VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Accredited by NAAC with 'A' Grade and by NBA for 5 UG Programmes)

(Approved by AICTE and affiliated to Anna University, Chennai)

MADURAI – 625009

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E - COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR SEMESTERS I TO VIII

GOLDEN GOALS OF VET:

1. Regularity & Punctuality.
2. Nil Failures, High Subject Average & More Centums.
3. Research & Development.
4. Focus in General Knowledge & Depth in the Subject.
5. Communication Skills (Spoken English & Learning more Languages).
6. Extracurricular Activities & Co-Curricular Activities (All-around Development).
7. Good Health and Food Habits.
8. Human Values.

VISION AND MISSION OF THE INSTITUTE

VISION OF VCET

To emerge and sustain as a center of excellence for technical and managerial education upholding social values.

MISSION OF VCET

Our aspirants are

- Imparted with comprehensive, innovative and value – based education.
- Exposed to technical, managerial and soft skill resources with emphasis on research and professionalism.
- Inculcated with the need for a disciplined, happy, married and peaceful life.

VISION AND MISSION OF CSE DEPARTMENT

VISION

To become a Center of Excellence in the field of Computer Science and Engineering upholding social values.

MISSION

- Heightening the knowledge of the faculty in recent trends through continuous development programs.
- Transforming the students into globally competent and technically well-equipped Computer Professionals with strong theoretical and practical knowledge.
- Cultivating the spirit of social and ethical values for the cause of development of our Nation.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625 009

(Autonomous)

REGULATIONS - 2021

B.E. COMPUTER SCIENCE AND ENGINEERING (CBCS)

CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER – I

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21IP101	Induction Programme *(Common to all B.E./B.Tech. Programmes)*	-	0	0	0	0
THEORY							
2.	21EN101	Professional English – I *(Common to all B.E./B.Tech. Programmes)*	HS	3	2	0	4
3.	21MA101	Matrices and Calculus *(Common to all B.E./B.Tech. Programmes)*	BS	3	2	0	4
4.	21PH101	Engineering Physics *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
5.	21CH101	Engineering Chemistry *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
6.	21CS101	Problem Solving and Python Programming. *(Common to all B.E./B.Tech. Programmes)*	ES	3	0	0	3
7.	21TA101	தமிழர் மரபு *(Common to all B.E./B.Tech. Programmes)*	EE	1	0	0	1
PRACTICAL COURSES							
8.	21CS102	Problem Solving and Python Programming Laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
9.	21PC101	Physics and Chemistry Laboratory *(Common to all B.E./B.Tech. Programmes)*	BS	0	0	4	2
Total Credits							**22**

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SEMESTER – II

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21EN102	English – II *(Common to all B.E./B.Tech. Programmes)*	HS	3	0	0	3
2.	21MA103	Sampling Techniques and Numerical Methods *(Common to B.E.CSE/B.Tech.IT/B.E.ECE)*	BS	3	2	0	4
3.	21PH103	Physics for Information Science *(Common to B.E.CSE/B.Tech.IT)*	BS	3	0	0	3
4.	21ME101	Engineering Graphics *(Common to all B.E./B.Tech. Programmes)*	ES	2	0	2	3
5.	21EE104	Basic Electrical and Electronics Engineering for Information Science *(Common to B.E CSE/B.Tech.IT)*	ES	3	0	0	3
6.	21CS103	Programming in C *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
7.	21CH103	Environmental Science *(Common to all B.E./B.Tech. Programmes)*	BS	2	0	0	2
PRACTICAL COURSES							
8.	21EM101	Engineering Practices Laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
9.	21CS104	Programming in C Laboratory *(Common to B.E. CSE/B.Tech.IT)*	PC	0	0	4	2
Total Credits							**25**

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SEMESTER-III

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21MA203	Discrete Mathematics *(Common to B.E.CSE/B.Tech.IT)*	BS	3	2	0	4
2.	21EC201	Digital Principles and System Design *(Common to B.E.CSE/B.Tech.IT/B.E.ECE)*	PC	3	0	0	3
3.	21CS201	Computer Organization and Architecture *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
4.	21CS202	Data Structures *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
5.	21CS203	Object Oriented Programming *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
6.	21TA102	தமிழரும் தொழில்நுட்பமும் *(Common to all B.E./B.Tech. Programmes)*	EE	1	0	0	1
PRACTICAL COURSES							
7.	21EC212	Digital Systems Laboratory *(Common to B.E.CSE/B.Tech.IT/B.E.ECE)*	PC	0	0	4	2
8.	21CS204	Data Structures Laboratory *(Common to B.E.CSE/B.Tech. IT)*	PC	0	0	4	2
9.	21CS205	Object Oriented Programming Laboratory *(Common to B.E.CSE/B.Tech.IT)*	PC	0	0	4	2
Total Credits							**23**

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SEMESTER-IV

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21MA205	Stochastic Process and its Applications *(Common to B.E.CSE/B.Tech.IT)*	BS	3	2	0	4
2.	21CS206	Database Management Systems *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
3.	21CS207	Design and Analysis of Algorithm *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
4.	21CS208	Operating Systems *(Common to B.E.CSE/B.Tech.IT)*	PC	3	0	0	3
5.	21CS209	Internet Programming	PC	3	0	0	3
PRACTICAL COURSES							
6.	21CS210	Database Management Systems Laboratory *(Common to B.E.CSE/B.Tech.IT)*	PC	0	0	4	2
7.	21CS211	Operating Systems Laboratory *(Common to B.E.CSE/B.Tech.IT)*	PC	0	0	4	2
8.	21CS212	Internet Programming Laboratory	PC	0	0	4	2
Total Credits							**22**

SEMESTER-V

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1	21CS301	Theory of Computation	PC	3	0	0	3
2	21XXXXX	Professional Elective-I	PE	2	0	2	3
3	21XXXXX	Professional Elective-II	PE	2	0	2	3
4		Naan Mudhalvan Scheme Course*	EE	2	0	0	2#
5	21MCCS01	Constitution of India	MC	1	0	0	0
6		Internship#	EE	0	0	0	1
THEORY WITH PRACTICAL COURSES							
7	21CS302	Computer Networks	PC	3	0	2	4
8.	21CS303	Artificial Intelligence and Machine Learning	PC	3	0	2	4
9.	21CS304	Object Oriented Software Engineering	PC	3	0	2	4
Total Credits							**22**

** Augmented Reality/Virtual Reality/Full Stack/Big Data Analytics/Cloud Essentials/Machine Learning*

 # Minimum Two Weeks Internship

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SEMESTER-VI

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21CS305	Compiler Design	PC	3	0	0	3
2.	21XXXXX	Professional Elective-III	PE	2	0	2	3
3.	21XXXXX	Professional Elective-IV	PE	2	0	2	3
4.	21XXXX	Open Elective-I	OE	3	0	0	3
5.	21XXXX	Open Elective-II	OE	3	0	0	3
6.		Naan Mudhalvan Scheme Course*	EE	2	0	0	2#
7.	21MCCS02	Essence of Indian Traditional Knowledge	MC	1	0	0	0
8.	21OCCSXX	One Credit Course	EE	0	0	2	1
THEORY WITH PRACTICAL COURSE							
9.	21CS306	Data Science	PC	3	0	2	4
PRACTICAL COURSE							
10.	21EN301	Professional Communication Laboratory *(Common to all B.E./B.Tech. Programmes)*	HS	0	0	2	1
Total Credits							**21**

SEMESTER- VII

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21CS401	Distributed Systems	PC	3	0	0	3
2.	21XXXX	Open Elective – III	OE	3	0	0	3
3.	21XXXX	Open Elective – IV	OE	3	0	0	3
4.		Naan Mudhalvan Scheme Course*	EE	2	0	0	2#
PRACTICAL COURSE							
5.	21CS402	Project Work-I	EE	0	0	4	2
Total Credits							**11**

** Augmented Reality/Virtual Reality/Full Stack/Big Data Analytics/Cloud Essentials/Machine Learning*

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SEMESTER-VIII

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21XXXXX	Professional Elective-V	PE	2	0	2	3
2.	21XXXXX	Professional Elective-VI	PE	2	0	2	3
PRACTICAL COURSE							
3.	21CS403	Project Work-II	EE	0	0	20	10
Total Credits							**16**

Total Credits: 162

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SEMESTER-WISE CREDIT DISTRIBUTION

	I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM	VIII SEM	Total Credits
HS	04	03	-	-	-	01	-	-	08
BS	12	09	04	04	-	-	-	-	29
ES	05	08	-	-	-	-	-	-	13
PC	-	05	18	18	15	07	03	-	66
PE	-	-	-	-	06	06	-	06	18
OE	-	-	-	-	-	06	06	-	12
EE	01	-	01	-	(1+2#)	(1+2#)	(2 +2#)	10	16
MC	-	-	-	-	0#	0#	-	-	-
Total	**22**	**25**	**23**	**22**	**22**	**21**	**11**	**16**	**162**

#Naan Mudhalvan Scheme Courses

S.No	Topic
1.	Humanities and Social Sciences including Management (HS)
2.	Basic Sciences (BS)
3.	Engineering Sciences including Workshop, Drawing, Basics of Civil / Electrical / Mechanical / Computer etc. (ES)
4.	Professional Core Courses (PC)
5.	Professional Electives : Courses relevant to chosen specialization / branch (PE)
6.	Open Electives: Electives from other Technical and / or emerging Courses (OE)
7.	Project Work, Seminar and Internship in Industry – Employability Enhancement Courses (EE)
8.	Mandatory Course(MC)
9.	One Credit Course (OC)

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PCS01	Data Science and Big Data Analytics	PE	2	0	2	3
2.	21PCS02	Exploratory Data Analysis	PE	2	0	2	3
3.	21PCS03	Neural Networks and Deep Learning	PE	2	0	2	3
4.	21PCS04	Information Recommender Systems	PE	2	0	2	3
5.	21PCS05	Computer Vision Algorithms and Applications	PE	2	0	2	3
6.	21PCS06	Image and Video Analytics	PE	2	0	2	3
7.	21PCS07	Text and Speech Analysis	PE	2	0	2	3
8.	21PCS08	Essentials of Business Analytics	PE	2	0	2	3

VERTICAL 2: FULL STACK DEVELOPMENT

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PCS09	Principles of Programming Languages	PE	2	0	2	3
2.	21PCS10	Web Technology and Design	PE	2	0	2	3
3.	21PCS11	Cloud Services Management	PE	2	0	2	3
4.	21PCS12	Android App Development	PE	2	0	2	3
5.	21PCS13	Web Application Security	PE	2	0	2	3
6.	21PCS14	Software Testing and Automation	PE	2	0	2	3
7.	21PCS15	Introduction to Dev-Ops	PE	2	0	2	3
8.	21PCS16	Python Application Programming Interface Development	PE	2	0	2	3

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VERTICAL 3: DATA CENTRE TECHNOLOGIES

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PCS17	Data Warehousing Concepts and Implementation	PE	2	0	2	3
2.	21PCS18	Data Storage Technologies	PE	2	0	2	3
3.	21PCS19	Software Defined Networks	PE	2	0	2	3
4.	21PCS20	Cloud Computing and Virtualization	PE	2	0	2	3
5.	21PCS21	Information Storage and Management	PE	3	0	0	3
6.	21PCS22	Stream Processing Framework	PE	2	0	2	3
7.	21PCS23	Fog and Edge Computing	PE	3	0	0	3
8.	21PCS24	Cloud Data Center Network Architectures	PE	2	0	2	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PIT01	Cryptographic Techniques	PE	3	0	0	3
2.	21PIT02	Paradigms of Network Security	PE	2	0	2	3
3.	21PIT03	Engineering Secure Software Systems	PE	3	0	0	3
4.	21PIT04	Digital and Mobile Forensics	PE	3	0	0	3
5.	21PIT05	Ethical Hacking Exploit Development	PE	2	0	2	3
6.	21PIT06	Social Network Security	PE	3	0	0	3
7.	21PIT07	Security and Privacy in Cloud	PE	3	0	0	3
8.	21PIT08	Crypto currency and Block chain Technologies	PE	2	0	2	3

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VERTICAL 5: CREATIVE MEDIA

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PIT09	Multimedia and Animation	PE	2	0	2	3
2.	21PIT10	Multimedia Data Compression and Storage	PE	3	0	0	3
3.	21PIT11	UI and UX Design	PE	2	0	2	3
4.	21PIT12	Video Processing and Analytics	PE	3	0	0	3
5.	21PIT13	Techniques for Visual Effects	PE	3	0	0	3
6.	21PIT14	Game Design and Development	PE	2	0	2	3
7.	21PIT15	Concepts of Augmented Reality and Virtual Reality	PE	3	0	0	3
8.	21PIT16	Strategies of Digital Marketing	PE	3	0	0	3

VERTICAL 6: PROGRESSIVE TECHNOLOGIES

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PIT17	Techniques of Robotic Process Automation	PE	3	0	0	3
2.	21PIT18	Cyber security Essentials	PE	3	0	0	3
3.	21PIT19	3D Printing and Design	PE	3	0	0	3
4.	21PIT20	Embedded System Design	PE	2	0	2	3
5.	21PIT21	Principles of Quantum Computing	PE	3	0	0	3
6.	21PIT22	Autonomous Ground Vehicle Systems	PE	3	0	0	3
7.	21PIT23	E-Learning Techniques	PE	3	0	0	3
8.	21PIT24	Next Generation Networks	PE	3	0	0	3

VERTICAL 7: COGNITIVE COMPUTING

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PCS25	Ethics and Artificial Intelligence	PE	3	0	0	3
2.	21PCS26	Introduction to Knowledge Engineering	PE	2	0	2	3
3.	21PCS27	Principles of Soft Computing	PE	2	0	2	3
4.	21PCS28	Optimization Techniques and Applications	PE	2	0	2	3
5.	21OMA01	Graph Theory and its Applications	PE	3	0	0	3
6.	21PCS29	Introduction to Game Theory	PE	2	0	2	3
7.	21PCS30	Cognitive Science Theory and Applications	PE	2	0	2	3
8.	21PCS31	Statistical Natural Language Processing	PE	2	0	2	3

VERTICAL 8: COMPUTING SCIENCES

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PCS32	Introduction to C	PE	2	0	2	3
2.	21PCS33	Fundamentals of Data Structures	PE	2	0	2	3
3.	21PCS34	Database Programming with PL/SQL	PE	2	0	2	3
4.	21PCS35	Java Programming	PE	2	0	2	3
5.	21PCS36	Fundamentals of Computer Networks	PE	2	0	2	3
6.	21PCS37	Software Testing and Tools	PE	2	0	2	3
7.	21PCS38	Web Programming	PE	2	0	2	3
8.	21PCS39	Machine Learning using Python	PE	2	0	2	3

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ONE CREDIT COURSE

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21OCCS01	Angular JS (LyncSpace,Chennai)	EE	0	0	2	1
2.	21OCCS02	Machine Learning Using Python (Cadence Design Systems,Bengaluru)	EE	0	0	2	1
3.	21OCCS03	Practical Approach to Data warehousing using Informatica (Zetspire Technologies Pvt,Madurai)	EE	0	0	2	1
4.	21OCCS04	Healthcare Automation using Machine Learning (Novitech R&D Private Limited, Coimbatore)	EE	0	0	2	1
5.	21OCCS05	Foundations of NoSQL Database (Wipro R&D ,Chennai)	EE	0	0	2	1
6.	21OCCS06	Introduction to Mainframe Systems (Megam Solutions, Madurai)	EE	0	0	2	1
7.	21OCCS07	Embedded Software Development (Embien Technologies, Madurai)	EE	0	0	2	1
8.	21OCCS08	Innovation and Design Thinking (Glorious Web Tech,Pudukottai)	EE	0	0	2	1

COURSE OFFERED TO OTHER DEPARTMENTS

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21CS105	C Programming	PC	2	0	0	2
2.	21CS214	Object Oriented Programming And Data Structures	PC	3	0	0	3
3.	21CS215	Object Oriented Programming Laboratory	PC	0	0	4	2
4.	21CS308	C and Data Structures	PC	2	0	2	3

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B.E COMPUTER SCIENCE AND ENGINEERING
CHOICE BASED CREDIT SYSTEM
SYLLABUS FOR SEMESTERS I TO VIII

SEMESTER - I

21IP101	**INDUCTION PROGRAMME** *(Common to all B.E./ B.Tech. programmes)*	**L**	**T**	**P**	**C**
		0	**0**	**0**	**0**

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

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

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

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

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

(i) Physical Activity

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

(ii) Creative Arts

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

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A

module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not e through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

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

(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

REFERENCE: Guide to Induction program from AICTE

21EN101	PROFESSIONAL ENGLISH-1 *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

1. To develop learners skills in listening and responding effectively
2. To improve basic grammar for better communication
3. To practice reading exercise for understanding vocabulary
4. To initiate and participate in pair presentation, extempore
5. To strengthen writing skills for various compositions

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	12

Listening – Listening for general information - Specific details - Conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form; **Speaking** - Self Introduction; Introducing a friend; Conversation - Politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form; **Reading** - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails; **Writing** - Writing emails / letters introducing oneself; **Grammar** - Present Tense (simple, continuous); Question types: Wh/ Yes or No/ and Tags **Vocabulary** - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II	NARRATION AND SUMMATION	12

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities; **Speaking** - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews; **Reading** - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs; **Writing** - Guided writing - Paragraph writing Short Report on an event (field trip etc.); **Grammar** - Past tense (Simple, continuous); Subject-Verb Agreement; and Prepositions; **Vocabulary** - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	12

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products; **Speaking** - Picture description; Giving instruction to use the product; Presenting a product; and Summarizing a lecture; **Reading** - Reading advertisements, gadget reviews; user manuals; **Writing** - Writing definitions; instructions; and Product /Process description; **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect, Present and past perfect continuous tenses; **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	12

Listening - Listening to TED Talks; Scientific lectures; and educational videos; **Speaking** – Small Talk; Mini presentations and making recommendations; **Reading** - Newspaper articles; Journal reports - Non Verbal Communication (tables, pie charts etc,) **Writing** - Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode) **Grammar** - Articles; Pronouns - Possessive & Relative pronouns; **Vocabulary** - Collocations; Fixed / Semi fixed expressions

UNIT V	**EXPRESSIONS**	**12**

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions; **Speaking** - Group discussions, Debates, and Expressing opinions through Simulations & Role-play; **Reading** - Reading editorials; and Opinion Blogs; **Writing** - Essay Writing (Descriptive or narrative); **Grammar** - Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences; **Vocabulary** - Cause & Effect Expressions - Content vs. Function words.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Listen and comprehend complex academic texts

CO2: Read and infer the denotative and connotative meanings of technical texts

CO3: Write definitions, descriptions, narrations and essays on various topics

CO4: Speak fluently and accurately in formal and informal communicative contexts

CO5: Express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University. English for Science & Technology. Cambridge University Press, 2021
2. Board of Editors, Department of English, Anna University. English for Engineers & Technologists. Orient Blackswan Private Ltd, 2020.
3. Board of Editors, Department of English, Anna University. Using English Orient Blackswan Private Ltd, 2017

REFERENCES:

1. Meenakshi Raman & Sangeeta Sharma. Technical Communication – Principles And Practices Oxford University Press, New Delhi, 2016
2. Lakshminarayanan K.R. A Course Book On Technical English. SciTech Publications (India) Pvt. Ltd., 2012
3. Ayesha Viswamohan. English For Technical Communication (With CD). McGraw Hill Education, ISBN: 0070264244. 2008.
4. Kulbhusan Kumar, RS Salaria, Effective Communication Skill. Khanna Publishing House. First Edition, 2018.
5. Dr. V. Chellammal. Learning to Communicate. Allied Publishing House, New Delhi, 2003.

21MA101	MATRICES AND CALCULUS (*Common to all B.E. / B.Tech. Programmes*)	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To explain the students about differential calculus.
- To demonstrate the functions of several variables technique to solve problems in many engineering branches.
- To demonstrate the various techniques of integration.
- To prepare the student to use mathematical tools in evaluating multiple integrals and their applications.

UNIT I	MATRICES	12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT II	DIFFERENTIAL CALCULUS	12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV	INTEGRAL CALCULUS	12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centre of mass.

UNIT V	MULTIPLE INTEGRALS	12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centre of mass, moment of inertia.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Use the matrix algebra methods for solving engineering problems.

CO2: Apply differential calculus tools in solving various application problems.

CO3: Make use of differential calculus ideas on several variable functions.

CO4: Identify suitable methods of integration in solving practical problems.
CO5**:** Solve practical problems of areas, volumes using multiple integrals.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, New Delhi, 2016.
2. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
3. James Stewart, "Calculus: Early Transcendentals", 8th Edition, Cengage Learning, New Delhi, 2015.

REFERENCES:

1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", 7th Edition, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, New Delhi, 2016.
3. Ramana. B.V., "Higher Engineering Mathematics", 6th Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
4. Thomas. G. B., Hass. J and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

21PH101	**ENGINEERING PHYSICS** (***Common to all B.E. / B.Tech. Programmes***)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To illustrate the students effectively to achieve an understanding of mechanics.
- To infer the students to gain knowledge of electromagnetic waves and its applications.
- To explain the basics of oscillations, optics and lasers.
- To outline the importance of quantum physics.
- To relate the students towards the applications of quantum mechanics.

UNIT I	**MECHANICS**	**9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum– double pendulum –Introduction to nonlinear oscillations.

UNIT II	**ELECTROMAGNETIC WAVES**	**9**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

UNIT III	**OSCILLATIONS, OPTICS AND LASERS**	**9**

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave – sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference– Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV	**BASIC QUANTUM MECHANICS**	**9**

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V	**APPLIED QUANTUM MECHANICS**	**9**

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the importance of mechanics.
CO2: Extend their knowledge in electromagnetic waves.
CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers.
CO4: Interpret the importance of quantum physics.
CO5: Summarize quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow, "An Introduction to Mechanics", 1st Edition, McGraw Hill Education, 2017.
2. E.M.Purcell and D.J.Morin, "Electricity and Magnetism", 3rd Edition, Cambridge University Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", 7th Edition, McGraw-Hill, 2017.

REFERENCES

1. R.Wolfson. "Essential University Physics", Volume 1 & 2. , 1st Edition (Indian Edition) Pearson Education, 2009.
2. Paul A. Tipler, "Physics" - Volume 1 & 2, 1st Edition (Indian Edition), CBS Publishers & Distributors, 2004.
3. K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", 2nd Edition, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R. Resnick and J. Walker, "Principles of Physics", 10th Edition (Indian Edition), Wiley, 2015.
5. N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students", 1st Edition, Springer Verlag, 2012.

21CH101	ENGINEERING CHEMISTRY (*Common to all B.E. / B.Tech. Programmes*)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe water quality parameters and water treatment techniques.
- To discuss basic principles and preparatory methods of nanomaterials.
- To demonstrate the basic concepts and applications of phase rule and composites.
- To identify different types of fuels, their preparation, properties and combustion characteristics.
- To illustrate the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**.Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II	NANOCHEMISTRY	9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials**: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of**: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.

UNIT IV	FUELS AND COMBUSTION	9

Fuels: Introduction: Classification of fuels; **Coal and coke**: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Power alcohol and biodiesel.**

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Ignition temperature**: spontaneous ignition temperature, Explosive range; **Flue gas analysis** - ORSAT Method. **CO2 emission and carbon foot print.**

UNIT V	**ENERGY SOURCES AND STORAGE DEVICES**	**9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and applications of solar cells**; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; **Electric vehicles-working principles; Fuel cells:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: Describe the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3: Apply the knowledge of phase rule and composites for material selection requirements.

CO4: Identify suitable fuels for engineering processes and applications.

CO5: Demonstrate different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", 12th Edition, S. Chand Publishing, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B.B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-II M Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", 2nd Edition, Cambridge University Press, Delhi, 2019
5. O.V. Roussak and H.D. Gesser, "Applied Chemistry-A Text Book for Engineers and Technologists", 2nd Edition, Springer Science Business Media, New York, 2013.

21CS101	PROBLEM SOLVING AND PYTHON PROGRAMMING *(Common to all B.E./B.Tech Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe the basics of algorithmic problem solving.
- To solve problems using Python conditionals and loops.
- To illustrate Python functions and use function calls to solve problems.
- To make use of Python data structures - lists, tuples, and dictionaries to represent complex data.
- To explain input/output with files in Python.

UNIT-I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT-II	DATA TYPES, EXPRESSIONS, STATEMENTS	9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT-III	CONTROL FLOW, FUNCTIONS, STRINGS	9

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

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: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT-V	FILES, MODULES, PACKAGES	9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Make use of design approaches to solve computational problems.

CO2: Develop and execute basic Python programs using expressions and input/output statements.

CO3: Utilize strings, functions and control statements to develop real world problems.

CO4: Construct programs using Python data types like lists, tuples and dictionaries.

CO5:Prepare a Python application by incorporating files and exceptions

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher,"Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
3. Martin C. Brown, "Python: The Complete Reference", 4th Edition, McGraw Hill, 2018.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", 1st Edition, Pearson Education, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", 3rd Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019

21CS102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY *(Common to all B.E./B.Tech Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To describe the problem solving approaches.
- To solve the basic programming constructs in Python.
- To illustrate various computing strategies for Python-based solutions to real world problems.
- To make use of Python data structures - lists, tuples, and dictionaries.
- To explain input/output with files in Python.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.,)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.,- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)

8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error,voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.,

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1:Develop algorithmic solutions to simple computational Problems
CO2: Illustrate and execute basic Python programs using simple statements.
CO3: Build program for scientific problems using strings, functions and control statements.
CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications.
CO5: Experiment the python packages, files and exceptions for developing software applications

21PC101	PHYSICS AND CHEMISTRY LABORATORY (*Common to all B.E. / B.Tech., Programmes*)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To explain the proper use of various kinds of physics laboratory equipment.
- To extend how data can be collected, presented and interpreted in a clear and concise manner.
- To infer problem solving skills related to physics principles and interpretation of experimental data.
- To summarize error in experimental measurements and techniques used to minimize such error.
- To translate the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 7 Experiments)

1 Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – Determination of the velocity of sound and compressibility of liquids
10. Post office box - Determination of Band gap of a semiconductor.
11. Photoelectric effect

12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1:.Explain the functioning of various physics laboratory equipment

CO2: Relate the graphical models to analyze laboratory data

CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.

CO4: Explain Access, process and analyze scientific information.

CO5: Translate students to solve problems individually and collaboratively

REFERENCES :

1. "Physics Laboratory Manual", Department of Physics, Velammal College of Engineering & Technology, Madurai (2021)
2. P. Mani, "Physics Laboratory", Dhanam Publications, 2021

*****Each class is divided in to two batches (30 students / batch) and each batch will perform their experiments alternatively per week in physics and chemistry laboratory

21PC101	PHYSICS AND CHEMISTRY LABORATORY *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To identify the required glass wares and instruments for chemical analysis.
- To estimate water quality parameters such as hardness, dissolved oxygen and chloride content.
- To relate electrochemical techniques such as pH metry, conductometry and potentiometry.
- To interpret the data collected from the analysis.
- To express the skills to get accurate results

List of Experiments (Any 7 experiments)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate. (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.

12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel.
15. Proximate analysis of Coal.

COURSE OUTCOMES :

At the end of the course, learners will be able to

CO1: Extent the skills to choose and handle appropriate glass wares.

CO2: Interpret the water quality parameters using volumetric method.

CO3: Estimate the conductivity, pH & emf by electro chemical methods.

CO4: Infer the collected data for appropriate chemical analysis.

CO5: Demonstrate systematic approach to obtain accurate results

TEXT BOOK:

1.J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis" 2009.

SEMESTER-II

21EN102	ENGLISH-II *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations and participate in group discussions.
- Strengthen their Listening skill which will help them comprehend lectures and talks in their areas of specialization.
- Create awareness about the soft skills

UNIT I	INTRODUCTION TO TECHNICAL ENGLISH	9

Listening - Factual and Academic speeches; **Speaking** - Asking for and giving directions - **Reading** - Technical texts from - Newspapers /websites; **Writing** - Statements - Definitions - issue based writing instructions - Checklists - Recommendations; **Vocabulary Development**- technical vocabulary; **Grammar** - Error spotting - Compound words; **Soft skills** - Leadership Skills

UNIT II	READING AND STUDY SKILLS	9

Listening - Listening to longer technical talks and completing exercises based on them; **Speaking** - Describing a general process; **Reading** - Reading longer technical texts - Identifying the various transitions in a text - Paragraphing; **Writing** - Interpreting charts, graphs; **Vocabulary Development** - Vocabulary

used in formal letters/emails and reports **Grammar** - Impersonal passive voice, numerical adjectives - **Soft skills** - Teamwork		
UNIT III	**TECHNICAL WRITING AND GRAMMAR**	**9**
Listening - Listening to classroom lectures, talks on engineering /technology; **Speaking** - introduction to technical presentations; **Reading** - longer texts both general and technical, practice in speed reading; **Writing** - Describing a technical process; **Vocabulary Development** - Sequence words - Misspelled words; **Grammar** - Embedded sentences ; **Soft skills** - Decision making		
UNIT IV	**JOB APPLICATIONS**	**9**
Listening - Listening to Documentaries and Making Notes; **Speaking** - Mechanics of Presentations; **Reading** - Reading for Detailed Comprehension; **Writing** - Email Etiquette, Job Application, Cover Letter, Resume Preparation(softcopy and hard copy), Analytical Essay Writing; **Vocabulary Development** - Finding Suitable Synonyms, Paraphrasing; **Grammar** – Clauses, 'If' Conditionals; **Soft Skills** - Time Management.		
UNIT V	**GROUP DISCUSSION AND REPORT WRITING**	**9**
Listening - TED Talks; **Speaking** - Participating in a Group Discussion; **Reading** - Reading and Understanding Technical Articles; **Writing** - Writing Reports, Survey Report, Accident Report, Minutes of a Meeting; **Vocabulary Development** - Verbal Analogies; **Grammar** - Reported Speech; **Soft Skills** - Conflict Resolution.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES :

At the end of the course, learners will be able to

CO1: Critically read and interpret information in technical texts

CO2: Write convincing job applications, resume and effective reports

CO3: Present the technical ideas effectively in spoken and written forms

CO4: Understand spoken language in lectures and talks

CO5: Demonstrate basic soft skills in life

TEXT BOOKS:

1. Board of Editors, Fluency in English-A Course book for Undergraduate Engineers and Technologist. Orient Blackswan Pvt Ltd, Hyderabad: 2018
2. Jawahar, Jewelcy & Rathna.P. Communicative English Workbook. VRB Publishers Pvt Ltd. Chennai. 2018.
3. Board of Editors, Department of English, Anna University, Chennai. Mindscapes-English for Technologists and Engineers. Orient Black Swan Pvt Ltd, Chennai, 2012.

REFERENCES:

1. Verma, Shalini. Technical Communication for Engineers. Vikas Publishing House Pvt Ltd. New Delhi. 2015
2. Raman, Meenakshi & Sharma, Sangeeta. Technical Communication English Skills for Engineers. Oxford University Press. 2008.
3. Rizvi, Ashraf.M. Effective Technical Communication. MC Graw Hill Education Pvt Ltd. New Delhi. 2016.

21MA103	SAMPLING TECHNIQUES AND NUMERICAL METHODS *(Common to B.E. CSE/ B.Tech. IT/B.E.ECE)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To describe the necessary basic concepts in probability
- To explain the concept of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the basic concepts of classification of design of experiments.
- To choose the method for solving algebraic and transcendental equations using numerical techniques.
- To discuss the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.

UNIT I	PROBABILITY	15

Introduction-Sample Spaces and Events-Axioms of Probability-Interpretations and Properties of Probabilities-Conditional Probabilities-Baye's theorem- Independence.

UNIT II	TESTING OF HYPOTHESIS	15

Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, $\chi 2$ and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

UNIT III	DESIGN OF EXPERIMENTS	15

Introduction, aim, basic designs of experiments, one way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT IV	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	15

Newton Raphson method –Method of False position- pivoting – Gauss Jordan methods – Iterative method: Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

UNIT V	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	15

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's $1/3^{rd}$ rules, $3/8^{th}$ rule.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply the concepts of Probability in Engineering problems.

CO2:Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and $\chi 2$ test.

CO3**:** Apply the basic concepts of classifications of design of experiments.

CO4: Solve the system of equations and the eigen value problems using iterative procedure.

CO5:Interpret the value of an unknown function at any interpolated point of the given tabulated values**.**

TEXT BOOKS:

1. JAY.L. Devore, “Probability and Statistics for Engineering and the Science”, 9th Edition, Cengage Learning, 2021.
2. Johnson. R.A., and Irwin Miller, John Freund, "Miller and Freund’s Probability and Statistics for Engineers", 12th Edition, Pearson Education, Asia, 2011.
3. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis", 7th Edition, Pearson Education, Asia, New Delhi, 2008.

REFERENCES:

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics", 3rd Edition, Tata McGraw Hill, 2012.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill, New Delhi, 2007.

21PH103	PHYSICS FOR INFORMATION SCIENCE *(Common to B. E. CSE / B. Tech. IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the importance in studying electrical properties of materials.
- To extend the students knowledge in semiconductor physics.
- To illustrate knowledge on magnetic properties of materials.
- To summarize different optical properties of materials, optical displays and applications.
- To translate an idea of significance of nano structures, quantum confinement, ensuing nano device applications and quantum computing

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann-Franz law - Success and failures - Electrons in metals - Particle in a three dimensional box - Degenerate states - Fermi- Dirac statistics - Density of energy states - Electron effective mass - Concept of hole.

UNIT II	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors - Energy band diagram - Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - extrinsic semiconductors - Carrier concentration in n-type & p-type semiconductors - Variation of carrier concentration with temperature - Variation of Fermi level with temperature and impurity concentration - Carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and devices - Ohmic contacts - Schottky diode.

UNIT III	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetic dipole moment - Atomic magnetic moments - Magnetic permeability and susceptibility - Magnetic material classification: diamagnetism - Paramagnetism - Ferromagnetism - Antiferromagnetism - Ferrimagnetism - Ferromagnetism: origin and exchange interaction saturation magnetization and Curie temperature - Domain Theory- M versus H behaviour - Hard and soft magnetic materials - Examples and uses - Magnetic principle in computer data storage - Magnetic hard disc (GMR sensor).

UNIT IV	OPTICAL PROPERTIES OF MATERIALS	9

Classification of optical materials - carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode - solar cell - LED - Organic LED - Laser diodes - Optical data storage techniques.

UNIT V	NANODEVICES AND QUANTUM COMPUTING	9

Introduction - Quantum confinement - Quantum structures: quantum wells, wires and dots - Band gap of nanomaterials. Tunneling - Single electron phenomena: Coulomb blockade - Resonant- tunneling diode - single electron transistor - quantum cellular automata - Quantum system for information processing - quantum states - classical bits - quantum bits or qubits - CNOT gate - multiple qubits - quantum gates - advantage of quantum computing over classical computing (qualitative).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Demonstrate the classical and quantum electron theories, and energy band structures.

CO2: Infer knowledge on basics of semiconductor physics and its applications in various devices.

CO3: Summarize magnetic properties of materials and their applications in data storage.

CO4: Extend the functioning of optical materials for optoelectronics

CO5: Translate the basics of quantum structures towards quantum computing.

TEXT BOOKS:

1. Jasprit Singh, "Semiconductor Devices Basic Principles", First Edition (Indian Edition), Wiley, 2007.
2. S.O. Kasap, "Principles of Electronic Materials and Devices", Fourth Edition (Indian Edition), McGraw-Hill Education, 2020.
3. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", First Edition (Indian Edition) McGraw-Hill Education, 2020.

REFERENCES

1. 1. Charles Kittel, "Introduction to Solid State Physics", Indian Edition Wiley, 2019.
2. Y.B.Band and Y.Avishai, "Quantum Mechanics with Applications to Nanotechnology and Information Science", 1st Edition, Academic Press, 2013.
3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, "Introduction to Nanoelectronics", 1st Edition, Cambridge University.Press, 2008.
4. G.W. Hanson, "Fundamentals of Nanoelectronics", Indian Edition, Pearson Education 2009.
5. B.Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small Systems", CRC Press, 2014.

21ME101	ENGINEERING GRAPHICS *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To sketch the projection of points, lines and planes.
- To sketch the projection of simple solids
- To sketch the projection of sectioned solids and development of lateral surfaces
- To sketch the isometric and perspective views of simple solids.
- To sketch the orthographic projection of various objects freehand.

UNIT I	PROJECTIONS OF POINTS, LINES AND PLANE SURFACE	12

Importance of graphics in engineering applications – Use of drafting instruments - Lettering and dimensioning. Introduction to Orthographic projections - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.

Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method. (Not for Examination)

UNIT II	PROJECTION OF SOLIDS	12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT III	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT IV	ISOMETRIC AND PERSPECTIVE PROJECTIONS	12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

UNIT V	FREEHAND SKETCHING	12

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Introduction to drafting packages and demonstration. (Not for examination).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Construct the orthographic projections of points, straight lines and plane surfaces.

CO2: Sketch the orthographic projections of simple solids

CO3: Sketch the orthographic projections of sectional solids and lateral surfaces of the solids.

