger Steuart, —Computer Forensics and Investigationsو, Cengage Learning, New Delhi, 2009.
4 Cory Altheide and Harlan Carvey, —Digital Forensics with Open Source Toolsو Elsevier Publication, April 2011

REFERENCES:

1.Bill Nelson, Amelia Philips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, 2018.
2 John R. Vacca, "Computer Forensics", Firewall Media, 2009.

CO'S-PO'S & PSO'S MAPPING

X22CIE23- DIGITAL FORENSICS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	1	-	-	-	1	-	1	-	1	2	-
CO2	3	3	3	3	1	-	-	-	1	-	2	-	2	2	-
CO3	3	2	2	-	1	-	-	-	1	-	2	1	2	2	-
CO4	2	3	3	-	3	1	-	-	2	2	3	3	1	2	-
CO5	2	3	3	-	3	1	-	-	2	2	3	3	1	2	-
AVG	2.6	2.4	2.4	0.8	1.8	0.4	-	-	1.4	0.8	2.2	1.4	1.4	2	0

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE24	CYBER SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites: Nil

COURSE OBJECTIVES:

- To learn cybercrime and cyber law.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

UNIT I INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACK AND COUNTER MEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Who is – Net craft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Explain the basics of cyber security, cyber crime and cyber law
CO2: Classify various types of attacks and learn the tools to launch the attacks
CO3 Apply various tools to perform information gathering
CO4: Apply intrusion techniques to detect intrusion
CO5: Apply intrusion prevention techniques to prevent intrusion

TEXTBOOKS

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021

2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011

3.William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015

REFERENCES

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013

2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011

3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007

4. 5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014

CO'S-PO'S & PSO'S MAPPING

X22CIE24- CYBER SECURITY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	2	2	3	1	1	3	3
CO2	3	3	2	3	2	-	-	-	2	2	3	3	2	3	2
CO3	3	3	3	2	3	-	-	-	2	2	1	2	2	3	3
CO4	2	3	3	3	3	-	-	-	2	2	3	2	3	3	2
CO5	3	3	3	3	3	-	-	-	3	1	3	2	3	2	3
AVG	2.8	3	2.8	2.8	2.8	-	-	-	2.2	1.8	2.6	2	2.2	2.8	2.6

1–Low 2-Medium, 3-High, "- "- No Correlation

X22CIE26	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop semantic web related simple applications
- To explore Privacy and Security issues in Social Networking.
- To explain the data extraction and mining of social network.
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 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, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 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 communities social network infrastructures and communities, big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior 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, What is Neo4j, Nodes, Relationships, Properties

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

CO1: Develop semantic web related simple applications

CO2: Address Privacy and Security issues in Social Networking

CO3: Explain the data extraction and mining of social networks

CO4: Discuss the prediction of human behavior in social communities

CO5: Describe the applications of social networks

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x "Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖,First Edition, Cambridge University Press, 2010.

REFERENCES :

1.Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.

2.Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.

CO'S-PO'S & PSO'S MAPPING

X22CIE26-SOCIAL NETWORK SECURITY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	2	3	-	-	-		-	3	3	3	2
CO2	3	3	2	-	2	3	-	-	-	-	-	3	3	3	2
CO3	3	3	2	3	2	3	-	-	-	-	-	3	3	3	2
CO4	3	3	2	2	1	3	-	-	-	-	-	2	3	3	2
CO5	3	3	2	3	1	3	-	-	-	-	-	3	3	3	2
AVG	3	3	2	2.6	1.6	3	-	-	-	-	-	2.8	-	3	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CSE27	CRYPTO CURRENCY	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- To understand the importance of digital money through crypto mechanisms
- To be able to explain the different components involved within Blockchain
- To understand how the blockchain creates economic incentives
- To know the system works and how can they utilize and what application can be build using cryptocurrency

UNIT-IDIGITAL MONEY AND CRYPTOGRAPHY **9**

Physical Money and Digital Money - History of Money: Forms of Money, Fiat Currencies, Currency Pages, Quantitative Easing - Interbank Payment Mode: Same Bank, Different Bank, Correspondent Bank, Central Bank, International Payment, Cryptography: Encryption and Decryption, Hashed, Digital Signature.

