KCG

COLLEGE OF TECHNOLOGY

AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

REGULATIONS - 2023

CURRICULUM AND SYLLABI

(2023-2024)

B.TECH.- INFORMATION TECHNOLOGY

KCG College of Technology was founded in 1998 to fulfill the Founder-Chairman, Dr. KCG Verghese's vision of **"To Make Every Man a Success and No Man a Failure".** It is a Christian minority institution, affiliated to Anna University (Autonomous), Chennai and approved by AICTE, New Delhi.

VISION OF KCG

KCG College of Technology aspires to become a globally recognized centre of excellence for science, technology & engineering education, committed to quality teaching, learning and research while ensuring for every student a unique educational experience which will promote leadership, job creation, social commitment and service to nation building.

MISSION OF KCG

- Disseminate knowledge in a rigorous and intellectually stimulating environment.
- Facilitate socially responsive research, innovation and entrepreneurship.
- Foster holistic development and professional competency.
- Nurture the virtue of service and an ethical value system in the young minds.

VISION OF INFORMATION TECHNOLOGY

The department of Information Technology aspires to become a globally acclaimed center of excellence offering quality education and enabling innovative research in Information Technology department by producing competent Information Technology graduates to contribute towards nation building.

MISSION OF INFORMATION TECHNOLOGY

- Impart knowledge of fundamentals as well as emerging trends in Information Technology
- Inculcate innovative and entrepreneurial abilities as well as ethical values among the students
- Establish computing facilities and research activities to enhance the knowledge
- Enhancing competency of faculty with the advanced technologies in Information Technology

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

The graduates will:

PEO 1	Outstand as technically skilled professionals in Information Technology and relevant sector.
PEO 2	Devise, Implement and Deploy software solutions for computational problems.
PEO 3	Build software solutions for the challenging problems in industry and research.
PEO 4	Manifest the ethical values and exhibit social responsibility.

PROGRAM OUTCOMES (POs)

Engineering graduates will be able to:

PO 01	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 02	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 03	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 04	Use research based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 05	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 06	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 07	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 08	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 09	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 01	Design system to solve complex IT related problems using algorithm analysis, database technology, multimedia, web design, networking and principles of Software Engineering, to face the challenges in corporate and industries.
PSO 02	Communicate and function efficiently as an individual and as a member or leader in multidisciplinary teams in software development process.
PSO 03	Identify the need for sustainable development in software industries and follow the professional code of ethics.

INDEX

KCG COLLEGE OF TECHNOLOGY
AUTONOMOUS
REGULATIONS 2023
B.TECH.– INFORMATION TECHNOLOGY
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER–I

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
	23IP101	Induction Programme		-	-	-	-	-
THEORY								
1	23HS101	Essential Communication	HSMC	3	0	0	3	3
2	23MA101	Matrices and Calculus	BSC	3	0	0	3	3
3	23CS101	Programming in C	ESC	3	0	0	3	3
4	23HS102	Heritage of Tamils	HSMC	1	0	0	1	1
THEORY AND PRACTICALS								
5	23PH111	Engineering Physics	BSC	3	0	2	5	4
6	23CY111	Engineering Chemistry	BSC	3	0	2	5	4
PRACTICALS								
7	23CS121	C Programming Laboratory	ESC	0	0	4	4	2
8	23HS121	Communication Skills Laboratory	HSMC	0	0	2	2	1
9	23IT121	Information Technology Essentials	ESC	0	0	2	2	1
10	23HS122	General Clubs / Technical Clubs / NCC / NSS / Extension Activities	HSMC	0	0	2	2	1*
TOTAL				**16**	**0**	**12**	**30**	**22**

*** The grades earned by the students will be recorded in the Mark Sheet. However, the same shall not be considered for the computation of CGPA**

SEMESTER –II

Sl. No.	Course code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1	23HS201/ 23HS202	Professional English/ Foreign language	HSMC	3	0	0	3	3
2	23MA204	Probability and Statistics	BSC	3	1	0	4	4
3	23PH205	Physics for Information Science	BSC	3	0	0	3	3
4	23IT201	Data Structures and Algorithms	PCC	3	0	0	3	3
5	23HS203	Tamils and Technology	HSMC	1	0	0	1	1
THEORY AND PRACTICALS								
6	23EE281	Basic Electrical and Electronics Engineering	ESC	2	0	2	4	3
7	23ME211	Engineering Graphics	ESC	3	0	2	5	4
PRACTICALS								
8	23ME221	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	23IT221	Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
10	23HS221	Soft Skills	EEC	0	0	2	2	1*
TOTAL				**18**	**1**	**10**	**29**	**25**

*** The grades earned by the students will be recorded in the Mark Sheet. However, the same shall not be considered for the computation of CGPA**

SEMESTER-III

Sl. No.	Course code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1	23MA202	Discrete Mathematics	BSC	3	1	0	4	4
2	23IT301	Java Programming	PCC	3	0	0	3	3
3	23CS302	Database Management Systems	PCC	3	0	0	3	3
4	23HS301	Universal Human Values and Ethics	HSMC	3	0	0	3	3
THEORY AND PRACTICALS								
5	23CS311	Digital Principles and System Design	PCC	3	0	2	5	4
6	23IT311	Advanced Algorithms	PCC	3	0	2	5	4
PRACTICALS								
7	23IT321	Java Programming Laboratory	PCC	0	0	4	4	2
8	23CS322	Database Management Systems Laboratory	PCC	0	0	4	4	2
9	23ES391	Presentation Skills	EEC	0	0	2	2	1*
TOTAL				18	1	14	33	25

*** The grades earned by the students will be recorded in the Mark Sheet. However, the same shall not be considered for the computation of CGPA**

SEMESTER-IV

Sl. No.	Course code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1	23MA301	Linear Algebra	BSC	3	1	0	4	4
2	23IT401	Machine Learning Techniques	PCC	3	0	0	3	3
3	23CS401	Operating Systems	PCC	3	0	0	3	3
4	23IT402	Formal Languages and Automata Theory	PCC	3	0	0	3	3
5	23IT403	Computer Organization and Architecture	PCC	3	0	0	3	3
THEORY AND PRACTICALS								
6	23IT411	Web Technology	PCC	3	0	2	5	4
PRACTICALS								
7	23IT421	Machine Learning Techniques Laboratory	PCC	0	0	4	4	2
8	23CS421	Operating Systems Laboratory	PCC	0	0	4	4	2
9	23ES491	Aptitude and Logical Reasoning -1	EEC	0	0	2	2	1*
TOTAL				18	1	14	31	24