CO4: Construct the isometric projections and perspective projections of simple solids.

CO5: Sketch the orthographic projection of objects using freehand.

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", 31st Edition, Dhanalakshmi Publishers, Chennai, 2018.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", 15th Edition, New Age International (P) Limited, 2018.
3. Bhatt N.D. and Panchal V.M., "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2014.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", 2nd Edition, Tata McGraw Hill Publishing Company Limited, 2013.
2. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", 2nd Edition, Oxford University, Press, New Delhi, 2015.
3. Shah M.B., and Rana B.C., "Engineering Drawing", 2nd Edition, Pearson, 2009.

21EE104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING FOR INFORMATION SCIENCE *(Common to B.E. CSE / B.Tech.IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the basics of electric circuits and analysis.
- To summarize the basics of working principles and application of AC and DC machines.
- To interpret the domestic and industrial wiring.
- To demonstrate analog devices and their characteristics.
- To illustrate the application of operational amplifier.

UNIT I	ELECTRICAL CIRCUITS	9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws– Simple problems- Nodal Analysis, Mesh analysis. Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – (Simple problems only)

UNIT II	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and. Construction and Working Principle of DC motors, Back EMF equation, Types, Speed and Torque Equation, Transformer-Construction, Working principle and Three phase Alternator, Synchronous motor and Three Phase Induction Motor-construction, working principle and Applications(Qualitative Analysis)

UNIT III	DOMESTIC AND INDUSTRIAL WIRING	9

Lighting, provision of sockets-MCB- Selection of wires and cables-Protection-need for earthing, fuses, relay and circuit breakers. Load calculation, generation cost and Energy Tariff calculation for domestic and industrial loads- HT & LT wiring- Power factor correction.

UNIT IV	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing – Types, I-V Characteristics and Applications, Rectifier. (Qualitative Analysis)

UNIT V	OPERATIONAL AMPLIFIERS AND ITS APPLICATIONS	9

Operational amplifiers, Inverting and Non Inverting Amplifier, Summer, Differentiators, Integrator, Voltage to Current (V/I) and Current to Voltage (I/V) Converter, Multivibrator using 555timer IC.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Interpret the electric circuit parameters of simple DC Circuits.
CO2: Explain the working principle and applications of DC machines.
CO3: Demonstrate the working principle of AC machines.
CO4: Describe the characteristics of analog electronic devices.
CO5: Summarize the basic concepts of operational amplifiers.

TEXT BOOKS

1. Bhattacharya.S.K "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Education, 2017.
2. Sedha R.S., "A textbook book of Applied Electronics", 3rd Edition, S. Chand & Co., 2008.
3. Salivahanan. S, Suresh Kumar.N, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill 2012.
4. Roy Choudhary.D, Sheil B. Jani, "Linear Integrated Circuits", 5th Edition , New Age international Pvt Ltd publishers, 2018.

REFERENCES

1. Kothari DP and Nagrath. I.J, "Basic Electrical Engineering", 4th Edition, McGraw Hill Education, 2019.
2. Albert Malvino, David Bates, "Electronic Principles", 7th Edition, McGraw Hill Education; 2017.
3. Badriram, B.H.Vishwakarma, "Power system protection and switchgear", 2nd Edition, New age international Pvt Ltd publishers, 2011.

21CS103	PROGRAMMING IN C *(Common to B. E. CSE / B. Tech. IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To demonstrate the fundamentals of C programming
- To describe the reusable modules (collections of function)
- To examine code, document, test, and implement a well-structured program using the C
- To use the C programming concepts in trivial problem solving.
- To develop logics which will help them to create programs, applications in C.

UNIT-I	BASICS OF C PROGRAMMING	9

Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process

UNIT-II	ARRAYS AND STRINGS	9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT-III	FUNCTIONS AND POINTERS	9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference

UNIT-IV	STRUCTURES AND UNION	9

Structure - Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility

UNIT-V	FILE PROCESSING	9

Files –Defining and Opening a file, closing a file– input/output operations on files– error handling during I/O operations– random access to files–Command Line Arguments.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Develop simple applications using basic C components.
CO2: Solve applications adopting array and string concepts.
CO3: Construct and implement applications in C using functions and pointers.
CO4: Prepare applications in C by employing structure and union concepts.
CO5: Build applications using sequential and random access file processing.

TEXT BOOKS:

1. ReemaThareja, "Programming in C", Oxford University Press, 2nd Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", 2nd Edition, Pearson Education, 2015.
3. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", 8th edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.

21CH103	ENVIRONMENTAL SCIENCE *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To describe the structure and function of an ecosystem and biodiversity
- To interpret the environmental impacts of natural resources.
- To demonstrate causes, effects and control measures of different types of pollution.
- To manipulate the importance of disaster management, environmental ethics and values.
- To dramatize the important social issues and sustainable practices.

UNIT-I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	6

Multidisciplinary nature of environmental studies - ecosystem- general structure and function of an ecosystem-ecological succession-biodiversity-types-values of biodiversity- endangered and endemic species-red data book-hot spots of biodiversity-criteria- hot spots in India-threats to biodiversity(man-animal conflicts, habitat loss, poaching)-case studies-conservation of biodiversity- in-situ and ex-situ conservation

UNIT-II	NATURAL RESOURCES AND ITS ENVIRONMENTAL IMPACTS	6

Natural resources-forest resource-ecological functions – causes, effects and control measures of deforestation-water resource-sources-conflict over water-dams benefits and problems-food resource-overgrazing- impacts of over grazing- impacts of modern agriculture-energy resource-environmental impacts of wind mills and solar panels- role of an individual in conservation of natural resources.

UNIT III	ENVIRONMENTAL POLLUTION AND CONTROL	6

Air pollution-causes, effects and control methods - water pollution- causes, effects-waste water treatment-soil pollution-causes, effects-solid waste management–e-waste- causes, effects and management-Pollution control acts-air(prevention and control of pollution) act,1981-water(prevention and control of pollution) act,1974-wildlife (protection) act,1972 - e-waste management rules,2016-case studies - role of an individual in control of pollution.

UNIT IV	DISASTER MANAGEMENT AND ENVIRONMENTAL ETHICS	6

Disaster management-causes, effects and management of- flood, landslide, earthquake and tsunami-case studies-environmental ethics- value education-traditional value systems in India-water conservation-rain water harvesting-watershed management.

UNIT V	SOCIAL ISSUES AND SUSTAINABLE PRACTICES	6

Unsustainable development- social issues-climate change-causes, effects and control measures-global warming-causes, effects and control measures-Acid rain-causes, effects and control measures-ozone layer depletion-causes, effects and control measures-nuclear accident and holocausts-EIA-Sustainable development-goals-target- green buildings- ISO 14000 series.

	30 PERIODS

COURSE OUTCOMES :

At the end of the course, learners will be able to

CO1: Explain the concept, structure and function of an ecosystem and biodiversity.

CO2: Demonstrate the environmental impacts of natural resources.

CO3: Illustrate the suitable management method for pollution control.

CO4: Relate the proper way of managing disaster with environmental ethics.

CO5: Apply social issues and adopt suitable sustainable practices.

TEXT BOOKS:

1. Kaushik, A &Kaushik. C.P, "Environmental Science and Engineering", 6th Edition, New Age International, 2018.
2. Garg S.K &Garg, Ecological and Environmental studies, Khanna Publishers, 2015.
3. Wright &Nebel, Environmental science towards a sustainable future, 12th Editon, Prentice Hall of India Ltd, 2015.

REFERENCE BOOKS:

1. ErachBharucha, "Text book of Environmental studies for Undergraduate courses", 3rd Edition, UGC, 2021.
2. Ravi P. Agrahari, Environmental ecology, Biodiversity, climatic change & Disaster management, 1st Edition, McGraw Hill, 2020
3. Benney Joseph, "Environmental Science and Engineering", 1st Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017

21EM101	ENGINEERING PRACTICES LABORATORY *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To draw pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- To demonstrate the basic switch board wiring, fluorescent lamp wiring and stair case wiring using various electrical components.
- To choose various joints in steel plates using arc welding work and machining various simple processes like turning, drilling, tapping in parts
- To build a tray out of metal sheet using sheet metal work.
- To develop electronic circuit and testing for soldering and desoldering using PCB board.

LIST OF EXPERIMENTS:

GROUP – A (CIVIL & ELECTRICAL)

PART – I

CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

- Sawing,
- Planning and Making joints like T-Joint, Cross lap and Dovetail joint.

PART – II

ELECTRICAL ENGINEERING PRACTICES

- Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
- Staircase wiring
- Fluorescent Lamp wiring with introduction to CFL and LED types.
- Energy meter wiring and related calculations/ calibration
- Study of Iron Box wiring and assembly
- Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
- Measurement of resistance to earth of an electrical equipment.

GROUP – B (MECHANICAL & ELECTRONICS)

PART III

MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

- Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- Practicing gas welding.

BASIC MACHINING WORK:

- Usage of Spanners and screw drivers
- Facing and Turning.
- Taper Turning

ASSEMBLY WORK:

- Assembling a centrifugal pump.
- Assembling a household mixer.
- Assembling an air conditioner.

SHEET METAL WORK:

- Making of a square tray

FOUNDRY WORK:

- Demonstrating basic foundry operations.

PART IV

ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

- Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- Study elements of smart phone.
- Assembly and dismantle of computer / laptop

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build various plumbing joints

CO2: Develop various carpentry joints.

CO3: Construct various wiring electrical joints in common household electrical wire work.

CO4: Construct various welded joints, sheet metal and basic machining operations

CO5: Develop the electronic circuit for soldering and testing using PCB board.

21CS104	PROGRAMMING IN C LABORATORY *(Common to B.E. CSE / B.Tech IT)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To demonstrate the fundamentals of C programming
- To describe the reusable modules (collections of function)
- To examine code, document, test, and implement a well-structured program using the C
- To use the C programming concepts in trivial problem solving.
- To develop logics which will help them to create programs, applications in C.

LIST OF EXPERIMENTS

1. I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.
11. Mini project.

TOTAL :60 PERIODS

Course Outcomes:

At end of the course, learners will be able to

CO1: Develop simple applications using basic C components.
CO2: Solve applications adopting array and string concepts.
CO3: Construct and implement applications in C using functions and pointers.
CO4: Prepare applications in C by employing structure and union concepts.
CO5: Build applications using sequential and random access file processing.

SEMESTER-III

21MA203	DISCRETE MATHEMATICS *(Common to B.E. CSE / B.Tech IT)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To discuss the basic concepts of Combinatorics.
- To explain the students about the properties and characteristics of different graphs.
- To demonstrate the applications of algebraic structures.
- To identify the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering

UNIT I	LOGIC AND PROOFS	15

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II	COMBINATORICS	15

Mathematical induction – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

UNIT III	GRAPHS	15

Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV	ALGEBRAIC STRUCTURES	15

Groups – Subgroups – Cyclic groups - Homomorphism – Normal subgroup and Cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	15

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Some special lattices: Bounded, Modular, Distributive, complemented.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Extend student's logical and mathematical maturity and ability to deal with abstraction.
CO2: Explain the basic concepts of combinatorics.
CO3: Make use of the concept of graph theory in computer science and engineering.

CO4: Manipulate the applications of algebraic structures.
CO5**:** Demonstrate the basic theorems and properties of Lattices and Boolean Algebra.

TEXT BOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2011.
2. Tremblay J.P. & Manohar.R,"Discrete Mathematics Structures with Application to Computer Science", 1st Edition, Tata McGraw Hill Publication Ltd., New Delhi, 30th reprint 2011.
3. Liu C.L, Mohapatra D.P, "Elements of Discrete Mathematics: A computer oriented approach", 4th Edition, Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Grimaldi.R.P.,"Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Koshy, "Discrete Mathematics with Applications", 1st Edition, Elsevier Publications, 2006.
3. Bernard Kolman, Robert C Busby, Sharon Cutler Ross, "Discrete Mathematical Structures", 3rd Edition, Prentice Hall, New Delhi, 2015.

21EC201	DIGITAL PRINCIPLES AND SYSTEM DESIGN *(Common to B.E CSE /B.Tech.IT /B.E ECE)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the digital fundamentals, Boolean algebra and its applications in digital systems.
- To model combinational digital circuits using logic gates.
- To develop synchronous sequential circuits.
- To solve asynchronous sequential circuits.
- To summarize the various semiconductor memories

UNIT I	DIGITAL FUNDAMENTALS	9

Number systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map minimization, NAND and NOR implementations.

UNIT II	COMBINATIONAL CIRCUIT DESIGN	9

Design of Half and Full adders, Half and Full subtractors, Binary parallel adder – Carry look ahead adder, BCD adder, Multiplexer, Demultiplexer, Magnitude comparator, Decoder, Encoder and Priority Encoder.

UNIT III	SYNCHRONOUS SEQUENTIAL CIRCUITS	9

Flip flops – SR, JK, T, D, Master / Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - state minimization, state assignment, circuit implementation – Design of Counters- Ripple counters, Ring counters, Shift registers and Universal shift register.

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits.		
UNIT V	**MEMORY DEVICES AND VERILOG PROGRAMMING**	**9**
Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. Design of half adder, full adder, flip flops and counters using Verilog.		
		TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Make use of minimization techniques to simplify Boolean algebraic equations.

CO2: Build various combinational circuits using logic gates.

CO3: Develop synchronous sequential circuits using flip flops.

CO4: Build asynchronous sequential circuits using flip flops.

CO5: Explain various semiconductor memories and programmable logic devices.

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", 6th Edition, Pearson Education, 2017.
2. S.Salivahanan and S.Arivazhagan, "Digital Electronics", 1st Edition, Vikas Publishing House pvt Ltd, 2012.
3. Soumitra Kumar Mandal, "Digital Electronics", 2nd Edition, McGraw Hill Education Private Limited, 2016.

REFERENCES:

1. Charles H.Roth, "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
3. A.Anand Kumar, "Fundamentals of Digital Circuits", 4thEdition, PHI Learning Private Limited, 2016.

21CS201	**COMPUTER ORGANIZATION AND ARCHITECTURE** *(Common to B.E.CSE./ B.Tech.IT)*	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To explain the basic organization and operation of computer system.
- To discuss the Arithmetic and logical unit
- To describe the building of data path with the basic concept of pipelining
- To illustrate the parallelism and multi-core processors
- To demonstrate hierarchical memory system and I/O technologies.

UNIT-I	**BASIC ORGANIZATION OF COMPUTER SYSTEM**	**9**
Functional Units – Basic Operational Concepts – Performance – Instructions – operations and operands of a computer hardware– representing instructions – Logical operations – Decision making – Addressing and addressing modes.		
UNIT-II	**ARITHMETIC FOR COMPUTERS**	**9**
Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations		
UNIT-III	**PROCESSOR AND CONTROL**	**9**

Basic MIPS implementation – Building a Data path – Control Implementation scheme – Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.		
UNIT-IV	**PARALLELISM**	**9**
Parallel processing challenges – Flynn's classification –SISD,MIMD,SIMD,SPMD - Hardware multithreading – Multi-core processors - Message-Passing Multiprocessors		
UNIT-V	**MEMORY AND I/O ORGANIZATION**	**9**
Memory hierarchy – Memory technologies – Cache basics – Measuring and improving cache performance – Virtual memory – I/O Interface - Mode of Transfer - Programmed I/O, Interrupt –initiated I/O, DMA - Input/Output processors		
		TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, learners will be able to

CO1: Illustrate the basics structure of computers, operations and instructions.

CO2: Build arithmetic and logic unit to perform the arithmetic operations.

CO3: Utilize the data path to develop control unit.

CO4: Identify multithreading techniques to achieve parallelism.

CO5: Experiment with the performance of various memory and I/O technologies.

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", 5th Edition, Morgan Kaufmann / Elsevier 2014
2. Morris Mano, "Computer System Architecture", 3rd Edition, Prentice Hall of India,2017
3. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann, 5th Edition, Elsevier Publishers, 2012.

REFERENCES:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", 11th Edition, Pearson Education, 2019.
2. John P. Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hill, 2012.
3. Govindarajulu B"Computer Organization and Architecture"2nd Edition ,Tata McGraw Hill,2014

21CS202	**DATA STRUCTURES** *(Common to B.E.CSE/B.Tech.IT)*	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To explain the concepts of ADTs
- To describe linear data structures like lists, stacks and queues
- To illustrate nonlinear data structures like trees and graphs
- To demonstrate advanced nonlinear data structures and hashing.
- To develop skills to apply appropriate data structure concept in problem solving.

UNIT-I	**LINEAR DATA STRUCTURES – LIST**	**9**
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation — Singly linked lists- Circularly linked lists- Doubly-linked lists – Applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).		
UNIT-II	**LINEAR DATA STRUCTURES – STACKS, QUEUES**	**9**

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQue – applications of queues.		
UNIT-III	**NON LINEAR DATA STRUCTURES – TREES**	**9**
Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree.		
UNIT-IV	**ADVANCED NON LINEAR DATASTRUCTURES&HASHING**	**9**
Red-Black trees – Splay trees –Heap-Application of Heap-Binomial Heaps – Fibonacci Heaps. Hashing-Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.		
UNIT-V	**NON LINEAR DATA STRUCTURES – GRAPHS**	**9**
Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.		
		TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build abstract data types for linear data structures.

CO2: Make use of the different linear data structures for problem solving.

CO3: Select nonlinear tree data structures to resolve computing problems.

CO4: Utilize advanced nonlinear data structure and hashing for solving problems.

CO5: Infer data using graph structure and apply their algorithms for problem solving.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2010.
2. Reema Thareja, "Data Structures Using C", 2nd Edition , Oxford University Press, 2011
3. Allen B Drowney "Think Data Structures", 1st Edition,O'Reilly,2017

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 2nd Edition, McGraw Hill, 2002.
3. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", 1st Edition, Pearson Education, 1983.

21CS203	**OBJECT ORIENTED PROGRAMMING** *(Common to B.E.CSE /B.Tech.IT)*	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To describe basic java programming constructs, classes, methods and inheritance.
- To develop application using exception handling concepts and strings
- To demonstrate threading and I/O concepts in java applications
- To illustrate generics and collections for solving programming problems.
- To build interactive applications using java swings and database connectivity

UNIT-I	**INTRODUCTION TO OOPS AND JAVA**	**12**
Basic OOPs concepts –Characteristics of Java- Data types , Variables and Arrays-Classes – constructors, methods – Inheritance- Packages –Abstract classes - Interfaces-Inner Classes		
UNIT-II	**EXCEPTION HANDLING AND STRINGS**	**7**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements ,Object Class- Strings-String Comparison-String Methods-String buffer-String Tokenizer		
UNIT-III	**MULTITHREADING AND INPUT/OUTPUT**	**8**
Multi-threading Vs Multitasking-Java Thread model- Creating single and Multiple threads-Thread Methods- Synchronization- Inter thread Communication ,Input / Output Basics – Reading and Writing Console – Reading and Writing Files		
UNIT-IV	**EVENT DRIVEN PROGRAMMING AND DATABASE CONNECTIVITY**	**9**
Event handling Mechanisms-Event classes- Event Interfaces- Using Delegation event Model- Adapter classes- -Introduction to Swing –Swing Frames - Swing Components – Text Fields , Text Areas – Buttons-Check Boxes – Radio Buttons – Lists-Menus – layout management- Dialog Boxes-Connectivity to Databases- Drivers- DDL and DML operations		
UNIT-V	**GENERICS AND COLLECTIONS**	**9**
Generic Programming – Generic classes – generic methods – Bounded Types -Collections-Collection Interfaces-Collection Classes-Accessing a Collection – Arrays -ArrayList-– Map HashMap		
		TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop programs using basic java concepts.

CO2: Prepare java applications employing exception handling and strings

CO3: Construct java applications adopting thread and I/O concepts.

CO4: Solve java programming problems by incorporating Generics and collections.

CO5: Build GUI for java applications with database connectivity.

TEXT BOOK:

1. Herbert Schildt," Java The Complete Reference", 11th Edition, McGraw Hill Education, 2019
2. Paul Deitel, Harvey Deitel,," Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
3. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013

REFERENCES:

1. DT Editorial Services, "Java 8 Programming Black book", 1st Edition, Dreamtech press, 2015.
2. Joshua Bloch, "Effective Java",2nd Edition ,Pearson's Education,2016
3. Allen B. Downey, Chris Mayfield, "Think Java",2nd Edition,O'Reilly,2017

21EC212	DIGITAL SYSTEMS LABORATORY *(Common to B.E CSE / B.Tech.IT/ B.E. ECE)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To explain the various basic logic gates.
- To develop and implement the various combinational circuits.
- To model and implement combinational circuits using MSI devices.
- To build and implement sequential circuits.

- To develop code using HDL programming.

LIST OF EXPERIMENTS:

1. Verification of Boolean theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions and code converters.
3. Design and implement Half/Full Adder and Subtractor.
4. Design and implement combinational circuits using MSI devices:
   - 4 – bit binary adder / subtractor
   - Parity generator / checker
   - Magnitude comparator
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Design and implement asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the basic working principles of logic gates.
CO2: Build simplified combinational circuits using basic logic gates.
CO3: Model combinational circuits using MSI devices.
CO4: Develop sequential circuits like registers and counters.
CO5: Solve combinational and sequential circuits using HDL.

21CS204	DATA STRUCTURES LABORATORY *(Common to B.E.CSE/B.Tech.IT)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To demonstrate linear and non-linear data structures and their implementations.
- To describe the different operations of search trees.
- To compare various techniques of hashing.
- To illustrate graph traversal algorithms.
- To develop applications using different data structures.

LIST OF EXPERIMENTS

1. Implementation of Singly Linked List
2. Implementation of Doubly Linked List
3. Application of Linked List
4. Implementation of Stacks
5. Implementation of Queues
6. Application of Stack
7. Implementation of Tree Traversal
8. Implementation of Binary Search tree
9. Implementation of Balanced Tree
10. Create a hash table using open addressing with the following operations:

11. Implementation of Graph traversal Algorithms
12. Mini Project

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop functions for implementing linear data structures.
CO2: Make use of the different linear data structures for computational problem solving.
CO3: Build functions for implementing nonlinear tree data structures.
CO4: Choose appropriate hashing functions for collision free data storage and retrieval.
CO5: Utilize graph structure for manipulating data and problem solving.

21CS205	OBJECT ORIENTED PROGRAMMING LABORATORY *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To describe basic java programming constructs, classes, methods and inheritance.
- To develop application using exception handling concepts and strings
- To demonstrate threading and I/O concepts in java applications
- To illustrate generics and collections for solving programming problems.
- To build interactive applications using java swings and database connectivity

LIST OF EXPERIMENTS

1. Arrays and Classes
2. Inheritance and Interfaces
3. Packages and Strings
4. Exception handling
5. Multithreading
6. Thread Synchronization
7. File I/O
8. Generic Programming
9. Collections
10. Event driven Programming
11. Database connectivity
12. Mini project

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Develop programs using basic java concepts.
CO2: Prepare java applications employing exception handling and strings
CO3: Construct java applications adopting thread and I/O concepts.
CO4: Solve java programming problems by incorporating Generics and collections.
CO5: Build GUI for java applications with database connectivity.

SEMESTER-IV

21MA205	STOCHASTIC PROCESS AND ITS APPLICATIONS *(Common to B.E. CSE / B.Tech. IT)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To discuss the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To explain the basic probability concepts with respect to two dimensional random variables
- To make use of the basic concepts of random processes which are widely used in IT fields.
- To experiment the significance of advanced queuing models.
- To identify the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering

UNIT I	RANDOM VARIABLES	15

Discrete and Continuous random variables-Moments-Moment Generating Function-Discrete Probability Distribution (Binomial , Poisson & Geometric) - Continuous Probability Distribution (Uniform, Exponential, Normal, Weibull & Gamma)

UNIT II	TWO DIMENSIONAL RANDOM VARIABLES	15

Joint Distributions-Marginal and Conditional Distributions-Covariance-Correlation and Linear Regression.

UNIT III	RANDOM PROCESSES	15

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV	QUEUEING MODELS	15

Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms - Finite source models - M/G/1 queue – Pollaczek Khinchin formula.

UNIT V	NETWORKS, SERIES AND CYCLIC QUEUES	15

Series queues - Open Jackson networks - Closed Jackson networks - cyclic queues - extension of Jackson networks – Non Jackson networks.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply the basic concepts of Random variables and standard discrete and continuous distributions.

CO2: Calculate the correlation and regression of two dimensional random variables.

CO3 :Construct the functions of time when the probability measure is associated through random Process.

CO4: Develop the knowledge of various queueing models.

CO5: Solve the given network (open) problem using the suitable techniques.

TEXT BOOKS:

1. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Academic Press, 2014.

2. Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", 4th Edition, Wiley & Sons, 2004.

3. John.F.Shortle, James M.Thompson, Donald Gross "Fundamentals of Queueing Theory", 5th Edition, Wiley Series, 2018.
4. Sheldon M.Ross, "Introduction to Probability Models". 11th Edition, Academic Press, 2014.

REFERENCES:
1. Robertazzi, "Computer Networks and Systems: Queueing Theory and performance evaluation", 3rd Edition, Springer, 2006.
2. Taha. H.A., "Operations Research", 8th Edition, Pearson Education, Asia, 2007.
3. Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, 2004.
5. Yates. R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

21CS206	DATA BASE MANAGEMENT SYSTEM *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the fundamentals of data models and to represent a database system.
- To describe the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To illustrate the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To demonstrate Storage and Query processing Techniques.
- To develop a solutions to the real time problems using NoSQL.

UNIT I	RELATIONAL DATABASES	9

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 – PL/SQL, Triggers, Embedded SQL– Dynamic SQL.

UNIT II	DATABASE DESIGN	9

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 – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV	IMPLEMENTATION TECHNIQUES	9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Query optimization using Heuristics and Cost Estimation.

UNIT V	NOSQL DATABASE	9

Introduction to NoSQL Database system – Classification of NoSQL Databases : Graph databases – key – value stores – document stores – NoSQL vs SQL – Limitations of NoSQL – Mongo DB document model .

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Build and manipulate relational database using Structured Query Language and relational languages
CO2: Prepare database using ER-Diagram for real time Applications.
CO3:Make use of Normalization techniques to reduce cost due to redundancy constraints
CO4:Illustrate different types of scheduling and recovery techniques for concurrent transactions
CO5:Construct data structures like indexes and hash tables for the fast retrieval of data and Validate the query evaluation plan

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan,," Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe," Fundamentals of Database Systems", 1st Edition, Pearson Education, 2011
3. Raghu Ramakrishnan, Database Management Systems‖, 4th Edition, McGraw-Hill College Publications, 2015

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan,," An Introduction to Database Systems",8th Edition, Pearson Education, 2006.
2. Elvis C Foster, "Database Systems-A pragmatic Approach"2nd Edition CRC Press,2016
3. G.K.Gupta,"Database Management Systems, 1st Edition, Tata McGraw Hill, 2011.

21CS207	DESIGN AND ANALYSIS OF ALGORITHM *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe about different types of computing problem algorithms and learn how to analyze its efficiency.
- To explain how computing problems are solved using brute force and divide and conquer methods.
- To demonstrate dynamic programming and greedy techniques for solving the problem.
- To construct iterative improvement method for problem solving.
- To illustrate backtracking, branch and bound techniques

UNIT-I	INTRODUCTION	9

Introduction to Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and Basic efficiency classes- - Mathematical analysis for Recursive and Non-Recursive algorithms-Example: Fibonacci Numbers

UNIT-II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9

Brute Force: Selection sort and Bubble sort-Sequential search and String Matching - Closest-Pair and Convex-Hull Problems-Exhaustive Search: Travelling Salesman Problem-Knapsack Problem- Assignment problem. Divide and Conquer: Binary Search-Merge sort – Quick sort- Multiplication of Large Integers – Strassen's Matrix Multiplication

UNIT-III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9
Dynamic programming: Coin-row problem, Computing a Binomial Coefficient –The Knapsack problem and Memory functions- Optimal Binary Search Trees – Warshall's and Floyd's algorithm. Greedy Technique: -Dijikstra's Algorithm - Huffman Trees and codes		
UNIT-IV	**ITERATIVE IMPROVEMENT**	**9**
The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem		
UNIT-V	**BACKTRACKING AND BRANCH &BOUND**	**9**
Backtracking: n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound: Assignment problem – Knapsack Problem – Travelling Salesman Problem – P,NP-Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem		
		TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1:Examine mathematically the notion of algorithm, asymptotic notations, and algorithmic efficiency with properties.

CO2: Discover the efficiency of algorithms of time and space complexity using brute force and divide and conquer strategies.

CO3: Inspect the time and space complexity of the algorithms designed using Dynamic Programming and Greedy techniques.

CO4: Identify various iterative improvement techniques for problem solving

CO5: Construct the best solution for the given problem using backtracking and Branch & Bound technique.

TEXT BOOKS:

1 .Anany Levitin,"Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.

2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.

3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", 3rd Edition, Pearson Education, Reprint 2006.

REFERENCES:

1. S. Sridhar," Design and Analysis of Algorithms" ,1st Edition, Oxford University Press,2015

2. I. Chandra Mohan," Design and Analysis of Algorithms" ,1st Edition, PHI Learning,2012

3. R.Pannerselvam, Design and Analysis of Algorithms,2nd Edition, PHI Learning,2016

21CS208	OPERATING SYSTEMS *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe the working of Assembler, Macro Processor, Loader and Linker.
- To explain Scheduling algorithms and Synchronization.
- To illustrate the concept of Deadlocks.
- To distinguish various memory management schemes.
- To demonstrate I/O management and File systems

UNIT-I	OVERVIEW OF SYSTEM SOFTWARE	9
Assemblers & Macro Processors: Simple Assembly Scheme, Pass Structure of assemblers, Macro Definition and Call, Macro Expansion, Nested Macro Calls, Linkers and Loaders: Introduction, Relocation and linking Concepts and Types of Loaders.		
UNIT-II	**OVERVIEW OF OPERATING SYSTEMS**	**9**
Introduction: Computer System Organization, Computer System Architecture, Operating System Operations. Operating System Structure: OS Services, System calls, Types of System Calls, Operating – System Structure, OS Generation and System Boot.		
UNIT-III	**PROCESS MANAGEMENT AND DEADLOCK**	**9**
Process Management: Process Synchronization. CPU Scheduling: Scheduling Criteria, Scheduling Algorithms. Deadlock: System Model, Characterization, Deadlock Detection, Deadlock Prevention, Deadlock Avoidance, Deadlock Recovery.		
UNIT-IV	**STORAGE MANAGEMENT**	**9**
Memory Management: Main Memory – Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Tables, Segmentation. Virtual Memory: Demand paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.		
UNIT-V	**FILE SYSTEMS AND I/O SYSTEMS**	**9**
Mass Storage System-Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, Swap-Space Management; File-System Interface-File Concept, Access Methods, Directory Structure, Directory Organization, File system mounting, File Sharing and Protection; File System Implementation-File System Structure, Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance ,Recovery: I/O Systems –I/O Hardware, Application I/O Interface, Kernel I/O subsystem, Streams and Performance.		
		TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Examine the elements with various data structures used in development of language processors.

CO2: Make use of process scheduling, deadlocks and synchronization concepts to develop solutions for Multi-programmed environment.

CO3: Compare and contrast various memory management schemes.

CO4: Discover the functionality of file systems and disk.

CO5: Distinguish various schemes for I/O Management and File Systems.

TEXT BOOKS:

1. Leland L.Beck," System Software - An Introduction to System Programming", 3rd Edition, Pearson Education, 2011.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
3. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2017.

REFERENCES:

1. D.M.Dhamdhere ," System Programming", Tata McGraw Hill", 2nd Revised Edition, 2011.
2. Andrew S. Tanenbaum, Albert S.WoodHull," Operating Systems, Design and Implementation", 3rd Edition, Prentice Hall, 2012.
3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau,"Operating Systems-Three easy pieces",2nd

Edition, Create Space Independent Publishing Platform,2020

21CS209	INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain HTML5 and CSS3 elements to create webpages
- To describe java scripts to build interactive webpages at client side.
- To demonstrate java servlets and JSP for building web application with client server communication
- To build dynamic web applications using PHP and AJAX
- To construct web application using web services and XML

UNIT-I	WEBSITE BASICS, HTML 5, CSS 3	9

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – HTML5 –Basic HTML Elements-Tables – Lists – Image – HTML5 control elements –Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Backgrounds – Border Images –Colors – Shadows – Text – Transformations – Transitions – Animations

UNIT-II	CLIENT SIDE SCRIPTING	9

Java Script: An introduction to JavaScript–Control Statements – Functions- Arrays- JavaScript alert, prompt and confirm – Objects - Events- Regular Expressions- Validation-JQuery-Syntax-Selectors -Events- Effects

UNIT-III	SERVER SIDE PROGRAMMING	9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling-Understanding Cookies- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code

UNIT-IV	PHP and AJAX	9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation-Regular Expressions - –Cookies - Connecting to Database. AJAX: Ajax Client Server Architecture-XML Http Request Object

UNIT-V	XML and WEB SERVICES	9

XML: Basic XML- Document Type Definition- XML Schema , XSL and XSLT Transformation Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Construct Web pages using HTML/XML and style sheets.

CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Prepare dynamic web pages using server side scripting.

CO4: Make use of PHP programming to develop web applications.

CO5: Develop web applications using AJAX and web services.

TEXT BOOKS:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", 5th Edition, Prentice Hall, 2011.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", 1st Edition, Pearson Education, 2011.
3. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009

REFERENCES:

1. Stephen Wynkoop and John Burke, "Running a Perfect Website", 2nd Edition. QUE, 1999.
2. Gopalan N.P. and Akilandeswari J., "Web Technology",1st Edition, Prentice Hall of India, 2011.
3. UttamK.Roy, "Web Technologies",1st Edition, Oxford University Press, 2011

21CS210	DATABASE MANAGEMENT SYSTEMS LABORATORY *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To explain data definitions and data manipulation commands
- To illustrate the use of nested and join queries
- To describe functions, procedures and procedural extensions of data bases
- To make use of a front end tool
- To construct the database applications

LIST OF EXPERIMENTS

1. Data Definition Language Commands
2. Data Manipulation Language Commands
3. Data Control Language Commands, Nested queries
4. Set Operators and Join Queries
5. Views, Sequences, Synonyms
6. Database Programming using PL/SQL
7. PL/SQL – Triggers
8. PL/SQL – Functions
9. PL/SQL – Procedures
10. PL/SQL – Cursors
11. Database Connectivity with Front End Tools
12. Document database creation using Mongo DB
13. Case Study using real life database applications

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will able to

CO1: Use data definition language commands and declare and enforce integrity constraints on a database.
CO2: Populate and query a database using simple SQL queries and complex SQL queries.
CO3: Make use of database objects such as views, sequences and synonyms using SQL.
CO4: Prepare database Triggers, stored procedures, stored functions and cursors using PL/SQL.
CO5: Construct Mongo DB for database creation.

21CS211	OPERATING SYSTEMS LABORATORY *(Common to B.E.CSE / B.Tech.IT)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To describe the process involved in Assembler, Macro Processor, Loader and Linker.
- To illustrate Process Creation and Inter Process Communication.
- To demonstrate Deadlock Avoidance and Deadlock Detection Algorithms
- To explain Page Replacement Algorithms
- To discuss File Organization and File Allocation Strategies

LIST OF EXPERIMENTS

1. Implementation of Single Pass Assembler.
2. Implementation of Multi Pass Assembler.
3. Given the list of processes, their CPU burst times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
4. Given the list of processes, their CPU burst times display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Implement the Producer – Consumer problem using semaphores.
6. Developing Application using Inter Process Communication (using shared memory, pipes or message queues.
7. Implementation of Deadlock Avoidance using Bankers algorithm.
8. Implementation the following Memory Allocation Methods for fixed partition
   i. a) First Fit b) Worst Fit c) Best Fit
9. Implement the Paging Technique of Memory Management.
10. Implement the following Page Replacement Algorithms
    a) FIFO b) LRU c) Optimal
11. Implement the following File Allocation Strategies
    a) Sequential b) Indexed c) Linked
12. Implement Disk Management using Algorithms such as FCFS, SSTF, SCAN and C- SCAN.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop the programs on Assembler, Macro Processor, Loader and Linker

CO2:Make use of Scheduling Algorithms such as FCFS, SJF , Priority and Round Robin to schedule a given set of processes.

CO3: Utilize Banker's Algorithm for Deadlock avoidance.

CO4: Infer Solutions to Critical Section Problem using Semaphores.

CO5: Compare the performance of the various Memory management techniques.

21CS212	INTERNET PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To explain HTML5 and CSS3 elements to create webpages
- To describe java scripts to build interactive webpages at client side.

- To demonstrate java servlets and JSP for building web application with client server communication
- To build dynamic web applications using PHP and AJAX
- To construct web application using web services and XML

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML
   i. To embed an image in a web page
   ii. To fix the hot spots in that image
   iii. Show all the related information when the hot spots are clicked.
2. Create a web page with the following
   i. Cascading style sheets.
   ii. Embedded style sheets.
   iii. Inline style sheets..
3. Form validation using JavaScript.
4. Access and Modify web page using JQuery effects.
5. Write programs in Java using Servlets
   i. To invoke servlets from HTML forms
   ii. Session tracking using hidden form fields and cookies
6. Write programs in Java to create three-tier applications using servlets. Assume that the information is available in a database server.
7. Server side programs using JSTL.
8. i. Validate the form using PHP regular expression.
   ii. Creating AJAX application using PHP and MYSQL
9. i. Validating XML using XML Schema
   ii. Transforming XML using XSL and XSLT
10. Creating, publishing and testing web services

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Construct Web pages using HTML/XML and style sheets.

CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Prepare dynamic web pages using server side scripting.

CO4: Make use of PHP programming to develop web applications.

CO5: Develop web applications using AJAX and web services.

SEMESTER-V

21CS301	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To demonstrate the different types of finite automata and regular languages.
- To recognize the context free grammars
- To describe about push down automata.
- To illustrate the working of Turing machines

- To make use of Decidability and Un-decidability of various problems.

UNIT-I	**AUTOMATA FUNDAMENTALS**	**7**

Chomskian Hierarchy-Introduction to Automata Theory-Alphabets, Strings and Languages, Finite Automata- Deterministic finite Automata (DFA)-Nondeterministic finite Automata (NFA)-Finite Automata with epsilon transition.

UNIT-II	**REGULAR EXPRESSIONS AND LANGUAGES**	**11**

Operation of regular expression and their precedence-Finite Automata and Regular expression-DFA to Regular Expression-Regular expression to Finite Automata-Algebric laws of Regular Expression- Pumping Lemma for regular Languages, Closure properties of Regular Languages-Equivalance and Minimization of Finite Automata.

UNIT-III	**CONTEXT FREE GRAMMAR AND LANGUAGES**	**9**

Context Free Grammar-Parse tree-Ambiguity in Grammar and Language- Simplification of CFGs- Normal forms for CFGs – Chomsky Normal Form,Greibach Normal Form- Closure properties of CFLs-Pumping lemma for CFLs.

UNIT-IV	**PUSHDOWN AUTOMATA AND LINEAR BOUNDED AUTOMATA**	**9**

PUSH DOWN AUTOMATA (PDA): Definition of PDA- Language of PDA-Equivalence of PDA and CFG-Deterministic PDA.

LINEAR BOUNDED AUTOMATA (LBA):Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

UNIT-V	**TURING MACHINES AND UNDECIDABILITY**	**9**

Turing Machine-Programming Techniques for TM, Variations of TM- Universal TM.

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem.

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Construct finite automata to recognize the patterns for the real world problems.

CO2:Make use of algebraic laws and properties to write a regular language

CO3:Simplify the context free grammar by applying normal forms

CO4: Construct Pushdown automata and linear bound automata for the given Language.

CO5: Examine the suitable programming techniques for the construction of Turing Machine.

TEXT BOOKS:

1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008.
2. John C Martin, "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
3. Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", 3rd Edition, Prentice Hall of India, 2007.

REFERENCES:

1. Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.
2. Peter Linz, "An Introduction to Formal Language and Automata", 3rd Edition, Narosa Publishers, New Delhi, 2016.
3. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation",1st Edition, Pearson Education 2009

21MCCS01	CONSTITUTION OF INDIA	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- To explain the basic features and fundamental principles of Constitution of India.
- To explain the salient features and characteristics of the Constitution of India
- To explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers
- To explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India
- To explain the Local Self Government – Constitutional Scheme in India

TOPICS TO BE COVERED

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India.
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India.

CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status.

CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India.

CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions.

CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.

TEXT BOOKS:

1. Durga Das Basu,"Introduction to the Constitution of India", LexisNexis Butterworth's Wadhwa, 20th Edition, Reprint 2011.
2. Web link: https://www.india.gov.in/my-government/ constitution-India.

21CS302	COMPUTER NETWORKS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To describe the Network Architecture and the performance metrics of switched networks.
- To demonstrate the various Link layer services.
- To explain the concepts of subnetting and routing mechanisms.
- To illustrate the process-to-process delivery models and congestion control principles.
- To summarize the services of various protocols in Application layer.

UNIT-I	INTRODUCTION AND PHYSICAL LAYER	9

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT-II	DATA LINK LAYER	9

Introduction – Link-Layer Addressing – Error Detection and Correction– DLC Services-Framing –Data Link Layer Protocols – HDLC – PPP - Media Access Control –Random access- Wired LANs: Ethernet - Wireless LANs –IEEE 802.11- Connecting Devices.

UNIT-III	NETWORK LAYER	9

Network Layer Services– IPV4 Addresses-Classful Addressing-Classless Addressing-Dynamic Host Configuration Protocol (DHCP)- Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms and Protocols- IPV6 Addressing.

UNIT-IV	TRANSPORT LAYER	9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT-V	APPLICATION LAYER	9

World Wide Web and HyperText Transfer Protocol – File Transfer Protocol – Electronic Mail –Telnet – Secure Shell – Domain Name System – Simple Network Management Protocol.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Make use of various networking commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Design a topology using PCs and Switch with configuration of IP address and Observe the flow of data from host to host by creating network traffic.
3. Create a Network scenario and examine dynamically learning configured Switch MAC address table and ARP Cache table using simulation tool.
4. Simulation of Error correction and detection techniques.
5. Create a Network Scenario and assign subnet IP Addresses to various Network Devices and Verify the Connectivity using simulation tool.
6. Create a Network scenario with multiple routers and configure using RIP Routing in simulation tool.
7. Create a Network scenario with multiple routers and configure using OSPF Routing in simulation tool.
8. Create a Network scenario and generate the network traffic to examine the TCP/UDP communication using Simulation tool.

9. Implement the applications using TCP /UDP sockets like:
    - Chat
    - File transfer

10. Setting up DNS, HTTP, DHCP and E-mail server using simulation tool.

TOTAL:75 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Make use of evaluation metrics to measure the performance of packet switched network.

CO2: Utilize the Link layer services for various IEEE standards.

CO3: Experiment with subnetting to optimize network configuration and various routing algorithms for unicast routing.

CO4: Choose protocols for Process to Process communication in various application.

CO5: Utilize application layer protocols for real time Scenario.

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, Tata McGraw Hill, 2017.
2. William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education, 2022.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann Publishers Inc., 2017.

REFERENCES:

1. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2015.
2. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2022
3. Mulayam Singh, "CISCO PACKET TRACER LABS: Best practice of configuring or troubleshooting Network", 1st Edition, BookRix, 2019.

21CS303	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To infer knowledge in various search algorithms for problem solving.
- To relate uncertainty in causal networks through probabilistic reasoning.
- To extend the knowledge representation in solving AI based problems.
- To contrast the knowledge in supervised Machine learning algorithms
- To demonstrate unsupervised Machine learning algorithms and ensemble techniques.

UNIT-I	PROBLEM SOLVING	9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

UNIT-II	PROBABILISTIC REASONING	9

Acting under uncertainty – Bayesian inference – Naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks

UNIT-III	KNOWLEDGE REPRESENTATION	9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining - Backward Chaining –Resolution– Knowledge Representation - Ontological Engineering - Categories and Objects – Events -

Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

UNIT-IV	SUPERVISED LEARNING	9

Introduction to machine learning – Linear Regression Models -Least squares - single & multiple variables- Bayesian linear regression- gradient descent- Linear Classification Models- Discriminant function – Probabilistic discriminative model - Logistic regression - Probabilistic generative model – Naive Bayes- Maximum margin classifier – Support vector machine - Decision Tree - Random forests

UNIT-V	UNSUPERVISED LEARNING AND ENSEMBLE TECHNIQUES	9

Unsupervised learning - K-means - Instance Based Learning –KNN - Gaussian mixture models and Expectation maximization-Combining multiple learners- Model combination schemes – Voting- Ensemble Learning – bagging -Boosting – stacking

45 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Create the Tic-Tac-Toe game using any adversarial searching algorithm.
2. Design the Towers of Hanoi problem using search algorithms.
3. Create the environment for probabilistic inference using a Bayesian network.
4. Design a program using naïve Bayesian classifier for a sample training data set stored as a .CSV file.
5. Model the Greedy Best-First and A* search algorithms in generic ways.
6. Design a program in k-Nearest Neighbour algorithm to classify the iris data set.
7. Model the K-Means Algorithm for Colour Compression.
8. Create Linear Regression models using Python
9. Model the Decision Trees for data classification, using the real-time data set.
10. Design data classification for the real-time data set using Support Vector Machine

TOTAL :75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Choose appropriate search algorithms for AI based problems.
CO2: Make use of reasoning under uncertainty in Bayesian networks.
CO3:Utilize first order and predicate logic to solve AI based problems
CO4: Identify and apply Supervised Machine Learning algorithms to solve real world problems.
CO5: Build classifier models using Machine Learning algorithms for unstructured data.

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education,2021
2. Ethem Alpaydin,"Introduction to MachineLearning",4th Edition,MIT Press,2020.
3. Saikat Dull, S. Chjandramouli, Das, "Machine Learning ",1st Edition, Pearson,2018

REFERENCES:

1. Kevin Night,Elaine Rich,andNairB., "Artificial Intelligence",3rd Edition, McGraw Hill,2017
2. Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, "Foundations of Machine Learning", 2nd Edition, MIT Press, 2018.
3. Deepak Khemani,"Artificial Intelligence", 2nd Edition, Tata McGraw Hill Education,2013

21CS304	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To describe the knowledge wider in Software engineering concepts and engineering Process.
- To build Software Engineering Development Activities for efficient software systems.
- To familiarize using UML modeling to articulate complex ideas succinctly and precisely.
- To explain the importance of testing through various testing activities.
- To choose various project management techniques to maintain quality assurance.

UNIT - I	INTRODUCTION TO SOFTWARE ENGINEERING	9

Software Engineering- Software Engineering As A Branch Of The Engineering Profession- Stakeholders In Software Engineering-Software Quality- Software Engineering Projects - Activities Common To Software Projects

UNIT – II	SOFTWARE ENGINEERING DEVELOPMENT ACTIVITIES	9

Requirements Elicitation -Analysis -Types Of Requirements - Types Of Requirements Document- System Design -Object Design - Implementation –Testing.

UNIT – III	MODELING WITH UML	9

Introduction -An Overview Of UML -Use Case Diagrams- Class Diagrams Interaction Diagrams- State Machine Diagrams -Activity Diagrams

UNIT – IV	TESTING	9

Introduction: Testing The Space Shuttle - An Overview Of Testing - Testing Concepts - Faults, Erroneous States, And Failures - Test Cases - Test Stubs And Drivers - Corrections - Testing Activities - Component Inspection -Usability Testing - Unit Testing - Integration Testing - System Testing - Managing Testing .

UNIT – V	MANAGING THE SOFTWARE PROCESS	9

Project Management-Software Process Models -Cost Estimation -Building Software Engineering Teams -Project Scheduling And Tracking -Contents Of A Project Plan -Difficulties And Risks In Project Management.

45 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Develop a SRS document for an application.
2. Develop the Use Case model for an application.
3. Develop an UML Activity diagram by Identifying the business activities.
4. Identity the conceptual classes to develop a refinement domain model for an application.
5. Build the Interaction diagram for a scenario by identifying suitable objects.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Develop Component and Deployment diagrams for an application.

TOTAL:75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to :

CO1: Illustrate the fundamental concepts of software engineering to build software projects

CO2. Develop SRS document for a real-time application

CO3. Identify various Modeling with UML diagrams based on software requirements to construct UML Diagrams

CO4. Examine key techniques involved in testing the software based on requirements

CO5.Examine various software development process and requirement management techniques

TEXT BOOKS:

1. Bernd Bruegge,Allen H.Dutoit,"Object-Oriented Software Engineering Using UML, Patterns, and Java", 3rd Edition, Pearson Education 2018.
2. Roger Pressman, "Software Engineering: A Practitioner's Approach", 7th Edition, McGraw-Hill, 2020.
3. Ian Sommerville, "Software Engineering", 9th Edition, Addison-Wesley, 2016

REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning Publications 2020.
2. G.P. Bherde Deven, N. Shah, "Object Oriented Software Engineering", 4th Edition,DreamTech Publisher 2010.
3. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Ph.D., Jim Conallen, Kelli A. Houston ,"Object-Oriented Analysis and Design with Applications",3rd Edition, Addison Wesley 2007.

SEMESTER- VI

21CS305	COMPILER DESIGN	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES:

- To describe the fundamental principles in compiler design.
- To construct lexical analyzer for the various programming language tokens.
- To discover the skills needed for building parser for the various programming Language grammatical constructs.
- To illustrate the runtime storage management and various storage organizations.
- To classify a modern high-level language to executable optimized target code.

UNIT-I	INTRODUCTION AND LEXICAL ANALYSIS	15

Introduction: Process of Compilation - Phases of Compiler - Grouping of Phases - Cousins of Compiler – Assemblers-Linkers-Loaders- Compiler Construction Tools

Lexical Analyzer: Role Of The Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition Of Tokens - Language For Specifying Lexical Analyzer

UNIT-II	SYNTAX ANALYSIS	15

Need and Role of the Parser - Context Free Grammars –Writing Grammars- Top Down Parsing - Recursive Descent Parser - Predictive Parser - Bottom Up Parsing - Shift Reduce Parser – Operator Precedence Parser LR Parsers -SLR, CLR And LALR Parsing Table –Error Recovery In Parsers - Syntax Analyzer Generators

UNIT-III	INTERMEDIATE CODE GENERATION	15

Syntax Directed Definitions - Construction of Syntax Tree - Intermediate Languages - Declarations - Assignment Statements - Arithmetic Expression Evaluation In Assignment Statements - Boolean Expressions - Case Statements - Back Patching- Procedure Calls

UNIT-IV	TYPE SYSTEM AND RUN-TIME ENVIRONMENT	15

Type Systems- Specification of a Simple Type Checker - Run-Time Environments: Source Language Issues-Storage Organization - Stack Allocation Space - Access to Non-Local Data on the Stack - Heap Management

UNIT-V	CODE OPTIMIZATION AND CODE GENERATION	15

Code Optimization: Principal Sources of Optimization - DAG - Optimization of Basic Blocks - Global Data Flow Analysis.
Code Generation: Issues in Design of a Code Generator – Simple Code Generator Algorithm -Register Allocation And Assignment - Generating Code From Dags

TOTAL :75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Construct the Deterministic Finite Automata and simulate using LEX Tool

CO2: Build a suitable parser for the Context free Grammar to validate the given inputs and simulate using YACC tool

CO3:Construct the semantics rules for the given context free grammar and generate the intermediate code for programming construct

CO4:Apply various types of local and global optimization techniques for the given Programming construct

CO5:Develop a target program for the given programming language construct

TEXT BOOKS:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2013.
2. Keith D. Cooper and Linda Torczon," Engineering a Compiler", 2nd Edition, Morgan Kaufmann Publishers Elsevier Science, 2012.
3. Des Watson," A Practical Approach to Compiler Construction", 1st Edition, Springer International Publishing, 2017.

REFERENCES:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", 1st Edition, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation, "1st Edition, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 1st Edition, Pearson Education, 2008.

21CS306	DATA SCIENCE	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the data science process and data exploration.
- To interpret the fundamentals mathematics required for data science.
- To demonstrate the usage of R programming for data science.
- To experiment with data wrangling.
- To choose the data visualization techniques for data interpretation.

UNIT-I	INTRODUCTION TO DATA SCIENCE	8

Introduction to data science: data science classification - data science algorithms - Data Science Process: prior knowledge -data preparation –modeling –application –knowledge -Data Exploration: objectives of data exploration –datasets -descriptive statistics.

UNIT-II	MATHEMATICS FOR DATA SCIENCE	11

Mathematical preliminaries: Probability - Descriptive Statistics – Correlation Analysis – Statistical Analysis: Statistical Distributions - Statistical Significance - Linear Algebra: The Power of Linear Algebra - Factoring Matrices - Eigenvalues and Eigenvectors - Eigenvalue Decomposition.

UNIT-III	PROGRAMMING FOR DATA SCIENCE	9

R programming fundamentals: Data Types and Variables – Operators - Conditional Statements – Loops - R script – Functions – Vectors – Data frames - Common R libraries for Data Science: Dplyr -Esquisse - Ggplot2 - Tidyr - Shiny – Caret - E1071 – Mlr.

UNIT-IV	DATA WRANGLING	8

Introduction to Data Wrangling – Benefits –Data Wrangling Tasks: Data Discovery - Data Structuring - Data Cleaning - Data Enriching - Data Validating - Data Publishing – Web Scraping – String processing.

UNIT-V	DATA VISUALIZATION	9

Introduction to data visualization: Data Visualization and Theory - Computational Statistics and Data Visualization–Visualizing data distributions: Statistical visualizations – histograms - scatter plots - box plots – Data visualization in practice: Case studies.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Case study: Application of linear algebra in dimensionality reduction, correlation analysis and regression analysis of real-world data.
2. Case study: Outlier analysis on real-time data using probability and statistics.
3. Reading and pre-processing the given data using R programming.
4. To understand the nature of data through box-plot analysis using R programming.
5. Correlation analysis for feature selection using R programming.
6. Trend analysis through regression model using R programming.
7. Predictive analysis on health care data using R programming.
8. Prescriptive analysis on sales data using R programming.

TOTAL: 75 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Illustrate the data science process and data exploration.
CO2: Experiment with probability, statistics and linear algebra in data science applications.
CO3: Utilize R programming packages for real time data analysis.
CO4: Make use of data wrangling for different real world datasets.
CO5: Examine real-time data analysis using visualization techniques.

TEXT BOOKS:

1. Vijay Kotu, Bala Deshpande, "Data Science: Concepts and Practice", 2nd Edition, Elsevier Publications, 2019.
2. B. Uma Maheswari, R. Sujatha, "Introduction to Data Science: Practical Approach with R and Python", 1st Edition, Wiley, 2021.
3. Rafael A. Irizarry, "Introduction to Data Science Data Analysis and Prediction Algorithms with R", 1st Edition, Chapman & Hall, 2020.

REFERENCES:

1. Steven S. Skiena, "The Data Science Design Manual", Springer, 2017.
2. C.Chen, W.Hardle, A.Unwin, "Hand book of Data Visualization", Springer, 2008.
3. Roger D. Peng, "R Programming for Data Science",1st Edition , Leanpub, 2015.

21MCCS02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- To explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.
- To explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.
- To explain about the use of Traditional Knowledge to meet the basic needs of human being.
- To explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.
- To explain the use of Traditional Knowledge in Manufacturing and Industry.

UNIT-I TRADITIONAL AND MODERN KNOWLEDGE **3**

Two Worlds of Knowledge - Phase of Explorers, Sir Arthur Cotton and Irrigation, Smallpox Vaccination, Late Nineteenth Century, Voelcker, Howard and Agriculture, Havell and Indian Art; Indians at the Encounter - Gaekwad of Baroda and Technical Education, Science Education and Modern Industries, Hakim Ajmal Khan and Ayurveda, R. N. Chopra and Indigenous Drugs, Gauhar Jaan and Indian Classical Music; Linking Science and the Rural - Tagore's Sriniketan Experiment, Marthandam, the YMCA Model, Gandhi's Thoughts on Development, Nehru's View of Growth; Post- Independence Era - Modernization and Traditional Knowledge, Social Roots of Traditional Knowledge Activism, Global Recognition for Traditional Knowledge.

UNIT-II PROTECTION AND SHARING **3**

For Recognition and Protection - United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), International Labour Organization (ILO), UN Working Group on Indigenous Populations, Evolution of Other Organizations; Norms of Sharing - United Nations Environment Programme (UNEP), World Intellectual Property Organization (WIPO), World Trade Organization (WTO); IPR and Traditional Knowledge - Theoretical Background, Positive Protections of TK, Defensive Strategies, IPR Facilitation for TK.

UNIT-III TRADITIONAL KNOWLEDGE FOR BASIC NEEDS **3**

Indian Midwifery Tradition—The Dai System, Surface Flow Irrigation Tanks, Housing - A Human Right, Changing Priorities—Niyamgiri.

Biodiversity and Genetic Resources: Jeevani - The Wonder Herb of Kanis, A Holistic Approach - FRLHT, Basmati - In the New Millennium, AYUSH-Based Cosmetics.

UNIT-IV TRADITIONAL KNOWLEDGE IN MANUFACTURING **3**

Drug Discovery, A Sweetener of Bengal, The Sacred Ring of Payyanur, Channapatna Toys.

UNIT-V TRADITIONAL CULTURAL EXPRESSIONS **3**

Banarasi Saree, Music, Built and Tangible Heritage, Modern Yoga, Sanskrit and Artificial Intelligence, Climate Change and Traditional Knowledge.

TOTAL :15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.

CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.

CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being.

CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.

CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.

TEXT BOOKS:

1. Nirmal Sengupta "Traditional Knowledge in Modern India Preservation, Promotion, Ethical Access and Benefit Sharing Mechanisms" Springer, 2019.
2. Amit Jha,"Traditional Knowledge System in India", Atlantic Publishers and Distributors Pvt Ltd, 2009.
3. Basanta Kumar Mohanta, Vipin Kumar Singh "Traditional Knowledge System and Technology in India", Pratibha Prakashan, 2012.
4. Kapil Kapoor, Michel Danino "Knowledge Traditions and Practices of India", Central Board of Secondary Education, 2012.

WEB REFERENCES :

1. NPTEL video lecture on "Ayurvedic Inheritance of India", Video link: https://nptel.ac.in/courses/121/106/121106003/#.
2. Youtube video on "Introduction to Indian Knowledge Systems", Video link: https://www.youtube.com/watch?v=LZP1StpYEPM.
3. Youtube video on "12 Great achievements of Indian Civilization", Video link: https://www.youtube.com/watch?v=xmogKGCmclE.

21EN301	PROFESSIONAL COMMUNICATION LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To enhance effective communication skills that can lead to improved interpersonal relationships.
- To encourage and motivate students to set and achieve goals.
- To prepare students for an organized work life with confidence.
- To encourage students to participate in group discussion with positive attitude.
- To develop their confidence and help learners to attend interviews successfully.

UNIT I	COMMUNICATION AND PROFESSIONAL ETIQUETTES	6

Importance and Types of Communication Verbal communication -Presentation skills- Non-Verbal communication - Personal Appearance, Posture, Gestures, Facial Expressions, Eye Contact and Space Distancing - Professional Etiquettes.

UNIT II	GOAL SETTING AND MOTIVATION	6

Short term and Long term Goals- Strategies to set and achieve goals- Motivation.

UNIT III	TIME AND STRESS MANAGEMENT	6

Importance of Time - Time Management Skills - Sources of Stress - Managing Stress - Analysis of the Case Studies on time and stress management.

UNIT IV	GROUP DISCUSSIONS AND POSITIVE ATTITUDE	6

Group Discussions - Leadership Qualities - Decision Making - Problem Solving - Negotiation Skills - Positive Attitude.

UNIT V	RESUME MAKING AND INTERVIEW SKILLS	6

Preparing Resume - E-Resume - Covering Letter - Job Application through email - Career Portfolio -Types of Interviews - Mock Interviews.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Demonstrate effective communication skills through presentations.

CO2: Utilize their knowledge of motivation in setting and achieving goals.

CO3: Examine time and stress management.

CO4: Formulate their ideas into an effective communication in formal contexts.

CO5: Develop a well-composed resume and face interviews confidently.

TEXT BOOK:

1. Dhanavel S P, "English and Soft Skills", 1st Edition, Orient Black Swan Ltd, Hyderabad: 2012.
2. Dr.Tobin Porterfield and Bob Graham, "The 55 Soft Skills That Guide Employee and Organizational Success", Mason-West Publishing House, January, 2018.
3. Prashant Sharma, "Soft Skills Personality Development for Life Success", BPB Publications, New Delhi, January 2018.

REFERENCES:

1. M. Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hill Education Pvt. Ltd. New Delhi, 2016.
2. Mohan Krishna and Meera Banerji, "Developing Communication Skills", 1st Edition, Trinity Press, 2017.
3. N. Krishnaswami and T. Sriraman, "Creative English for Communication", 3rd Edition, Laxmi Publications Private Limited, 2017.

SEMESTER- VII

21CS401	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the foundation and challenges of distributed systems
- To infer the knowledge of message ordering and group communication
- To demonstrate the distributed mutual exclusion and deadlock detection algorithms.
- To predict the significance of check pointing and rollback recovery algorithms
- To summarize the characteristics of peer-to-peer and distributed shared memory systems

UNIT-I	INTRODUCTION	9

Introduction: Definition – Characteristics–Relation to computer system components –Motivation – Message-passing systems versus shared memory systems –Primitives for distributed communication – Synchronous versus asynchronous executions –Challenges of Distributed system: System Perspective. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts of a distributed computation.

UNIT-II	MESSAGE ORDERING AND GROUP COMMUNICATION	9

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order.

UNIT-III	DISTRIBUTED MUTEX & DEADLOCK	9

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification

UNIT-IV	**CHECKPOINTING AND ROLLBACK RECOVERY**	**9**

Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Koo–Toueg coordinated checkpointing algorithm – Juang–Venkatesan algorithm for asynchronous checkpointing and recovery.

UNIT-V	**P2P & DISTRIBUTED SHARED MEMORY**	**9**

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays –Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Types of memory consistency models

TOTAL: 45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Illustrate the models of communication in building a distributed environment
CO2: Interpret the order of message in communication network for synchronous and asynchronous system
CO3: Use the Mutex and Deadlock detection algorithm in real time application
CO4: Discover the issues of check pointing and rollback recovery mechanisms in distributed environment
CO5: Relate the features of peer-to-peer and memory consistency models for a given application.

TEXT BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2017
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", 2nd Edition ,Pearson Education, 2017.
3. Kshemkalyani, Ajay D, and Mukesh Singhal," Distributed computing: principles, algorithms, and Systems",1st Edition, Cambridge University Press, 2012.

REFERENCES: :

1. Liu M.L., "Distributed Computing, Principles and Applications", 4th Edition,Pearson Education, 2019.
2. Brendon Burns, "Designing Distributed Systems", OReilly Publication, 1st Edition, 2018
3. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", 1st Edition, Prentice Hall of India, 2012.

VERTICAL 1- DATA SCIENCE

21PCS01	DATA SCIENCE AND BIG DATA ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To illustrate the data science process and mathematics required for data science.
- To demonstrate Python programming for data analytics.
- To develop knowledge on analytic tools.
- To experiment NoSQL database.
- To choose the techniques for big data analytics.

UNIT-I	INTRODUCTION TO DATA SCIENCE	12

Data Science - Related Terminologies - Types of Analytics - Applications of Data Science - Data Science Process Model – Data Exploration - Mathematical preliminaries for Data Science: Probability – Statistics - Linear Algebra.

SUGGESTED ACTIVITIES:

- Case study-1: Outlier analysis on real-time data using probability and statistics.
- Case study-2: Application of linear algebra in dimensionality reduction, correlation analysis and regression analysis of real-world data.

UNIT-II	DATA ANALYTICS USING PYTHON	12

Introduction to Python- Data types and basic operators – Environment setup and essentials – Python libraries: NUMPY for mathematical essentials –Data manipulation using PANDAS – Data visualization by MATPLOTLIB.

SUGGESTED ACTIVITIES:

- Data pre-processing using PYTHON.
- Visualizing statistical analysis using PYTHON.

UNIT-III	DATA ANALYTICS – TECHNOLOGY AND TOOL	12

Map Reduce and Hadoop - Hadoop Framework, Understanding Map Reduce functions Analytics of Unstructured Data, Hadoop Eco System: PIG, HIVE, HBASE.

SUGGESTED ACTIVITIES:

- K-means clustering using Map Reduce.
- Setting up single node cluster in Hadoop to run word count application.

UNIT-IV	NOSQL DATA MANAGEMENT FOR BIG DATA	12

Introduction to NoSQL –RDBMS vs MongoDB - MongoDB: Introduction - Data types - MongoDB Query Language: Creating - Updating and deleing documents – Querying.

SUGGESTED ACTIVITIES:

- Creating and manipulating NOSQL database using MongoDB.

UNIT-V	TECHNIQUES FOR ANALYTICS	12

Defining big data analytics -Visual data analysis - Analytics techniques for decision making: Descriptive - Diagnostics - Predictive - Prescriptive–Case studies: Sentiment analysis - Health Care – Finance.

SUGGESTED ACTIVITIES:

- Prescriptive analysis on health care data using PYTHON.
- Predictive analysis on finance using PYTHON.

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Utilize probability, statistics and linear algebra for data science process and data exploration.
CO2: Make use of PYTHON for statistical data analytics on real world data applications.
CO3: Utilize Hadoop and Map Reduce technologies for huge data storage and management.
CO4: Experiment the NoSQL database using MongoDB.
CO5: Examine the variants of data analytic techniques to analyze the data of various domains.

TEXT BOOKS:

1. B. Uma Maheswari, R. Sujatha, "Introduction to Data Science: Practical Approach with R and Python", 1st Edition, Wiley, 2021.
2. Wes McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition, O'Reilly Media, Inc, 2017.
3. Rafael A. Irizarry, "Introduction to Data Science Data Analysis and Prediction Algorithms with R", 1st Edition, Chapman & Hall, 2020.

REFERENCES:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning", 1st Edition, TMH, 2019.
2. Steven S. Skiena, "The Data Science Design Manual", Springer, 2017.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 1st Edition, Wiley Publishers, 2015.

21PCS02	EXPLORATORY DATA ANALYSIS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe the methods and characteristics of data.
- To identify the relationship and groups among data.
- To demonstrate the characteristics of the data through statistical analysis.
- To summarize the concepts of building models from data.
- To examine and analyze the real time data.

UNIT-I	EXPLORING AND UNDERSTANDING DATA	12

Introduction: Sources of data – Process for making sense of data - Describing data: Variable types – Distribution of data – Hypothesis test – Preparing data tables: Cleaning the data – data type conversion – Combining variables – Unstructured data.

SUGGESTED ACTIVITIES:

- Hypothesis test for the given data using python/R.
- Data Pre-processing for the given data using python/R.

UNIT-II	RELATIONSHIPS AND GROUPS AMONG DATA	12

Understanding relationship: Exploring relationships between variables – Visualizing relationships – Understanding groups: Clustering - Association Rules - Learning Decision Trees from Data.

SUGGESTED ACTIVITIES:

- Association Rule Mining for the given data using python/R.
- Classification model generation using decision tree algorithm.

UNIT-III	EXPLORING THE DATA VISUALY	12

Principles of Analytic Graphics: Show comparisons - Show multivariate data - Exploratory Graphs: Characteristics of exploratory graphs – Boxplot – Histogram – Barplot – Scatterplots - Plotting Systems: The Base Plotting System - The ggplot2 System.

SUGGESTED ACTIVITIES:

- Statistical analysis for the given data using python/R.

UNIT-IV	BUILDING MODELS FROM DATA	12

Overview - Linear Regression - Logistic Regression - k-Nearest Neighbors - Classification and Regression Trees.

SUGGESTED ACTIVITIES:

- Trend analysis on numerical data using python/R.
- Classifier model building through logistic regression using python/R.

UNIT-V	CASE STUDIES	12

Data Analysis Case Study: Changes in Fine Particle Air Pollution – Credit card fraud detection – Trend analysis in stock market data.

SUGGESTED ACTIVITIES:

- Stock market data analysis

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Make use of modern tools to explore the data and its characteristics.

CO2. Illustrate the relationship and groups among the data for decision Making.

CO3. Experiment with the statistics and group the nature of the data.

CO4. Develop the data models using regression and classification techniques for real world data.

CO5. Complete appropriate analysis technique for solving the data.

TEXT BOOKS:

1. Glenn J. Myatt, Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining", 2nd Edition, Wiley, 2014.
2. Roger D. Peng, "Exploratory Data Analysis with R", 1st Edition, Leanpub, 2020.
3. Ronald K. Pearson,"Exploratory Data Analysis Using R", 1st Edition, CRC Press, 2018.

REFERENCES:

1. Brett Lantz, "Machine Learning with R", 2nd Edition, Packt Publishing, 2013.
2. Moro, P. Cortez and P. Rita. "A Data-Driven Approach to Predict the Success of Bank Telemarketing." Decision Support Systems, Elsevier, June 2014.
3. Steven S. Skiena, "The Data Science Design Manual", Springer, 2017.

21PCS03	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the theoretical foundations, algorithms and methodologies of neural network
- To experiment with different activation functions working in neural network.

- To design building blocks of deep learning models.
- To construct architectures and to train deep neural network.
- To utilize the practical knowledge in handling and analyzing real world applications

UNIT-I	INTRODUCTION TO NEURAL NETWORKS	12

Neural Networks: The Biological Neuron - The Perceptron - Multilayer Feed-Forward Networks. Training Neural Networks: Backpropagation Learning.

SUGGESTED ACTIVITIES: Implement XOR problem using Multilayer perceptron.

UNIT-II	ACTIVATION FUNCTIONS AND PARAMETERS	12

Activation functions, Loss Functions: Notation - Loss function for Reconstruction - Parameters Vs Hyperparameters

SUGGESTED ACTIVITIES: Estimate depth and width of Neural Networks

UNIT-III	INTRODUCTION TO DEEP NETWORKS	12

Defining Deep Learning - Common Architectural Principles of Deep Networks - Building Blocks of Deep Networks

SUGGESTED ACTIVITIES: Build CNN model for Handwritten Digit Recognition

UNIT-IV	ARCHITECTURES OF DEEP NETWORKS	12

Introduction to Convolutional Neural Networks (CNNs) - Recurrent Neural Networks - Recursive Neural Networks.

SUGGESTED ACTIVITIES: Develop a code to design object detection and classification using CNN

UNIT-V	APPLICATIONS	12

Large-Scale Deep Learning. Computer Vision- Speech Recognition- Natural Language Processing-Other Applications

SUGGESTED ACTIVITIES: Predict Sentiment for Movie Reviews Using Deep Learning

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1:Utilize different methodologies to create application using neural network

CO2: Make use of activation function and parameters to train the neural network

CO3: Experiment with working knowledge of deep learning models for solving problem

CO4: Identify appropriate deep learning models for analyzing the data for a variety of problems.

CO5: Build deep learning models for solving real world problems.

TEXT BOOKS:

1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach",1st Edition ,O'Reilly Media, 2017
2. Ian Goodfellow, YoshuaBengio, Aaron Courville," Deep Learning", 1st Edition, The MIT press, 2017
3. Bengio, Yoshua., "Learning deep architectures for AI. Foundations and trends in Machine Learning 2.1", 1st Edition, New Publishers, 2009

REFERENCES:

1. Nikhil Buduma and Nicholas Lacascio, "Fundamentals of Deep Learning", 1st Edition, O.Reilly, 2017.
2. Pradeep Pujari, Md. And Rezaul Karim, Mohit Sewak, "Practical Convolutional Neural Networks", 1st Edition, Packt Publishing, 2018.
3. Ragav Venkatesan and Baoxin Li, "Convolutional Neural Networks in Visual Computing (Data Enabled Engineering)", 1st Edition, CRC Press, 2017.

21PCS04	INFORMATION RECOMMENDER SYSTEMS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To identify the basic concepts of recommender systems.
- To describe different techniques of recommendation techniques.
- To discuss the performance evaluation of recommender systems based on various metrics.
- To indicate the advanced topics and current applications of recommender systems.
- To infer a simple recommender system using R.

UNIT-I	INTRODUCTION TO RECOMMENDER SYSTEMS	12

Introduction to Recommender system-Recommender System Function-Recommendation Techniques-Applications and Evaluation of recommendation systems-Issues with recommender system-Data Mining methods for Recommender System

SUGGESTED ACTIVITIES:

Construct the Similarity matrix for given application using R.

UNIT-II	COLLABORATIVE FILTERING	12

User-based nearest neighbor recommendation-Item-based nearest neighbor recommendation-Model based and pre-processing based approaches-Advances in Collaborative Filtering: Matrix Factorization model.

SUGGESTED ACTIVITIES:

Develop the model applicable for given application using R.

UNIT-III	CONTENT-BASED RECOMMENDATION	12

High level architecture of content-based systems-Advantages and drawbacks of content based filtering-State of art continent based system: Item Representation, Methods for user profiles-The role of user generated content in the recommendation.

SUGGESTED ACTIVITIES:

Identify the data ratings based on the customer feedback.

UNIT-IV	KNOWLEDGE BASED RECOMMENDATION	12

Introduction-Knowledge representation and reasoning-Interacting with constraint-based recommenders-Interacting with case-based recommenders-Developing constraint based recommenders.

SUGGESTED ACTIVITIES:

Choose the appropriate data set based on the similarity to evolve recommender models.

UNIT-V	HYBRID APPROACHES AND EVALUATION	12

Opportunities for hybridization-Monolithic hybridization design-Parallelized hybridization design –Pipelined hybridization design-Evaluation of Recommender System: Experimental Settings, Recommnedation System Properties-Recent Developments:Attackes on Collaborative recommender System

SUGGESTED ACTIVITIES:

Develop the recommender system using ITEM based collaborating filtering.