UNIT-IICRYPTOGRAPHY AND BLOCKCHAIN TECHNOLOGY **9**

Cryptography: Hash function - Digital Signature - ECDSA - Memory Hard Algorithm - Zero Knowledge Proof. Blockchain: Introduction - Advantage over conventional distributed database - Blockchain Network - Mining Mechanism - Distributed Consensus - Merkle Patricia Tree - Gas Limit - Transactions and Fee - Anonymity - Reward - Chain

UNIT-III CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLGOY **9**

Introduction to crypto and crypto currency - Primitives of crypto - Bitcoin - Point of Bitcoin - Working of Bitcoin - Bitcoin in practice - Bitcoin Predecessor - Bitcoin Decentralization - Store and use of Bitcoin - Bitcoin Mining - Ethereum: Ethereum Ecosystem - Case Study: Bitcoin cash.

UNIT-IV ETHEREUM AND SOLIDITY **9**

Alternative approaches to mining and consensus - Bitcoin and anonymity - Overview of Altcoins - Overview of Ethereum - Programming smart contracts on Ethereum - Solidity Language - Cryptocurrencies & the real world: Smart property, data feeds, and public randomness - Applications of cryptocurrencies and blockchains.

UNIT-VCRYPTO CURRENCY REGULATION AND BLOCKCHAIN APPLICATIONS **9**

Cryptocurrency Regulation: Stakeholders - Roots of Bitcoin - Legal Aspects - Cryptocurrency Exchange - Black Market and Global Economy. Blockchain Applications: Internet of Things - Medical Record Management System - Domain Name Service - future of Blockchain..

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Familiarize the functional/operational aspects of cryptocurrency ecosystem

CO3: Familiarize with Ethereum, smart contracts and related technologies, and solidity language strategies that can be applied for real time transactions.

CO4:Demonstrate how cryptographic primitives can be leveraged to construct secure electronic currencies like Bitcoin

CO5: Enumerate the Bitcoin features and its alternative options

TEXTBOOKS:

1. Antony Lewis, “The Basics of Bitcoin and Blockchains: An Introduction to Cryptocurrencies and Technology that powers them” 2018
2. Wiley, “Cryptocurrencies and Blockchain Technology Applications”, Wiley 2020
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).

REFERENCES:

1. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies",O'Reilly (2014)
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016

CO’S-PO’S & PSO’S MAPPING

X22CSE27-CRYPTOCURRENCY															
CO’s/PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	-	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	-	3	3	3	2

1–Low 2-Medium, 3-High, “-“-No Correlation

X22CSE28	NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To explore the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To learn various mechanisms for network security to protect against the threats in the networks.

UNIT-I INTRODUCTION **9**

Services, Mechanisms and attacks - The OSI Security Architecture- A Model for Network Security – Classical Encryption Technique – Symmetric Cipher Model – Substitution Technique – Rotor Machines – Steganography

UNIT-II WORD LEVEL ANALYSIS **9**

Simplified DES- Block Cipher principles – The Data Encryption Standard – The strength of DES – Confidentiality using symmetric encryption – Placement of encryption - Traffic confidentiality – Key distribution - Random number generation

UNIT-III PUBLIC KEY ENCRYPTION AND KEY MANAGEMENT **9**

Introduction to number theory – Public key cryptography and RSA – Key Management Diffie-hellman Key exchange

UNIT-IV AUTHENTICATION AND HASH FUNCTIONS **9**

Authentication requirements – Authentication functions – message authentication codes – Hash functions – Security of hash functions and MAC'S – MD 5 (Message Digest Algorithm) – HMAC. Digital Signatures and authentication protocols: Digital Signatures – Authentication protocols – Digital Signature Standard – Kerbews – X.509 Authentication Service.