*** The grades earned by the students will be recorded in the Mark Sheet. However, the same shall not be considered for the computation of CGPA**

SEMESTER-V

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1	23RE501	Research Methodology and Intellectual Property Rights	ESC	2	0	0	2	2
2	23IT501	Computer Networks and Communications	PCC	3	0	0	3	3
3		Department Elective -1	DEC	-	-	-	-	3
4		Department Elective - 2	DEC	-	-	-	-	3
5		Open Elective – 1 (Emerging Technology)	OEC	3	0	0	3	3
THEORY AND PRACTICALS								
6	23IT511	Principles of Software Engineering	PCC	3	0	2	5	4
PRACTICALS								
7	23IT521	Computer Networks and Communications Laboratory	PCC	0	0	4	4	2
8	23IT522	Mini Project	EEC	0	0	3	3	2
9	23IT523	Summer Internship	EEC	0	0	0	0	1
10	23ES591	Aptitude and Logical Reasoning–2	EEC	0	0	2	2	1*
TOTAL				-	-	-	-	23

*** The grades earned by the students will be recorded in the Mark Sheet. However, the same shall not be considered for the computation of CGPA**

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	credits
				L	T	P		
THEORY								
1	23IT601	Cryptography and Security	PCC	3	0	0	3	3
2		Department Elective - 3	DEC	-	-	-	-	3
3		Department Elective - 4	DEC	-	-	-	-	3
4		Open Elective - 2 (Management / Safety Courses)	OEC	3	0	0	3	3
THEORY AND PRACTICALS								
5	23CE611	Environmental Science and Engineering	ESC	3	0	2	5	4
6	23IT611	IoT and It's Applications	PCC	3	0	2	5	4
PRACTICALS								
7	23IT621	Project Work – Phase 1	EEC	0	0	4	4	2
8	23IT622	Technical Training	EEC	0	0	2	2	1
9	23IT623	Technical Seminar – 1	ESC	0	0	2	2	1
TOTAL				**18**	**0**	**14**	**32**	**24**

SEMESTER -VII

Sl. No.	Course Code	Course Title	Category	periods Per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1		Open Elective – 3 (Management Courses)	OEC	3	0	0	3	3
2		Department Elective – 5	DEC	-	-	-	-	3
3		Department Elective – 6	DEC	-	-	-	-	3
4	23IT701	Technical Comprehension	EEC	2	0	0	2	2
THEORY AND PRACTICALS (INTEGRATED COURSE)								
5	23IT711	Computer Graphics and Multimedia	PCC	3	0	2	5	4
PRACTICALS								
6	23IT721	Project Work - Phase 2	EEC	0	0	6	6	3
7	23IT722	Technical Seminar – 2	ESC	0	0	4	4	2
TOTAL				-	-	-	-	20

SEMESTER -VIII

Sl. No.	Course code	Course Title	Categpry	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
PRACTICALS								
1	23IT821 / 23IT822	Capstone Project / Internship Cum Project	EEC	0	0	20	20	10
TOTAL				0	0	20	20	10

TOTALCREDITS: 173

DEPARTMENT ELECTIVE COURSES: VERTICALS

VERTICAL 1: CLOUD COMPUTING

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23IT031	Distributed Computing	DEC	2	0	2	4	3
2	23IT032	Cloud Services Management	DEC	2	0	2	4	3
3	23IT033	Virtualization	DEC	2	0	2	4	3
4	23IT034	Cloud Database Management	DEC	2	0	2	4	3
5	23IT035	Storage Technologies	DEC	2	0	2	4	3
6	23IT036	Security and Privacy in Cloud	DEC	2	0	2	4	3
7	23IT037	Stream Processing	DEC	2	0	2	4	3
8	23IT038	Cloud Web Services	DEC	2	0	2	4	3

VERTICAL 2 : FULL STACK DEVELOPMENT

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23CS031	Java Full Stack Development	DEC	2	0	2	4	3
2	23CS032	Mobile App Development	DEC	2	0	2	4	3
3	23CS033	UI and UX Design	DEC	2	0	2	4	3
4	23CS034	MERN Stack Web Development	DEC	2	0	2	4	3
5	23CS035	DevOps	DEC	2	0	2	4	3
6	23CS036	Web Application Security	DEC	2	0	2	4	3
7	23CS037	Advanced Java Programming	DEC	2	0	2	4	3
8	23CS038	Python Full Stack Development with Machine Learning (Industry Supported Course)	DEC	2	0	2	4	3

VERTICAL 3 : ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23AD046	Knowledge Engineering	DEC	3	0	0	3	3
2	23IT039	Data Science	DEC	2	0	2	4	3
3	23IT040	Deep Learning	DEC	2	0	2	4	3
4	23AD040	Natural Language Processing	DEC	2	0	2	4	3
5	23IT041	Cognitive Systems	DEC	2	0	2	4	3
6	23IT042	Big Data Analytics	DEC	2	0	2	4	3
7	23IT043	Data Mining and Warehousing	DEC	2	0	2	4	3
8	23AD045	Data Exploration and Visualization	DEC	2	0	2	4	3

VERTICAL 4 : NETWORK & SECURITY SYSTEMS

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23EC049	Network Essentials	DEC	2	0	2	4	3
2	23EC050	Network Engineering	DEC	2	0	2	4	3
3	23EC051	Switching, Routing, And Wireless Essentials	DEC	2	0	2	4	3
4	23EC052	Enterprise Networking, Security, and Automation	DEC	2	0	2	4	3
5	23EC053	Network Design	DEC	3	0	0	3	3
6	23CB031	Ethical Hacking	DEC	2	0	2	4	3
7	23CB034	Security in Computing	DEC	2	0	2	4	3
8	23CS039	Crypto Currency andBlockchain Technology	DEC	3	0	0	3	3