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Relate the basic knowledge of recommender systems for real world problems

CO2: Prepare the concepts of collaborative filtering for measuring the similarity

CO3: Make use of content based and knowledge based techniques for solving real world applications

CO4: Choose hybrid approaches for current applications to generate precise recommendations

CO5: Develop a simple recommender system using R programming

TEXT BOOKS:

1. Francesco Ricci · Lior Rokach · Bracha Shapira · Paul B. Kantor," Recommender Systems Handbook",3rd Edition,Springer,2022
2. Jannach D., ZankerM.and FelFering A., "Recommender Systems: An Introduction",1st Edition, Cambridge University Press,2011.
3. C.C. Aggarwal, Recommender Systems: The Textbook", Springer Edition, 2016.

REFERENCES:

1. Suresh K. Gorakala, Michele Usuelli ,"Building a Recommendation System with R", 1st Edition, Packt Publishing,2015
2. J. Leskovec, A. Rajaraman and J. Ullman, "Mining of massive datasets", 2nd Edition. Cambridge, 2012.
3. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems For Learning", 1st Edition, Springer, 2013

21PCS05	COMPUTER VISION ALGORITHMS AND APPLICATIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To outline the image processing foundations for computer vision
- To utilize the concepts of edge detection techniques
- To classify the methods of digital morphology
- To demonstrate three-dimensional motion and object recognition techniques
- To find the steps for detect and recognize the face and human gait analysis

UNIT-I	IMAGE PROCESSING FOUNDATIONS	12

Introduction- Elements of visual perception- Histogram Processing-Spatial Filters-Image Restoration and Reconstruction

SUGGESTED ACTIVITIES:

- Develop application to display grayscale image using read and write operation.

UNIT-II	EDGE-DETECTION TECHNIQUES	12

Edge Detection - Models of Edges- Noise- Template-Based Edge Detection- The Canny Edge Detector- The Shen-Castan (ISEF) Edge Detector- Color Edges.

SUGGESTED ACTIVITIES:

- Create application for Non Linear Filtering technique using edge detection

UNIT-III	DIGITAL MORPHOLOGY	12

Morph Grey-Level Morphology- Elements of Digital Morphology: Binary Operations, Binary Dilation, Binary Erosion, MAX, Color Morphology.

SUGGESTED ACTIVITIES:

- Create a vision program to implement the binary operations.

UNIT-IV	3D VISION AND MOTION	12

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus- 3D object recognition

SUGGESTED ACTIVITIES:

- Develop a program to determine the 3D shape from texture and 3D object detection.

UNIT-V	**APPLICATIONS**	**12**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape- human gait analysis.

SUGGESTED ACTIVITIES:

- Create an application to face detection and human gait actions.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to:

CO1: Demonstrate the image processing foundations for computer vision.
CO2: Make use of edge detection techniques for image segmentation and data extraction
CO3: Classify the elements of digital morphology techniques
CO4: Make use of 3D vision, motion for object recognition techniques
CO5: Develop applications to recognize the face and human gait analysis

TEXT BOOKS:

1. Rafael C.Gonzalez, Richard E.Woods," Digital Image Processing", 3rd Edition, Pearson, 2018.
2. J.R.Parker,"Algorithms for Image Processing and Computer Vision",2nd Edition, Wiley, 2019.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer 2022.

REFERENCES:

1. Jan Erik Solem,"Programming Computer Vision with Python: Tools and algorithms for analyzing images", 2nd Edition, O'Reilly Media, 2019.
2. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2018.
3. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", 2nd Edition, Cambridge University Press, 2018.

21PCS06	**IMAGE AND VIDEO ANALYTICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:

- To summarize the basic steps image processing system
- To demonstrate the feature extraction techniques
- To make use of methods on image retrieval and object recognition
- To explain the video enhancement and noise reduction
- To determine and demonstrate video analysis action recognition

UNIT-I	**IMAGE PROCESSING**	**12**

Basic steps of Image processing system – Pixel relationship- Image Transforms-. Image Enhancement- Image Segmentation.

SUGGESTED ACTIVITIES:

- Create a program for implement the Contrast-limited adaptive histogram equalization on medical images.

UNIT-II	**FEATURE EXTRACTION**	**12**

Feature Extraction - Binary object feature, Histogram-based (Statistical) Features, Intensity features, Shape feature extraction.

SUGGESTED ACTIVITIES:

- Create application for geometric and radiometric distortions of binary images.

UNIT-III	**OBJECT RECOGNITION AND IMAGE RETRIEVAL**	**12**

Object Recognition -Patterns and pattern class, Bayes' Parametric classification, Feature Selection and image retrieval.

SUGGESTED ACTIVITIES:

- Create a vision program to determine the edge detection of an image using different operators.

UNIT-IV	**DIGITAL VIDEO PROCESSING**	**12**

Digital Video, Sampling of video signal, Video Enhancement and Noise Reduction- Change Detection.

SUGGESTED ACTIVITIES:

- Develop an application for video enhancement and noise reduction.

UNIT-V	**VIDEO ANALYSIS ACTION RECOGNITION**	**12**

Video Analysis Action Recognition, Video based rendering, Context and scene understanding. Case Study: Surveillance.

SUGGESTED ACTIVITIES:

- Create a program for video action recognition in surveillance systems.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to:

CO1: Demonstrate the steps involved image processing system
CO2: Classify the feature extraction for real time applications.
CO3: Make use of the image retrieval and object recognition.
CO4: Demonstrate the video enhancement and noise reduction
CO5: Develop an applications in video analysis action recognition

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 4th Edition. Prentice-Hall, 2018.
2. A. Murat Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
3. Debjyoti Paul, Charan Puvvala,"Video Analytics Using Deep Learning",1st Edition, APress, 2020.

REFERENCES:

1. Oge Marques, "Practical Image and Video Processing Using MATLAB", 2nd Edition, Wiley-IEEE Press,2019
2. Yu Jin Zhang, "Image Engineering: Processing, Analysis and Understanding", 2nd Edition, Tsinghua University Press, 2015.
3. Francesco Camastra, Alessandro Vinciarelli,"Machine Learning for Audio, Image and Video Analysis",1st Edition, Springer, 2018.
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2019.

21PCS07	TEXT AND SPEECH ANALYSIS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe the basic need of Online Data Analysis.
- To indicate the text processing models involved in Text Mining.
- To build Text classification using supervised learning algorithms.
- To explain filters and transform methods in Speech Processing.
- To summarize various classification methods in Speech recognition.

UNIT-I	INTRODUCTION	12

Introduction –Approaches to Text Analysis – Analysis of Text as Social Information – Online Data sources – NGram viewer- Challenges and limitations of Online data Digital sources.

SUGGESTED ACTIVITIES:

- Implement Ngram viewer using Python.
- Text Preprocessing Using Python.

UNIT-II	TEXT PREPROCESSING	12

Lexical Resources – WordNet, Roget Thesaurus, Wikipedia –Basic Text Processing – Tokenization , Stop word Removal , Stemming and Lemmatization –Language Models –Text statistics – Advanced Text processing – Part of speech Tagging, Collocation identification.

SUGGESTED ACTIVITIES:

- Perform Text analysis using Voyant tool.

UNIT-III	TEXT CLASSIFICATION	12

Supervised Learning Algorithms – Regression , Decision Trees, Support vector Machines – Text Analysis Methods – Approaches, Plan and Qualitative Narrative Analysis – Sentimental Analysis

SUGGESTED ACTIVITIES:

- Sentiment analysis using Stanford's sentiment analysis.

UNIT-IV	SPEECH PROCESSING	12

Introduction – dimensions of Automatic Speech recognition – Digital signal processing –Digital filters - Discrete Fourier Transforms – Fast Fourier Transforms methods – relation between DFT and Digital filters

SUGGESTED ACTIVITIES:

- Speech processing using MatLab.

UNIT-V	SPEECH ANALYSIS	12

Feature Extraction – Pattern classification Methods – Minimum Distance Classifiers, Discriminant Functions, Generalized discriminators – Minimum Error classification –Bayes Classifier – Iterative Training : The EM Algorithm

SUGGESTED ACTIVITIES:

- Explore the Tool PRRAT for speech analysis.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Make use of Ngram viewer as a tool for text analysis.

CO2: Choose the available tools for text pre-processing.

CO3: Utilize Supervised classification algorithms to perform text classification.

CO4: Experiment with filter and Transformation methods for speech processing.

CO5: Select the appropriate Classification methods for pattern analysis.

TEXT BOOKS:

1. Gabe Ignatow,Rada mihalcea, "An Introduction to Text mining, Research Design, Data Collection and Analysis",1st Edition, SAGE Publications, 2018.
2. Brandon walsh, Sarah Horowitz," A course book on "Introduction to Text Analysis, License under Creative Commons Attribution-Non Commercial-ShareAlike 4.0", 1st Edition, International License. 2018.
3. Ben Gold, Nelson Morgan, Dan Ellis, "Speech and Audio Signal Processing", 2nd Edition, Willey Publications, 2011.

REFERENCES:

1. Cheng Xiang Zhai, Sean Massung, "Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining", 1st Edition, Morgan & Claypool Publishers, 2016.
2. Emil Hvitfeldt, Julia Silge, "Supervised Machine Learning for Text Analysis in R", 1st Edition , Chapman and Hall/CRC, 2021
3. Himanshu Mohan, Megha Yadav , "Speech Recognition System and its Application", 3rd Edition, LAP LAMBERT Academic Publishing.2019.

21PCS08	ESSENTIALS OF BUSINESS ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To discuss the concepts and methods of business analytics.
- To summarize the knowledge of organizational structures of business analytics.
- To infer the knowledge of descriptive analytics in business analytics.
- To identify the concept of predictive and prescriptive analytics in real world problems.
- To demonstrate the business analytics concepts in recent trends.

UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS	12

Business analytics-Terminology-Business Analytics Process-Relationship of Business Analytics Process and organization Decision making Process-Business Analytics Data-Business Analytics Technology

SUGGESTED ACTIVITIES:

Make use of analytics tool for health care analytics. (Case Study).

UNIT-II	ORGANIZATION STRUCTURES OF BUSINESS ANALYTICS	12

Organization Structures of Business analytics-Team management-Management Issues: Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

SUGGESTED ACTIVITIES:

Select the measures to determine the data set for health care analytics.

UNIT-III	**DESCRIPTIVE ANALYTICS**	**12**

Introduction, Visualizing and Exploring Data, Descriptive Statics, Sampling and Estimation, Introduction to probability Distributions.

SUGGESTED ACTIVITIES:

Develop the model using descriptive analytics for healthcare analytics.

UNIT-IV	**PREDICTIVE ANALYTICS**	**12**

Introduction to Predictive Modelling, Logic Driven Models, Data Driven Models, Data Mining: Simple illustration of Data Mining, Data Mining methodologies

SUGGESTED ACTIVITIES:

Develop and test predictive model for health care analytics.

UNIT-V	**PRESCRIPTIVE ANALYTICS**	**12**

Introduction to prescriptive modelling, Linear Optimization, Integer and Non Linear Optimizations, Optimization Analytics

SUGGESTED ACTIVITIES:

Develop the prescriptive model for health care applications.

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Discover the knowledge of business analytics to solve the business problems.

CO2: Choose the organizational structures for small business.

CO3: Make use of technical skills in descriptive analytics for real world problems.

CO4: Demonstrate the concept of predictive analytics and prescriptive analytics to establish best decision for the small business.

CO5: Develop data-driven solutions to support decision-making in real-world business situations.

TEXT BOOKS:

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M., "Starkey Business Analytics Principles,Concepts,and Applications with SAS:What,Why, and How",1st Edition, Pearson Education, 2014.
2. James Evans,"Analytics, Global Edition", 1st Edition, Pearson's Education, 2020.
3. JayLiebowitz ,"Business Analytics, An Introduction",1st Edition, Auer Bach Publications,2013

REFERENCES:

1. Randy Bartlett,"A Practitioner's Guide To Business Analytics: Using Data Analysis Tools to Improve Your Organization's Decision Making and Strategy", 1st Edition, McGraw Hill Professional, 2013.
2. Larissa T. Moss & Shaku Atr,"Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications", 1st Edition, Addition Wesley Technology Series, 2013.
3. S.Albright,Wayne Winston, "Business Analytics: Data Analysis &Decision Making",6th Edition, Cengage Learning, 2014.

VERTICAL 2-FULL STACK DEVELOPMENT

21PCS09	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the various ways to describe syntax and semantics of programming languages
- To interpret data, data types, and basic statements of programming languages
- To demonstrate the parameter passing and function call mechanisms
- To illustrate the object-orientation, concurrency, and event handling in programming languages
- To summarize knowledge about functional and logic programming paradigms

UNIT-I	SYNTAX, SEMANTICS AND BASIC STATEMENTS	12

Describing syntax & semantics: Introduction – The General Problem of Describing Syntax – Formal Methods of Describing Syntax – lexical analysis – The Parsing Problem – Recursive-decent parsing – Bottom-up parsing – Data Types: User-Defined Ordinal Types – Array Types – Record Types - Statement-level Control structures.

SUGGESTED ACTIVITIES:

Determine type compatibility rules of a C compiler, Determine the scope of variables having the same name and different names declared within a while / for loop.

UNIT-II	SUBPROGRAMS	12

Subprograms – Design Issues – Local referencing – Overloaded subprograms – Generic Subprograms – Design Issues for function.

SUGGESTED ACTIVITIES:

Devise a subprogram and calling code in which pass-by-reference and pass-by-value-result of one or more parameters produces different results.

UNIT-III	IMPLEMENTING SUBPROGRAMS	12

The general semantics of calls and returns – Implementing subprograms with Stack-Dynamic Local Variables – Nested Subprograms – Blocks – Implementing Dynamic Scoping.

SUGGESTED ACTIVITIES:

Chess / checkers game using object oriented programming – C++/Smalltalk / Python / Java, Design a Tic-tac-toe game that uses even driven programming concepts.

UNIT-IV	FUNCTIONAL PROGRAMMING	12

Introduction – Mathematical Functions - Fundamentals of Functional programming languages – Introduction to LISP – An Introduction to Scheme – Common LISP – F# - Error handling.

SUGGESTED ACTIVITIES:

Lisp recursive function to return 'nth' item from a list, diagonal of a matrix, sum of the diagonal of matrix & a sub-string from a string.

UNIT-V	LOGIC PROGRAMMING	12

Introduction – Logic Programming concept – Prolog – Theoretical Foundation: Clausal Form, Limitations, Skolemization - Logic Programming in Perspective.

SUGGESTED ACTIVITIES:

Prolog program to find the factorial of a number, simplification of arithmetic expression involving additive, multiplicative identity & solve Sudoku puzzle.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to:

CO1: Illustrate data types, functions, syntax and semantics of all programming languages
CO2: Classify the design of subprograms
CO3: Develop a dynamic subprograms
CO4: Examine the concepts of Functional Programming LISP and F#
CO5: Inspect Prolog Programming to solve logical problems

TEXT BOOKS:

1. Robert W. Sebesta, "Concepts of Programming Languages", 10th Edition, Addison Wesley, 2012
2. Michael L. Scott, "Programming Language Pragmatics", 3rd Edition, Morgan Kaufmann, 2009.
3. Allen B Tucker, and Robert E Noonan, "Programming Languages – Principles and Paradigms", 2nd Edition, Tata McGraw Hill, 2007.

REFERENCES:

1. Richard A. O'Keefe, "The Craft of Prolog", 1st Edition, MIT Press, 2009.
2. R. Kent Dybvig, "The Scheme Programming Language", 4th Edition, MIT Press, 2009.
3. W. F. Clocksin, C. S. Mellish, "Programming in Prolog: Using the ISO Standard", 5th Edition, Springer, 2003.

21PCS10	WEB TECHNOLOGY AND DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To apply HTML5 elements to create webpages
- To build interactive webpages at client side using CSS3
- To utilize java script for event handling and form validation
- To construct dynamic web applications using PHP
- To develop web application using AJAX and XML

UNIT-I **HTML5** **12**

HTML5: Heading, Linking, Images, Lists, Tables, internal linking- Form

SUGGESTED ACTIVITIES:

- Create Websites using HTML 5 tags
- Use Image maps in webpages

UNIT-II **CSS3** **12**

Inline Style sheet- Embedded Style Sheet- External Style Sheet- Positioning Elements: Absolute Positioning, z-index, Relative Positioning, span, Backgrounds, Box Model, Text Flow- Text Shadows, Box Shadows, Animations, Transitions and Transformations.

SUGGESTED ACTIVITIES:

- Design Websites using style sheets
- Create an attractive webpage for any product using Animations, transition and transformation

UNIT-III **JAVA SCRIPT** **12**

Prompt Dialogs – Control Statements – Functions- Arrays – Objects- DOM – Event Handling

SUGGESTED ACTIVITIES:

- Form validation using JavaScript
- Use Event handling and DOM to change content of any tags

UNIT-IV	PHP	12

PHP: Converting between data types, Arithmetic Operators, Arrays, Strings, Regular Expressions, Form Processing, Reading From Databases, Cookies

SUGGESTED ACTIVITIES:

- Validate the form using PHP regular expression.
- Create a web application that uses PHP and MySQL

UNIT-V	XML and AJAX	12

XML Basics – Structuring Data – XML Namespaces – DTD – XSLT transformation – Creating AJAX Applications using XML Http Request Object and JSON

SUGGESTED ACTIVITIES:

- Creating AJAX application using PHP a
- Transforming XML using XSL and XSLT

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Construct Web pages using HTML5.
CO2: Make use of CSS3 to create interactive webpages.
CO3: Build dynamic web pages with validation using Java Script objects.
CO4: Make use of PHP programming to develop web applications.
CO5: Construct web applications using XML and AJAX.

TEXT BOOKS:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", 5th Edition, Prentice Hall, 2011.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", 2nd Edition, Pearson Education, 2011.
3. Gopalan N.P. and Akilandeswari J., "Web Technology, Prentice Hall of India", 2nd Edition, 2011.

REFERENCES:

1. Stephen Wynkoop and John Burke,"Running a Perfect Website", 2nd Edition, QUE, 1999.
2. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3. UttamK.Roy, "Web Technologies," 2nd Edition, Oxford University Press, 2011.

21PCS11	CLOUD SERVICES MANAGEMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To enumerate the basic concepts of Cloud services.
- To demonstrate the IaaS with Amazon VPC.
- To illustrate the knowledge of PaaS and SaaS with Google App Engine.
- To summarize the concepts of Cloud security.
- To develop web services with AWS.

UNIT-I	CLOUD SERVICES - INTRODUCTION	12

Understanding Cloud computing – Developing Cloud services – Pros & cons of Cloud service Development, Types of Cloud services development – Cloud services development services and Tools – Cloud services for Everyone.

SUGGESTED ACTIVITIES:

- Explore online Calender Applications using cloud services.

UNIT-II	CLOUD SERVICE MODELS	12

Cloud Ecosystem – Cloud Design Objectives, Cost Model – Importance of Cloud Services- Infrastructure as a Service (Iaas) - Amazon VPC

SUGGESTED ACTIVITIES:

- Use GAE launcher to launch the web applications.

UNIT-III	PLATFORM & SOFTWARE SERVICE MODELS	12

Platform as a Service (PaaS) – Types of PaaS – PaaS Products (Google Cloud, Microsoft Azure, AWS) – Software as a Service (SaaS) – SaaS Applications – Characteristics of SaaS- benefits of SaaS and its Applications – Saleforce , Zoom.

SUGGESTED ACTIVITIES:

- Build a Serverless Web Application using Amazon Web services.

UNIT-IV	CLOUD SECURITY	12

Cloud security Risks – Privacy Impact Assesment – Operating system security – security of virtualization – Security risk posed by Shared images , Management OS

SUGGESTED ACTIVITIES:

- Use Xoar to achieve cloud security.

UNIT-V	CLOUD APPLICATION DEVELOPMENT	12

Amazon Web services: EC2 instances –Connecting clients – security rules – launching EC2, S3 and SQL services - Cloud-Based Simulation of a Distributed Trust Algorithm - A Trust Management Service

SUGGESTED ACTIVITIES:

- Use the AWS Management Console to launch an EC2 instance and connect to an AWS Account.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build Web Applications using cloud

CO2: Make use of IaaS Model in Cloud Ecosystem along with Amazon VPC

CO3: Construct Paas, SaaS Models to meet the real-world challenges.

CO4: Utilize security Tools to avoid the security risk on the web services

CO5: Develop applications using Amazon Web Services

TEXT BOOKS:

1. Micheal Miller,"Cloud Computing, web based applications, That change the way you Work and Collaborate online", Que Publishers,1st Edition, Aug 2008
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things",1st Edition, Morgan Kaufmann Publishers, 2012
3. Dan C.Marinescu, "Cloud computing, Theory and Practice",1st Edition, Morgan Kaufmann, 2103.

REFERENCES:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, "Mastering Cloud Computing",1st Edition, McGraw Hill,2013
2. Michael Miller, "Cloud Computing : Web-based Applications that change the way you work and collaborate online", 1st Edition, Pearson Education, 2008
3. John W Rittinghouse and James F Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, Hard cover Edition, 2020.

21PCS12	ANDROID APP DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize system requirements for android applications
- To model suitable design using android mobile development frameworks
- To utilize SQLite for mobile applications.
- To make use of Audio, Video, Bluetooth for mobile development.
- To choose Sensors and GPS for location-based services

UNIT-I	ANDROID BASICS	12

Creating Applications and Activities: Android Application manifest file, Externalizing resources ,Android application life cycle, Android Application class , Activity Life cycle, Activity class

SUGGESTED ACTIVITIES:

- Construct an application that draws basic graphical primitives on the screen
- Develop an application that uses Font and Colours

UNIT-II	ANDROID USER INTERFACE DESIGN	12

Building User Interfaces: Android user interface fundamentals, Layouts , Fragments , Android widgets – Views, Adapters -Intents and Broadcast Receivers

SUGGESTED ACTIVITIES:

- Develop an application that uses Layout Managers
- Develop an application that uses event listeners

UNIT-III	ANDROID DATA STORAGE	12

Databases and Content Providers – Introduction to SQLite, Content values and cursors, Working with SQLite Databases, Creating and using content providers, Adding search to the application. Expanding the User Experience: Action bars ,Menus , Dialogs , Toast , Notification

SUGGESTED ACTIVITIES:

- Develop an application that uses GUI components
- Develop an application that makes use of databases.

UNIT-IV	ANDROID NATIVE CAPABILITIES	12

Audio, Video and Using the Camera: Playing Audio and Video, Using camera for taking pictures, Recording Video- Bluetooth, NFC, Networks and WIFI : Using Bluetooth, Managing Network and Internet Connectivity, Managing WiFi, Near Field Communication- Telephony and SMS.

SUGGESTED ACTIVITIES:

- Develop an application that plays Audio and Video
- Develop an application that sends SMS to a user

UNIT-V	SENSORS AND GPS	12

Hardware Sensors – Maps, Geo Coding and Location based Services: Using Emulator for Location based services, selecting a location Provider, Finding Your Current Location, Using the Geocoder, creating Map based activities.

SUGGESTED ACTIVITIES:

- Develop a native application that uses GPS location information
- Develop an application that uses Google Maps

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Sketch the basics of Android applications.

CO2: Build user interface for mobile applications.

CO3: Make use of database to store mobile data of android applications.

CO4: Examine native capabilities of android applications.

CO5: Utilize Sensors and GPS for Android applications

TEXT BOOKS:

1. Reto Meier, "Professional Android 4 Development", 1st Edition, John Wiley and Sons, 2012
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", 2nd Edition, Wrox, 2012
3. Valentino Lee, Heather Schneider, and Robbie Schell, "Mobile Applications: Architecture, Design, and Development", 2nd Edition, Prentice Hall, 2004.

REFERENCES:

1. Brian Fling,"Mobile Design and Development",2nd Edition, O"Reilly Media,2009
2. Maximiliano Firtman , "Programming the Mobile Web ", 2nd Edition, O"Reilly Media, 2010.
3. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, "Android SDK3 for Dummies", 2nd Edition, Wiley 2011.

21PCS13	WEB APPLICATION SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the common Web application Security vulnerabilities.
- To outline the capabilities of various browser proxies.
- To demonstrate the SQL Injection Vulnerabilities.
- To explain the principles of file security.
- To illustrate the security of a large scale web application

UNIT-I INTRODUCTION — **12**

Introduction - The OWASP Top Ten List - Security Fundamentals: Input Validation, Attack Surface Reduction, Classifying and Prioritizing Threats – Authentication.

SUGGESTED ACTIVITIES:

Installation of rootkits and examine the variety of options available, IP Address and Port Scanning, Service Identity Determination: Nmap - IP scanning in Windows

UNIT-II BROWSER SECURITY PRINCIPLES — **12**

Defining the Same-Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting - Cross-Site Request Forgery – CSRF.

SUGGESTED ACTIVITIES:

Perform reconnaissance to find all the relevant information on selected website, Exploit MS web server, attacking vulnerabilities.

UNIT-III DATABASE SECURITY PRINCIPLES — **12**

Database Security Principles - Structured Query Language (SQL) Injection - Setting Database Permission - Stored Procedure Security

SUGGESTED ACTIVITIES:

Install and configure the virtual machines to perform SQL Injection attack

UNIT-IV FILE SECURITY PRINCIPLES — **12**

File Security Principles: Keeping Your Source Code Secret - Security Through Obscurity - Forceful Browsing - Directory Traversal.

SUGGESTED ACTIVITIES:

Experimenting with password-cracking utilities, attempting dictionary, hybrid, and brute-force attacks; Use any tool to find all the vulnerabilities with its level and generate a report for an organization

UNIT-V	**SECURE DEVELOPMENT AND DEPLOYMENT**	**12**

Secure Development Methodologies - Baking Security In - The Holistic Approach to Application Security - Industry Standard Secure Development Methodologies and Maturity Models: SDL - CLASP - SAMM - BSIMM

SUGGESTED ACTIVITIES:

Exploit windows to gain access of victim's machine using a penetration testing framework, Perform a study on CLASP Application Security Process.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to:

CO1: Make use of OWASP to understand the need of web application security.

CO2: Discover and prevent web security vulnerabilities

CO3: Examine the various SQL Injections and the possible Vulnerabilities

CO4: Develop the practices of applying the File Security Principles.

CO5: Identify and aid in fixing any security vulnerabilities during the web development process.

TEXT BOOKS:

1. Bryan and Vincent, "Web Application Security, A Beginners Guide", 1st Edition, McGraw-Hill, 2011.
2. Alfred Basta, Melissa Zgola, "Database Security", 1st Edition, Course Technology, 2012.
3. Michael Gertz and Sushil Jajodia, "Handbook of Database Security— Applications and Trends", Springer, 2008.

REFERENCES:

1. Bhavani Thuraisingham, "Database and Applications Security", 1st Edition, Auerbach Publications, 2005.
2. Dafydd Stuttard, and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, John Wiley & Sons; 2011.
3. W. F. Clocksin, C. S. Mellish, "Programming in Prolog: Using the ISO Standard", 5th Edition, Springer, 2003.

21PCS14	**SOFTWARE TESTING AND AUTOMATION**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:

- To explain the basics of testing process.
- To interpret the test cases criteria in simple applications.
- To illustrate the design of test cases.
- To summarize the test management and test automation techniques.
- To outline the needs for test metrics and measurements.

UNIT-I	**INTRODUCTION**	**12**

Testing axioms, Basic definitions, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, The Defect Repository and Test Design

SUGGESTED ACTIVITIES:

- Examine the open source testing tool "Selenium"

UNIT-II	TEST CASE DESIGN STRATEGIES	12

Test case Design Strategies, Using Black Box Approach to Test Case Design, Boundary Value Analysis, Equivalence Class Partitioning, Graph based testing-Cause-effect graphing, Using White Box Approach to Test design, Test Adequacy Criteria, Code Coverage Testing

SUGGESTED ACTIVITIES:

- Develop C program for the programming constructs such as if, for, switch, while, do while, if-else, and build the possible test cases.

UNIT-III	LEVELS OF TESTING	12

The need for Levels of Testing, Unit Testing, Integration Testing, API testing, System Testing, Acceptance Testing, Regression Testing, Alpha Testing, Beta Testing, Adhoc Testing

SUGGESTED ACTIVITIES:

- Select any two functionalities in GMAIL and develop the test cases with sample and expected output.
- Plan the test cases for simple calculator in windows application.
- Build a simple website for a user registration and login. Perform all possible levels of testing in the website and validate the results.

UNIT-IV	TEST MANAGEMENT	12

People and organizational issues in testing, Organization structures for testing teams, Test Planning, Test Plan Components, Test Plan Attachments, Introducing the test specialist, Skills needed by a test specialist

SUGGESTED ACTIVITIES:

- Develop a test plan document for Library Management System.

UNIT-V	TEST AUTOMATION	12

Need for Software test automation, Manual to Automated Testing, Tools needed for automation, Design and architecture for automation, Coverage in Test Automation, Types of Test Automation

SUGGESTED ACTIVITIES:

- Examine any one free test automation tool e.g. Katalon Studio.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Infer the basic concepts and terminologies of testing to test simple applications
CO2: Develop test cases using design strategies by employing suitable techniques
CO3: Utilize the various levels of testing to validate the systems
CO4: Choose suitable organizational structures for managing the issues in testing
CO5: Develop the skills needed for various automation testing techniques

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", 1st Edition, Pearson Education, 2017.
2. Dr. D. Chitra, A. Kaliappan, "Software Testing", 1st Edition, Technical Publications, 2019
3. Arnon Axelrod, "Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects", 1st Edition, Apress Publisher, 2018

REFERENCES:

1. Paul C. Jorgensen, Byron DeVries, "Software Testing A Craftsman's Approach", 5th Edition,Auerbach Publications, 2021
2. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
3. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", 1st Edition, Pearson Education, 2008.

21PCS15	INTRODUCTION TO DEV-OPS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the basic concepts of DevOps.
- To construct the Pipeline for development of life cycle.
- To demonstrate and develop DevOps code.
- To make use of continuous integration and continuous deployment Pipeline.
- To build the applications using Docker and Kubernetes.

UNIT-I	DEVOPS: AN OVERVIEW	12

DevOps: Origins, Roots: Addressing Dev versus Ops Practices: Continuous Integration, Continuous Delivery, Supporting Practices, Culture, Containerization Tools.

SUGGESTED ACTIVITIES:

- To study and install Version Control System / Source Code Management, install git and create a GitHub account.
- To implement various GIT operations on local and Remote repositories using GIT Cheat-Sheet

UNIT-II	ESTABLISHING DEVOPS	12

Embracing the New Development Life Cycle: Inviting Everyone to the Table, Changing Processes, Shifting Ops "Left": Thinking about Infrastructure. Planning Ahead: Moving beyond the Agile Model, Forecasting Challenges, Gathering Requirements, Designing an MVP.

SUGGESTED ACTIVITIES:

- To build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.

UNIT-III	DESIGNING AND DEVELOPING DEVOPS CODE	12

Designing: Constructing Your Design, Designing for DevOps, Architecting Code for the Six Capabilities of DevOps, Documenting Design Decisions, Avoiding Architecture Pitfalls. Developing Code Engineering for Error, Writing Maintainable Code, Programming Patterns, Choosing a Language Avoiding Anti-Patterns, DevOpsing Development, Establishing Good Practices.

SUGGESTED ACTIVITIES:

- To implement Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.

UNIT-IV	DEVOPS CI/CD PIPELINE	12

Overviewing Git and its command lines, Understanding the Git process and GitFlow pattern. The CI/CD principles, Using a package manager Using Jenkins, Using Azure Pipelines.

SUGGESTED ACTIVITIES:

- To develop Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)

UNIT-V	CONTAINERIZED APPLICATIONS WITH DOCKER AND KUBERNETES	12

Installing Docker, Creating a Dockerfile, Building and running a container on a local machine, Pushing an image to Docker Hub, Deploying a container to ACI with a CI/CD pipeline. Installing Kubernetes, First example of Kubernetes application deployment, Using HELM as a package manager, Using AKS, Creating an AKS service.

SUGGESTED ACTIVITIES:

- To implement a LAMP/MEAN Stack using Puppet Manifest.

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:
CO1: Utilize the basic concepts of DevOps.
CO2: Make use of the development life cycle using pipelining.
CO3: Develop the DevOps code by applying the basic concepts.
CO4: Model the continuous integration and continuous deployment Pipeline in GIT.
CO5: Construct the real time applications for given scenario using Docker and Kubernetes.

TEXT BOOKS:

1. Sanjeev Sharma," The DevOps Adoption Playbook", 1st Edition, Wiley Publication, 2017.
2. Emily Freeman,"DevOps for Dummies", 1st Edition, 2020.
3. Mikael Krief,"Learning DevOps" 1st Edition, Packt Publishing, 2019.

REFERENCES:

1. James Turnbull, Sid Orlando, "The Art of Monitoring", 1st Edition, 2016.
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", 1st Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", 2nd Edition, 2016.

21PCS16	PYTHON APPLICATION PROGRAMMING INTERFACE DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To show the prospects of application programming interface in web development.
- To build a Restful API service using the Flask-Restful package
- To utilize Python APIs to build and access database.
- To construct an authentication and security services with JWT
- To develop a function to send out mails using Mailgun API and upload image using Flask-Uploads

UNIT-I	INTRODUCTION TO API	12

Understanding API - Open API -The Flask Web Framework - Building a Simple Recipe Management Application - Using curl or httpie to Test All the Endpoints – Postman

SUGGESTED ACTIVITIES:

- Build a Simple Recipe Management Application using FLASK

UNIT-II	FLASK-RESTFUL	12

Flask-RESTful - Virtual Environment - Creating a Recipe Model - Configuring Endpoints - Making HTTP Requests to the Flask API using curl and httpie

SUGGESTED ACTIVITIES:

- Build a basic web application using Flask Web Framework

UNIT-III	DATABASE MANIPULATION WITH SQLALCHEMY	12

Databases – SQL – ORM - Defining Models - Password Hashing

SUGGESTED ACTIVITIES:

- Build a Database using Flask-Migrate

UNIT-IV	AUTHENTICATION SERVICES AND SECURITY WITH JWT	12

JWT - Flask-JWT-Extended - Designing the Methods in the Recipe Model - Refresh Tokens - The User Logout Mechanism

SUGGESTED ACTIVITIES:

- Develop a user login function using Flask-JWT Extended package

UNIT-V	MAILGUN API	12

Mailgun API- Mailgun API to Send Out Emails - User Account Activation Workflow - HTML Format Email – Working with images

SUGGESTED ACTIVITIES:

- Develop an Email activation function using Mailgun API
- Develop an image uploading API using Flask-Uploads

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Demonstrate the concept of APIs to interface the web services with the backend.
CO2: Build a Restful API service using the Flask-Restful package.
CO3: Make use of Python APIs for database management.
CO4: Develop a user login/logout function using JWT
CO5: Utilize Python APIs for sending mails and working with image.

TEXT BOOKS:

1. Jack Chan, Ray Chung, Jack Huang, "Python API Development Fundamentals", 1st Edition, Packt Publishing, 2019.
2. Kunal Relan, Building REST APIs with Flask, 1st Edition, APress, 2019
3. Gaston C. Hillar, Hands-On RESTful Python Web Services, 2nd Edition, Packt Publishing, 2018

REFERENCES:

1. Python Development Team, Guido Van Rossum, "Python 3.5 C API", 1st Edition, Samurai Media Limited, 2015
2. Jose Haro Peralta, "Micro service APIs Using Python, Flask, Fast API, Open API and More", 1st Edition, Manning, 2022
3. William S. Vincent, "Django for APIs: Build web APIs with Python and Django", 1st Edition, Welcome To Code publisher, 2022

VERTICAL 3-DATA CENTRE TECHNOLOGIES

21PCS17	DATA WAREHOUSING CONCEPTS AND IMPLEMENTATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To identify the scope and components of Data Warehousing.
- To explain the issues in Data Warehousing.
- To solve the real time problems using Source integration tools..
- To develop various algorithms based for Multidimensional Data Models.
- To choose various Query Processing and Optimization techniques for Reporting.

UNIT-I	DATA WAREHOUSE - AN OVERVIEW	12

Data Warehouse Components- Designing the Data Warehouse- Building a Data warehouse -Getting Heterogeneous Data into the Warehouse -Getting Multidimensional Data out of the Warehouse-Physical Structure of Data Warehouses-Metadata Management-Data Warehouse Project Management.

SUGGESTED ACTIVITIES:

- Build a Data Warehouse/Data Mart (using open-source tools like Pentaho Data Integration tool)

UNIT-II	DATA WAREHOUSE - ISSUES AND PROJECTS	12

Data Extraction and Reconciliation-Data Aggregation and Customization-Query Optimization-Update Propagation- Modeling and Measuring Data Warehouse Quality- Interestingness of Patterns -Three Perspectives of Data Warehouse Metadata.

SUGGESTED ACTIVITIES:

- Explore visualization features of the tool for analysis like identifying trends etc.

UNIT-III	SOURCE INTEGRATION	12

Schema Integration - Data Integration - Virtual - Materialized - Architecture for Source Integration - data integration workflows -Methodology for Source Integration.

SUGGESTED ACTIVITIES:

- Design multi-dimensional data models namely Star, snowflake and Fact constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, Manufacturing, Automobile, etc.).

UNIT-IV	MULTIDIMENSIONAL DATA MODELS AND AGGREGATION	12

Multidimensional View of Information- ROLAP Data Model - MOLAP Data Model- Logical Models for Multidimensional Information-Conceptual Models for Multidimensional Information-Inference Problems for Multidimensional Conceptual Modeling, Multidimensional versus Multirelational OLAP.