UNIT-V NETWORKSECURITY AND SYSTEM SECURITY **9**

Electronic Mail Security – IP Security – Web Security – Intruders – Malicious S/Ws – Firewalls.

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

CO1: Implement various symmetric encryption techniques for given applications
CO2: Illustrate various public key encryption techniques
CO3: Understand various key encryption mechanisms and key management strategies that can be applied for real time transactions.
CO4: Evaluate authentication and hash algorithms
CO5: Summarize the basic network security mechanisms

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security", Sixth edition, Pearson Education, 2013.
2. Behrouz A. Forouzan "cryptography and network security", ACM Digital Library, 2007
3. Man Young Rhee,"Internet security: cryptographic principles", "Algorithms and Protocols" Whey publications, 2003

REFERENCES:

1. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.
2. Joey Holland, "Cryptography: Principles and Practice" Larsen and Keller, 2017.
2. Sahadeo Padhye, Rajeev A. Sahu, Vishal Saraswat, "Introduction of Cryptography", CRC press, 2018.

CO'S-PO'S & PSO'S MAPPING

X22CSE28- NETWORK SECURITY															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	-	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	-	3	3	3	2

1–Low 2-Medium, 3-High, "-"- No Correlation

VERTICAL 5: CREATIVE MEDIA

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE29	Multimedia and Animation	3	0	0	3	40	60	100
2	PE	X22CIE30	Multimedia Data Compression and Storage	3	0	0	3	40	60	100
3	PE	X22CSE31	Human computer interaction	3	0	0	3	40	60	100
4	PE	X22CIE32	Visual Effects	3	0	0	3	40	60	100
5	PE	X22CIE33	Game Development	3	0	0	3	40	60	100
6	PE	X22CIE34	Video Creation and Editing	3	0	0	3	40	60	100
7	PE	X22CSE35	Image and video Analytics	3	0	0	3	40	60	100

X22CIE05	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms
- To elaborate on the video analytics techniques.

UNIT -I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT- II IMAGE PRE-PROCESSING 9

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 multisperalct images - Local pre-processing in the frequency domain - Line detection by local preprocessing 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-R-CNN-Faster R-CNN-You Only Look Once (YOLO)-Salient Features-Loss Functions-YOLO architectures

UNIT- IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition Deep Face solution by Facebook-FaceNet for Face Recognition- Implementation using Face Net Gesture Recognition.

UNIT- V VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem Rest Net Architecture-Rest Net and skip connections-Inception Network-Google Net architecture Improvement in Inception v2-Video Analytics-Rest Net and Inception v3. 3

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basics of image processing techniques for computer vision and video analysis.
CO2: Explain the techniques used for image pre-processing.
CO3: Develop various object detection techniques.
CO4: Understand the various face recognition mechanisms.
CO5: Elaborate on deep learning-based video analytics

TEXT BOOK:

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

REFERENCES:

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

CO'S-PO'S & PSO'S MAPPING

X22CIE05-IMAGE AND VIDEO ANALYTICS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	3	-	-	-	3	3	2	1	2	1	3
CO2	2	2	3	3	3	-	-	-	3	2	1	1	2	2	1
CO3	1	2	2	3	3	-	-	-	1	2	1	2	1	1	3
CO4	1	2	3	3	3	-	-	-	2	2	2	3	2	2	2
CO5	3	2	2	2	3	-	-	-	2	1	1	3	3	2	1
AVG	2	1.8	2.4	2.6	3	-	-	-	2.2	2	1.4	2	2	1.6	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE29	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I: INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II: MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III: MULTIMEDIA AUTHORING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV: ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Key frame, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V: MULTIMEDIA APPLICATIONS 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL:45 PERIODS

COURSEOUTCOMES:

CO1: Get the bigger picture of the context of Multimedia and its applications.

CO2: Use the different types of media elements of different formats on content pages.

CO3: Author 2D and 3D creative and interactive presentations for different target multimedia applications.