VERTICAL 5 : SOFTWARE ENGINEERING

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23IT044	Software Design	DEC	3	0	0	3	3
2	23IT045	Software Project Management	DEC	3	0	0	3	3
3	23IT046	Human Computer Interaction	DEC	3	0	0	3	3
4	23IT047	Software Quality Assurance and Testing	DEC	3	0	0	3	3
5	23IT048	Agile Methodology	DEC	3	0	0	3	3
6	23IT049	Software Requirements Engineering	DEC	3	0	0	3	3
7	23IT050	Software Reliability Metrics and Models	DEC	3	0	0	3	3
8	23IT051	Software Architecture	DEC	3	0	0	3	3

OPEN ELECTIVE – EMERGING TECHNOLOGIES

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23AE0971	Aviation Management	OEC	3	0	0	3	3
2	23OAS971	Space Engineering	OEC	3	0	0	3	3
3	23OCB971	Cyber Law	OEC	3	0	0	3	3
4	23OEC972	Fundamentals of Wearable Devices	OEC	3	0	0	3	3
5	23OED971	Introduction to Design Thinking	OEC	3	0	0	3	3
6	23OED972	Intellectual Property Law	OEC	3	0	0	3	3
7	23OEE971	Renewable Energy Technologies	OEC	3	0	0	3	3
8	23OMA971	Resource Management Techniques	OEC	3	0	0	3	3
9	23OMA972	Graph Theory	OEC	3	0	0	3	3
10	23OME971	Quality Engineering	OEC	3	0	0	3	3

OPEN ELECTIVE – MANAGEMENT COURSES

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
1	23OMG971	Total Quality Management	OEC	3	0	0	3	3
2	23OMG972	Engineering Economics and Financial Accounting	OEC	3	0	0	3	3
3	23OMG973	Engineering Management and Law	OEC	3	0	0	3	3
4	23OMG974	Knowledge Management	OEC	3	0	0	3	3
5	23OMG975	Industrial Management	OEC	3	0	0	3	3
6	23OMG976	Entrepreneurship and Business Opportunities	OEC	3	0	0	3	3
7	23OMG977	Modern Business Administration and Financing	OEC	3	0	0	3	3
8	23OMG978	Essentials of Management	OEC	3	0	0	3	3

OPEN ELECTIVE – SAFETY RELATED COURSES

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
1	23OAU981	Automotive Safety	OEC	3	0	0	3	3
2	23OCE981	Disaster Management	OEC	3	0	0	3	3
3	23OME981	Industrial Safety	OEC	3	0	0	3	3

SEMESTER-WISE CREDIT DISTRIBUTION

SEMESTER	HSMC	BSC	ESC	PCC	DEC	OEC	EEC	Total
Semester I	5	11	6					22
Semester II	4	7	9	5				25
Semester III	3	4		18				25
Semester IV		4		20			1	24
Semester V			2	9	6	3	2	23
Semester VI			5	7	6	3	3	24
Semester VII			2	4	6	3	5	20
Semester VIII							10	10
Total	12	26	24	63	18	9	21	173

SEMESTER –I

23IP101	INDUCTION PROGRAMME	L	T	P	C
		-	-	-	0

COURSE OBJECTIVES:

- This is a mandatory 2 weeks 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 objectives
- Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.
- One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character

- Hence, the purpose of this Programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature
- **Physical Activity**
  This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.,
- **Life skills**
  Every student would choose one skill related to daily needs such as stitching, accounting, finance management, etc.,

Universal human values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through dos 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.

Club Activity

Students will be introduced to more than 20 Clubs available in the college-both technical and non-technical. The student can choose as to which club the student will enroll in.

Value Based Communication
This module will focus on improving the communication skills of students
Lectures by Alumni
Lectures by alumni are arranged to bring in a sense of belonging to the student towards the institution and also to inspire them to perform better
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
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
Address by different heads
Heads of Placement, Training, Student affairs, counsellor, etc would be interacting with the students to introduce them to various measures taken in the institution for the betterment of students.
Induction Programme is totally an activity-based Programme and therefore there shall be no tests / assessments during this Programme.
REFERENCES:
Guide to Induction program from AICTE

23HS101	ESSENTIAL COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To help learners extract information from short and simple correspondence
- To familiarize learners with different text structures by engaging them in reading, writing and grammar learning activities
- To help learners write coherent, short paragraphs and essays
- To enable learners to use language efficiently while expressing their opinions via various media.

UNIT I	FORMATION OF SENTENCES	9

Reading- Read pictures-notices- short comprehension passages and recognize main ideas and specific details. Writing- framing simple and compound sentences, completing sentences, developing hints, writing text messages. Language development- Parts of Speech, Wh- Questions, yes or no questions, direct and indirect questions. Vocabulary development– prefixes- suffixes- articles – countable and uncountable nouns

UNIT II	NARRATION AND DESCRIPTION	9

Reading – Read short narratives and descriptions from newspapers, dialogues and conversations. Reading strategies and practices. Language development – Tenses- simple present, present continuous, present perfect, simple past, past continuous, past perfect, simple future, future continuous, past participle, pronouns. Vocabulary development- guessing meanings of words in context. Writing – Write short narrative paragraphs, biographies of friends/relatives - writing- topic sentence- main ideas- free

writing, short narrative descriptions using some suggested vocabulary and structures.		
UNIT III	**COMPARING AND CONTRASTING**	**9**
Reading- short texts and long texts -understanding different types of text structures, -coherence-jumbled sentences. Language development- degrees of comparison, concord- Vocabulary development – single word substitutes- discourse markers- use of reference words Writing - comparative and contrast paragraphs writing- topic sentence- main idea, free writing, compare and contrast using some suggested vocabulary and structures.		
UNIT IV	**SOCIAL MEDIA COMMUNICATION**	**9**
Reading- Reading blogs, social media reviews, posts, comments, process description, Language development - relative clause, Vocabulary development- social media terms-words, abbreviations and acronyms Writing- -e-mail writing-conventions of personal email, descriptions for simple processes, critical online reviews, blog, website posts, commenting to posts.		
UNIT V	**ESSAY WRITING**	**9**
Reading- Close reading non-technical longer texts Language development - modal verbs, phrasal verbs- Vocabulary development - collocation. Writing- Writing short essays- brainstorming – developing an outline- identifying main and subordinate ideas.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Summarize simple, level-appropriate texts of around 300 words recognizing main ideas and specific details.	