SUGGESTED ACTIVITIES:

- Perform various OLAP operations such slice, dice, roll up, drill down and pivot.

UNIT-V	QUERY PROCESSING AND OPTIMIZATION	12

Queries at the Back End-Queries at the Front End- Queries in the Core-Transactional Versus Data Warehouse Queries -Canned Queries Versus Ad-hoc Queries-Multidimensional Queries - Reporting and Query tools and Applications -Extensions of SQL

SUGGESTED ACTIVITIES:

- Perform various Query Operations (Canned Queries, Ad-hoc Queries).

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Identify the warehousing components and tools for organizing large database

CO2: Outline the issues for Modeling and measuring data warehousing Quality.

CO3: Classify various Source integration tools to solve the real time problems.

CO4: Determine the Multidimensional Data Models and Aggregation to analyze Multidimensional Information.

CO5: Develop Multidimensional Queries for process and Optimization.

TEXT BOOKS:

1. MatthiasJarke, MaurizioLenzerini, YannisVassiliou, PanosVassiliadis,"Fundamentals of Data Warehouse", 2nd Edition, Springer 2022.
2. Alex Petrov **,"**Database Internals: A Deep-Dive Into How Distributed Data Systems Work**",** 1st Edition, O'Reilly Media 2019.
3. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", 10th Edition, Tata McGraw – Hill, 2016.

REFERENCES:

1. Ralph Kimball, Margy Ross," The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", 3rd Edition, Wiley 2015.
2. Alan Beaulieu, "Learning SQL: Generate, Manipulate, and Retrieve Data", 1st Edition, O'Reilly Media 2020.

3. Dan Linstedt , Michael Olschimke,"Building a Scalable Data Warehouse with Data Vault 2.0", Elsevier Science & Technology ,2015.

21PCS18	DATA STORAGE TECHNOLOGIES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To enumerate the information and data storage concepts.
- To demonstrate the different approaches of data storage.
- To show the concepts of Data Storage Devices.
- To summarize the architecture of storage system.
- To choose the concept of Networked Attached Storage and Storage Area Networks.

UNIT-I	INTRODUCTION TO INFORMATION AND DATA STORAGE	12

Information and Data, Data in business Environments, Data life cycle Management, Data Storage Models, Creating Structured Data, Data Base management systems, Challenges in Data Storage Management, Data Centre Environment.

SUGGESTED ACTIVITIES:

- Review and understand the components and Systems in a Data Centre Environment

UNIT-II	DATA STORAGE APPROACHES	12

Types of Data Storage, File Based Storage, Block Level Data Storage, Object Based Data Storage, Working on stored data, Storage Performance Tuning.

SUGGESTED ACTIVITIES:

- Block Level Data Storage, Object Based Data Storage

UNIT-III	DATA STORAGE DEVICES	12

Data Storage Units, Primary And Secondary Storages, Hard Disk Drives, Magnetic Tapes, Optical Storage Discs, Solid State Drives, Storage Arrays, Selecting Storage Devices, Improving Data Storage Efficiency.

SUGGESTED ACTIVITIES:

- Storage Devices

UNIT-IV	STORAGE SYSTEM ARCHITECTURE	12

Storage Architecture basics, storage logical components, Direct attached storage, Intelligent Storage systems, Storage consolidation, Tiered storage.

SUGGESTED ACTIVITIES:

- Explore the management interface and general task to be performed within an Intelligent Storage system

UNIT-V	NETWORKED STORAGE SYSTEMS	12

Review of Enterprise Networking Options, Towards Networked Storage, Networked Attached storage, Storage Area Networks, Choosing NAS or SAN, Multi-protocol Arrays, Implementing Storage Solutions.

SUGGESTED ACTIVITIES:

- Explore the management interface and general task to be performed within the fibre channel SAN
- Configure the interface and provision storage within an IP SAN

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Discuss the challenges in data Storage Management for business Environment.
CO2: Select a suitable data storage for an application.
CO3: Identify the efficiency for improving the data storage
CO4: Develop the Storage system architecture for data storage
CO5: Build the different network storage area systems for real time scenario.

TEXT BOOKS:

1. K.L.James, "Data Storage Technologies", 1st Edition, independently Published, 2019.
2. G.Somasundaram, Alok Shrivastava, "Information Storage and Management", EMC Education Series, 2nd Edition, Wiley, Publishing Inc., 2012.
3. R.Marc Farley, "Building Storage Networks", 1st Edition, Tata McGraw Hill, Osborne, 2001.

REFERENCES:

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas,"Introduction to Storage Area Networks", 9th Edition, IBM Corp, 2017.
2. Robert Spalding,"Storage Networks: The Complete Reference", 1st Edition, Tata McGraw Hill Osborne, 2003.
3. Meeta Gupta, "Storage Area Network Fundamentals", 1st Edition, Pearson Education Limited, 2002.

21PCS19	SOFTWARE DEFINED NETWORKS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To illustrate the separation of data plane and control plane in software defined networks.
- To demonstrate the functions and components of the SDN architecture.
- To examine the role of SDN in data center networks.
- To develop programs to interface different applications with SDN.
- To utilize SDN controllers for improved network management and application performance.

UNIT-I	INTRODUCTION TO SDN	12

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Need for SDN: Evolution of switches and control planes, data center innovation and needs –SDN Working – Centralized and Distributed Control and Date Planes.

SUGGESTED ACTIVITIES:

- Installation of Mininet and Open Day Light controller

UNIT-II	OPEN FLOW & SDN CONTROLLERS	12

Open Flow Specification: Openflow 1.0 and Open Flow Basics - Drawbacks of Open SDN - SDN via APIs, SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Controllers: General Concepts.

SUGGESTED ACTIVITIES:

- Configuring Open Flow switches and capture the data flow

UNIT-III	DATA CENTERS	12

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

SUGGESTED ACTIVITIES:

- Build and emulate network protocols using Mininet

UNIT-IV	SDN PROGRAMMING	12

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV)

SUGGESTED ACTIVITIES:

- ONOS deployment and Northbound – Southbound Interfacing

UNIT-V	SDN APPLICATION AND USECASES	12

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

SUGGESTED ACTIVITIES:

- Setting up the Environment and Implementation of Open day light Controllers in Mininet

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Distinguish between the features of Software Defined Network with traditional network
CO2: Outline the various components and functionalities of SDN
CO3: Examine the role of SDN in data centers
CO4: Make use of SDN Northbound APIs to communicate between the SDN Controller and the services
CO5: Experiment with the applications and use cases of SDN

TEXT BOOKS:

1. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann, 2017
2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", 1st Edition, O'Reilly Media, 2013
3. Vivek Tiwari, "SDN and Open Flow for Beginners, Amazon Digital Services", 1st Edition, M.M.D.D. Multimedia LLC., 2013

REFERENCES:

1. SiamakAzodolmolky, "Software Defined Networking with Open Flow", 1st Edition, Packet Publishing, 2013.
2. Fei Hu (Editor), "Network Innovation through Open Flow and SDN: Principles and Design", 1st Edition, CRCPress, 2014.
3. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", 1st Edition, Addison-Wesley Professional, 2015

21PCS20	CLOUD COMPUTING AND VIRTUALIZATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the concept of cloud computing.
- To summarize the various issues in cloud computing.
- To express the emergence of cloud as next generation computing paradigm
- To describe the novel concepts of virtualization
- To understand Server, desktop and storage virtualization

UNIT-I	INTRODUCTION TO CLOUD COMPUTING	12

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing -Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics

SUGGESSTED ACTIVITIES:

- Install virtual box/VM ware workstation
- Implementation of virtual machine using Ubuntu OS

UNIT-II	CLOUD ARCHITECTURE, SERVICES AND STORAGE	12

NIST- Service Oriented Architecture – REST -Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3

SUGGESSTED ACTIVITIES:

- Case study:-Azure Cloud,Open stack

UNIT-III	CLOUD ENABLING TECHNOLOGIES	12

Web Services – Publish-Subscribe Model – Hadoop – MapReduce – Google App Engine-Federation of cloud

SUGGESSTED ACTIVITIES:

- Install Google App Engine
- Install Hadoop

UNIT-IV	INTRODUCTION TO VIRTUALIZATION	12

Basics of Virtualization: Characteristics – Taxonomy of Virtualization Techniques – Hardware Level Virtualization – Operating System Level Virtualization

SUGGESSTED ACTIVITIES:

- Case study: Types of virtualization

UNIT-V	SERVER ,DESKTOP AND STORAGE VIRTUALIZATION	12

Microsoft virtual server -Server virtualization platforms -Desktop Virtualization: Installing (PC, Windows, Linux)-Deploying and managing VMs-Storage Virtualization-overview-Appliances-services

SUGGESSTED ACTIVITIES:

- Microsoft virtual PC

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Complete in-depth and comprehensive knowledge of the Cloud Computing fundamentals
CO2: Discover the architecture of cloud computing and storage in cloud
CO3: Relate the cloud knowledge and enabling technologies that help in the development of cloud
CO4: Illustrate the various types of virtualizations and its importance
CO5: Demonstrate the server, desktop and storage virtualization concepts.

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, "Mastering in Cloud Computing", 1st Edition, Tata McGraw Hill Education Private Limited, 2017.
2. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", 1st Edition , Auerbach Publications ,2006,
3. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", 1st Edition ,A Press 2005

REFERENCES:

1. Tom Clark, "Storage Virtualization: Technologies for Simplifying Data Storage and Management", 1st Edition, Pearson Education, 2018.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, "Introduction to Vivek Tiwari, "SDN and Open Flow for Beginners", 1st Edition, Amazon Digital Services, Inc., 2017.
3. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann,1st Edition 2005.

21PCS21	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the components and functions of information storage systems.
- To demonstrate the functionalities of storage networking.
- To develop the storage for the given specification.
- To demonstrate the process of backup and replication.
- To identify the storage components and security mechanism for the storage networking models.

UNIT-I	STORAGE SYSTEM	9

Introduction - Evolution of storage architecture - Key Data center elements – Host, connectivity, storage, and application in both classic and virtual environments – RAID implementations – techniques - RAID levels - impact of RAID on application performance -Components of Intelligent Storage Systems - Provisioning and Intelligent Storage System

UNIT-II	STORAGE NETWORKING TECHNOLOGIES	9

Fibre Channel SAN - components - Connectivity options - topologies - Access protection mechanism – zoning - FC protocol stack – Addressing – SAN based virtualization – VSAN - IP SAN - iSCSI and FCIP protocols for Storage access over IP network - FCoE and its components - Network Attached Storage (NAS)– NAS Hardware devices– NAS Software Components – NAS Connectivity options - NAS operations – Applying the NAS Solution – File level virtualization in NAS – Integration of NAS and SAN - CAS –Object based storage - Unified Storage platform.

UNIT-III	BUSINESS CONTINUITY	9

Information availability and Business Continuity - Business Continuity terminologies - Business Continuity Planning Life cycle– Failure Analysis: Single Points of Failure, solution, - Clustering and Multipathing software –Business Impact Analysis –Practice : EMC powerpath –Features, Dynamic Load balancing – Automatic powerpath Failover/

UNIT-IV	BACKUP AND RECOVERY	9

Backup purpose, Methods, targets and topologies - Data Deduplication: Method, implementation- backup in virtualized environment – Fixed Content and Data Archive and solution – Replication - Local Replication - Remote Replication (local host, storage array & Network based replication)- Three-Site Remote Replication - Continuous Data Protection

UNIT-V	SECURING AND MANAGING STORAGE	9

Information security framework – Storage Security Domains – Implementation in storage networks: FC-SAN, NAS, IP-SAN – securing Cloud Service Environments - Monitoring the storage infrastructure - Parameters, components – Storage infrastructure management activities - Information lifecycle management (ILM) and Storage Tiering .

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1:Categorize the components and functions of information storage systems

CO2: Illustrate the functionalities of storage networking.

CO3: Demonstrate the process of business continuity for storage networking system

CO4: Show the process of backup and replication

CO5: Choose the storage components and security mechanism for the storage networking models

TEXT BOOKS:

1. John Wiley and Sons, "Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments", EMC Education Services, 2nd Edition, 2012.
2. Robert Spalding, "Storage Networks: The Complete Reference", McGraw Hill Education, 1st Edition, 2017.
3. Shanmuganathan Kumaravel, Libor MiklasTata, Jon Tate, Pall Beck, Hector Hugo Ibarra," Introduction to Storage Area Networks", IBM Redbooks,9th Edition, 2017.

REFERENCES:

1. Gerardus Blokdyk ,"Storage Virtualization A Complete Guide",5 STAR Cooks, 2019.
2. Thejendra BS,"Disaster Recovery and Business Continuity", IT Governance Publishing, 3rd Edition, 2016.
3. James O'Reilly, "Network Storage: Tools and Technologies for Storing Your Company's Data", Morgan Kaufmann, 2016.

21PCS22	STREAM PROCESSING FRAMEWORK	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES :

- To describe concepts and challenges of distributed stateful stream processing.
- To demonstrate Flink's system architecture, event-time processing mode and fault-tolerance model.
- To explain the fundamentals and building blocks of the DataStream API.
- To identify data from and write data to external systems with exactly-once consistency.
- To indicate the continuous running streaming applications.

UNIT-I	FUNDAMENTALS OF STATEFUL STREAM PROCESSING	12

Traditional Data Infrastructures-Stateful Stream Processing-The Evolution of Open Source Stream Processing-Introduction to Dataflow Programming-Processing Streams in Parallel-Time Semantics-State and Consistency Models

SUGGESTED ACTIVITIES:

- Install Oracle Virtual box and create two VMs on your laptop.
- Develop a Hello World application using Google App Engine.

UNIT-II	THE ARCHITECTURE OF APACHE FLINK	12

Introduction to Dataflow Programming-Processing Streams in Parallel-Time Semantics-The Architecture of Apache Flink-Event-Time Processing-State Management-Checkpoints-Save points, and State Recovery.

SUGGESTED ACTIVITIES:

- Use Azure Cloud Shell within the Azure portal to run the file creation simulator located on GitHub.

UNIT-III	THE DATASTREAM API (V1.7)	12

Set Up the Execution Environment-Transformations-Setting the Parallelism-Supported Data Types-Defining Keys and Referencing Fields-Implementing Functions-Including External and Flink Dependencies

SUGGESTED ACTIVITIES:

- Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box.

UNIT-IV	TIME-BASED AND WINDOW OPERATORS	12

Configuring Time Characteristics-Process Functions-Window Operators-Joining Streams on Time-Handling Late Data.

SUGGESTED ACTIVITIES:

- Create an application (Ex: Word Count) using Hadoop Map/Reduce.

UNIT-V	Stateful Operators and Applications	12

Implementing Stateful Functions-Enabling Failure Recovery for Stateful Applications-Ensuring the Maintainability of Stateful Applications-Performance and Robustness of Stateful Applications-Evolving Stateful Applications-Queryable State.

SUGGESTED ACTIVITIES:

- Clone the Starter Project from GitHub and Perform a Test Run.
- Implementation of Single-Sing-On.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Illustrate the concepts of distributed stateful stream processing.
CO2: Demonstrate the architecture of Apache Flink for event-time processing mode and fault-tolerance model.
CO3: Build the fundamentals of DataStream API.
CO4: Experiment with time-based and window operators.
CO5: Evaluate and implement the Stateful Operators and Applications

TEXT BOOKS:

1. Fabian Hueske, Vasiliki Kalavri,,"Stream Processing with Apache Flink,"1st Edition,O'Reilly Media,2019.
2. Idan Gabrieli, "Cloud Computing for Beginners-Database Technologies and Infrastructure as a Service" Packt Publishing, 2021.
3. Michael Miller, "Cloud Computing: Web-based Applications that change the way you work and collaborate "1st Edition, Pearson Education, 2008.

REFERENCES:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, Mastering Cloud Computing, 1st Edition, McGraw Hill, 2013.
2. IBM, Introduction to Storage Area Networks and System Networking, 5th Edition, November 2012.
3. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 6th reprint 2003.

21PCS23	FOG AND EDGE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the concept of fog and edge computing
- To paraphrase the Edge computing Architecture
- To relate the fog and edge computing in Internet of things
- To summarize the improved performance of network slicing in enabling technologies
- To describe the concept of optimization in fog and edge computation

UNIT-I	INTERNET OF THINGS (IOT) AND NEW COMPUTING PARADIGMS	9

Introduction- Relevant Technologies- Fog and Edge Computing Completing the Cloud- Hierarchy of Fog and Edge Computing - Business Models- Opportunities and Challenges- Networking Challenge- Management Challenge

UNIT-II	INTEGRATING IOT , FOG , CLOUD INFRASTRUCTURES	9

Introduction-Methodology-Integrated C2F2T Literature by Modeling Technique-Integrated C2F2T Literature by Use-Case Scenarios-Integrated C2F2T Literature by Metrics-Future Research Directions		
UNIT-III	**MANAGEMENT AND ORCHESTRATION OF NETWORK SLICES**	**9**
Introduction-Background-Network Slicing-Network Slicing in Software-Defined Clouds-Network Slicing Management in Edge and Fog- Internet of Vehicles : Architecture, Protocol and Security-Seven layered model architecture for Internet of Vehicles- IoV: Network Models, Challenges and future aspects		
UNIT-IV	**OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING**	**9**
Preliminaries-The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing-Metrics-Further Quality Attributes-Optimization Opportunities along the Fog Architecture-Optimization Opportunities along the Service Life Cycle-Toward a Taxonomy of Optimization Problems in Fog Computing		
UNIT-V	**APPLICATIONS AND ISSUES**	**9**
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications-Testing Perspectives of Fog-Based IoT Applications-Legal Aspects of Operating IoT Applications in the Fog- Case Study: Technologies in Fog Computing		
TOTAL: 45 PERIODS		

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Illustrate the concept of fog and edge computing for relevant business models

CO2: Use the integration modelling techniques for IOT and FOG infrastructure

CO3: Relate the orchestration of slicing concept in different network models

CO4: Solve the issues of formal modeling framework using optimization

CO5: Demonstrate the technologies of fog and edge computing for a given real time scenarios

TEXT BOOKS:

1. Rajkumar Buyya, Satish Narayana Srirama," Fog and Edge Computing: Principles and Paradigms" ,1st Edition,Wiley publication, 2019
2. John Mutumba Bilay , Peter Gutsche, Mandy Krimmel and Volker Stiehl ,"SAP Cloud Platform Integration: The Comprehensive Guide", 2nd Edition, Rheinwerg publishing, 2019
3. Perry Lea ,"IoT and Edge Computing for Architects",2nd Edition, Packt Publishing, 2020

REFERENCES: :

1. Bahga, Arshdeep, and Vijay Madisetti. Cloud computing: A hands-on approach, 1st Edition, CreateSpace Independent Publishing Platform, 2013.
2. Ovidiu Vermesan, Peter Friess, Internet of Things –From Research and Innovation to Market Deployment, 1st Edition, River Publishers, 2014
3. Michael Missbach, Thorsten Staerk, Cameron Gardiner, Joshua McCloud, Robert Madl, Mark Tempes, George Anderson, SAP on Cloud, 1st Edition, Springer, 2016

21PCS24	CLOUD DATA CENTRE NETWORK ARCHITECTURES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To outline the basics of Cloud DCNs.
- To interpret the Architecture and Technology Evolution of DCNs.
- To relate the Interaction Technologies between Cloud DCN components.

- To summarize the concept of Cloud DCN Security.
- To express the Cutting -Edge Technologies for cloud Application.

UNIT-I	INTRODUCTION TO CLOUD DCNs	12

Cloud computing -Virtualization Technologies in cloud computing-SDN for cloud computing-DCN Prospects-DCN Challenges.

SUGGESTED ACTIVITIES:

- Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S.
- Place the application and its datasets into a VM cloud environment connecting to existing enterprise applications and datasets on-premises as required.

UNIT-II	ARCHITECTURE AND TECHNOLOGY EVOLUTION OF DCNs	12

Physical Architecture of DCNs-Technology Evolution of DCNs-Service models of cloud DCNs-Interaction between components in the Cloud DCN solution.

SUGGESTED ACTIVITIES:

- Create a Cloud Plat form using Python for Cloud DNS API.
- Set up a Development Environment using Python libraries.

UNIT-III	INTERACTION TECHNOLOGIES BETWEEN CLOUD DCN COMPONENTS	12

Components of Cloud DCN solutions-Physical cloud engine switches-Cloud Engine Virtual Switches; Interaction Technologies - OpenFlow- NETCONF-OVSDB-YANG.

SUGGESTED ACTIVITIES:

- Develop a Case study application and store the application data in cloud datastore.
- Store Image and video files in cloud storage using python.

UNIT-IV	CLOUD DCN SECURITY	12

Cloud DCN Security Challenges-Cloud DCN Security Architectures-Benefits of Cloud DCN Security Solution.

SUGGESTED ACTIVITIES:

- Find a procedure to transfer the files from one virtual machine to another virtual machine.

UNIT-V	CUTTING -EDGE TECHNOLOGIES AND APPLICATION	12

Container-Hybrid Cloud-AI Fabric; Application Scenarios-Advanced Content Security Defense.

SUGGESTED ACTIVITIES:

- Find a procedure to launch virtual machine using trystack
- Create a Cloud Storage bucket using Amazon Simple Storage Service

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the basis of Cloud DCNs.

CO2: Make use of Architecture and Technology Evolution of DCNs.

CO3: Utilize the Interaction Technologies between Cloud DCN components.

CO4: Develop the knowledge on Cloud DCN Security.

CO5: Build the cloud applications using Cutting -Edge Technologies.

TEXT BOOKS:

1. Lei Zhang and Le Chen, "Cloud Data Center Network Architectures and Technologies" 1st Edition, CRC Press, 2021.
2. Dinesh G.Dutt, "Cloud Native Data Center Networking Architecture, Protocols, and Tools", 1st Edition, O'Reilly Media, 2020.

3. Yang Liu, Jogesh K.Muppala, Malathi Veeraraghavan, Dong Lin, Mounir Hamdi, "Data Center Networks Topologies, Architectures and Fault -Tolerance Characteristics", 1st Edition, Springer, 2013.

REFERENCES:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing Concepts, Technology & Architecture", 1st Edition, Pearson Education, 2013.
2. James Bond, "The Enterprise Cloud Best Practices for Transforming Legacy IT", 1st Edition, O'Reilly Media, 2015.
3. Gary Lee, "Cloud Networking Understanding Cloud-based Data Center Networks", 1st Edition, Elsevier Science, 2014.

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

21PIT01	CRYPTOGRAPHIC TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate various encryption techniques.
- To experiment with various symmetric key models.
- To utilize the principles of public key cryptosystems for privacy.
- To build systems using the principles of hash functions and digital signature.
- To summarize the various aspects of Modern cryptography techniques.

UNIT-I	INTRODUCTION	9

Basics of Number theory – Integers and Operations on Integers – Modular arithmetic – Prime Numbers – Primality related properties and Algorithms – Pseudo Random Number Generation. Classical Cryptography: Basic conventions and Terminology – Substitution Ciphers -Transposition ciphers – Rotor machines – Cryptanalysis.

UNIT-II	SYMMETRIC KEY CRYPTOGRAPHY	9

Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid"s algorithm- Congruence and matrices – Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Evaluation criteria for AES – Advanced Encryption Standard – RC4 -Key distribution.

UNIT-III	PUBLIC KEY CRYPTOGRAPHY	9

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing -Factorization – Eulers totient function, Fermats and Eulers Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT-IV	MESSAGE AUTHENTICATION AND INTEGRITY	9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT-V	MODERN ASPECTS OF CRYPTOGRAPHY	9

Modern Cryptography - Principles - Perfectly Secret Encryption - Shannon's Theorem - Constructing CPA-Secure Encryption Schemes - CPA-Secure Encryption from Pseudorandom Functions

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the fundamentals of classical encryption techniques.

CO2: Apply the different operations of symmetric cryptographic algorithms.

CO3: Make use of different cryptographic operations of public key cryptography.

CO4: Build the various authentication schemes to simulate different applications.

CO5: Summarize the various aspects of Modern Cryptography principles.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security principles-and-practice", 7th Edition, Pearson publication, 2017.
2. Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", 2nd Edition, CRC press, 2015.
3. Padmanabhan T R, Shyamala C K and Harini N, "Cryptography and Security", 1st Edition, Wiley Publications, 2011.

REFERENCES :

1. William Stallings, "Cryptography and Network Security", 4th Edition, Pearson Education Asia, Prentice Hall, 2000.
2. Forouzan B. A., "Cryptography and Network Security", 7th Edition, Pearson Education, 2017.
3. Wen Bo Mao, "Modern Cryptography-Theory and Practice", 1st Edition, Prentice Hall, USA, 2003.

21PIT02	PARADIGMS OF NETWORK SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain various security attacks, services and mechanisms.
- To identify various encryption techniques for authentication.
- To develop sniffing solutions using public key cryptography.
- To apply the fundamentals of IP security for Email authentication.
- To construct model for dealing security issues.

UNIT I	SECURITY ATTACKS ,SERVICES AND MECHANISMS	12

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Understanding Session Hijacking, TCP session hijacking, ARP attacks, route table modification, UDP hijacking.

SUGGESTED ACTIVITIES :

- **Prevention from XSS Attack and ARP Poisoning.**

UNIT II	CONVENTIONAL ENCRYPTION AND HARDWARE HACKING	12

Symmetric Encryption Principles, Symmetric encryption algorithms, cipher block modes of operation, Understanding Brute Force, Understanding Amateur Cryptography Attempts, Understanding Hardware Hacking, Housing and Mechanical Attacks, External Interfaces , Protocol Analysis.

SUGGESTED ACTIVITIES :

- Implementation of DES Algorithm, substitution techniques and Transposition Techniques.

UNIT III	PUBLIC KEY CRYPTOGRAPHY AND SNIFFING	12

Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service, Popular Sniffing Software, Advanced Sniffing Techniques.

SUGGESTED ACTIVITIES :

- Implementation of RSA algorithm.
- Configuration of a mail agent to support Digital Certificates.

UNIT IV	**EMAIL PRIVACY AND IP SECURITY**	**12**

Internet Mail Architecture, E-mail Formats, E-mail Threats and Comprehensive, E-mail Security, Pretty Good Privacy (PGP) and S/MIME. IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations.

SUGGESTED ACTIVITIES :

- Authentication of Email.

UNIT V	**VIRUSES AND THREATS**	**12**

Introduction, Types of Malicious Software, Dealing with Cross-platform Issues, How to Secure against Malicious Software, Intrusion Detection Systems, Password Management, Firewall Design principles.

SUGGESTED ACTIVITIES :

- Detection Method of IDS.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the security attacks, services and mechanisms.
CO2: Make use of encryption techniques for authentication.
CO3: Apply public key cryptography algorithm for authentication.
CO4: Experiment with Email privacy and security.
CO5: Build a model of Firewall and test the security issues.

TEXT BOOKS:

1. William Stallings,"Network Security Essentials (Applications and Standards)" 6th Edition, Pearson Education, 2018.
2. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh and Wiley Dreamtech, "Hack Proofing your network", 2nd Edition, Syngress publications, March 1, 2002.
3. Matt Bishop, "Computer Security: Art and Science," Addison Wesley, 2nd Edition, 2019.

REFERENCES:

1. Charlien Kaufman, Radia Perlman and Mike Speciner "Network Security – Private Communication in a Public World",1st Edition, Pearson education, 2011.
2. Michael Whitman and Herbert Mattord,"Principles of Information Security", 6th Edition, Cengage Learning, 2017.
3. William Stallings,"Cryptography and network Security", 6th Edition, Pearson education, 2015.

21PIT03	**ENGINEERING SECURE SOFTWARE SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To compare various critical and non-critical systems.
- To illustrate software requirements document and formal specification for a software system.
- To outline distributed system design and architectures.

- To identify the system security failures.
- To build a framework for highly secure software.

UNIT I	SECURITY A SOFTWARE ISSUE	9

Introduction, the problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of Detecting Software Security,What Makes Software Secure: Properties of Secure Software, Influencing the security properties of software, Asserting and specifying the desired security properties.

UNIT II	REQUIREMENTS ENGINEERING FOR SECURE SOFTWARE	9

Introduction, Misuse and Abuse Cases, The SQUARE process Model, SQUARE sample outputs, Requirements elicitation and prioritization.

UNIT III	SECURE SOFTWARE ARCHITECTURE AND DESIGN	9

Introduction, software security practices for architecture and design: architectural risk analysis, software security knowledge for architecture and design: security principles, security guidelines and attack patterns Secure coding and Testing: Code analysis, Software Security testing, Security testing considerations throughput the SDLC.

UNIT IV	SECURITY AND COMPLEXITY	9

System Assembly Challenges: introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security.

UNIT V	GOVERNANCE AND MANAGING FOR MORE SECURE SOFTWARE	9

Governance and security, Adopting an enterprise software security framework, Risk Management Framework for software security, Security and project management, Maturity of Practice.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Compare and contrast the critical and non-critical systems.

CO2: Explain the software requirements document and formal specification for a software system.

CO3: Summarize the distributed system architectures and design.

CO4: Identify the system security failures.

CO5: Build a framework for highly secure software.

TEXT BOOK:

1. Julia H. Allen, "Software Security Engineering: A Guide for Project Managers", Addison-Wesley Professional, Pearson Education, 1st Edition, May 2008.
2. Asoke K. Talukder and Manish Chaitanya, "Architecting Secure Software Systems", CRC Press, 1st Edition, Auerbach Publications, 2019.
3. Mark S. Merkow and Lakshmikanth Raghavan, "Secure and Resilient Software", CRC Press, 1st Edition, 2019.

REFERENCES:

1. Gary McGraw, "Software Security Building Security in", 1st Edition, Addison Wesley, 2006.
2. Jason Grembi, "Secure Software Development A Security Programmer's Guide", 1st Edition, Cengage Learning, 2009.
3. Nancy R. Mead, Julia H. Allen,et.al., "Software Security Engineering A Guide for Project Managers",1st Edition, Pearson Education, 2004.

21PIT04	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the basic digital forensics techniques.
- To interpret well-trained computer crime investigators.
- To apply the knowledge for processing evidence using forensic tools.
- To identify the various tools involved in forensic investigation.
- To outline the various phases of mobile forensics extraction.

UNIT-I	FUNDAMENTALS OF DIGITAL FORENSICS	9

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues- Introduction to computer crime Investigations& its types– Assess the situation – Acquire the data – Analyze the data – Report the investigation.

UNIT-II	DATA ACQUISITION AND TOOLS	9

Digital evidence, First responder tool kit, techniques of digital forensics, recovery of deleted files, stochastic forensics, steganography, Acquisition methods, The Booting Process, web attack forensics, web application forensic tool.

UNIT-III	PROCESSING EVIDENCE	9

Types of digital evidence, Evidence gathering consideration, data security requirement, Preservation stratergies, seizure, acquisition and examination analysis, Rules of evidence, Good forensic practices.

UNIT-IV	FORENSICS INVESTIGATION TOOLS	9

Current computer forensics tools- software, hardware tools, validating and testing forensic software, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

UNIT-V	MOBILE FORENSICS	9

Mobile forensics- Mobile forensic & its challenges- Mobile phone evidence extraction process: The evidence intake phase- The identification phase, The preparation phase, The isolation phase, The processing phase, The verification phase, The document and reporting phase , The presentation phase- Mobile forensic tool leveling system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Summarize forensic analysis tools to recover important evidence for identifying Computer crime.
CO2: Demonstrate as well-trained computer crime investigators.
CO3: Apply the knowledge for processing evidence using forensic tools.
CO4: Make use of the various tools involved in forensic investigation.
CO5: Explain the various phases of mobile forensics extraction.

TEXT BOOKS:

1. Dr. Jeetendra Pande and Dr. Ajay Prasad, "Digital forensics", 1st Edition, Uttarakhand Open University, 2016.
2. Jason sachouski, "Computer Forensics and Investigations", 2nd Edition, CRC press, 2018.
3. Satish Bommisetty, Rohit Tamma and Heather Mahalik, "Practical Mobile Forensics", 2nd Edition, Packt Publishing Ltd., 2014.

REFERENCES :

1. Vacca, J, "Computer Forensics, Computer Crime Scene Investigation", 2nd Edition, Charles River Media, 2005.
2. Iosifl.Androulidakis, "Mobile phone security and forensics: A practical approach", 1st Edition, Springer publications, 2012.
3. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", 1st Edition, Addison Wesley, 2002.

21PIT05	ETHICAL HACKING EXPLOIT DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To infer various security tools to assess the computing system.
- To identify publicly available tools used to gather information on potential targets.
- To apply scanning techniques used to identify network system open ports.
- To classify network system vulnerabilities and confirm their exploitability.
- To construct flawless wireless network and apply security patches.

UNIT-I	INTRODUCTION TO HACKING	12

Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement –Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary –Reports.

SUGGESTED ACTIVITIES:

- Setup a honey pot and monitor the honey pot on network.

UNIT-II	INFORMATION GATHERING AND SCANNING	12

Information Gathering Techniques –Active Information Gathering –Passive Information Gathering–Sources of Information Gathering-Tracing the Location-Traceroute-ICMP Trace route –TCP Trace route and its Usage – UDP Trace route –Enumerating and Fingerprinting the Webservers –Google Hacking – DNS Enumeration –Enumerating SNMP –SMTP Enumeration – Target Enumeration and Port Scanning Techniques–Advanced Firewall/IDS Evading Techniques.

SUGGESTED ACTIVITIES:

- Create a social networking website login page using phishing techniques.

UNIT-III	NETWORK ATTACKS	12

Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing –Promiscuous and Non promiscuous versus Mode – MITM, ARP, Denial of Service and Hijacking Session with MITM Attacks – SSL Strip: Stripping HTTPS Traffic –DNS, ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing –Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force and Traditional Brute Force – Attacking SMTP, SQL Servers – Testing for Weak Authentication.

SUGGESTED ACTIVITIES:

- Demonstration of DoS attacks.

- Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security and Management.

UNIT-IV	EXPLOITATION	12

Introduction to Metasploit–Reconnaissance with Metasploit –Port Scanning with Metasploit, Compromising a windows Host with Metasploit –Client Side Exploitation Methods –Creating a Custom Executable and a Backdoor with SET – PDF Hacking– Social Engineering Toolkit– Browser and Post Exploitation– Acquiring Situation Awareness– Hashing and Windows Hashing Methods –Cracking the Hashes– Brute force Dictionary attacks – Password Salts– Rainbow Tables– John the Ripper– Gathering OS Information– Harvesting Stored credentials.

SUGGESTED ACTIVITIES:

- Install rootkits and study variety of options.
- Study of Techniques uses for Web Based Password Capturing

UNIT-V	WIRELESS AND WEB HACKING	12

Wireless Hacking – Introducing Air crack – Cracking a WEP – Cracking a WPA/WPA2 Wireless Network Using Air cracking – Evil Twin Attack – Causing Denial of Service on the Original AP.

Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks –Further Reading– Crawling Restricted Links–Testing for the Vulnerability –Authentication Bypass with Insecure Cookie Handling– SQL Injection Attacks –Cross-Site Scripting and it types.

SUGGESTED ACTIVITIES:

- Demonstration of SQL injection attacks.
- Implement passive scanning, active scanning, session hizaking, cookies extraction using Burp suit tool.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Summarize the various security tools to assess the computing system.

CO2: Experiment with the vulnerabilities across any computing system using penetration testing.

CO3: Make use of prediction mechanism to prevent any kind of attacks.

CO4: Utilize the various techniques to protect the system from malicious software and worms.

CO5: Identify the wireless network flaws and apply security patches.

TEXT BOOKS:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 1st Edition, 2015.
2. Allen Harper, Ryan Linn, Stephen Sims, Michael Baucom and Moses Frost, "Gray Hat Hacking: The Ethical Hacker's Handbook", 5th Edition, McGraw Hill, 2018.
3. Stefano Novelli, Marco Stefano Doria and Marco Silvestri, "Hacklog Volume 1 Anonymity: IT Security & Ethical Hacking Handbook", 1st Edition, BW / Inforge, 2019.

REFERENCES:

1. Alana Maurushat, "Ethical Hacking",1st Edition, University Of Ottawa Press,2019.
2. Kevin Beaver, "Ethical Hacking for Dummies",6th Edition, Wiley publications, 2018.
3. Mohuya Chakraborty, Satyajit Chakrabarti and ValentinaE.Balas, "Proceedings of International Ethical Hacking Conference 2019", 1st Edition, Springer Singapore, 2020.

21PIT06	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To outline the components of the social network analysis.
- To infer about the privacy in social networks.
- To explain about data mining and text mining.
- To interpret the knowledge about web mining.
- To build the real time application systems.

UNIT-I	INTRODUCTION	9

Social Network Analysis – Basic concepts – Design, Theorization, Data Processing – Tensor Decomposition - Characteristics of Online Communication - Rich Media Communication Patterns – Applications of SNA.

UNIT-II	PRIVACY IN SOCIAL NETWORKS	9

Privacy breaches – definitions for publishing data – Privacy preserving mechanisms - Trust Network Analysis - Trust Transitivity Analysis - The Dirichlet Reputation System.