CO4: Use different standard animation techniques for 2D, 21/2 D, 3D application.

CO5: Understand the complexity of multimedia applications in the context of cloud, security, big data streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCE BOOKS:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

CO'S-PO'S&PSO'SMAPPING

X22CIE29- MULTIMEDIA AND ANIMATION															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	3	-	-	3	2	1	2	3	2	3
CO2	3	3	3	3	3	3	-	-	3	3	2	2	3	2	3
CO3	3	3	3	3	3	3	-	-	3	3	2	3	3	2	3
CO4	3	3	3	3	3	3	2	-	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	-	3	3	2	3	3	3	3
AVG	3	3	2.8	3	3	3	0.8	-	3	2.8	2.2	2.6	3	2.4	3

1–Low2-Medium,3-High, "- "-No Correlation

X22CIE30 MULTIMEDIA DATA COMPRESSION AND STORAGE L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of compression techniques.
- To study uunderstand the categories of compression for text, image and video.
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices
- To understand the concepts of data streaming services

UNIT -I BASICS OF DATA COMPRESSION 9

Introduction —Lossless and Lossy Compression– Basics of Huffman coding- Arithmetic coding Dictionary techniques- Context based compression – Applications.

UNIT- II IMAGE COMPRESSION 9

LosslessImagecompression–JPEG-CALIC-JPEGLS-Predictionusingconditionalaverages–Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding.

UNIT -III VIDEO COMPRESSION 9

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once (YOLO)-Salient Features-Loss Functions-YOLO architectures

UNIT- IV DATA PLACEMENT ON DISKS 9

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks– TertiarystorageDevices– ContinuousPlacementonHierarchicalstoragesystem–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:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basics of text, Image and Video compression
CO2: Understand the various compression algorithms for multimedia content
CO3: Explore the applications of various compression techniques
CO4: Explore knowledge on multimedia storage on disks
CO5: Understand scheduling methods for request streams

TEXT BOOK:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2.PhilipK.C.Tse,MultimediaInformationStorageandRetrieval:TechniquesandTechnologies,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 Standards, Taylor& Francis, 2019

CO'S-PO'S & PSO'S MAPPING

X22CIE30- MULTIMEDIA DATA COMPRESSION AND STORAGE															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	2	2	-	-	-	1	-	-	1	-	2	-	3
CO2	3	-	-	-	2	-	-	1	-	-	1	-	1	-	3
CO3	-	-	-	-	-	1	-	3	-	-	3	-	2	-	2
CO4	2	1	3	2	1	-	-	-	1	1	1	2	2	-	2
CO5	2	2	1	3	1	-	-	-	1	3	2	1	2	-	3
AVG	3	2.6	2.4	2.6	1	-	-	-	2.4	-	-	-	1.8	2.8	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE31	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the foundations of Human Computer Interaction
- Understanding Interaction Styles and to become familiar with the design technologies for individuals and persons with disabilities.
- To understand the process of Evaluation of Interaction Design.
- To clarify the significance of task analysis for ubiquitous computing
- To get insight on web and mobile interaction.

UNIT -I FOUNDATIONS OF HCI 9

Context of Interaction –Ergonomics - Designing Interactive systems – Understanding Users cognition and cognitive frameworks, User Centered approaches Usability, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories. Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design**.**

UNIT- II INTERACTION STYLES 9

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system - Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface. Understanding interaction styles, Direct Navigation and Immersive environments, Fluid navigation, Expressive Human and Command Languages, Communication and Collaboration Advancing the user experience, Timely user Experience, Information search.