CO2:	Demonstrate the understanding of more complex grammatical structures and diction while reading and writing.
CO3:	Use appropriate expressions to describe, compare and contrast people, things, situations etc., in writing.
CO4:	Establish the ability to communicate effectively through emails.
CO5:	Determine the language use appropriate for different social media platforms.
CO6:	Use appropriate expressions for narrative descriptions and process descriptions.

TEXT BOOKS:

1	Susan Proctor, Jack C. Richards, Jonathan Hull. Interchange Level 2. Cambridge University Press and Assessment
2	Susan Proctor, Jack C. Richards, Jonathan Hull. Interchange Level 3. Cambridge University Press and Assessment

REFERENCES:

1	Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013
2	Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning , USA: 2007

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	-	-	-	-	-	1	1	-	2	3	-	2	-	-	-
2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
3	-	-	-	-	-	1	1	-	2	3	-	2	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
5	-	-	-	-	-	1	1	-	3	3	-	2	-	-	-
6	-	-	-	-	-	1	1	-	3	3	-	2	-	-	-
Overall Correlation	-	-	-	-	-	**1**	**1**	-	**3**	**3**	-	**2**	-	-	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23MA101	MATRICES AND CALCULUS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

UNIT I	MATRICES	9

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	9

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	9

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 multiplier.

UNIT IV	INTEGRAL CALCULUS	9

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.		
UNIT V	**MULTIPLE INTEGRALS**	**9**
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.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply the matrix algebra techniques and applications in Engineering Problems.
CO2:	Make use of the concept of limits and rules of differentiation to differentiate functions
CO3:	Find the derivative of functions of several variables
CO4:	Examine the application of partial derivatives
CO5:	Compute integrals by different techniques of Integration.
CO6:	Apply the concept of integration to compute multiple integrals.
TEXT BOOKS:	
1	Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.
REFERENCES:	
1	Dr.P.Sivaramakrishnadas, Dr.C.Vijayakumari., — Matrices and Calculus‖ Pearson Publications Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016

3	Bali. N., Goyal. M. and Watkins. C., ―Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4	Narayanan. S. and Manicavachagom Pillai.T. K., ―Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
6	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-

Recommended by Board of Studies	**02-08-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23CS101	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic constructs of C Language.
- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop modular applications in C using functions and pointers.
- To develop applications in C using structures and Unions.
- To understand file handling 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 – Preprocessor 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- Types of file processing: Sequential access, Random Access- Sequential access file- Random access file- Command line arguments.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Describe the basic constructs of C Programming Language.
CO2:	Develop simple applications using C basic constructs.
CO3:	Construct and Implement applications using Arrays and Strings.
CO4:	Develop and Implement applications using Functions and pointers.
CO5:	Construct applications using structures and Unions.
CO6:	Demonstrate File handling concepts and Command line arguments.

TEXT BOOKS:	
1	Reema Thareja, "Programming in C", Oxford University press, Second Edition, 2016.
2	Kernighan B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:	
1	Paul Deitel and Harvey Deitel, "C How to program with an introduction to C++", Eighth Edition, Pearson Education,2018.
2	Yashwant Kanetkar, "Let us C", seventeenth Edition, BPB Publications, 2020.
3	Anita Goel and Ajay Mittal, "Computer Fundamentals and

	programming in C", First Edition, Pearson Education, 2013.
4	Byron S. Gotfried, "Schaum's outline of Theory and Problems of Programming with C", McGraw-Hill Education,1996.
5	PradipDey, ManasGhosh, "Computer Fundamentals and Programming in C" Second Edition, Oxford University Press, 2013.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	1	1	1	1	3	1	-
2	3	2	1	1	1	-	-	-	1	1	1	1	3	1	-
3	3	2	1	1	1	-	-	-	1	1	1	1	3	1	-
4	3	2	1	1	1	-	-	-	1	1	1	1	3	1	-
5	3	2	1	1	1	-	-	-	1	1	1	1	3	1	-
6	2	1	-	-	1	-	-	-	1	1	1	1	3	1	-
Overall Correlation	3	2	1	1	1	-	-	-	1	1	1	1	3	1	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23HS102	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- Explain the classical literature of Tamil and highlight notable Tamil poets.
- Explain the creation of traditional Tamil musical instruments.
- Explain the sports and games associated with Tamil heritage.
- Explore the education and literacy practices during the Sangam period.
- Explain the contributions of Tamils to the Indian freedom struggle.
- Explain the development and history of printing in Tamil Nadu.

UNIT I	LANGUAGE AND LITERATURE	3

Language Families in India – Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

UNIT II	HERITAGE – ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

UNIT III	FOLK AND MARTIAL ARTS	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu,

Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.		
UNIT IV	**THINAI CONCEPT OF TAMILS**	**3**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas		
UNIT V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
TOTAL: 15 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain the evolution of Tamil language and literature, focusing on its cultural, ethical, and secular themes.	
CO2:	Outline the making of musical instruments related to Tamil heritage.	
CO3:	Discuss the sports and games of Tamils	
CO4:	Explain the education and literacy during Sangam age.	
CO5:	Express the importance and contribution of Tamils to Indian Freedom Struggle	
CO6:	Outline the print history of books in Tamil Nadu	
TEXT BOOKS:		
1	தமிழக வரலாறு-மக்களும் பண்பாடும்-கே.கேபிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).	