UNIT-III	DATA MINING AND TEXT MINING	9

Data Mining in a Nutshell - Social Media - Motivations for Data Mining in Social Media - Data Mining Methods for Social Media - Related Efforts. Text Mining: Keyword Search - Classification Algorithms - Clustering Algorithms - Transfer Learning in Heterogeneous Networks.

UNIT-IV	WEB MINING	9

Web Community - Web Data Model - Information Retrieval Performance Evaluation Metrics - Web Content Mining - Web Linkage Mining: Web Graph Measurement and Modeling - Web Linkage Mining.

UNIT-V	APPLICATIONS	9

Analysis of Communities and Their Evolutions in Dynamic Networks - Socio-Sense: A System for Analyzing the Societal Behavior from Web Archive - A Hybrid User-based and Item-based Web Recommendation System - User-based and Item-based Collaborative Filtering Recommender Systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the components of the social network analysis.

CO2: Interpret knowledge about the privacy in social networks.

CO3: Illustrate about data mining and text mining.

CO4: Demonstrate web mining in social network.

CO5: Develop the application related to real time systems.

TEXT BOOKS:

1. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
2. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", 1st Edition, Springer, 2012.
3. Brij B. Gupta and Somya Ranjan Sahoo, "Online Social Networks Security: Principles, Algorithm, Applications, and Perspectives", 1st Edition, CRC Press Publishers, 2021.

REFERENCES :

1. Charu C. Aggarwal, "Social Network Data Analytics", 1st Edition, Springer, 2014.

2. Przemyslaw Kazienko and Nitesh Chawla, "Applications of Social Media and Social Network Analysis", 1st Edition, Springer, 2015.
3. Nilanjan Dey, Samarjeet Borah, Rosalina Babo, Amira S. Ashour, "Social Network Analytics", 1st Edition, Academic Press Publishers, 2018.

21PIT07	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the concept of cloud computing.
- To explain the architecture and services of cloud.
- To identify the need of security in cloud computing.
- To outline the privacy in cloud computing.
- To illustrate cloud security polices for audit and compliance.

UNIT-I	INTRODUCTION	9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On demand Provisioning.

UNIT-II	CLOUD ARCHITECTURE, SERVICES AND STORAGE	9

Basics of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms- Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage.

UNIT-III	CLOUD SECURITY STANDARDS	9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

UNIT-IV	PRIVACY IN CLOUD	9

Privacy- Data Life Cycle- Key privacy concerns in cloud- Responsibility for protecting privacy-Changes to privacy Risk Management and Compliance in Relations to cloud computing- Legal and Regularity Implications- Laws and Regulations.

UNIT-V	AUDIT AND COMPLIANCE	9

Audit and Compliance -Internal Policy Compliance -Governance, Risk, and Compliance (GRC) - Illustrative Control Objectives for Cloud Computing -Incremental CSP-Specific Control Objectives - Additional Key Management Control Objectives- Control Considerations for CSP Users - Regulatory/External Compliance - Auditing the Cloud for Compliance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Interpret the concept of cloud computing.
CO2: Summarize the architecture and services of cloud.
CO3: Experiment with IAM practices in cloud computing.
CO4: Explain the privacy issues in cloud computing.
CO5: Outline cloud security polices for audit and compliance.

TEXT BOOKS:

1. Tim Mather, Subra Kumaraswamy, and Shahed Latif," Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", 1st Edition, O'Reilly Publications, September 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things",1st Edition, Morgan Kaufmann Publishers, 2012.
3. Liliana F. B. Soares, Diogo A. B. Fernandes and Joao V. Gomes," Security ,privacy and trust in cloud systems",1st Edition, Springer-Verlag Berlin Heidelberg publications,2014.

REFERENCES :

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", 1st Edition, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", 1st Edition, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

21PIT08	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To infer the basic concepts of Blockchain technologies.
- To identify Ethereum basics and its applications.
- To outline Bitcoin basics and its challenges.
- To apply the fundamentals of crypto currencies.
- To develop the applications of Blockchain technologies and deal with privacy issues.

UNIT I	INTRODUCTION OF BLOCKCHAIN	12

Peer-to-Peer (P2P) Networking, Blockchain Architecture, Blocks in Blockchain, Types of Block chain, the Logical Components of Blockchain, Core Components of Blockchain Architecture, Smart contracts and their applications.

SUGGESTED ACTIVITIES :

- Study of Basic Cryptography Concepts for Blockchain

UNIT II	ETHEREUM BASICS	12

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

SUGGESTED ACTIVITIES :

- Creating and Building up Ethereum Wallet.
- Building a Private Ethereum Network and Deploying Smart Contract

UNIT III	INTRODUCTION OF BITCOIN	12

Bitcoin features, Blockchain and Bitcoin, Bitcoin Security, Bitcoin Transaction, Transaction Lifecycle, Consensus Protocol, Role of Bitcoin Crimes, Dark Side of Bitcoin Crimes, Open Challenges to Bitcoin Crimes.

SUGGESTED ACTIVITIES :

- Creating and Building a Bitcoin Wallet.

UNIT IV	FUNDAMENTALS OF CRYPTOCURRENCIES	12

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Foundations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash – Smart Contracts – Ricardian Contracts.

SUGGESTED ACTIVITIES :

- Study of Hyperledger
- Creating a Business Ledger using Hyperledger

UNIT V	SECURITY AND PRIVACY ISSUES OF BLOCKCHAIN TECHNOLOGY	12

Introduction, Blockchain - Aspects for Consideration, Security of block chain, Privacy of blockchains, Security Issues of Blockchain Technology, Privacy Issues of Blockchain Technology, Types of Attack, Security Enhancement to Blockchain Systems, Applications of Blockchain in Health care, Finance.

SUGGESTED ACTIVITIES :

- Building and deploying multichain private Blockchain

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the concepts of Blockchain technologies.

CO2: Develop Ethereum block chain contract.

CO3: Make use of the concepts of Bitcoin and their usage.

CO4: Experiment with the basic principles of Cryptocurrencies.

CO5: Utilize the knowledge of blockchain technologies to develop various applications.

TEXT BOOKS:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", 2nd Edition, Packt Publishing, 2018.
2. Pethuru Raj, Kavita Saini and Chellammal Surianarayanan," Blockchain Technology and Applications", 1st Edition, CRC Press, 2021.
3. Elad Elrom, "The Blockchain Developer – A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchian-based Projects", 1st Edition, Apress, 2019.

REFERENCES:

1. Saravanan Krishnan, Raghvendra Kumar, S. Balaji, , Valentina Emilia Balas and Y. Harold Robinson , "Handbook of Research on Blockchain Technology", 1st Edition, Academic Press, 2020.
2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications using Ethereum-supported Tools, Services, and Protocols", 1st Edition, Packt Publishing, 2019.
3. Melanie Swan," Blockchain Blueprint for a New Economy", 1st Edition, O'Really Media Inc, 2015.
4. Shiho Kim and Ganesh Chandra Deka," Advanced Applications of Blockchain Technology", 1st Edition, Springer, 2019.

VERTICAL 5: CREATIVE MEDIA

21PIT09	MULTIMEDIA AND ANIMATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To infer multimedia system design.
- To utilize multimedia file handling, various software programs used in creation and implementation of multimedia.
- To identify various types of animation.
- To make use of strong knowledge about the fundamental principles of animation.
- To model various types of drawings.

UNIT I	MULTIMEDIA SYSTEM DESIGN	12

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. Compression and decompression − Binary, color, gray scale and still video image compression, Video image compression, audio compression.

SUGGESTED ACTIVITIES:

- Study the notes of a piano and stimulate them using the keyboard and store them in file
- Devise a routine to produce the animation effect of a square transforming to a triangle and then to a circle.

UNIT II	MULTIMEDIA FILE HANDLING & HYPERMEDIA	12

Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies. Multimedia authoring systems- User interface design - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.

SUGGESTED ACTIVITIES:

- Write a program to play “wave” or “midi” format sound files

UNIT III	ANIMATION BASICS	12

Animation: Stop Motion Photo Animation- Cel and Paper Animation- Cel Animation, Stop Motion Animation, Computer Animation, 2-D Animation, 3-D Animation.

SUGGESTED ACTIVITIES:

- Designing Flipbook.
- Drawing Basic Shapes.

UNIT IV	ANIMATION PRACTICES	12

Squash and Stretch, slow in and slow out, timing and placement, Generic walk, Double bounce and sneak, Full rigged character, Character walk

SUGGESTED ACTIVITIES:

- Designing Characters with Wax and Oil Based Clay.
- Using characters in stop motion animation.

UNIT V	DRAWINGS	12

Audio record and breakdown, Story Board, Key Pose animation, Key Drawings and in Betweens Clean ups, Background art- Light and shade, Light and Shadow, Depth layering, Inking and colouring, Digital colouring

SUGGESTED ACTIVITIES:

- Experimental Work with different mediums like sand, stones, grass, hard board, pen and Ink , water colors, poster colors, dry brush etc.
- Draw all kinds of facial expressions.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Outline the design of Multimedia System Design.

CO2: Develop various types of Multimedia File handing methods and experiments with various shapes and hypermedia files.

CO3: Make use of various types of animation in developing applications.

CO4: Identify various techniques in animation.

CO5: Experiment with types of drawings.

TEXT BOOKS:

1. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", 1st Edition, Pearson Education India, 2015.
2. Chris Patmore ," The Complete Animation Course: The Principles, Practice, and Techniques of Successful Animation", 1st Edition, Baron's Educational Series, 2003.
3. Tony White, "Animation Masterclasses from Pencils to Pixels- A Complete Course in Animation & Production", 1st Edition, CRC Press, 2022.

REFERENCES :

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", 1st Edition, PHI, 1998.
2. Richard Williams, "The Animator's Survival Kit", 1st Edition, Faber and Faber Publications, 2009.
3. Chris Webster, "Animation The Mechanics of motion", 1st Edition, Focal Press, 2005.

21PIT10	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the fundamentals of compression techniques.
- To illustrate the various coding and algorithms of Text and Image compression.
- To apply the compression techniques in multimedia processing applications.
- To learn about standards and techniques of video compression.
- To explain the basics of multimedia communication and retrieval that is commonly used in industry.

UNIT-I	FUNDAMENTALS OF COMPRESSION	9

Introduction To multimedia – Graphics, Image and Video representations — Storage requirements of multimedia applications – Need for compression – Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression.

UNIT-II	TEXT AND IMAGE COMPRESSION	9

Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon-Fano coding-Dictionary techniques – LZW family algorithms - Image Compression – JPEG Standard –JPEG 2000 standards – JBIG and JBIG2 standards.		
UNIT-III	**AUDIO COMPRESSION**	**9**
Audio compression Techniques – ADPCM in speech coding– Phase Insensitivity – Chanel Vocoder – Formant vocoder – G.726 ADPCM – MPEG audio – CELP vocoders – Linear Predictive coding.		
UNIT-IV	**VIDEO COMPRESSION**	**9**
Video compression – MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-4 – Motion compensation techniques –H.261 Standard –H.263 Standard.		
UNIT-V	**MULTIMEDIA COMMUNICATION AND RETRIEVAL**	**9**
Basics of computer and multimedia network – Multiplexing Technologies –Quality of Multimedia Data Transmission –Multimedia over ATM Networks – Media on Demand– Radio propagation channel –Trends in Wireless Interactive Multimedia.		
	TOTAL :45 PERIODS	

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Outline the fundamentals of multimedia compression techniques.

CO2: Summarize the various algorithms of Text and Image compression.

CO3: Apply the various compression techniques for multimedia processing applications.

CO4: Compare various video compression techniques.

CO5: Explain the basic concepts of multimedia communication and retrieval.

TEXT BOOKS:

1. Darrel Hankerson, Greg A Harris and Peter D Johnson, "Introduction to Information Theory and Data Compression", 2nd Edition, Chapman and Hall, CRC press, 2003.
2. Khalid Sayood," Introduction to Data Compression", Morgan Kauffman Harcourt India, 5th Edition, 2020.
3. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", 1st Edition, Pearson education, 2004.

REFERENCES :

1. David Solomon, "Data Compression – The Complete Reference", 4th Edition, Springer Verlog, New York, 2006.
2. Brusilovsky, Peter et.al, "The Adaptive Web: Methods and Strategies of Web Personalization", 1st Edition, Springer, 2007.
3. David Salomon, "Handbook of Data Compression", 5th Edition, Springer publication, 2010.

21PIT11	UI AND UX DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To outline the design of graphical user interfaces.
- To illustrate the user interfaces design process.
- To demonstrate the concepts and principles of UX.
- To develop an UX plane for an application.

- To build a simple application with UI and UX.

UNIT I	INTRODUCTION TO THE USER INTERFACE	12

The importance of User Interface (UI) – The importance of Good Design – A Brief Historical Overview of Interface Design – Characteristics of Graphical and Web User Interface – Interaction Styles – The Graphical User Interface – Web User Interface – Principles of UI Design – The Merging of Graphical Business Systems and the Web.

SUGGESTED ACTIVITIES:

- GUI Basics – Building an Interface.

UNIT II	USER INTERFACE DESIGN PROCESS	12

Know Your User or Client - Understand the Business Function - Understand the Principles of Good Interface and Screen Design - Develop System Menus and Navigation Schemes - Select the Proper Kinds of Windows - Select the Proper Interaction Devices - Choose the Proper Screen-Based Controls - Create Meaningful Graphics, Icons, and Images - Choose the Proper Colors - Organize and Layout Windows and Pages.

SUGGESTED ACTIVITIES:

- Graphics – The Canvas.

UNIT III	INTRODUCTION TO THE USER EXPERIENCE	12

The Tao of UXD Basics- What Is User Experience Design? - The Broad Definition - The Project Ecosystem - Identify the Type of Site - Choose Your Hats - Understand the Company Culture - Proposals for Consultants and Freelancers - UX Design Guidelines.

SUGGESTED ACTIVITIES:

- Widget Events – Binding Actions.

UNIT IV	UX PLANE	12

The Strategy Plane - The Scope Plane - The Structure Plane - The Skeleton Plane - The Surface Plane - The Elements Applied - User Experience and the Web - Meet the Elements.

SUGGESTED ACTIVITIES:

- Improving the User Experience.

UNIT V	UI/ UX Design Tools	12

Invaders Revenge - An Interactive Multi-touch Game - Invaders Revenge – An animated multi-touch game- Atlas – An efficient management of images-Boom – simple sound effects - Ammo – simple animation- Invader – transitions for animations - Dock – automatic binding in the Kivy language - Fleet – infinite concatenation of animations - Scheduling events with the clock- Shooter – multi-touch control- Invasion – moving the shooter with the keyboard - Combining animations with '+' and '&'.

SUGGESTED ACTIVITIES:

Develop sound effect and shooter for a simple game.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the design of graphical user interfaces.

CO2: Summarize the User Interfaces to design a good product.

CO3: Relate the concepts and principles of UX.

CO4: Experiment with UX plane.
CO5: Develop a simple application incorporating UI and UX.

TEXT BOOKS:

1. Wilbert O. Galitz, "The Essential Guide to User Interface Design An Introduction to GUI Design Principles and Techniques", 3rd Edition, Wiley Publishing, Inc., 2017.
2. Russ Unger and Carolyn Chandler, "A Project Guide to UX Design: For user experience designers in the field or in the making", 2nd Edition, New Riders Publishing, 2012.
3. Roberto Ulloa, "Kivy – Interactive Applications and Games in Python", 2nd Edition, Packt Publishing, 2015.

REFERENCES:

1. Jesse James Garrett, "The Elements of User Experience: User-Centered Design for the Web and Beyond", 2nd Edition, Pearson Education. 2011.
2. Rex Hartson and Pardha S. Pyla, "The UX Book Process and Guidelines for Ensuring a Quality User Experience", Elsevier, 2012.
3. Pamala Deacon, "UX and UI Strategy: A step by step Guide on UX and UI design", 1st Edition, Packt Publishing, 2020.

21PIT12	VIDEO PROCESSING AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the fundamentals of video processing.
- To identify the moving objects using motion estimation techniques.
- To experiments with video processing tools for analytics.
- To utilize data streams for categorization of videos.
- To construct application for video analytics.

UNIT-I	VIDEO FUNDAMENTALS	9

Basic Concepts and Terminology – Analog Video Standards – Digital Video Basics – Analog to Digital Conversion – Color Representation and Chroma Sub Sampling – Video Sampling Rate and Standards Conversion – Digital Video Formats – Video Features – Colour, Shape and Textural features.

UNIT-II	MOTION ESTIMATION	9

Fundamentals of Motion Estimation – Optical Flow – 2D and 3D Motion Estimation – Block Based Methods – Phase Correlation Methods – Block Matching Methods – Hierarchical Motion Estimation – Genaralized Block Motion Estimation

UNIT-III	VIDEO SEGMENTATION AND ANALYTICS	9

Direct Methods – Optical Flow Segmentation – Simultaneous Estimation and Segmentation: Motion Field Model – The Algorithm – Relationship to other algorithms.

UNIT-IV	MINING DATA STREAMS	9

Introduction to Streams Concept – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Video Database – Categorization of Videos – Video Query Categorization.

UNIT-V	EMERGING TRENDS	9

Affective Video Content Analysis – Parsing a Video into Semantic Segments – Video Indexing and Abstraction for Retrieval – Automatic Video Trailer Generation– Video in painting– Forensic Video Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the basic video processing functions.
CO2: Experiment with optical flow and motion estimation.
CO3: Make use of segmentation techniques for video analytics.
CO4: Select techniques to index and retrieve videos for faster access
CO5: Develop applications for video analytics.

TEXT BOOKS:

1. A. Murat Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
2. Oges Marques, "Practical Image and Video Processing Using MATLAB", 1st Edition, Wiley and Sons (IEEE Press), 2011.
3. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", 1st Edition, Cambridge University Press, 2012.

REFERENCES :

1. Alan C. Bovik, "Handbook of Image and video processing", 2nd Edition, Academic Press, 2005.
2. Al Bovik, "The Essential Guide to Video Processing", 1st Edition, Academic Press, 2009.
3. Suhel Dhanani and Michael Parker, "Digital Video Processing for Engineers: A Foundation for Embedded Systems Design", 1st Edition, Newnes publishers, 2012.

21PIT13	TECHNIQUES FOR VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the basics of visual effects.
- To summarize basic compositing theory.
- To experiment with intermediate compositing techniques.
- To make use of advanced compositing methods.
- To build applications with advanced effects.

UNIT-I	INTRODUCTION	9

Digital Image Basics – Resolution – Color – Packing it in – File formats – Video and Film – Film to Computer – Video to Computer – Image Quality – Desktop Hardware options – Telecine – Film Scanners.

UNIT-II	BASIC COMPOSITING AND TOOLS	9

Basic Compositing theory – Channels – Mattes – Filters – Geometric transformation – Basic tools – Compositing with alpha channel – Simple keying – Filters and Effects – Geometric Transformations.

UNIT-III	INTERMEDIATE COMPOSITING	9

Rig removal with a clean plate – Rotoscoping – Tracking – Stabilizing – Destabilizing – Tracking for animation.

UNIT-IV	ADVANCED COMPOSITING	9

Tweaking Colors – Color tools – Matte painting for the moving camera – Reserving footage – Changing speed – Motion blur – Stretching time.

UNIT-V	QUALITY AND ADVANCED SPECIAL EFFECTS	9

Quality and Efficiency – Minimizing data loss – Consolidating operations – Beyond black and white – Nonlinear color spaces – working with 3D elements – Related 2D disciplines – case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the concept of Visual Effects.
CO2: Outline about various compositing and tools.
CO3: Utilize the concepts of Intermediate compositing for animation.
CO4: Make use of advanced compositing techniques.
CO5: Experiment with 2D and 3D animation techniques.

TEXT BOOKS:

1. Doug Kelly, " Digital Compositing In Depth: The Only Guide to Post Production for Visual Effects in Film",1st Edition, Coriolis Group Books,2000.
2. Ron Brinkmann, "The art and science of digital compositing: Techniques for visual effects, Animation and Motion Graphics",2nd Edition, Morgan Kaufmann,2008.
3. Jeffrey Okun , Susan Zwerman ,"The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures",Routledge,3rd Edition,2020.

REFERENCES :

1. Angie Taylor," Creative After Effects 7: Workflow Techniques for Animation, Visual Effects and Motion Graphics", 1st Edition, Focal press, 2006.
2. Charles Finance and Susan Zwerman, "The Visual Effects Producer: Understanding the Art and Business of VFX,Routledge, 1st Edition, 2015.
3. Gress Jon, "[digital] Visual Effects and Compositing, 1st Edition, New Riders publications, 2014.

21PIT14	GAME DESIGN AND DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To illustrate the basic concepts of game programming.
- To experiment with 3D graphics concepts.
- To apply the terminologies like sound, physics and cameras for developing simple games.
- To choose user interfaces and scripting for developing games.
- To make use of gaming concepts for game development.

UNIT I	INTRODUCTION TO GAME PROGRAMMING	12

Game Programming Overview: Evolution of Video Game Programming - The Game Loop - Time and Games – Game Objects. 2D Graphics: 2D Rendering Foundations - Sprites – Scrolling - Tile Maps. Linear Algebra for Games.

SUGGESTED ACTIVITIES:

- Installation of Pygame and Pygame Zero and Implementation of colour models and shading models in Python.

UNIT II	3D GRAPHICS	12

Basics - Coordinate Spaces - Lighting and Shading – Visibility - World Transform, Revisited - Input Devices - Event-Based Input Systems - Mobile Input.

SUGGESTED ACTIVITIES:

- Experiment with game script in natural language for story creation.
- Practical problems in game level design.

UNIT III	**SOUND, PHYSICS AND CAMERAS**	**12**

Basic Sound - 3D Sound - Digital Signal Processing - Planes, Rays, and Line Segments. - Collision Geometry - Collision Detection - Physics-Based Movement - Types of Cameras - Perspective Projections - Camera Implementations - Camera Support Algorithms.

SUGGESTED ACTIVITIES:

- Implementation of simple animations in Pygame and Processing.py

UNIT IV	**USER INTERFACES AND SCRIPTING**	**12**

Menu Systems - HUD Elements - Other UI Considerations - Scripting Languages - Implementing a Scripting Language - Data Formats.

SUGGESTED ACTIVITIES:

- Installation of Unity scripts routines for character rendering, transformations and sound processing.

UNIT V	**GAME DEVELOPMENT**	**12**

Side-Scroller for iOS - Tower Defense for PC/Mac - Tetris game.

SUGGESTED ACTIVITIES:

- Implementation of Sudoku Game
- Implementation of Tic Tac Toe Game

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the basic concepts of game programming.

CO2: Experiment with 3D graphics concepts.

CO3: Make use of the concepts of sound, physics and cameras to develop simple games.

CO4: Apply the concepts of user interfaces and scripting to develop games.

CO5: Utilize the gaming concepts to develop games in various platforms.

TEXT BOOKS:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison-Wesley Professional, 2nd Edition, 2014.
2. K. Patinson, "Game Development: Gaming Design and Programming", Code Academy Publishers, 1st Edition, 2021.
3. James R Parker and J R Parker, "Introduction to Game Development:", Mercury Learning & Information Publishers, 1st Edition, 2015.

REFERENCES:

1. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress Publishers,1st Edition, 2007.
2. Paul Vincent Craven, "Program Arcade games", Apress Publishers, 4th Edition, 2016.
3. Steve Rabin, "Introduction to Game Development", Charies River Media Publishers, 2nd Edition, 2009.

21PIT15	CONCEPTS OF AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To demonstrate various augmented reality methods.
- To explain the scientific, technical and engineering aspects of augmented reality.
- To explain the scientific, technical and engineering aspects of virtual reality.
- To develop applications based on AR and VR technologies.
- To summarize the applications of AR and VR.

UNIT-I	INTRODUCTION	9

Introduction to Augmented Reality, Other Enhancements, The Relationship between Augmented Reality and Other Technologies, Virtual and Mixed Reality, Cyber Space, Virtuality and the Virtuality Continuum, The Reality Continuum, The Metaverse and the Metaverse Roadmap, Introduction to VR – The three I's of VR, Early commercial VR technology, VR becomes an Industry, Five classic components of VR system

UNIT-II	AUGMENTED REALITY HARDWARE	9

The Two-Step Process of Augmented Reality Applications, Hardware Components For AR - Sensors, Processors, Displays, Augmented Reality System.

UNIT-III	VIRTUAL REALITY HARDWARE	9

Input Devices: Trackers, Navigation and Gesture Interfaces, Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays, Computing Architecture for VR, Modeling.

UNIT-IV	AR AND VR SOFTWARE DEVELOPMENT	9

Software involved directly in the Augmented Reality application- Environmental acquisition, Sensor integration, Application engine, Rendering software, Augmented Reality libraries, Software used to create content for the Augmented Reality Application, VR Programming – Toolkits and Scene graphics, World toolkit, Java 3D, General Haptics Open Software Toolkit (GHOST).

UNIT-V	APPLICATIONS	9

AR Applications – Magic books, Magic Mirrors, Magic Windows and Doors, Magic Lens, Navigation Assistance, Non referential augmentation, Objective view augmented reality, Traditional VR applications – Medical Applications of VR, Virtual anatomy, Triage and Diagnostic, Surgery, Rehabilitation, Education, arts and Entertainment, Military VR Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the basic knowledge of AR and VR.

CO2: Outline the scientific, technical and engineering aspects of AR.

CO3: Outline the scientific, technical and engineering aspects of VR.

CO4: Experiment with technologies related to AR and VR software development.

CO5: Summarize the applications of AR and VR engineering.

TEXT BOOKS:

1. Burdea, G. C. and P. Coffet, "Virtual Reality Technology", 2nd Edition, Wiley-IEEE Press, 2006.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", 1st Edition, Morgan Kaufmann, 2013.

3. John Vince, "Virtual Reality Systems", 1st Edition, Pearson Education, 2002.

REFERENCES :

1. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Application, Foundations of Effective Design", 1st Edition, Morgan Kaufmann, 2009.
2. George Mather, "Foundations of Sensation and Perception",3rd Edition, Psychology Press, 2009.
3. Chetankumar G Shetty, "Augmented Reality - Theory, Design and Development", 1st Edition, McGraw Hill 2020.

21PIT16	STRATEGIES OF DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the fundamentals of Digital Marketing.
- To outline the optimization of search engine.
- To utilize the most popular social media platforms to grow business.
- To experiment with various tools for digital marketing.
- To plan case studies for understanding real world scenarios.

UNIT-I	INTRODUCTION TO DIGITAL MARKETING	9

Introduction- From Traditional to model marketing-Premise of Traditional Marketing-Evolution of Digital Marketing-Rise of the Internet- Growth and Impact of Search Technologies- Understanding e models-Digital -The next wave of Marketing.

UNIT-II	SEARCH ENGINE OPTIMIZATION (SEO)	9

SEO tools-Picking a product-Picking a domain name-Domain Registration & Hosting-Page Optimization-Home Page Optimization-Site Optimization-Registering with Directories-Link Building- Common SEO Abuse Techniques-Appearing Natural-SEO as a Standalone Product-The Social Elements of Relevancy-Interactive Elements-Choosing a Domain Name-Hosting-Copywriting.

UNIT-III	SOCIAL MEDIA OPTIMIZATION (SMO)	9

Blogging-API-Widget-Likes-Groups-Application-Open Graph-Traditional Marketing
Elucidation of out bound tactics-Inbound Marketing- Magnet, Sledgehammer Concept-Content Marketing-Get Found Tactics -Convert Tactics-Analyze Tactics.

UNIT-IV	SEARCH ENGINE MARKETING	9

Emergence of Digital Marketing as a tool- Pull and Push Marketing-Media consumption drivers for new marketing environment-Digital Marketing Channel-Digital Marketing Frame work -Digital Marketing application and benefits-Critical Success Factors for Digital Marketing.

UNIT-V	CASE STUDIES	9

Google Analytics -Website Analysis and Quality Control-A Microlevel Elucidation of Lead Generation Strategy-Content Formats for Mobile-Lead Nurturing-SEO Next-Social Media Monitoring Strategy-Google Algorithms-Steps to increase Google Page Rank.

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the fundamentals of Digital Marketing.

CO2: Summarize about search engine optimization techniques.

CO3: Make use of most popular social media platforms to grow business.

CO4: Apply the knowledge about various online advertisement techniques.

CO5: Plan case studies for understanding real world scenarios.

TEXT BOOKS:

1. Puneet Singh Bhatia," Fundamentals of Digital Marketing," 1st Edition, Pearson Education, 2017.
2. Aaron Matthew Wall, "Search Engine Optimization Book", 1st Edition, 2005.
3. Dave Chaffey and Fiona Ellis, "Digital Marketing: Strategy, Implementation & Practice", 7th Edition, Pearson Education, 2019.

REFERENCES:

1. Rob Stokes, "eMarketing: the essential guide to digital marketing", 6th Edition, The Red & Yellow Creative School of Business, 2008.
2. Jayakumar K, "IT Business Process Management and Strategic Marketing", 2nd Edition, 2014.
3. Vandana Ahuja, "Digital Marketing", 1st Edition, Oxford University Press, 2015.

VERTICAL 6: PROGRESSIVE TECHNOLOGIES

21PIT17	TECHNIQUES OF ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the fundamentals of Robotic Process Automation.
- To model the basics of Robotic Process Automation tool.
- To outline the automation techniques of Robotic Process Automation.
- To experiment with bot using triggering concept.
- To develop and maintain the bot.

UNIT-I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	9

History of Automation - What is RPA - RPA vs Automation - Benefits of RPA - Components of RPA - RPA platforms - About UiPath - UiPath Robot - Record and Play-UiPath stack - Learning UiPath Studio-Task recorder-Step-by-step examples using the recorder.

UNIT-II	RPA TOOL	9

What is a Sequence? - Using activities with workflows – Flowchart - Control Flow, Sequencing the workflow - Control flow, various types of loops, and decision making - Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow.

UNIT-III	DATA MANIPULATION	9

Variables and scope–Collections -Arguments – Purpose and use - Data table usage with examples - Clipboard management - File operation with step-by-step example - CSV/Excel to data table and vice versa.

UNIT-IV	TAKING CONTROL OF THE CONTROLS	9

Taking Control of the Controls - Implementing the Attach Window activity -Finding the control - Techniques for waiting for a control - Act on controls – mouse and keyboard activities -Working with UiExplorer - Handling events - Handling events - Screen Scraping-When to use OCR-Types of OCR available - Avoiding typical failure points-SAP automation-Java plugin-Citrix automation.

UNIT-V	HANDLING USER EVENTS AND ASSISTANT BOTS	9

What are assistant bots? - Monitoring system event triggers - Monitoring image and element triggers -Launching an assistant bot on a keyboard event- Common exceptions and ways to handle them - Logging and taking screenshots - Debugging techniques - Collecting crash dumps - Error reporting -Nesting workflows -Reusability of workflows.

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the fundamentals of Robotic Process Automation.

CO2: Identify the different Robotic Process Automation tools and its usage.

CO3: Outline the automation techniques of Robotic Process Automation.

CO4: Apply the various triggering concept for monitoring bots.

CO5: Plan, develop and deploy bots.

TEXT BOOKS:

1. Alok Mani Tripathi, "Learning Robotic Process Automation", 1st Edition Packt Publishing, 2018.
2. Nandan Mullakara, Arun Kumar and Asokan, "Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere", 1st Edition, Packt Publishing, 2020.
3. Robert Fantina, Andriy Storozhuk and Kamal Goyal, "Introducing Robotic Process Automation to Your Organization", 1st Edition, Apress Publication, 2021.

REFERENCES :

1. Christian Czarnecki, Peter Fettke, "Robotic Process Automation: Management, Technology, Applications", 1st Edition, Walter de Gruyter Publishing, 2021.
2. Tom Taulli "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", 1st Edition, Apress Publication, 2020.
3. Husan Mahey "Robotic Process Automation with Automation Anywhere", 1st Edition, Packt Publishing LTD, 2021.

21PIT18	CYBER SECURITY ESSENTIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the basics of cyber security.
- To outline the security aspects of operating systems and networks.
- To make use of cryptographic techniques in network security.
- To explain the privacy principles and policies.
- To illustrate the security management and incidents.

UNIT-I	INTRODUCTION TO CYBER SECURITY	9
Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls – Authentication Access Control and Cryptography - Web-User Side - Browser Attacks - Web Attacks- Targeting Users - Obtaining User or Website Data - Email Attacks.		
UNIT-II	**SECURITY IN OPERATING SYSTEM & NETWORKS**	**9**
Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack-Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service		
UNIT-III	**DEFENCES: SECURITY COUNTER MEASURES**	**9**
Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.		
UNIT-IV	**PRIVACY IN CYBERSPACE**	**9**
Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.		
UNIT-V	**MANAGEMENT AND INCIDENTS**	**9**
Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law – Information and Laws - Cyber crime - Cyber Warfare and Home Land Security.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the basic concepts of computer security.

CO2: Illustrate methods for Security in operating system and networks.

CO3: Identify the various security counter measures.

CO4: Summarize the privacy principles and policies.

CO5: Interpret the management strategies of cyber space.

TEXT BOOKS:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, “Security in Computing”, 5th Edition, Pearson Education, 2015.
2. MarttiLehto and Pekka Neittaanmäki, “Cyber Security: Analytics, Technology and Automation edited”, Springer International Publishing Switzerland, 2015.
3. George K. Kostopoulous, “Cyber Space and Cyber Security”, 2nd Edition, CRC Press, 2017.

REFERENCES :

1. Jan L.Harrington,”Network Security A Practical Approach”, 1st Edition, Morgan Kaufmann Publishers, 2005.
2. Edward Amoroso, “Cyber Security”, 1st Edition, Silicon Press, 2006.
3. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations",1st Edition, CBS publishers, New Delhi, 2004.

21PIT19	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To infer the importance of 3D printing in manufacturing.
- To compare different 3D printing technologies.
- To select a suitable material for 3D printing.
- To choose different methods for Post-processing of 3D printing parts.
- To develop the applications of 3D printing.

UNIT-I	INTRODUCTION AND BASIC PRINCIPLES	9

3D Printing, Generic 3D Printing Process, Benefits of 3D Printing, Distinction Between 3D Printing and CNC Machining, Other Related Technologies Development of 3D Printing Technology: Introduction, Computers, Computer-Aided Design Technology, Other Associated Technologies, The Use of Layers, Classification of 3D Printing Processes, Metal Systems, Hybrid Systems, Milestones in 3D Printing Development, 3D Printing around the World.

UNIT-II	3D PRINTING PROCESS CHAIN & PHOTOPOLYMERIZATION PROCESSES	9

Eight Steps in Additive Manufacture, Variations from One 3D Printing Machine to Another, Metal Systems, Maintenance of Equipment, Materials Handling Issues, design for 3D printing. Introduction to Photopolymerization Processes: Photopolymerization Materials, Reaction Rates, Vector Scan SL, SL Resin Curing Process, SL Scan Patterns, Vector Scan Micro stereolithography, Mask Projection Photo polymerization Technologies and Processes, Two-Photon SL.

UNIT-III	POWDER BED FUSION PROCESSES & EXTRUSION-BASED SYSTEMS	9

Powder Bed Fusion Processes: Introduction, SLS Process Description, Powder Handling, Approaches to Metal and Ceric Part Creation, Variants of Powder Bed Fusion Processes, Process Par 3D Printingeters, Applied Energy Correlations and Scan Patterns, Typical Materials and Applications, Materials - Capabilities and Limitations. Extrusion-Based Systems: Introduction, Basic Principles, Plotting and Path Control, Materials, Limitations of FDM, Bioextrusion, Other Systems.

UNIT-IV	DESIGN, GUIDELINES FOR PROCESS SELECTION & SOFTWARE ISSUES	9

Design for 3D Printing - Design for Manufacturing and Assembly, Core DFM for 3D Printing Concepts and Objectives, 3D Printing Unique Capabilities, Exploring Design Freedoms, Design Tools for 3D Printing. Guidelines for Process Selection - Selection Methods for a Part, Challenges of Selection, Preliminary Selection, Production Planning and Control.

Software Issues for 3D Printing - Preparation of CAD Models – the STL File, Problems with STL Files, STL File Manipulation, Beyond the STL File, Additional Software to Assist 3D Printing.

UNIT-V	MEDICAL APPLICATIONS & FUTURE DIRECTIONS FOR 3D PRINTING	9

Medical Applications for 3D Printing - Use of 3D Printing to Support Medical Applications, Software Support for Medical Applications, Limitations of 3D Printing for Medical applications, Further Development of Medical 3D Printing Applications. Use of Multiple Materials in 3D Printing - Discrete Multiple Material Processes, Porous Multiple Material Processes, Blended Multiple Material Processes, Embedded Component 3D Printing,

Commercial Applications Using Multiple Materials, Future Directions, Business Opportunities and Future Directions

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the basics of 3D printing.
CO2: Explain different 3D printing Technologies.
CO3: Identify suitable materials for 3D printing.
CO4: Make use of different methods for Post-processing of 3D printing parts.
CO5: Plan 3D printing for medical applications and commercial applications.