UNIT -III EVALUATION OF INTERACTION 9

Evaluation Techniques- assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models. Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models

UNIT- IV MODELS AND THEORIES 9

Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

UNIT- V WEB AND MOBILE INTERACTION 9

Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Interapp integration, Mobile web.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basics of human computer interactions via usability engineering and cognitive modeling.
CO2: Understand the basic design paradigms, complex interaction styles.
CO3. Understand the models and theories for user interaction
CO4: Examine the evaluation of interaction designs and implementations
CO5: Elaborate the above issues for web and mobile applications

TEXT BOOK:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, NiklasElmqvist, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Sixth Edition, Pearson Education, 2016.
2. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004

REFERENCES:

1. Helen Sharp Jennifer Preece Yvonne Rogers, "Interaction Design: Beyond HumanComputer Interaction", Wiley, 5th Edition, 2019.
2. Alan Cooper,RobertReimann, David Cronin, Christopher Noessel,"About Face: The Essentials of Interaction Design", 4th Edition, Wiley, 2014.
3. Donald A. Norman, "Design of Everyday Things", MIT Press, 2013. 6. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.

CO'S-PO'S & PSO'S MAPPING

X22CIE31- HUMAN COMPUTER INTERACTION															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	-	1	-	-	1	-	2	-	3
CO2	1	-	1	2	2	1	-	1	-	-	1	-	1	-	3
CO3	2	3	2	2	-	1	-	3	-	-	3	-	2	-	2
CO4	2	3	1	2	-	2	-	-	1	1	1	2	2	-	2
CO5	2	2	3	3	3	3	-	-	1	3	2	1	2	-	3
AVG	3	2.6	2.4	2.6	1	-	-	-	2.4	-	-	-	1.8	2.8	2

1–Low 2-Medium, 3-High, "-"- No Correlation

X22CIE32	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state-of-the-art vfx techniques
- To become familiar with popular compositing techniques

UNITI ANIMATIONBASICS **9**

VFX production pipeline, Principles of animation, Techniques: Keyframe,kinematics,Fullanimation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNITII CGI, COLOR, LIGHT **9**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image-based lights, PBR lights, photometric light, BRDF shading model

UNITIII SPECIALEFFECTS **9**

Special Effects – props, scaled models, animatronics, pyro techniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNITIV VISUALEFFECTSTECHNIQUES **9**

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNITV COMPOSITING **9**

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

COURSEOUTCOMES

On successful completion of the course, the student will able

CO1: To implement animation in 2D/3D following the principles and techniques
CO2: To use CGI, color and light elements in VFX applications
CO3: To create special effects using any of the state-of-the-art tools
CO4: To apply popular visual affects techniques using advanced tools
CO5: To use compositing tools for creating VFX for a variety of applications

TEXTBOOKS:

1. ChrisRoda,RealTimeVisualEffectsfortheTechnicalArtist,CRCPress,1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge,4th Edition,2017.
3. John Gress, Digital Visual Effects and Compositing**,** NewRidersPress,1st Edition,2014.

REFERENCE:

1. Jon Gress, "Digital Visual Effects and Compositing", NewRidersPress,1st Edition,2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual story telling Routledge,1st Edition,2016.
5. EranDinur, "The Complete guide to Photo realism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, "The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

CO'S – PO'S & PSO'S MAPPING

XSSCIE32 – VISUAL EFFECTS															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	-	-	-	1	2	1	1	3	3	2
CO2	1	3	3	2	1		-	-	3	2	2	2	1	1	1
CO3	2	3	3	2	1		-	-	1	2	1	2	2	2	2
CO4	3	3	2	2	3	-	-	-	3	3	2	2	2	3	1
CO5	1	2	1	1	2	-	-	-	1	3	2	3	2	3	1
AVG	2	2.8	2.4	2	1.6	-	-	-	1.8	2.4	1.6	2	2	2.4	1.4

1–Low 2-Medium, 3-High, "-"- No Correlation

722CIE33	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the History and Generations of video games.
- Toknowthebasicsof 2Dand3Dgraphicsforgame development.
- To know the stages of game development.
- Tounderstandthebasicsofagameengine.
- To learn and develop simple games using Pygame environment

UNIT I INTRODUCTION TO GAME DEVELOPMENT **9**

Games Overview; History of Games. Lecture: History and Generations of Video Games-Overview of Game Platforms-the Elements of Gameplay-Maths behind Game Development-Generic Programming

UNIT II 3D GRAPHICS FOR GAME DESIGN **9**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation– Controller Based Animation**.**

UNIT III GAME DESIGN PRINCIPLES **9**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT IV GAME ENGINE DESIGN **9**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path finding**.**

UNIT V GAME DEVELOPMENT USING PYGAME **9**

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development–DeviceHandlinginPygame–OverviewofIsometricandTileBasedarcadeGames – Puzzle Games.