2	கணினித்தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
REFERENCES:	
1	**கீழடி- வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)**
2	பொருனை- ஆற்றங்கரை **நாகரிகம் (தொல்லியல் துறை வெளியீடு)**

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
2	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
4	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
5	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
6	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
Overall Correlation		-	-	-	-	**2**	**2**	-	-	-	-	-	-	-	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23PH111	ENGINEERING PHYSICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To make the students effectively achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of optics and lasers.
- To equip the students successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I	MECHANICS	9

Types of stress, Stress-strain diagram and its uses- factors affecting elastic modulus- tensile strength- Bending of beams, bending moment – theory and experiment: Uniform and non-uniform bending, Center of mass (CM) – CM of continuous bodies –rod, motion of the CM. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of rod, disc, solid sphere – M.I of a diatomic molecule - torque -rotational energy state of a rigid diatomic molecule – M.I of disc by torsional pendulum

UNIT II	ELECTROMAGNETIC WAVES	9

Concept of field-introduction to gradient, divergence and curl of field – Stokes theorem (No proof)-Gauss divergence theorem (No proof) - The Maxwell's equations in integral form and differential form - wave equation; Plane electromagnetic waves in vacuum - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Energy and momentum in EM waves-Poynting's vector - Cell-phone reception.

UNIT III	OPTICS AND LASERS	9

Reflection and refraction of light waves - total internal reflection –

types of optical fiber, Numerical Aperture and acceptance angle - interference –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients(Qualitative) - population inversion - CO2 laser, semiconductor laser (Homo junction) - 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 a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V	ADVANCED 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

PRACTICAL EXERCISES: (Any Seven 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 wavelength of the laser using grating
6. Airwedge- Determination of thickness of a thinsheet /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:	
After completion of the course, the students will be able to:	
CO1:	Determine the mechanical properties of materials.
CO2:	Apply the principles of electromagnetic waves to real world system.
CO3:	Determine the thickness of thin wire and the characteristic parameter of an optical fiber.
CO4:	Apply the principles of lasers to real world application.
CO5:	Organize the quantum mechanical properties of particles and waves.
CO6:	Utilize the quantum mechanical principles towards the formation of energy bands.
TEXT BOOKS:	
1	D.Kleppner and R.Kolenkow, "An Introduction to Mechanics", McGraw Hill Education (Indian Edition), 2017.
2	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", McGraw-Hill (Indian Edition), 2017.

REFERENCES:	
1	R.Wolfson," Essential University Physics", Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2	Paul A. Tipler, "Physic – Volume 1 & 2", CBS, (Indian Edition), 2004.
3	K.Thyagarajan and A.Ghatak,"Lasers: Fundamentals and Applications," Laxmi Publications, (Indian Edition), 2019.
4	D.Halliday, R.Resnick and J.Walker, "Principles of Physics", Wiley (Indian Edition), 2015.
5	N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students",Springer Verlag, 2016.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
6	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-

Recommended by Board of Studies	26-07-2023		
Approved	1st ACM	Date	09-09-2023

23CY111	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	1	4

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage batteries.

UNIT I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Sewage treatment primary treatment and disinfection (UV, Ozonation, break-point chlorination). Hardness-Estimation of Hardness of water by EDTA-numerical Problems-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 (Metal oxide and Metal) Synthesis and Characterization of nanomaterials: sol-gel, solvothermal, laser ablation, chemical

vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, energy, sensor , electronics and catalysis.

UNIT III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system – water system; CO_2 system; Reduced phase rule; Two component system: lead-silver system – Pattinson process. Composites: 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: Fossil Fuels, 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. CO_2 emission and carbon sequestration, Green Hydrogen.

UNIT V	ENERGY SOURCES AND STORAGE DEVICES	9

Nuclear fission and fusion- 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 and its advanced technology, supercapacitor.	
	TOTAL: 45 PERIODS
LIST OF EXPERIMENTS	**TOTAL: 30 PERIODS**
1. Determination of hardness causing salts in water sample by EDTA method. 2. Determination of alkalinity in water sample. 3. Determination of chloride content of water sample by argentometric method. 4. Determination of strength of given Barium chloride using conductivity meter. 5. Determination of strength of Acid using pH meter. 6. Determination of strength of FAS by potentiometer 7. Determination of strength of acids in a mixture using conductivity meter. 8. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method. **9.** Estimation of Nickel in steel	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Interpret the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2:	Illustrate the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3:	Estimate the knowledge of phase rule and composites for material selection requirements
CO4:	Choose a suitable fuel for engineering processes and applications
CO5:	Relate the different forms of energy resources and apply them for suitable applications in energy sectors.
CO6:	Explain the different types of batteries, fuel cells and working principles of Electric vehicles

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", S. Chand Publishing, 12th Edition, 2018.Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
REFERENCES:	
1	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014New Delhi, 2018.
4	ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019
5	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-	2	-	-	-	-	1	2	-	-
2	2	1	-	-	-	-	2	-	-	-	-	1	2	-	-
3	2	1	-	-	-	-	2	-	-	-	-	1	2	-	-
4	3	2	1	1	-	-	3	-	-	-	-	2	3	-	-
5	3	2	1	1	-	-	3	-	-	-	-	2	3	-	-
6	2	1	-	-	-	-	2	-	-	-	-	1	2	-	-
Overall Correlation	**3**	**2**	**1**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23CS121	C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To familiarize with C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

PRACTICALS :

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.

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

HARDWARE : Standalone desktops – 30 No's

SOFTWARE: : C / C++ / Equivalent Compiler

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Demonstrate knowledge on C programming constructs.

CO2:	Develop programs in C using basic constructs.
CO3:	Develop programs in C using arrays and strings
CO4:	Develop applications in C using functions and pointers.
CO5:	Develop applications in C using structures and union.
CO6:	Develop applications in C using file processing.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	1	-	1	-	2	-	1	2	1	1
2	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1
3	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1
4	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1
5	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1
6	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1
Overall Correlation	3	2	1	1	3	1	-	1	-	2	-	1	3	3	1

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23HS121	COMMUNICATION SKILLS LABORATORY	L	T	P	C
		0	0	2	2

COURSE OBJECTIVES:

- To enable the students to comprehend the main idea and specific information of the listening passage
- To help students express themselves clearly, and communicate effectively with others.
- To introduce authentic language use and context-specific vocabulary that might not be encountered in textbooks.