TEXT BOOKS:

1. Ian Gibson, David W Rosen and Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", 2nd Edition, Springer, 2010.
2. Ben Redwood, Filemon Schoffer and Brian Garret, "The 3D Printing Handbook: Technologies, design and applications", 1st Edition, 3DHubs publications, 2017.
3. Dorling Kindersley, "3D printing projects: Amazing ideas to print and make", 1st Edition, DK publishing, 2017.

REFERENCES :

1. Chua Chee Kai and Leong Kah Fai, "Rapid Prototyping: Principles &Applications", 3rd Edition, World Scientific publisher, 2010.
2. Ali K. Kamrani and EmandAbouel Nasr, "Rapid Prototyping: Theory &Practice", 1st Edition, Springer, 2006.
3. D.T. Pham, S.S. Dimov, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", 1st Edition, Springer 2012.

21PIT20	EMBEDDED SYSTEM DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To infer the architecture and programming of ARM processor.
- To illustrate the design and analysis of embedded computing platform.
- To develop the basic concepts and overview of real time Operating system and the processes involved.
- To compare the general purpose system with real time operating system.
- To apply embedded systems concepts in various domains.

UNIT I	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	12

Embedded Computing - Complex Systems and Microprocessors, Characteristics of embedded computing applications, Challenges in embedded system design, Embedded system Design process. ARM Processor, Processor and Memory Organization, Data Operations, Flow of Control, TI C55x DSP - Processor and Memory Organization, Addressing Modes, Data Operations, Flow of Control.

SUGGESTED ACTIVITIES:

- Study of ARM evaluation system

UNIT II	EMBEDDED COMPUTING PLATFORM DESIGN	12

The CPU Bus–Memory devices and I/O devices–Models of programs– Assembly, linking and loading – Basic Compilation Techniques – Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size– Program validation and testing.

SUGGESTED ACTIVITIES:

- Interfacing ADC and DAC & Interfacing LED and PWM.

UNIT III	PROCESSES AND OPERATING SYSTEMS	12

Introduction – Kernel, Threads –Multiple tasks and multiple processes – Multirate systems– Preemptive real–time operating systems– Priority based scheduling– Inter process communication mechanisms, Evaluating Operating System Performance, Power Management and Optimization for Processes.

SUGGESTED ACTIVITIES:

- Interfacing real time clock and serial port.
- Interfacing keyboard and LCD.

UNIT IV	NETWORKS	12

Distributed Embedded Architectures – Networks for embedded systems: I2C, Ethernet, Field bus– Network based Design, Internet Enabled Systems.

SUGGESTED ACTIVITIES:

- Interfacing of servo motor and DC motor.
- Interfacing stepper motor and temperature sensor.

UNIT V	APPLICATIONS OF EMBEDDED SYSTEMS	12

Telephone Answering Machine - Cell Phones – Compact DISCs and DVDs -– Audio Players– Video Accelerator – Digital Still Cameras – Elevator Controller.

SUGGESTED ACTIVITIES:

- Implementing zigbee protocol with ARM.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the architecture and programming of ARM processor.
CO2: Outline the concepts of embedded systems.
CO3: Make use of system design techniques to develop software for embedded systems.
CO4: Compare the general purpose system with real time operating system.
CO5: Model real-time consumer/industrial applications using system concepts.

TEXT BOOK:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 4th Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2016.
2. Jane W.S.Liu , "Real Time Systems" Pearson Education, 3rd Indian Reprint, 2018.
3. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition, Cengage Learning, 2012.

REFERENCES:

1. Sriram V Iyer and Pankaj Gupta, "Embedded Real Time Systems Programming", 1st Edition, TataMcGrawHill, 2017.
2. Geoffrey Brown,"Discovering the STM32 Micro controller", 1st Edition, Indiana University press, 2016.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison Wesley Professional, 2007.
4. C.M. Krishna and Kang G. Shin, "Real-Time Systems", 1st Edition, Tata McGraw-Hill Education, 2010.
5. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design and Programming", 1st Edition, Dream Tech Press, 2005.

21PIT21	PRINCIPLES OF QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the foundation of traditional computing.
- To interpret the knowledge on the modeling of quantum circuit.
- To summarize the knowledge of basic quantum algorithms.
- To outline the knowledge of advanced quantum algorithms.
- To interpret the quantum computational complexity and error correction methods.

UNIT I	INTRODUCTION AND BACKGROUND	9

Overview of traditional computing – Computers and the Strong Church–Turing Thesis - The Circuit Model of Computation- A Linear Algebra Formulation of the Circuit Model - Reversible Computation - A Preview of Quantum Physics - Quantum Physics and Computation

UNIT II	DIRAC NOTATION AND QUANTUM MECHANICS	9

The Dirac Notation and Hilbert Spaces - Dual Vectors – Operators - The Spectral Theorem- Functions of Operators - Tensor Products - The Schmidt Decomposition Theorem - Some Comments on the Dirac Notation. The State of a Quantum System - Time-Evolution of a Closed System - Composite Systems - Measurement - Mixed States and General Quantum Operations - Mixed States, Partial Trace, General Quantum Operations.

UNIT III	A QUANTUM MODEL OF COMPUTATION	9

The Quantum Circuit Model - Quantum Gates - 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates - Efficiency of Approximating Unitary Transformations - Implementing Measurements with Quantum Circuits.

UNIT IV	INTRODUCTORY QUANTUM ALGORITHMS	9

Probabilistic Versus Quantum Algorithms - Phase Kick-Back - The Deutsch Algorithm - The Deutsch–Jozsa Algorithm - Simon's Algorithm.

UNIT V	QUANTUM ERROR CORRECTION	9

Classical Error Correction - The Error Model, Encoding, Error Recovery - The Classical Three-Bit Code - Fault Tolerance - Quantum Error Correction - Error Models for Quantum Computing, Encoding, Error Recovery.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the foundations of traditional computing

CO2: Interpret the knowledge on the modeling of quantum circuit
CO3: Infer the knowledge of basic quantum computing.
CO4: Extend the knowledge of advanced quantum algorithms.
CO5: Summarize the quantum computational complexity and error correction methods.

TEXT BOOK:

1. Jack Hidary, "Quantum Computing: An Applied Approach" Springer, 2019.
2. Chris Bernhardt "Quantum Computing for Everyone" 1st Edition, The MIT Press, 2019.
3. Wolfgang Scherer, "Mathematics of Quantum Computing: An Introduction Hardcover" Springer, 2019.

REFERENCES:

1. Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, "Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations", 1st Edition, Springer, 2018.
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", 10th Edition, Cambridge University Press, 2010.
3. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing",1st Edition, Oxford University Press, 2007.

21PIT22	AUTONOMOUS GROUND VEHICLE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To outline the fundamentals of autonomous driving.
- To identify the different ways of sensing internal states of Autonomous Ground Vehicles (AGVs).
- To model the environment perception for autonomous driving.
- To develop the navigation techniques of AGVs.
- To utilize the fundamentals of vehicle control systems and connected vehicles.

UNIT I	INTRODUCTION TO AUTONOMOUS DRIVING	9

Autonomous Driving Technologies Overview – Autonomous Driving Algorithms –Autonomous Driving Client System – Autonomous Driving Cloud Platform – Components of autonomy – Difference between Unmanned and Autonomous Vehicles – Introduction to Unmanned Aerial Vehicles (UAVs).

UNIT II	SENSORS FOR AUTONOMOUS GROUND VEHICLES	9

Sensor Characteristics –Vehicle Internal State Sensing: OEM Vehicle Sensors, GPS, Inertial Measurements, Magnetometer – External World Sensing: RADAR, Lidar, Image Processing Sensors.

UNIT III	ENVIRONMENT PERCEPTION AND MODELING	9

Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm –Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features – Multiple Sensor Based Multiple Object Tracking.

UNIT IV	NAVIGATION FUNDAMENTALS	9

Introduction – Navigation: GNSS Overview, GPS, GLONASS, Galileo, Compass – Inertial Navigation Overview: Inertial Sensor Technology – GNSS/INS Integration Overview – Case Study on Kalman Filtering.

UNIT V	VEHICLE CONTROL AND CONNECTED VEHICLE	9

Vehicle Control: Cruise Control, Antilock Brake Systems, Steering Control and Lane Following, Parking – Connected Vehicles: Vehicle to Vehicle Communication, Vehicle to Infrastructure Communication.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Identify the requirements and design challenges of AGVs.
CO2: Select suitable sensors to sense the internal state and external world of AGVs.
CO3: Make use of lane detection, road detection & vehicle detection algorithms.
CO4: Utilize ground vehicle navigation algorithms.
CO5: Develop ground vehicle control systems.

TEXT BOOKS:

1. Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, "Creating Autonomous Vehicle Systems", 1st Edition, Morgan & Claypool, 2018.
2. Umit Ozguner, Tankut Acarman, Keith Redmill, "Autonomous Ground Vehicles", 1st Edition, Artech House, 2011.
3. Sumit Ranjan, "Applied Deep Learning and Computer Vision for Self-Driving Cars: Build autonomous vehicles using deep neural networks and behavior-cloning techniques", 1st Edition, Packt Publishing, 2020.

REFERENCES: -

1. Hong Cheng, "Autonomous Intelligent Vehicles Theory, Algorithms, and Implementation", Springer, 2011.
2. Mohinder S. Grewal, Angus P. Andrews, Chris G. Bartone, "Global Navigation Satellite Systems, Inertial Navigation, and Integration", 3rd Edition, John Wiley & Sons, 2013.
3. Thomas Bräunl, "Embedded Robotics: From Mobile Robots to Autonomous Vehicles with Raspberry Pi and Arduino", Springer, 2022.

21PIT23	E-LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the various E-learning approaches and Components.
- To experiment with Design Thinking.
- To identify the types of design models for E-learning.
- To select various E-learning Authoring tools for development.
- To utilize E-learning courseware for evaluation and management solutions.

UNIT I	INTRODUCTION	9

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

UNIT II	DESIGNING E-LEARNING COURSE CONTENT	9

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

UNIT III	CREATING INTERACTIVE CONTENT	9

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements

– Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources– Courseware Development – Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

UNIT IV	LEARNING PLATFORMS	9

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

UNIT V	COURSE DELIVERY AND EVALUATION	9

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats –Using Communication Tools for E-Learning – Course Evaluation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Compare the phases of activities in models of E-learning

CO2: Identify appropriate instructional methods and delivery strategies

CO3: Choose appropriate E-learning Authoring tools.

CO4: Develop interactive E-learning courseware.

CO5: Organize the E-learning courseware.

TEXT BOOK:

1. Raymundo Solak, "E-Learning Techniques: An Inexpensive Software Application For Developing Learning Solutions", 1st Edition, 2022.
2. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", 1st Edition, O'Reilly Media, 2017.
3. Crews, T. B., Sheth, S. N., Horne, T. M., "Understanding the Learning Personalities of Successful Online Students", 1st Edition, Educause Review, 2014.

REFERENCES:

1. Madhuri Dubey, "Effective E–learning Design, Development and Delivery", 1st Edition, University Press, 2011.
2. Clark, R. C., Mayer, R. E., "E-Learning and the Science of Instruction",3rd Edition, 2011.
3. Rob Philips, Carmel McNaught and Gregor Kennedy, "Evaluating e-Learning Guiding Research and Practice", 1st Edition, Taylor and Francis publishers, 2012.

21PIT24	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To outline the fundamentals of 5G internet.
- To develop the concept of small cells in 5G mobile networks.
- To interpret the mobile clouds in 5G network context.
- To select the role of cognitive radios in 5G networks.
- To experiment with security issues in 5G networks.

UNIT I	PERVASIVE CONNECTED WORLD AND 5G INTERNET	9

Historical Trend of Wireless Communications – Evolution of LTE Technology to Beyond 4G – 5G Roadmap – Ten Pillars of 5G – Internet of Things and Context Awareness –Networking Reconfiguration and Virtualization Support – Mobility – Quality of Service Control – Emerging Approach for Resource over Provisioning.		
UNIT II	**SMALL CELLS FOR 5G MOBILE NETWORKS**	**9**
Introduction to Small Cells – Capacity Limits and Achievable Gains with Densification – Mobile Data Demand – Demand vs. Capacity – Small Cell Challenges.		
UNIT III	**COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS**	**9**
Introduction – Cooperative Diversity and Relaying Strategies: Cooperation and Network Coding, Cooperative ARQ MAC Protocols – PHY Layer Impact on MAC Protocol Analysis: Impact of Fast Fading and Shadowing on Packet Reception for QoS Guarantee, Impact of Shadowing Spatial Correlation – Study: NCCARQ, PHY Layer Impact.		
UNIT IV	**MOBILE CLOUDS AND COGNITIVE RADIO**	**9**
Introduction – The Mobile Cloud – Mobile Cloud Enablers – Network Coding – Overview of Cognitive Radio Technology in 5G Wireless – Spectrum Optimization using Cognitive Radio – Relevant Spectrum Optimization Literature in 5G – Cognitive Radio and Carrier Aggregation – Energy Efficient Cognitive Radio Technology.		
UNIT V	**SECURITY AND SELF ORGANISING NETWORKS**	**9**
Overview of Potential 5G Communications System Architecture – Security Issues and Challenges in 5G Communications Systems – Self Organising Networks: Introduction, Self Organising Networks in UMTS and LTE, The Need for Self Organising Networks in 5G, Evolution towards Small Cell Dominant HetNets.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Compare the 5G network with older generations of networks.

CO2: Identify suitable small cells for different applications in 5G networks.

CO3: Explain 5G network scenarios.

CO4: Develop applications to mobile cloud.

CO5: Utilize applications with 5G network support.

TEXT BOOKS:

1. Mahmoud Elkhodr, "Enabling Technologies and Architectures for Next-Generation Networking Capabilities", IGI Global, 2019.
2. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis) Mathiopoulos, "New Directions in Wireless Communications Systems: From Mobile to 5G", CRC Press, 2017.
3. Yin Zhang, Min Chen, "Cloud Based 5G Wireless Networks – Springer Briefs in Computer Science", Springer, 2016.

REFERENCES:

1. Thierry Van de Velde, "Value-Added Services for Next Generation Networks", Auerbach Publications, 2019.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.
3. Byrav Ramamurthy, "Next-Generation Internet: Architectures and Protocols", Cambridge University Press, 2011.

VERTICAL 7: COGNITIVE COMPUTING

21PCS25	ETHICS AND ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the need for ensuring ethics in AI.
- To outline ethical issues with the development of AI agents.
- To interpret the ethical considerations in different AI applications.
- To demonstrate the relation of ethics with nature.
- To summarize the risk for Human rights and other fundamental values.

UNIT-I	INTRODUCTION TO ETHICS AND AI	9

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities.

UNIT-II	FRAMEWORK AND MODELS	9

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral.

UNIT-III	CONCEPTS AND ISSUES	9

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder.

UNIT-IV	PERSPECTIVES AND APPROACHES	9

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents.

UNIT-V	CASES AND APPLICATION	9

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the ethical issues in the development of AI agents.
CO2: Illustrate the ethical considerations of AI with perspectives on ethical values.
CO3: Experiment with the ethical policies in AI based applications and Robot development.
CO4: Make use of the AI concepts for addressing societal problems by adapting the legal concepts and securing fundamental rights.
CO5: Choose the AI concepts to overcome the evil genesis.

TEXT BOOKS:

1. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", 1st Edition, Oxford University Press, 2020
2. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", 1st Edition, Springer, 2018
3. S. Matthew Liao, "Ethics of Artificial Intelligence", 1st Edition, Oxford University Press, 2020

REFERENCES:

1. N. Bostrom and E. Yudkowsky. "The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, Editors, The Cambridge Handbook of Artificial Intelligence. Cambridge University Press, Cambridge, 2014.
2. Wallach, W., & Allen, C, "Moral machines: Teaching Robots right from wrong", 1st Edition, Oxford University Press, 2010.

3. Mark Coeckelbergh, "AI Ethics", 1st Edition, MIT Press, 2020

21PCS26	INTRODUCTION TO KNOWLEDGE ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To illustrate the differences between data, information and knowledge.
- To infer the various techniques for knowledge based systems.
- To demonstrate object oriented knowledge.
- To interpret knowledge organization.
- To contrast knowledge based system design

UNIT-I	INTRODUCTION	12

Data, Information and Knowledge - Knowledge Engineer Skills - Knowledge-Based Systems Introduction – Knowledge Reuse – Knowledge Engineering Techniques.

SUGGESTED ACTIVITIES:

- Data pre-processing and annotation
- Creation of datasets

UNIT-II	KNOWLEDGE ACQUISITION	12

Knowledge and Intelligence – Applications of Knowledge Reuse – Ethical Model of Knowledge – Stages, challenges, Approaches of Knowledge Acquisition – Techniques

SUGGESTED ACTIVITIES:

- Learn existing datasets
- Implementing Treebank's

UNIT-III	KNOWLEDGE REPRESENTATION	12

Roles of Knowledge Representation – Classification of Knowledge – Relationship Between Attributes – Object Oriented Knowledge Representation – Advanced Knowledge Representation Techniques

SUGGESTED ACTIVITIES:

- Implementation of object oriented representation
- Design the classification of knowledge

UNIT-IV	KNOWLEDGE MANIPULATION	12

Knowledge Organization – Indexed Organization – Knowledge Management Platform –Reasoning – Knowledge Codification – Testing of Knowledge Based Systems

SUGGESTED ACTIVITIES:

- Implementation of Knowledge organization
- Testing of knowledge based systems

UNIT-V	KNOWLEDGE BASED SYSTEM DESIGN	12

Semantic Web - Role Played by Social Networking Site – Representation of Design Knowledge - Knowledge Acquisition and Documentation Structuring - UML Notations in KADS

SUGGESTED ACTIVITIES:

- Representation of UML notations
- Scientific distributions used in python for Knowledge Acquisition.

TOTAL:60 PERIODS

COURSE OUTCOMES

At the end of the course, learners will be able to:

CO1: Summarize the concept of Data, Information and knowledge.
CO2: Identify the concepts of knowledge acquisition for an expert system
CO3: Model the knowledge using object oriented representation for real-world phenomena.
CO4: Make use of knowledge organization to index and design knowledge.
CO5: Construct Semantic Web using the knowledge based system design practices.

TEXT BOOKS:

1. Ela Kumar, "Knowledge Engineering", 1st Edition, I.K International Publishing ,2018
2. Hamed Fazlallahtabar, "Knowledge Engineering: The Process Paradigm", 1st Edition, CRC Press,2020
3. Simon Kendal and Malcolm Creen, "An Introduction to Knowledge Engineering", 1st Edition, Springer, 2007

REFERENCES:

1. Emilia Mendes, "Practitioner's Knowledge Representation -A Pathway to Improve Software Effort Estimation", 1st Edition, Springer, 2014.
2. Michael Gelfond, Yulia Kahi, " Knowledge Representation, Reasoning, and the Design of Intelligent Agents", 1st Edition, Cambridge University Press, 2014.
3. Lucja M. Iwariska and Stuart C. Shapiro, "Natural Language Processing and Knowledge Representation Language for Knowledge and Knowledge for Language", 1st Edition, AAAI Press/MIT Press,2000

21PCS27	PRINCIPLES OF SOFT COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the basic concepts of neural network.
- To compare various techniques in neural networks.
- To outline the basic concepts of fuzzy logic.
- To relate the fuzzy systems and its applications.
- To identify soft computing and integrated soft computing techniques to solve problems.

UNIT-I | **NEURAL NETWORKS** | **12**

Basic Concepts of Neural network, Model of an artificial neuron, neural Network architecture: single layer and multilayer feed forward networks, recurrent networks, Characteristics, Learning Methods, Applications.

SUGGESTED ACTIVITIES:

- Classify upper case letters and lower case letters using perceptron network

UNIT-II | **BACKPROPAGATION NETWORK** | **12**

Architecture : perceptron model – solution - single layer artificial neural network - multilayer perception model - back propagation learning methods - effect of tuning parameters - selection of parameters, applications.

SUGGESTED ACTIVITIES:

- Build BPN for training a single hidden layer back propagation network with bipolar sigmoidal units.

UNIT-III | **FUZZY LOGIC** | **12**

Basic concepts of fuzzy logic - Fuzzy sets and Crisp sets - Fuzzy set theory and operations - Properties of fuzzy sets - Fuzzy and Crisp relations - Fuzzy to Crisp conversion.

SUGGESTED ACTIVITIES:

- Develop fuzzy logic methodology to analyze lading of an aircraft

UNIT-IV	FUZZY SYSTEMS	12

Crisp logic - predicate logic - fuzzy logic - fuzzy rule based system – defuzzification - Applications

SUGGESTED ACTIVITIES:

- Construct genetic algorithm to solve a traveling salesman problem.

UNIT-V	GENETIC ALGORITHM	12

Fundamentals of genetic algorithm - genetic modeling - Integration of neural network - fuzzy and genetic algorithms.

SUGGESTED ACTIVITIES:

- Use neural network and fuzzy logic to control the motion of an inverted pendulum.

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Identify neural network techniques and their roles in building intelligent machines
CO2: Make use of Backpropagation network for real world problems
CO3. Experiment with fuzzy logic and reasoning to handle uncertainty
CO4: Examine fuzzy systems for solving complex problem
CO5: Compare various soft computing approaches for a given problem

TEXT BOOKS:

1. S. Rajasekaran & GA Vijayalakshmi Pai "Neural Networks, Fuzzy Logic, and Genetic Algorithms synthesis and application", 1st Edition, PHI, 2013
2. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", 1st Edition, PHI, Pearson Education 2004.
3. Vojislav Kecman, "Learning & Soft Computing Support Vector Machines, Neural Networks, and Fuzzy Logic Models", 1st Edition, Pearson Education, 2006.

REFERENCES:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3rd Edition, Wiley India, 2004
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", 1st Edition, Addison Wesley, N.Y., 2002.
3. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic concepts & Applications", 1st Edition, IEEE Press, PHI, New Delhi, 2004.

21PCS28	OPTIMIZATION TECHNIQUES AND APPLICATIONS	L	T	P	C
		2	0	2	3

COURSEOBJECTIVES:

- To describe the basics of Optimization Techniques.
- To relate the knowledge of numerical methods for Liner Programming.
- To utilize the concept of Non-linear programming with Equality and Inequality Constraint.
- To construct dynamic programming models using sequential Optimization.
- To illustrate various meta heuristic solutions for the real time problems.

UNIT-I	INTRODUCTION TO OPTIMIZATION TECHNIQUES	12

Introduction to Optimization Techniques-Need for Optimization-Historical Perspective-Optimization Parameters-Types of Optimization-Advanced Optimization Techniques-Applications of Optimization Techniques -Limitations of Optimization Techniques -Optimization methods in Engineering.

SUGGESTED ACTIVITIES:

- Evaluate the Optimization function on Optimization Techniques.

UNIT-II	LINEAR PROGRAMMING	12

Formulation - Graphical Method and Simplex Method – Primal vs Dual relationships - Sensitivity Analysis-Dual Simplex Method.

SUGGESTED ACTIVITIES:

- Construct and Solve Linear Programming Problem by Simplex method.
- Construct and Solve Linear Programming Problem by Dual Simplex method.

UNIT-III	NON LINEAR PROGRAMMING	12

Nonlinear Programming (with Equality Constraints): Lagrangian Multiplier - Equality constrained optimization -Projected Gradient Methods with equality constraints.

Nonlinear Programming (Inequality Constraints): Khun concept - Khun Tucker conditions.

SUGGESTED ACTIVITIES:

- Construct and nonlinear optimization problems by using numerical optimization methods (indirect) - Newtons methods.
- Construct and solve nonlinear optimization problems using with equality constraints using Lagrangian Multiplier.
- Construct and solve nonlinear optimization problems using with inequality constraints using using Khun Tucker conditions.

UNIT-IV	SEQUENTIAL OPTIMIZATION	12

Representation of multi stage decision process -Types of multi stage decision problems- Concept of sub optimization and the principle of optimality- Recursive equations –Forward and backward recursions.

SUGGESTED ACTIVITIES:

- Case study on Multistage Decision Making Under Uncertainty.
- Case study on Principle on Optimality with Forward recursion and Backward Recursion.

UNIT-V	META-HEURISTIC OPTIMIZATION TECHNIQUES	12

Classification of heuristic solution techniques - Heuristic and Meta Heuristic Programming: Simulated Annealing, Genetic Algorithm, Particle Swarm Optimization algorithm - Applications of optimization problems.

SUGGESTED ACTIVITIES:

- Exemplifying the optimization of real-world problem using Simulated Annealing.
- Exemplifying the optimization of real-world problem using Genetic Algorithm.
- Exemplifying the optimization of real-world problem using Particle Swarm Optimization Algorithm.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the basics of Optimization Techniques.

CO2: Make use of Linear Programming for solving optimization problems.

CO3: Identify the usage of Non Linear Programming for solving optimization problems.

CO4: Express the multi stage decision problems using sequential optimization

CO5: Develop the knowledge of various metaheuristic algorithms for real world problems.

TEXT BOOKS:

1.Vikrant Sharma, Vinod Kumar Jain and Atul Kumar, "An Introduction to Optimization Techniques",1st Edition, CRC Press, Taylor and Francis Group, 2021.

2. Rardin, R. L., "Optimization in Operations Research", 2nd Edition, Pearson 2019.
3. Xin-she Yang, "Optimization Techniques and Applications with Examples"1st Edition, Wiley Publishers, 2018.

REFERENCES:

1. Jeeva Jose, "Introduction to Machine Learning", 1st Edition, Khanna Book Publishing, 2020.
2. Nayak, S., "Fundamentals of Optimization Techniques with Algorithms", 1st Edition, Elsevier Science, 2020.
3. Foulds, L. R. "Optimization Techniques: An Introduction". 1st Edition, United States, Springer New York, 2012.

21OMA01	GRAPH THEORY AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To discuss the fundamentals of graph theory.
- To calculate the graph coloring, matching and covering number.
- To identify the types of graphs and operation on graphs.
- To explain the concepts of trees.
- To discuss the concepts of directed graphs and its properties.

UNIT I	**INTRODUCTION**	**9**
Basic definitions in graphs – walk – path – circuits - Isomorphism.		
UNIT II	**MATRICES AND COLORING**	**9**
Adjacency matrix and its properties - incidence matrix and its properties - Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering.		
UNIT III	**TYPES OF GRAPHS**	**9**
Connected and disconnected graph - Operation on graphs - Eulerian graph – Hamiltonian graph.		
UNIT IV	**TREES (CONNECTIVITY) PLANARITY**	**9**
Properties of trees – distance and centers in tree –Algorithms (Kruskal's and Dijkstra Algorithm) - Rooted and binary trees - Spanning trees – Planar graphs: Definition and Properties.		
UNIT V	**DIRECTED GRAPHS**	**9**
Directed graphs – Types of directed graphs – digraphs & its properties and binary relations – directed paths and connectedness – Euler graphs. (Theorems Statement only)		
	TOTAL : 45 PERIODS	

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Demonstrate the nature of graphs and illustrate isomorphism on graphs.

CO2: Construct the adjacent matrix and incident matrix for the given graph and also develop the chromatic polynomial for the given graph.

CO3: Apply various types of graphs and determine the existence of Eulerian, Hamiltonian path & circuits.

CO4: Interpret the planarity of graphs and the classes of trees with properties.

CO5: Identify the types of directed graphs with its properties.

TEXT BOOKS:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", 1st Edition, Dover Publications, IAC, 2016.
2. J.A.Bondy and USR.Moorthy, "Graph Theory with Applications", 2nd Edition, Indian

Reprint, Springer Publishers, 2015.
3. Frank Harary, "Graph Theory", Narosa Publishers, New Delhi, 2013.

REFERENCES:
1. William Kocay & Donald.L,.Kreher, "Graphs, Algorithm and Optimization", CRT Press, 2005.
2. Krishnaiyan "KT" Thulasiraman, "Handbook of Graph Theory, Combinatorial Optimization, and Algorithms", CRC Press Taylor & Francis Group, 2016.
3. R. Diestel, "Graduate Texts in Mathematics, Graph theory", 5th Edition, Springer 2017.

21PCS29	INTRODUCTION TO GAME THEORY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the novel concepts of game theory including cooperative games,
- To describe the non-cooperative games.
- To extend the games beyond normal and extensive form.
- To identify the problems in mechanism design.
- To express several auctions in games

UNIT-I	INTRODUCTION TO GAME THEORY	12

Strategic form- Perfect information extensive-form games-Imperfect-information extensive-form games.

SUGGESSTED ACTIVITIES:

CASE STUDY :Gametheory Explorer

UNIT-II	NON-COOPERATIVE GAMES	12

Self-interested agents-Games in normal form-analysing games-solutions.

SUGGESSTED ACTIVITIES:

Implement the winner Nim-game

UNIT-III	GAMES BEYOND NORMAL AND EXTENSIVE FORMS	12

Repeated Games- The Prisoner's Dilemma-Stochastic Games-Bayesian Games-Congestion Games-Graphical Games -Communication Games

SUGGESSTED ACTIVITIES:

Implementation of Tic-Tac-Toe game

UNIT-IV	MECHANISM DESIGN	12

Mechanism design with unrestricted preferences - Quasilinear preferences - Efficient mechanisms - VCG Mechanisms

SUGGESSTED ACTIVITIES:

Implement prisoners dilemma

UNIT-V	AUCTIONS	12

Auctions, Mechanism design for Sponsored search auctions- Single-good auctions- Multiunit auctions-Combinatorial auctions- Exchanges

SUGGESSTED ACTIVITIES:

Finding the Second price auction

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Demonstrate the game theory concepts.
CO2: Illustrate the various types of non-cooperative game theory concepts.
CO3: Relate the normal and extensive games
CO4: Discover the various mechanism design concepts.
CO5: Construct the auctions concepts

TEXT BOOKS:

1. Yoav Shoham and Kevin Leyton-Brown "Multiagent Systems" , 1st Edition ,Cambridge University Press, 2010
2. Giacomo Bonanno "Game Theory" University of California 1st Edition 2015
3. Martin J. Osborne,"An Introduction to Game Theory",1st Edition, The MIT Press 2003

REFERENCES:

1. Roger B. Myerson, "Game Theory: Analysis of Conflict, "Harvard University Press, Cambridge, Massachusetts, USA, 1997.
2. Michael Maschler, Eilon Solan, and Shmuel Zamir,"Game Theory", , 1st Edition Cambridge University Press, 2013
3. Y. Narahari.,"Game Theory and Mechanism Design",1st Edition IISc Press and the World Scientific Publishing Company, 2014.

21PCS30	COGNITIVE SCIENCE THEORY AND APPLICATIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe the basics of Cognitive Science.
- To associate the concept of the mind and intelligence, embracing psychology, artificial intelligence, neuro science and linguistics.
- To extend the role of neuroscience in the cognitive field.
- To paraphrase advanced analytics with cognitive computing.
- To express various applications of cognitive computing life problems.

UNIT-I	FOUNDATION OF COGNITIVE SCIENCE	12

What is Cognitive Science-Cognitive Psychology: The Architecture of the Mind, Cognitive Psychology: Future Explorations, Philosophy: Foundations of Cognitive Science Artificial Intelligence: Knowledge Representation, Artificial Intelligence: Search, Control and Learning.

SUGGESTED ACTIVITIES:

- Experiment with data for calculating reaction time in cognitive system.

UNIT-II	COGNITIVE PSYCHOLOGY	12

Cognitive Psychology–The Architecture of the Mind-The Nature of Cognitive Psychology-A Global View of the Cognitive Architecture-Propositional Representation-Schematic Representation-Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- The Connectionist Approach to Cognitive Architecture.

SUGGESTED ACTIVITIES:

- Experimentation on Short-term Memory for cognitive Analysis.
- Experimentation on Semantic Memory for cognitive Analysis.

UNIT-III	COGNITIVE NEUROSCIENCE	12

The Neuroscience Perspective-Methodology in Neuroscience -Techniques for the Study of Brain Image-Evaluating Techniques for the study of Brain Image-Traditional Brain Recording Methods-Modern Brain Imaging Methods-Brain Stimulation Techniques.

SUGGESTED ACTIVITIES:

- Build Neural network models for Cognitive Processes.
- Build Competitive Learning Neural Networks for feature mapping.

UNIT-IV	BIG DATA VS COGNITIVE COMPUTING	12

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

SUGGESTED ACTIVITIES:

- Build cognitive model to improve mental fitness using big data and game play.
- Build a Probabilistic Model for handling Big Data.

UNIT-V	COGNITIVE APPLICATIONS	12

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application and Smarter cities: Cognitive Computing in Government.

SUGGESTED ACTIVITIES:

- Build a cognitive healthcare application.
- Build a cognitive based smart city application.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the basics of Cognitive Science using python Libraries.
CO2: Make use of knowledge by individual minds, brains, and machines.
CO3: Utilize the knowledge of neuroscience in the cognitive field.
CO4: Interpret advanced analytics to cognitive computing.
CO5: Illustrate various applications of cognitive computing.

TEXT BOOKS:

1. Jay Friedenberg, Gordon Silverman, Michael James Spivey ,"Cognitive Science: an introduction to the study of mind",4th Edition, Sage Publications,2021
2. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics", 1st Edition, Wiley, 2015.
3. Vijay Raghvan, Venu Govindaraju, C.R. Rao, "Cognitive Computing: Theory and applications", 1st Edition, Elsevier publications, 2016.

REFERENCES:

1. Jose Luis Bermudez,"CognitiveScience:An Introduction to the Science of the Mind",1st Edition Cambridge University Press, NewYork, 2014.
2. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.
3. Neil A. Stillingd, Steven E.Weisler, Christopher H.Chase, Mark H. Feinstein, JayL. Garfield and Edwina L. Rissland, "Cognitive Science An Introduction" 2nd Edition, MIT Press, 1998.

21PCS31	STATISTICAL NATURAL LANGUAGE PROCESSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
- To relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.
- To apply the Statistical learning methods and cutting-edge research models from deep Learning
- To demonstrate the state-of-the-art algorithms and techniques for text-based processing.
- To learn a Statistical Methods for Real World Applications and explore deep learning based NLP

UNIT-I	INTRODUCTION TO NLP	12

Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross entropy.

SUGGESTED ACTIVITIES:

- Create CORPUS linguistics based on digestive approach (Text Corpus method)

UNIT-II	TEXT PREPROCESSING AND MORPHOLOGY	12

Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer

SUGGESTED ACTIVITIES:

- Check a current methods for statistical approaches to machine translation.

UNIT-III	LANGUAGE MODELLING	12

Words: Collocations- Frequency-Mean and Variance –Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios.

SUGGESTED ACTIVITIES:

- Perform POS tagging for a given natural language and Select a suitable language modelling technique based on the structure of the language.

UNIT-IV	WORD SENSE DISAMBIGUATION	12

Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus.

SUGGESTED ACTIVITIES:

- Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology

UNIT-V	SYNTAX AND SEMANTICS	12

Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction

SUGGESTED ACTIVITIES:

- Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply the principles and Process of Human Languages such as English and other Indian

Languages using computers.

CO2: Make use of semantics and pragmatics of English language for text processing

CO3: Develop CORPUS linguistics based on digestive approach to check a current methods for statistical approaches to machine translation.

CO4: Build POS tagging for a given natural language for a suitable language modelling technique based on the structure of the language.

CO5: Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.

TEXT BOOKS:

1. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" ,1st Edition, Manning Publications, 2019.
2. Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application".1st Edition, PACKT publisher, 2018
3. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", 1st Edition,Wiley-Blackwell, 2012

REFERENCES:

1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" , 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd Edition, Prentice Hall, 2009
3. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010.

VERTICAL 8 - COMPUTING SCIENCES

21PCS32	INTRODUCTION TO C	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the organization of a digital computer and expose to the number systems
- To describe logically and write pseudo code or draw flow charts for problems.
- To illustrate the syntax of C
- To demonstrate the C programming concepts in trivial problem solving.
- To use arrays, strings, functions, pointers, structures and unions in C.

UNIT-I	INTRODUCTION	12

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

SUGGESTED ACTIVITIES:

- Decision-making constructs: if-else, goto, switch-case, break-continue (exchange the values of two variables, circulate the values of n variables, distance between two points).

UNIT-II	C PROGRAMMING BASICS	12

Problem formulation – Problem Solving - Introduction to C, programming –fundamentals – structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using

operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

SUGGESTED ACTIVITIES:

- Loops: for, while, do-while
- Decision Making for Branching

UNIT-III	**ARRAYS AND STRINGS**	**12**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

SUGGESTED ACTIVITIES:

- Arrays: 1D and 2D, Multi-dimensional arrays, traversal
- Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)

UNIT-IV	**FUNCTIONS AND POINTERS**	**12**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

SUGGESTED ACTIVITIES:

- Functions: call, return, passing parameters by (value, reference), passing arrays to function.

UNIT-V	**STRUCTURES AND UNIONS**	**12**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

SUGGESTED ACTIVITIES:

- Identification and solving of simple real life or scientific or technical problems and develop C Program. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Illustrate the concepts of Computer Organization and Number Systems.

CO2: Develop simple programs using expressions, branching control and looping control statements.

CO3: Execute simple applications in C using arrays and strings.

CO4: Build simple applications in C by employing functions and pointers concepts.

CO5: Prepare small application projects using structures or unions.