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

CO1: Describe the history and generations of video games.

CO2:Explaintheconceptsof2Dand3dGraphics

CO3: Design effective game design documents with game play elements and mechanics.

CO4: Implementation of gaming engines.

CO5: Develop a simple 2D game using Pygame with graphics and interactivity.

TEXTBOOKS:

1. SanjayMadhav,"GameProgrammingAlgorithmsandTechniques:APlatformAgnostic Approach", Addison Wesley,2013.
2. PaulCraven,"PythonArcadegames",ApressPublishers,2016.

REFERENCES:

1. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress, 2007.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press, 2006.
3. JungHyunHan,"3DGraphicsforGameProgramming",ChapmanandHall/CRC,2011.

CO'S-PO'S&PSO'SMAPPING

X22CIE33-GAME DEVELOPMENT															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	3	3	3	3	2
CO2	3	3	2	3	3	-	-	-	-	-	3	3	3	3	2
CO3	3	2	2	2	3	-	-	-	-	-	3	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	3	3	3	3	2
CO5	2	2	2	3	3	-	-	-	-	-	3	3	3	3	2
AVG	2.8	2.4	2	2.8	3	-	-	-	-	-	3	3	3	3	2

1–Low,2-Medium,3-High,"-"- No Correlation

X22CIE34	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT-I FUNDAMENTALS **9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT-II STORYTELLING **9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT-III USING AUDIO AND VIDEO **9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT-IV WORKING WITH FINAL CUT PRO **9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT-V WORKING WITH AVID XPRESS DV 4 **9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL:45 HOURS

COURSE OUTCOMES:

CO1: Compare the strengths and limitations of Nonlinear editing
CO2: Identify the infrastructure and significance of storytelling.
CO3: Apply suitable methods for recording to CDs and VCDs.
CO4: Address the core issues of advanced editing and training techniques.
CO5: Design and develop projects using AVID XPRESS DV 4

TEXTBOOKS:

1.Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

REFERENCES:

1. Walter Murch In the Blink of an Eye: A Perspective on Film Editing"
2. Karel Reisz and Gavin Millar The Technique of Film Editing"
3. Maxim Jago, "Adobe Premiere Pro Classroom in a Book"

CO'S-PO'S & PSO'S MAPPING

X22CIE32-VIDEO CREATION AND EDITING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	1	1	-	-	-	1	2	3	2	3	1	1
CO2	2	3	3	3	1	-	-	-	1	2	2	1	1	1	1
CO3	2	2	3	3	1	-	-	-	3	1	1	1	2	1	2
CO4	2	2	2	2	1	-	-	-	3	1	1	1	2	2	2
CO5	2	1	3	3	1	-	-	-	3	2	1	2	2	2	1
AVG	2.2	1.8	2.6	2.4	1	-	-	-	2.2	1.6	1.6	1.4	2	1.4	1.4

1–Low 2-Medium, 3-High, "-"- No Correlation

VERTICAL 6: EMERGING TECHNOLOGIES

S. No	Category	Course Code	Course Title	L	T	P	C	Marks		
								CA	EA	TOT
THEORY										
1	PE	X22CIE01	Big Data Analytics	3	0	0	3	40	60	100
2	PE	X22CSE37	Neural Networks and deep learning	3	0	0	3	40	60	100
3	PE	X22CIE24	Cyber Security	3	0	0	3	40	60	100
4	PE	X22CSE39	Robotics process Automation	3	0	0	3	40	60	100
5	PE	X22CIE10	UI and UX Design	3	0	0	3	40	60	100
6	PE	X22CSE05	Digital Marketing	3	0	0	3	40	60	100
7	PE	X22CIE42	Design Thinking	3	0	0	3	40	60	100