Exercise : 1	Listening to conversations set in everyday social context and complete gap-filling exercise
Exercise : 2	Listening to a monologue in everyday social context. Diagram labelling and MCQ
Exercise : 3	Listening to a group conversation in academic setting and answer MCQ
Exercise : 4	Listening to a lecture and answer MCQ or gap filling
Exercise : 5	Listening to Ted Talks, podcasts, documentaries - discussion
Exercise : 6	Listening to a lecture and reading a text on the same subject- compare and contrast
Exercise : 7	Speaking Introducing oneself
Exercise : 8	Answering questions based on the introduction
Exercise : 9	Speaking on a given prompt for 2 mins.
Exercise : 10	Answering questions based on the topic spoken
Exercise : 11	Role play- Engaging in conversation
Exercise : 12	Engaging in Podcast Discussion

TOTAL: 25 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Demonstrate fluency in speaking in variety of situations
CO2:	Express their knowledge by talking continuously for more than two minutes on a topic

CO3:	Develop active listening for more meaningful interactions and conversations
CO4:	Use a full range of structures naturally and appropriately
CO5:	Identify the specific information in conversations, interviews, talks and lectures
CO6:	Develop the ability to compare and analyse different forms of information, identifying key similarities and differences.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	-	-	-	-	-	1	1	-	2	3	-	2	-	-	-
2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
3	-	-	-	-	-	1	1	-	2	3	-	2	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
5	-	-	-	-	-	1	1	-	3	3	-	2	-	-	-
6	-	-	-	-	-	1	1	-	2	3	-	-	-	-	-
Overall Correlation	-	-	-	-	-	**1**	**1**	-	**3**	**3**	-	**2**	-	-	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23IT121	INFORMATION TECHNOLOGY ESSENTIALS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To design and develop web pages using HTML and CSS.
- To understand the general concepts of PHP scripting language and MySQL functionalities for the development of simple data-centric applications.
- To provide a basic knowledge of computer software.
- To understand various types of information systems and their complexities.
- To Simplify and transfer this problem solving process to wide variety of problems

UNIT I	WEB AND SCRIPTING ESSENTIALS	10

Internet Basics – Browser Fundamentals – Authoring Tools – Introduction to HTML5 –HTML5 Tags–HTML5 Forms–Cascading Style Sheets (CSS3) Fundamentals–Need for Scripting Languages–Introduction to JavaScript.

Suggested Activities:

- Browse the internet on special topics given by instructor.
- Learn HTML basic tags for web page design.
- Identify different types of form validations in the websites that are commonly used.
- Practical - Design of a small simple website, interlinking set of web pages created using the HTML tags and CSS.

Suggested Evaluation Methods:

- Quizzes on all the topics of the unit.
- Discussion on form validation.
- Peer evaluation of the simple web-sites created.

UNIT II	SERVER-SIDE ESSENTIALS (PHP)	10

Introduction to PHP – PHP Variables – Constants – Operators –

Flow Control and Looping –Arrays – Strings – Functions – PHP and HTML– Database Management–Introduction to My SQL – MySQL Commands – MySQL Database Creation –Connecting MySQL and PHP – Querying MySQL Database with PHP.

Suggested Activities:

- Practical –Simple programs using PHP.
- Design of a dynamic webpages using PHP.
- Database creation using MySQL and PHP scripts.
- Practical - Creation of session and cookies.

Suggested Evaluation Methods:

- Quizzes on different topics of the unit.
- Demonstration of the implementations.
- Group discussions design of web page.

UNIT III	APPLICATION ESSENTIALS	10

Creation of Simple Interactive Applications – Simple Database Applications – Introduction to Information Systems – Personal Information System – Information Retrieval System – Social Networking Applications.

Suggested Activities:

- Flipped classroom on social networking applications.
- Explore the web to know more about the concepts and technologies used for the design of Information Systems. Students may present their findings orally or by a written report.
- Design a simple web or mobile application.
- Explore and analyze some of the visual analytics software.

Suggested Evaluation Methods:

- Quizzes on features of social networking applications.

	• Presentations on various information systems. • Demonstration of application. • Discussions through forums.
	TOTAL: 30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Build dynamic website / web based applications using HTML, PHP, and MYSQL database.
CO2:	Build websites that meet specified needs and interests using basic elements to control at you and style.
CO3:	Illustrate the programs by applying concepts and error handling techniques of HTML, Java Script and MYSQL.
CO4:	Identify the fundamental concepts and key issues in the design of commonly used applications.
CO5:	Illustrate the programs by applying concepts and error handling techniques of PHP and MYSQL.
CO6:	Discuss and transfer this problem solving process to wide variety of problems.
TEXT BOOKS:	
1	Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step – by - Step Guide to Creating Dynamic Websites", O'Reilly Media, Inc, 2014.
2	Luke Welling, Laura Thomson, "PHP and MYSQL Web Development", Pearson Education 5TH EDN December 2016
REFERENCES:	
1	Steven Holzner, ―PHP: The Complete Reference‖, Fifth Edition, Mc Graw Hill, 2017.
2	Niederst Robbins, Jennifer, ―Learning Web Design: A Beginner's Guide to HTML, CSS, Javascript and Web Graphics‖, Fifth Edition, O'Reilly Media, 2018.
3	Laura Lemay, Rafe Colburn, Jennifer Kyrnin, ―Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016.
4	R. Kelly Rainer, Casey. Cegielski, Brad Prince― Introduction to Information Systems‖, Fifth Edition, Wiley Publication, 2014.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	-	-	-	-	-	-	1	2	1	-
2	3	2	1	1	1	-	-	-	-	-	-	1	2	1	-
3	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
4	3	2	1	1	1	-	-	-	-	-	-	1	2	1	-
5	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
6	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
Overall Correlation	2	2	1	1	1	-	-	-	-	-	-	1	2	1	-
Recommended by Board of Studies							28-07-2023								
Approved by Academic							1st ACM			Date			09-09-2023		

SEMESTER - II

23HS201	PROFESSIONAL ENGLISH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To help learners extract information from longer, technical and scientific texts
- To familiarize learners with different text structures by engaging them in reading, writing and grammar learning activities
- To help learners write coherent, extensive reports and essays.
- To enable learners to use language efficiently while expressing their opinions in professional and business situations

UNIT I	WORKPLACE COMMUNICATION	9

Reading – Reading brochures (technical context), advertisements, telephone messages, gadget reviews social media messages, digital communication relevant to technical contexts and business. Writing – Writing emails -emails on professional contexts including introducing oneself, writing checklist, writing single sentence definition, product description- advertising or marketing slogans, Language Development– Tenses, Concord, Question types: Wh/ Yes or No/ and Tags, imperative sentences, complex sentences. Vocabulary - One-word substitutes; Abbreviations & Acronyms as used in technical contexts and social media.