TEXT BOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2016.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 2nd Edition, Oxford University Press, 2013.
3. Yashavant P. Kanetkar, "Let Us C", 14th Edition, BPB Publications, 2016.

REFERENCES:

1. Byron S Gottfried, "Programming with C", 2nd Edition, Tata McGraw-Hill, 2006
2. Dromey R.G., "How to Solve it by Computer", 4th Edition, Pearson Education, 2007.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", 2nd Edition, Pearson Education, 2006.

21PCS33	FUNDAMENTALS OF DATA STRUCTURES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the concepts of ADTs
- To describe linear data structures like lists, stacks
- To illustrate the linear data structure like queues, circular queue
- To demonstrate nonlinear data structures like Binary tree, Binary search tree
- To infer the representation of graph and its traversals

UNIT-I	LINEAR DATA STRUCTURES – LIST	12

Abstract Data Types (ADTs) -List ADT -Array-based implementation -Linked list implementation -Singly linked lists- Circularly linked lists- Doubly-linked lists - Applications of lists -Polynomial Manipulation - All operations (Insertion, Deletion, Merge, Traversal).

SUGGESTED ACTIVITIES:

- Implementation of Singly Linked List
- Implementation of Doubly Linked List
- Application of Linked List

UNIT-II	LINEAR DATA STRUCTURES – STACKS	12

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression

SUGGESTED ACTIVITIES:

- Implementation of Stacks
- Application of Stack

UNIT-III	LINEAR DATA STRUCTURES – QUEUES	12

Queue ADT – Operations - Circular Queue – Priority Queue - deQue – applications of queues

SUGGESTED ACTIVITIES:

- Implementation of Queues
- Application of Queues

UNIT-IV	NON LINEAR DATA STRUCTURES – TREES	12

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT

SUGGESTED ACTIVITIES:

- Implementation of Binary Trees and operations of Binary Trees
- Implementation of Binary Search Trees

UNIT-V	NON LINEAR DATA STRUCTURES – GRAPHS	12

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

SUGGESTED ACTIVITIES:

- Graph representation and Traversal algorithms
- Applications of Graphs

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build abstract data types for linear data structures.

CO2: Utilize the linear data structures like stack for problem solving.

CO3:Choose the different linear data structure like queue to various computing problems

CO4: Select nonlinear tree data structures to resolve the computing problems.

CO5: Make use of data using graph structure and apply their algorithms for problem solving.

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2010.
2. Reema Thareja, Data Structures Using C, 2nd Edition , Oxford University Press, 2011
3. Richard F Gilberg , A Forouzan ,"Data Structures-A Pseudo code Approach with C", 2nd Edition , Cengage,2005

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 2nd Edition, McGraw Hill, 2002.
3. Aho, Hopcroft and Ullman, Data Structures and Algorithms,1st Edition, Pearson Education, 1983.

21PCS34	DATA BASE PROGRAMMING WITH PL/SQL	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the fundamentals of PL/SQL
- To use the concepts of control and conditional structures.
- To describe the handling of exceptions and usage of cursors.
- To illustrate PL/SQL programming with procedures and functions.
- To develop applications with triggers

UNIT I	PL/SQL FUNDAMENTALS	12

Introduction to PL/SQL, Benefits of PL/SQL, Creating PL/SQL Blocks, Defining and using Variables and Datatypes, Writing PL/SQL Executable Statements, Nested Blocks, Review of SQL DML, Retrieving Data in PL/SQL, Manipulating Data in PL/SQL, Using Transaction Control Statements

SUGGESTED ACTIVITIES:

Developing simple PL/SQL Programs with defined functions

UNIT II	PROGRAM STRUCTURES TO CONTROL EXECUTION FLOW	12

Conditional Control: IF Statements, Conditional Control: CASE Statements, Iterative Control: Basic Loops, Iterative Control: WHILE and FOR Loops, Iterative Control: Nested Loops – Case Studies

SUGGESTED ACTIVITIES:

- Apply SQL concepts in PL/SQL Programming
- Develop PL/SQL Programs using control structures and conditional statements

UNIT III	EXCEPTION HANDLING AND CURSORS	12

Handling Exceptions, Trapping Oracle Server Exceptions, Trapping User-Defined Exceptions, Introduction to Explicit Cursors, Using Explicit Cursor Attributes, Cursor FOR Loops, Cursors with Parameters, Using Cursors for UPDATE, Using Multiple Cursors

SUGGESTED ACTIVITIES:

• Implementation of PL/SQL cursors		
UNIT IV	**PROCEDURE AND FUNCTIONS**	**12**
Creating Procedures, Using Parameters in Procedures, Passing Parameters, Creating Functions, Using Functions in SQL Statements, Review of the Data Dictionary, Managing Procedures and Functions **SUGGESTED ACTIVITIES:** • Implementation of PL/SQL procedures and functions		
UNIT V	**TRIGGERS AND PACKAGES**	**12**
Introduction To Triggers, Creating DML Triggers, Creating DDL and Database Event Triggers, Managing Triggers, Creating Packages, Managing Package Concepts, Advanced Package Concepts: Getting the Best out of Packages **SUGGESTED ACTIVITIES:** • Implementation of PL/SQL triggers		
		TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Construct SQL concepts in PL/SQL Programming

CO2: Make use of control and conditional structures in PL/SQL Programming

CO3: Develop PL/SQL Programs with exception handling and cursors

CO4: Utilize procedures and functions in PL/SQL Programming

CO5: Build triggers and packages for a given application

TEXT BOOKS:

1. Steven Feuerstein, Bill Pribyl, "Oracle PL/SQL Programming", 6th Edition, O'Reilly Media, Inc.,2014
2. .RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 1st Edtion,Pearson Education, 2011
3. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ,"Database System Concepts", 6th Edition, Tata McGraw Hill, 2011

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2012.
2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems", 1st Edition, Tata McGraw Hill, 2011.

21PCS35	JAVA PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the basic concepts of java.
- To describe the concepts of Exceptions and use strings.
- To illustrate Multi-threading and Input/output concepts for developing applications.
- To demonstrate about generics and collections.
- To build GUI using swing components.

UNIT-I	**INTRODUCTION TO OOPS AND JAVA**	**12**

Basic OOPs concepts –Characteristics of Java- Data types , Variables and Arrays-Classes – Constructors, Methods – Inheritance- Packages –Interfaces

SUGGESTED ACTIVITIES:

- Develop java program using basic java concepts

UNIT-II	**EXCEPTION HANDLING AND STRINGS**	**12**

Exceptions - Exception hierarchy - throwing and catching exceptions – Built-in exceptions, creating own exceptions, Stack Trace Elements-Strings-String Comparison-String Methods-String buffer-String Tokenizer

SUGGESTED ACTIVITIES:

- Develop java applications to handle various exceptions.

UNIT-III	**MULTITHREADING AND INPUT/OUTPUT**	**12**

Multi-threading Vs Multitasking-Java Thread model- Creating single and Multiple threads-isAlive() and Join Methods- Thread Priorities-Input / Output Basics – Reading and Writing Console – Reading and Writing Files

SUGGESTED ACTIVITIES:

- Build java application to support multithreading concepts

UNIT-IV	**GENERICS AND COLLECTIONS**	**12**

Generic Programming – Generic classes – generic methods – Bounded Types ,Collections-Collection Interfaces-Collection Classes-Accessing a Collection – List – Map

SUGGESTED ACTIVITIES:

- Use collection framework to store and manipulate group of objects

UNIT-V	**EVENT DRIVEN PROGRAMMING**	**12**

Event handling Mechanisms-Event classes- Event Interfaces- Using Delegation event Model -Introduction to Swing –Swing application-Swing Applets- layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists-Menus – Dialog Boxes

SUGGESTED ACTIVITIES:

- Create window based application using swing components

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1:Demonstrate java applications using classes, inheritance, interfaces and packages
CO2:Outline java applications using exception handling and strings
CO3:Illustrate java applications using threads and I/O concepts
CO4:Develop an applications using Generics and collections
CO5: Build GUI using swing components.

TEXT BOOKS:

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013
3. Paul Deitel, Harvey Deitel, ,"Java SE 8 for programmers, 3rd Edition, Pearson, 2015

REFERENCES:

1. Steven Holzner, ,"Java 2 Black book",1st Edition, Dream Tech press, 2011.
2. Timothy Budd,"Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000
3. Gopalan N.P. and Akilandeswari J., Web Technology, 1st Edition, Prentice Hall of India, 2011.

21PCS36	FUNDAMENTALS OF COMPUTER NETWORKS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe the state-of-the-art in network architectures and physical layer services.
- To interpret the various Link layer services.
- To demonstrate the concepts of subnetting and routing mechanisms.
- To illustrate the process-to-process delivery models.
- To explain the services of various protocols in application layer.

UNIT-I	INTRODUCTION PHYSICAL LAYER	12

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media.

SUGGESTED ACTIVITIES:

- Make use of various networking commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine

UNIT-II	DATA LINK LAYER	12

Introduction – Link-Layer Addressing – Error Detection and Correction– DLC Services-Framing Media Access Control –Random access- Wired LANs: Ethernet -Wireless LANs –IEEE 802.11- Connecting Devices.

SUGGESTED ACTIVITIES:

- Implement the applications using TCP /UDP sockets like: Chat and File transfer

UNIT-III	NETWOK LAYER	12

Network Layer Services– IPV4 Addresses-Classful Addressing-Classless Addressing-Dynamic Host Configuration Protocol (DHCP)- Network Layer Protocols: IP- Unicast Routing Algorithms and Protocols.

SUGGESTED ACTIVITIES:

- Implementation of DNS using UDP sockets.

UNIT-IV	TRANSPORT LAYER	12

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol

SUGGESTED ACTIVITIES:

- Simulation of error correction code (like CRC).

UNIT-V	APPLICATION LAYER	12

WWW and HTTP – FTP – Email –Telnet –SSH – DNS.

SUGGESTED ACTIVITIES:

- Implementation of ARP/RARP protocols.

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Identify the role of each layer in computer networks and physical layer services.
CO2: Utilize the Link layer services in the various standards defined by IEEE standards.
CO3: Apply subnetting to optimize network configuration and various routing algorithms for unicast routing.
CO4: Choose protocols for Process to Process communication in different application.
CO5: Utilize the different application layer protocols for real time application.

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, Tata McGraw Hill, 2013.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education, 2013.

REFERENCES:

1. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
2. Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach,"1st Edition, McGraw Hill Publisher, 2011.
3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

21PCS37	SOFTWARE TESTING AND TOOLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe the fundamentals of testing process.
- To illustrate the types of testing.
- To identify the steps involved in test cases development.
- To explain the techniques of testing.
- To infer the basics about testing tools.

UNIT-I	TESTING FUNDAMENTALS	12

Definition, Basics and Types of Software Testing, Software Testing as a Career Path (Skills, Salary, Growth), Software Testing Principles: Learn with Examples, STLC – Software Testing Life Cycle Phases & Entry, Exit Criteria

SUGGESTED ACTIVITIES:

- Examine the open source testing tool "Selenium

UNIT-II	TYPES OF TESTING	12

Manual Testing, Automation Testing, Unit Testing, Integration Testing, System Testing, Sanity and Smoke Testing, Regression Testing

SUGGESTED ACTIVITIES:

- Create a basic test case in Selenium IDE.

UNIT-III	TESTCASE DEVELOPMENT	12

Test Documentation, Test Scenario and Template, Test Cases and Template, Test Analysis, Requirements Traceability Matrix (RTM), Test Data Generation

SUGGESTED ACTIVITIES:

- Execute a sample login test in Selenium IDE

UNIT-IV	TESTING TECHNIQUES	12

Boundary Value Analysis, Equivalence Partitioning, Decision Table Testing, State Transition Testing, Use Case Testing

SUGGESTED ACTIVITIES:

- Perform the testing process for scrolling a web page

UNIT-V	TESTING TOOLS	12

Need for Tools, Test Management Tools, Defect/Bug Tracking Tools, Automation Testing Tools, Unit Testing Tools, Integration Testing Tools

SUGGESTED ACTIVITIES:

- Examine the API testing tool "Postman".

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Illustrate the basic concepts of testing.
CO2: Make use of the different types of testing to design simple applications.
CO3: Experiment with various levels of developing a simple test case.
CO4: Choose the testing techniques to simple applications.
CO5: Relate the tools needed for different types of testing.

TEXT BOOKS:

1. Nageshwar Rao Pusuluri, "Software Testing Concepts and Tools", 1st Edition, Dreamtech Press, 2006
2. Dr. D. Chitra, A. Kaliappan, "Software Testing", 1st Edition, Technical Publications, 2019
3. Paul C. Jorgensen, Byron DeVries, "Software Testing A Craftsman's Approach", 5th Edition, Auerbach Publications, 2021

REFERENCES:

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2013.
2. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", 1st Edition, Pearson Education, 2008.
3. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", 1st Edition, Pearson Education, 2017.

21PCS38	WEB PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To summarize the fundamentals of web programming.
- To discuss the concepts of PHP.
- To construct web page using CSS.
- To describe the basic concepts in java script.
- To build an interactive webpage using AJAX.

UNIT-I	WEB FUNDAMENTALS	12

Web Fundamentals - Programming Languages for the Web-HTML Basics- the working environment

SUGGESTED ACTIVITIES:

- Develop static web page using HTML

UNIT-II	PHP	12

The PHP language -More on the PHP language -Using HTML with PHP- forms- sessions- cookies

SUGGESTED ACTIVITIES:

- Develop web applications using PHP

UNIT-III	CSS	12

Using CSS and templates - Intro to databases Database manipulation in PHP

SUGGESTED ACTIVITIES:

- Construct web page using CSS and templates

UNIT-IV	JAVASCRIPT	12

Basics of JavaScript Programming the browser and forms with JavaScript Manipulating windows and frames with JavaScript Using dates- timers- string manipulation and regular expressions DHTML

SUGGESTED ACTIVITIES:

- Use java script to design responsive web page

UNIT-V	AJAX	12

AJAX basics - Security pitfalls and basic solutions- SQL injections, HTML/JS injections, X-site scripting, DoS, DDoS, File upload vulnerabilities, Password encryption, Password recovery flaws

SUGGESTED ACTIVITIES:

- Create interactive web application using AJAX

TOTAL :60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1:Demonstrate the fundamentals of web programming

CO2:Develop web application using PHP

CO3:Illustrate the concepts of CSS and templates for web page design

CO4:Construct web applications using java script

CO5: Build an interactive webpage using AJAX.

TEXT BOOKS:

1. Steven A. Gabarro, "Web Application Design and Implementation", 1st Edition, Wiley, 2006
2. John Dean, "Web Programming With HTML5, CSS, And JavaScript", 1st Edition, ones and Bartlett Publishers, Inc 2018
3. Chris Bates,"Web Programming: Building Internet Applications", 3rd Edition ,Wiley, 2016

REFERENCES:

1. Deitel and Deitel and Nieto,"Internet and World Wide Web - How to Program", 5th Edition, Prentice Hall, 2011.
2. StephenWynkoop and John Burke,"Running a Perfect Website", QUE, 2nd Edition, 2019.
3. Chris Bates, "Web Programming -Building Intranet Applications", 3rd Edition, Wiley Publications, 2009

21PCS39	MACHINE LEARNING USING PYTHON	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the fundamental concepts of machine learning.
- To illustrate the fundamental concepts of Python for machine learning techniques.
- To describe the supervised machine learning (ML) algorithms for model building.
- To identify the unsupervised machine learning (ML) algorithms for model building.
- To summarize the concepts of evaluating, selecting and improving the model performance.

UNIT-I	INTRODUCTION TO MACHINE LEARNING	12

Introduction to Analytics and Machine Learning (ML) – Learning style of machine learning algorithms: Supervised – Classification – Prediction – Unsupervised – Clustering – Association - Evaluating Learning Systems - Process for Building Learning Systems.

SUGGESTED ACTIVITIES:

- Data preprocessing using Python.

UNIT-II	PYTHON FOR MACHINE LEARNING	12

Introduction to Python- Data types and basic operators – Environment setup and essentials – Python libraries: NUMPY for mathematical essentials –Data manipulation using PANDAS – Data visualization by MATPLOTLIB.

SUGGESTED ACTIVITIES:

- Visualizing statistical analysis using Python.

UNIT-III	SUPERVISED MACHINE LEARNING	12

Prediction Categorical: Classification - Decision Tree - Naive Bayes - Support Vector Machine - Neural Network - Prediction Numerical: Linear Regression - Logistic regression.

SUGGESTED ACTIVITIES:

- Predictions in numerical data using Python.
- Classifying the categorical data using Python.

UNIT-IV	UNSUPERVISED MACHINE LEARNING	12

Introduction to Clustering: K-Means clustering – Distance based clustering - Hierarchical Clustering - Association rule mining: APRIORI algorithm.

SUGGESTED ACTIVITIES:

- Clustering using Python.

UNIT-V	MODEL EVALUATION, SELECTION AND IMPROVISATION	12

Model Evaluation and Selection: Metrics for Evaluating Classifier – Sampling - Cross-Validation - Model Selection Using Statistical Tests - ROC Curves - Techniques to Improve Classification Accuracy: Introducing Ensemble Methods - Bagging – Boosting.

SUGGESTED ACTIVITIES:

- Generating association rules using Python.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Examine the different style of machine learning methods.
CO2: Make use of PYTHON for machine learning techniques.
CO3: Choose suitable supervised ML method for categorical and numerical data to build models.
CO4: Select suitable unsupervised ML method to build models for decision making.
CO5: Prepare evaluation metrics to interpret and improve the model performance.

TEXT BOOKS:

1. Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python", 1st Edition, Wiley, 2019.
2. Mark E. Fenner, "Machine Learning with Python for Everyone", 1st Edition, Addison-Wesley, 2020.
3. Müller, Andreas C. and Sarah Guido, "Introduction to machine learning with Python: a guide for data scientists", 1st Edition, O'Reilly Media, Inc., 2016.

REFERENCES:

1. Brett Lantz, "Machine learning with R", 1st Edition, Packt Publishing Ltd, 2013.
2. Wes McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition, O'Reilly Media, Inc,, 2017.
3. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.

ONE CREDIT COURSE

21OCCS01	ANGULAR JS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate the built-in directives offered by Angular.
- To explain how Angular interact with Document Object Model of a web page.

TOPICS TO BE COVERED:

GETTING STARTED

- Introduction to Angular: Angular overview - Single Page Application - Angular CLI - Create an angular project - Angular project files overview.
- Components: Angular components overview - Creating a component - Lifecycle hooks - Lifecycle event sequence - Component interaction - Parent and children communicate using a service - Sharing data between child and parent directives and components.

UNDERSTANDING ANGULAR

- Templates: Understanding templates - Displaying values with interpolation - Data binding overview - Working with binding methods - Understanding Pipes - Using a pipe in a template.
- Directives: Understanding Directives - Working with different types of directives.
- Dependency injection in Angular: Understanding dependency injection - Creating an injectable service - Configuring dependency providers.

ROUTING AND NAVIGATION

- Understanding Angular Routing and Navigation: Defining a basic route - Getting route information - Setting up wildcard routes - Displaying a 404 page - Setting up redirects - Using relative paths - Accessing route parameters - Lazy loading - Working with Link parameters array.

FORMS

- Introduction to forms: Understanding Reactive forms and Template-driven forms - Setup in reactive forms - Setup in template-driven forms - Understand data flow in forms - Form validation - Building dynamic forms.

HTTP CLIENT

- Communicating with backend services using HTTP: What is HTTP? - Setup for server communication - Requesting data from a server - Understand Observe and Response types - Working with JSON Data - Handling request errors - Sending data to a server - Write an interceptor - Tracking and showing request progress - CRUD Operations.

AUTHENTICATION

- Understanding Authentication: What is Authentication? - How Authentication Work? - Introduction to JSON Web Tokens - User Signing up and in - Sending Token & Requiring - Authentication Status.

TOTAL : 15 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Experiment with the built-in directives offered by Angular.

CO2: Build an interactive web application using the Angular framework.

TEXT BOOKS:

1. Felipe Coury, Ari Lerner and Carlos Taborda, "ng-book The Complete Guide to Angular 6", 1st Edition, Fullstack.io publication, 2018.
2. Sukesh Marla, "Journey to Angular Development", 1st Edition, BPB publication, 2021.

REFERENCES :

1. ShyamSeshadri, "Angular: Up and Running: Learning Angular, Step by Step", 1st Edition, Kindle Edition, O'Reilly, 2018.
2. Dhananjay Kumar , "Angular Essentials: The Essential Guide To Learn Angular", 1st Edition, BPB publication, 2019.

21OCCS02	MACHINE LEARNING USING PYTHON	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To solve business analytic problems with Python.
- To demonstrate ML pipelines for solving the business problems.

TOPICS TO BE COVERED:

- Introduction and intuition behind AI and ML.
- Real world problems solved using various ML techniques.
- High level overview of various ML Algorithms.
- Introduction to ML approaches for solving various business problems.
- Supervised vs unsupervised learning
- Introduction to python
    - Pandas, Numpy, SKLearn
    - EDA - Example.
- Regression - intuition, various regression algorithms, evaluation metrics, mini problem solving
- Classification- intuition, various regression algorithms, evaluation metrics, mini problem solving
- Model deployment strategies - introduction to MLOps.
- Labs
    - Project-1: Build an optimized Regression model.
    - Project-2: Build an optimized Classification model.

TOTAL : 15 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Make use of PYTHON libraries for solving business analytic problems.

CO2: Build an optimized Regression and Classification models for business analytics using PYTHON.

TEXT BOOKS:

1. Mark E. Fenner, "Machine Learning with Python for Everyone", 1st Edition, Addision-Wesley (EPUB), 2020.
2. Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python", 1st Edition, Wiley, 2019.

REFERENCES :

1. B. Uma Maheswari, R. Sujatha, "Introduction to Data Science: Practical Approach with R and Python", 1st Edition, Wiley, 2021.
2. Wes McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition, O'Reilly Media, Inc, 2017.

21OCCS03	PRACTICAL APPROACH TO DATA WAREHOUSING USING INFORMATICA	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To identify the scope of Data Warehouse modernization
- To illustrate the modern approaches of Data Ware housing

TOPICS TO BE COVERED:

- Data warehouse modernization
- Informatica Intelligent data Services
- Approaches of Data warehousing
- Snowflake schema
- Slowly changing Dimension Concepts
- Dimension table
- Configuring Informatica Repository Server
- Informatica Server Tools
- Constrained Based Loading
- Application Source Qualifier

TOTAL : 15 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Demonstrate the slowly changing Dimension concepts to solve the real time problems.

CO2: Develop the Informatica Server tools for Optimization.

TEXT BOOKS:

1. Matthias Jarke, Maurizio Lenzerini, Yannis Vassiliou and Panos Vassiliadis,"Fundamentals of Data Warehouse", 2nd Edition, Springer 2022.
2. Alex Petrov, "Database Internals: A Deep-Dive Into How Distributed Data Systems Work", 1st Edition, O'Reilly Media 2019.

REFERENCES :

1. Ralph Kimball, Margy Ross," The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling", 3rd Edition, Wiley 2015.
2. Alan Beaulieu, "Learning SQL: Generate, Manipulate, and Retrieve Data", 1st Edition, O'Reilly Media 2020.

21OCCS04	HEALTHCARE AUTOMATION USING MACHINE LEARNING	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To develop better diagnostic tools to analyse Healthcare data.

- To adapt Machine learning-enabled automation for healthcare organizations to improve resource management.

TOPICS TO BE COVERED:

- Machine Learning Concepts
- Healthcare Automation
- Patient Risk Identification
- Pattern Imaging Analytics
- Clinical Trial Research
- Predicting Epidemics
- Maintaining Healthcare Records
- Personalized Treatment
- Robotic Surgery
- Improved Radiotherapy

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Implement wide range of healthcare use cases using Machine Learning algorithms

CO2: Build Machine Learning Models for driving massive improvement and innovation in the healthcare industry

TEXT BOOKS:

1. Amiya Ranjan Panda, Hrudaya Kumar Tripathy, Pradeep Kumar Mallick, Sushruta Mishra , "Technical Advancements of Machine Learning in Healthcare", 1st Edition, Springer Singapore, 2021.
2. Achyuth Sarkar, G. Nalinipriya, Om Prakash Jena, Sachi Nandan Mohanty, "Machine Learning for Healthcare Applications",1st Edition, Wiley,2021.

REFERENCES :

1. Arjun Panesar, "Machine Learning and AI for Healthcare- Machine Learning and AI for Healthcare Big Data for Improved Health Outcomes",1st Edition, Apress, 2020.
2. Jitendra Kumar Verma, Prashant Johri, Sudip Paul , "Applications of Machine Learning", 1st Edition, Springer Singapore, 2020.

21OCCS05	FOUNDATION OF NOSQL DATABASE	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To describe the origins of NoSQL databases and the characteristics that distinguish them from Traditional relational database management systems.
- To discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

TOPICS TO BE COVERED:

- Definition and need of NoSQL Database
- Types of Databases
- Document-oriented Databases
- Key Value Pair Databases

- Column-oriented Databases
- Graph Databases
- Introducing MongoDB - An Open-Source NoSQL Database
- Introducing Apache Cassandra - An Open-Source NoSQL Database
- Introducing IBM Cloudant - A NoSQL DBaaS

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Differentiate and identify right database models for real time applications

CO2: Choose and implement advanced data model functions for the real time applications

TEXT BOOKS:

1. Pramod J. Sadalage, Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Pearson Publications, 2012
2. Eric Redmond, "Seven Databases in Seven Weeks: A Guide to Modern Databases and the Nosql Movement", 1st Edition, O Reilly Publications, 2012.

REFERENCES :

1. Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, "An introduction to Information Retrieval", 1st Edition,Cambridge University Press,2018
2. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, "The Design and Implementation of Modern Column-Oriented Database Systems", 1st Edition, Now Publishers,2017.

21OCCS06	INTRODUCTION TO MAINFRAME SYSTEMS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To summarize the concepts of mainframe computing and its environment.
- To infer mainframe application programming.

TOPICS TO BE COVERED:

- Introduction to the new Mainframe Environment
- Mainframe Hardware systems
- Mainframe Operating system
- TSO ISPF Essentials
- PF Keys and customizing ISPF panel
- Mainframe datasets
- IBM Mainframe Application Programming

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Make use of mainframe environment for solving real time problems.

CO2: Experiment with mainframe programming for various application.

TEXT BOOKS:

1. Taulli,"Modern Mainframe Development: COBOL, Databases, and Next-Generation Approaches", 1st Edition, OReilly, 2019.
2. Mike Ebbers John Kettner Wayne O'Brien Bill Ogden, "Introduction to the New Mainframe z/OS

Basics", 1st Edition,Redbooks,2011

REFERENCES :

1. Gerardus Blokdyk," IBM mainframe",2nd Edition, 5STARCooks,2018
2. Stephen H. Kaisler ,"First Generation Mainframes: The IBM 700 Series", 1st Edition ,Cambridge Scholars Publishing,2018

21OCCS07	EMBEDDED SOFTWARE DEVELOPMENT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate the hardware and software development components of embedded systems.
- To make use of simulating tools for designing and developing embedded systems.

TOPICS TO BE COVERED:

- Embedded System Development Components
- Compilation with GCC and GNU Make
- Memory Types, Segments and Management
- Introduction to STM32 Microcontroller and its architecture
- STM32 timers and interrupts
- GPIO interface in STM32
- Embedded software development for real time applications

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Summarize the hardware and software requirements of embedded system

CO2: Make use of software tools for embedded system development.

TEXT BOOKS:

1. Ivan Cibrario Bertolotti, Tingting Hu, "Embedded Software Development- The Open-Source Approach", 1st Edition, CRC Press, 2020
2. Donald Norris, "Programming with STM32 – Getting started with Nucleo Board C/C++", 1st Edition, McGrow Hill Education, 2018

REFERENCES :

1. Klaus Elk, "Embedded Software Development for the Internet Of Things The Basics, the Technologies and Best Practices", 1st Edition, CreateSpace Independent Publishing, 2016.
2. Mazidi, Muhammad Ali, Chen, Shujen, Ghaemi, Eshragh, "STM32 Arm Programming for Embedded Systems", ist Edition, MicroDigitalEd, 2019.

21OCCS08	INNOVATION AND DESIGN THINKING	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To find a specific social need for the stakeholder's requirements for the societal project
- To show measurable criteria and Select the best design solution among the potential solutions

TOPICS TO BE COVERED:

- Project Identification: Introduction to Human Centered Design
- Identification of Stakeholder Requirements
- Description Problem Environment
- Creation of Stakeholder's Profiles
- Development of Customer Specification
- Development of Evaluation Criteria
- Development of Task-Analysis
- Refinement of design Specification on users 'feedback
- Evaluation of Potential Solutions
- Selection of best design

TOTAL : 15 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1 : Identify a specific social need for the stakeholder's requirements for the societal project

CO2 : Develop measurable criteria and Select the best design solution among the potential solutions

TEXT BOOKS:

1. Prof. Nigel Cross , "Design Thinking: Understanding How Designers Think and Work", 1st Edition, Bloomsbury Publishing India Private Limited, 2011.
2. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business, 1st Edition, 2013

REFERENCES :

1. George Anderson ,"Design Thinking for Tech", 1st Edition, Pearson, 2022.
2. Michael Lewrick , Patrick Link, Larry Leifer , Design Thinking Tool Box, Wiley ,1st Edition, 2020.

COURSE OFFERED TO OTHER DEPARTMENTS

21CS105	C PROGRAMMING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To describe the basic programming principles of C language.
- To choose a suitable C-construct to develop C code for a given problem.
- To use the C-language syntax rules to correct the bugs in the C program.
- To develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.
- To illustrate the concepts of Structures and Unions

UNIT I	BASICS OF C PROGRAMMING	6

Introduction to C- Structure of a C Program- Compiling and Executing C Programs- C tokens- Input/Output Statements in C- Operators in C- Type Conversion and Typecasting

UNIT II	DECISION CONTROL AND LOOPING STATEMENTS	6

Decision Control Statements- Conditional Branching Statements- Iterative Statements- Nested Loops- Break and Continue Statements- Goto Statement

UNIT III	ARRAYS AND STRINGS	6

Introduction to Arrays: Declaration, Accessing the Elements of an Array - Storing Values in Arrays Operations on Arrays - Two dimensional arrays - String operations

UNIT IV	FUNCTIONS AND POINTERS	6
Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion. Pointers – Declaring Pointer Variables- Pointer Expressions and Pointer Arithmetic -Null Pointers -– Parameter passing: Pass by value, Pass by reference		
UNIT V	**STRUCTURES AND UNION**	**6**
Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation– Union		
		TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to

CO1: Develop simple applications using basic C components..

CO2: Build applications adopting array and string concepts.

CO3: Develop and implement applications in C using functions and pointers.

CO4:Build applications in C by employing structure and union concepts

CO5: Design simple applications that make use of C construct.

TEXT BOOKS:

1. ReemaThareja, "Programming in C", Oxford University Press, 2nd Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", 2nd Edition, Pearson Education, 2015.
3. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2. YashwantKanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
4. PradipDey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.

21CS214	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To describe the fundamentals of object oriented programming in C++.
- To explain the basics of OOP and Object-oriented approach to design software
- To illustrate the concept of data structures through ADT including List, Stack, Queues.
- To demonstrate the concept of Non-Linear Data Structures and their applications.
- To choose the various sorting and searching techniques

UNIT I	BASIC OOPS CONCEPTS	9
Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static ClassMembers – Overloading: Function overloading and Operator Overloading.		
UNIT II	**INHERITANCE & POLYMORPHISM**	**9**

Base Classes and Derived Classes – Protected Members – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes - Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Virtual Destructors – Dynamic Binding.		
UNIT III	**LINEAR DATA STRUCTURES**	**9**
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions		
UNIT IV	**NON-LINEAR DATA STRUCTURES**	**9**
Trees – Binary Trees – Binary tree representation and traversals – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components		
UNIT V	**SORTING AND SEARCHING**	**9**
Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search –Binary Search		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to

CO1: Develop simple applications using Basic OOPS concepts
CO2: Build C++ programs using inheritance
CO3: Construct the concept of stack, linked list and memory allocation
CO4: Solve problems related to trees and Graphs
CO5: Compare different sorting and searching algorithms

TEXT BOOKS:

1. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill Education,2017
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Addison-Wesley, 2014.
3. Ellis Horowitz, SartajSahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Second Edition, Universities Press, 2008.

REFERENCES:

1. Bhushan Trivedi, "Programming with ANSI C++, A Step-By-Step approach", 1st Edition, Oxford University Press, 2010.
2. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 2nd Edition, Wiley. 2013.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, McGraw Hill, 2010.

21CS215	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES :

- To describe the fundamentals of object oriented programming, particularly in C++.
- To use object oriented programming to implement data structures.
- To illustrate linear data structures and their applications
- To demonstrate non-linear data structures and their applications.
- To explain the concept of data structures through ADT

LIST OF EXPERIMENTS

1. Basic Programs for C++ Concepts
2. Array implementation of List Abstract Data Type (ADT)
3. Linked list implementation of List ADT
4. Cursor implementation of List ADT
5. Stack ADT - Array and linked list implementations
6. Implement stack Applications using Stack ADT
7. Queue ADT – Array and linked list implementations
8. Implement Queue Applications using Queue ADT
9. Search Tree ADT - Binary Search Tree
10. Graphs- Breadth first and Depth first search
11. Insertion sort
12. Quick Sort
13. Develop a C++ application to solve real world problem using ADT algorithms

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop simple applications using Basic OOPS concepts.
CO2: Execute and Implement programs using inheritance and use them in programs.
CO3: Construct the concept of stack, linked list and memory allocation.
CO4:Solve problems related to trees and Graphs
CO5:Compare different sorting and searching algorithms

TEXT BOOKS:

1. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill Education,2017
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Addison-Wesley, 2014.
3. Ellis Horowitz, SartajSahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", 2nd Edition, Universities Press, 2008.

REFERENCES:

1. Bhushan Trivedi, "Programming with ANSI C++, A Step-By-Step approach",1st Edition,Oxford University Press,2010.
2. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 2nd Edition, Wiley. 2011.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, McGraw Hill, 2010.
4. BjarneStroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley, 2013.

21CS308	C AND DATA STRUCTURES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To explain the concepts of C programming using arrays.
- To describe the concepts of function and structure for problem solving.
- To make use of the concept List, Stack, Queues ADTs.
- To illustrate Tree and Graph data structure for solving real time problems

- To choose different searching and sorting algorithms.

UNIT-I	INTRODUCTION TO C	12

Structure of C Program-Pre-processor Directives-Compilation and Linking Processes-Data types-Storage classes-Constants-Variables-Operators-Expressions-Input/output Statements--Arrays: Declaration-Initilization-1-Dimensional Array-Two Dimensional Arrays.

Suggested Activities:

- Practice of C programming using statements, expressions, decision making and iterative statements
- Practice of C programming using Arrays

UNIT-II	FUNCTIONS, POINTERS AND STRUCTURES	12

Functions: Pass by value-Pass by reference and Recursion-Pointer definition-Initialization-pointer arithmetic-Structures-Definition-Structure with Structure-Programs using structures

Suggested Activities:

- Call by value & Call by reference
- Passing Structure Members as arguments to Function
- Implement C programs using Pointers and Structures

UNIT-III	LINEAR DATA STRUCTURES	12

Abstract Data Type(ADT)-Stacks ADT and Queues ADT -Array- based Implementation-Linked List-Linked List based Implementation of stack and queues-Evaluation of Expression-Linked list based Polynomial Addition.

Suggested Activities:

- Array implementation of List ADT
- Array implementation of Stack and Queue ADTs
- Linked list implementation of List, Stack and Queue ADTs
- Applications of List, Stack and Queue ADTs

UNIT-IV	NON LINEAR DATA STRUCTURE	12

Trees - Binary trees - Binary tree representation and traversals - Binary Search Tree Applications of trees. Graph - Definitions - Representations - Breadth first traversal - Depth first traversal

Suggested Activities:

- Implementation of Binary Trees and operations of Binary Trees
- Implementation of Binary Search Trees

UNIT-V	SEARCHING AND SORTING ALGORITHMS	12

Liner Search-Binary Search- Bubble sort –Insertion Search-Merge sort-Quick Sort-Hash Tables-Overflow Handling.

Suggested Activities:

- Implementation of searching techniques
- Implementation of Sorting algorithms : Insertion Sort, Quick Sort, Merge Sort
- Implementation of Hashing – any two collision techniques

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Develop C programs for simple applications using basic constructs and arrays.
CO2: Construct C programs involving functions, recursion, pointers & structures.
CO3: Build abstract data types for linear data structures.
CO4: Categorize the different non-linear data structures to resolve problems.
CO5: Solve the problems using various sorting algorithms and hashing techniques.

TEXT BOOKS:

1. ReemaThareja, "Programming in C", 2nd Edition, Oxford University Press, 2016.
2. ReemaThareja, "Data Structures Using C", 2nd Edition , Oxford University Press, 2011
3. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press, 2011.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++,8th Edition, Pearson Education, 2018.
2. Yashwant Kanetkar, "Let us C", 17th Edition, BPB Publications, 2020.
3. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2010.