X22CIE42	DESIGN THINKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn design thinking concepts and principles.
- Use design thinking methods in every stage of the problem.
- Learn the different phases of design thinking.
- Apply various methods in design thinking to different problems

UNIT I INTRODUCTION **9**

Why Design - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project – Integration of Artificial Intelligence and Design Thinking

UNIT II UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM **9**

Search field determination - Problem clarification - Understanding of the problem - Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs – Behavioral science in empathetic design

UNIT III IDEATION AND PROTOTYPING **9**

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques – Digital Prototyping.

UNIT IV TESTING AND IMPLEMENTATION **9**

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking – Continuous improvement process.

UNIT V FUTURE **9**

Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow – Design Thinking for global challenges and sustainability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Learn what design thinking is and why it is useful.

CO2: Understand people's problems by talking to them and finding their needs.

CO3: Think of new and creative ideas to solve problems.

CO4: Try out your ideas, get feedback, and improve them.

CO5: Know how design thinking helps in real-life situations, companies, and for solving big world problems.

TEXT BOOKS:

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking. [Unit 1, 2, 3, 4]
2. Designing for Growth: a design thinking tool kit for managers By Jeanne Liedtka and Tim Ogilvie. [Unit 1]
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown. [Unit 5]

REFERENCES:

1. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
4. http://ajjuliani.com/design-thinking-activities/
5. https://venturewell.org/class-exercises

CO’S-PO’S & PSO’S MAPPING

722CIE42-DESIGN THINKING															
CO’s/PO’s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	2	2	3	1	1	3	3
CO2	3	3	2	3	2	-	-	-	2	2	3	3	2	3	2
CO3	3	3	3	2	3	-	-	-	2	2	1	2	2	3	3
CO4	2	3	3	3	3	-	-	-	2	2	3	2	3	3	2
CO5	3	3	3	3	3	-	-	-	3	1	3	2	3	2	3
AVG	2.8	3	2.8	2.8	2.8	-	-	-	2.2	1.8	2.6	2	2.2	2.8	2.6

1–Low 2-Medium, 3-High, “- “- No Correlation

X22CSE05	DIGITAL MARKETING	L T P C
		3 0 0 3

COURSE OBJECTIVES

- The primary objective of this module is to examine and explore the role and importance of
- Digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT – I:INTRODUCTION TO ONLINE MARKET **9**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT- II: SEARCH ENGINE OPTIMISATION **9**

Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT –III: E- MAIL MARKETING **9**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-

UNIT- IV: MEDIA MARKETING **9**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand Conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influence Marketing.

UNIT- V: DIGITAL TRANSFORMATION **9**

Digital Transformation & Channel Attribution- Analytic- Ad-words, Email, Mobile, Social Media, Web Analytic - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45 HOURS

COURSE OUTCOMES:

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOK

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.

2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN- 10: 0199455449

3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st Edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN:8126566930.

4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.

5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South- Western ,Cengage Learning.

6. Pulizzi,J Beginner's Guide to Digital Marketing, Mcgraw Hill

COs-PO's & PSO's MAPPING

X22CSE05-DIGITAL MARKETING															
CO's/PO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	3	-	-	-	-	1	2	3	3	3	3
CO2	2	2	2	2	3	-	-	-	-	1	2	3	3	3	3
CO3	1	1	1	3	2	-	-	-	-	1	2	1	3	2	1
CO4	3	3	2	3	1	-	-	-	-	1	3	3	2	3	2
CO5	2	2	1	2	3	-	-	-	-	2	3	2	1	2	1
AVG	2.2	2.2	1.6	2	2.4	-	-	-	-	1.2	2.4	2.4	2.4	2.6	2

1–Low 2-Medium, 3-High,"-"- No Correlation