UNIT II	EXPRESSING CAUSE AND EFFECT	9

Reading - Reading longer technical texts– Cause and Effect Essays, and emails of complaint. Writing - writing complaint emails (raising tickets) and responses to complaints, writing Cause and effect paragraphs and essays. Language Development– Active, Passive and Impersonal Passive Voice transformations, Infinitive and Gerunds Vocabulary – Synonyms- contextual meaning of

words, Same word acting as different parts of speech, causal expressions.		
UNIT III	**PROVIDING SOLUTIONS TO PROBLEMS**	**9**
Reading - Case Studies, editorials, news reports etc. Writing – Letter to the Editor, Writing instructions and recommendations, Problem solution essay / Argumentative Essay, Language Development – Error correction; If conditional sentences Vocabulary - Compound Words, discourse markers.		
UNIT IV	**INTERPRETATION OF GRAPHICS**	**9**
Reading - Reading newspaper articles, nonverbal communication (charts and graphs) Writing –Transferring information from nonverbal (chart, graph etc, to verbal mode) Process– description. Language development–Possessive & Relative pronouns, numerical adjectives Vocabulary Homonyms and Homophones, sequence words.		
UNIT V	**REPORT WRITING AND RESUME WRITING**	**9**
Reading – Company profiles, journal reports. Language Development– Reported Speech Vocabulary-reporting words and phrases. Writing - Writing accident report, survey report and progress report, project proposal, minutes of the meeting, writing statement of purpose, internship application and resume		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Summarize long technical and scientific text of not less than 500 words recognizing main ideas and specific details	
CO2:	Demonstrate the understanding of more complex grammatical structures and diction while reading and writing	
CO3:	Use appropriate expressions to describe process and product, compare and contrast data, analyze problems, provide solutions and prove an argument in writing	

CO4:	Establish the ability to communicate effectively in professional environment through emails and reports
CO5:	Determine the language use appropriate for different social media platforms used for digital marketing
CO6:	Convert skills to assets and position themselves in job market through their own professional narratives
TEXT BOOKS:	
1	V. Chellammal, Deepa Mary Francis, K N Shoba, P R Sujatha Priyadharshini, Veena Selvam, English for Science & Technology I, Cambridge University Press and Assessment
2	V. Chellammal, Deepa Mary Francis, K N Shoba, P R Sujatha Priyadharshini, Veena Selvam, English for Science & Technology II, Cambridge University Press and Assessment
REFERENCES:	
1	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
2	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	-	-	-	-	-	1	1	-	2	3	-	2	-	-	-
2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
3	-	-	-	-	-	-	1	-	2	3	-	2	-	-	-
4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
5	-	-	-	-	-	-	1	-	2	3	-	2	-	-	-
6	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
Overall Correlation	-	-	-	-	-	1	1	-	2	3	-	3	-	-	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23MA204	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of Estimation Theory for small and large samples this plays an important role in real life problems.
- To provide required advanced statistical tools in solving engineering problems
- To introduce the basic concepts of classifications of statistical quality control this plays very important roles in the field of agricultural engineering

UNIT I	PROBABILITY AND RANDOM VARIABLES	9+3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II	TWO- DIMENSIONAL RANDOM VARIABLES	9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Curve Fitting- Method of Least Squares-Central limit theorem (for independent and identically distributed random variables, without proof)- Simple problems.

UNIT III	ESTIMATION THEORY	9+3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means.

UNIT IV	NON- PARAMETRIC TESTS	9+3

Introduction - The Sign test - The Signed - Rank test - Rank - sum

tests - The U test - The H test- Tests based on Runs - Test of randomness - The Kolmogorov Tests.		
UNIT V	**STATISTICAL QUALITY CONTROL**	**9+3**
Control charts for measurements ($\bar{x}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.		
		TOTAL: 60 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Apply the fundamental knowledge of the concepts of probability and one dimensional random variables in engineering.	
CO2:	Apply standard probability distributions to real life phenomenon.	
CO3:	Apply the basic concepts of two dimensional random variables in engineering applications.	
CO4:	Apply the concept of estimation theory for small and large samples in real life problems.	
CO5:	Apply the notion of sampling distributions and statistical techniques used in engineering and management problems.	
CO6:	Apply the basic concepts of classifications of statistical quality control in the field of engineering.	
TEXT BOOKS:		
1	Johnson. R.A., Miller. I.R and Freund. J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.	
2	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007.	
REFERENCES:		
1	Dr.P. Sivaramakrishna Das, C. Vijayakumari, ―A text book of probability and statistics‖, Pearson Publications.	
2	Gupta. S.C. and Kapoor. V. K., ―Fundamentals of Mathematical Statistics‖, Sultan Chand & Sons, New Delhi,	

	12th Edition, 2020.
3	Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
4	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
6	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-

Recommended by Board of Studies	**28-07-2023**		
Approved	**1st ACM**	**Date**	**09-09-2023**

23PH205	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students understand the importance in studying electrical properties of materials.
- To enable the students to gain knowledge in semiconductor physics
- To instill knowledge on magnetic properties of materials.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate 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 in periodic potential – Energy bands in solids – tight binding approximation - 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 (qualitative) – Hall effect and devices – Ohmic contacts – Schottky diode – introduction to solid state drive (SSD)

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 – Bloch sphere – quantum gates – advantage of quantum computing over classical computing.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply the knowledge of classical and quantum electron theories to energy band structures.
CO2:	Utilize the basics of intrinsic and extrinsic semiconductor physics and its application in various devices.
CO3:	Apply the knowledge of magnetic properties of materials in data storage.

CO4:	Explain the electro optical properties and optoelectronic devices.
CO5:	Explain the quantum structures, quantum confinement and Nano devices.
CO6:	Explain the role of quantum structures in information processing technique.
TEXT BOOKS:	
1	Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007.
2	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.
3	Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.
REFERENCES:	
1	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2	Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3	V.V.Mitin, V.A. Kochelap and M.A.Stroscio, Introduction to Nanoelectronics, Cambridge Univ.Press, 2008.
4	G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.
5	B.Rogers, J.Adams and S.Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	2	1	-	-	-	-	-	-	-	-	-	1	2	-	-
5	2	1	-	-	-	-	-	-	-	-	-	1	2	-	-
6	2	1	-	-	-	-						1	2		
Overall Correlation	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**-**

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

23IT201	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the basic concepts of data structures and algorithms.
- To be familiar with writing recursive methods.
- To implement operations on Linked List, Stack and Queues.
- To implement traversal operations of trees and graphs.
- To understand concepts about various algorithm design techniques, searching and sorting techniques.

UNIT I	INTRODUCTION TO ALGORITHMS	9

Introduction to Data vs Information - Data Structures - Classification Abstraction - Abstract data types (ADT) - Array - Characteristics - Storage Representations. Array Order Reversal- Recursion- Array operations, Algorithm- complexity Time and Space trade off.

UNIT II	LINKED LIST	9

Array vs Linked List Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list Polynomial Manipulation using List - Advantages and disadvantages of singly linked list - Circular linked list- Doubly linked list - Circular Doubly Linked List.

UNIT III	STACKS & QUEUES	9

Introduction Array Representation of a Stack Linked List Representation of a Stack - Stack Operations - Algorithm for Stack Operations - Stack Applications: Tower of Hanoi - Infix to postfix Transformation - Evaluating Arithmetic Expressions. Queue Introduction Array Representation of Queue Linked List Representation of Queue - Queue Operations - Algorithm for Queue Operations - Queue Applications: Priority Queue.

UNIT IV	TREES AND GRAPHS	9
Preliminaries of Tree ADT - Binary Trees - The Search Tree ADT Binary Search Trees - AVL Trees - Tree Traversals - B-Trees – Heap Tree Preliminaries of Graph ADT - Representation of Graph, Graph Traversal - BFS DFS Applications of Graph Shortest – Path Algorithms Minimum Spanning Tree Prims Algorithm.		
UNIT V	**GRAPH ALGORITHM DESIGN TECHNIQUES AND SEARCHING AND SORTING TECHNIQUES**	**9**
Divide and Conquer Strategy - Greedy Algorithm - Dynamic Programming - Backtracking Strategy - List Searches using Linear Search - Binary Search – Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Illustrate the concept of recursive algorithms.
CO2:	Demonstrate the different types of data structures.
CO3:	Illustrate the operations on linear data structures.
CO4:	Select appropriate data structure as applied to specified problem definition.
CO5:	Explain and implement the various algorithm design techniques.
CO6:	Identify appropriate sort and search algorithm for a given application.

TEXT BOOKS:	
1	Jean-Paul Tremblay, Paul G. Sorenson, 'An Introduction to Data Structures with Application', TMH, 2017.
2	Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C., "Introduction to algorithms", 3rd edition, MIT.

REFERENCES:	
1	Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition, 2004.
2	Darren R. Hayes, "Practical Guide to Computer Forensics Investigations", 2014.
3	Larry R. Nyhoff, ADTs, "Data Structures, and Problem Solving with C++", Prentice Hall Edition, 2004.
4	Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-	-	-	-	-	-	1	1	-	-
2	2	1	-	-	-	-	-	-	-	-	-	2	3	-	-
3	2	1	-	-	1	-	-	-	-	-	-	2	3	1	-
4	3	2	1	1	1	-	-	-	-	-	-	2	3	1	-
5	2	1	-	-	1	-	-	-	-	-	-	1	3	1	-
6	3	2	1	1	1	-	-	-	-	-	-	1	3	1	-
Overall Correlation	3	2	1	1	1	-	-	-	-	-	-	2	3	1	-

Recommended by Board of Studies	28-07-2023		
Approved by Academic	1st ACM	Date	09-09-2023

23HS203	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To summarize the weaving industry and ceramic technology during Sangam Age
- To explain the design and construction of houses during Sangam Age and the sculptures and temples of Chola,Pallava and Pandya period
- To Explain about the water bodies of Sangam age and relate it to the agricultural usage
- To Outline to students the agriculture and irrigation technology during the Chola Period
- To help students Interpret and explain the digitalization of Tamil books and development of Tamil software

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences – Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books –Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
TOTAL: 15 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Summarize the weaving industry and ceramic technology during Sangam Age	
CO2:	Explain the design and construction of houses during Sangam Age	
CO3:	Explain the sculptures and temples of Chola,Pallava and Pandya period.	
CO4:	Explain about the water bodies of Sangam age and relate it to the agricultural usage	
CO5:	Outline the agriculture and irrigation technology during the Chola Period.	
CO6:	Interpret and explain the digitalization of tamil books and development of Tamil software	
TEXT BOOKS:		
1	Dr.K.K.Pillay ,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL	

REFERENCES:	
1	Dr.S.Singaravelu ,"Social Life of the Tamils - The Classical Period", Published by: International Institute of Tamil Studies.
2	Dr.S.V.Subatamanian , Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", Published by: International Institute of Tamil Studies

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
3	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
4	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
5	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
6	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-
Overall Correlation	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-

Recommended by Board of Studies	28-07-2023		
Approved by Academic	1st ACM	Date	09-09-2023

23EE281	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics, functional elements and working of measuring instruments
- To demonstrate the load test on DC machines, working of PN Junction diodes, Zener diodes and rectifiers.

UNIT I	ELECTRICAL CIRCUITS	6

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor– Ohm 's Law-Kirchhoff's Laws -Nodal Analysis, Mesh analysis with independent sources only (Steady State)- Introduction to AC Circuits –Steady state analysis of RL, RC, and RLC circuits (Simple problems only).

UNIT II	ELECTRICAL MACHINES	6

Construction and Working principle of DC Generators, EMF equation, Types and Applications- Working Principle of DC motors, Torque Equation, Types and Applications. - Construction, Working principle and Applications of Single- Phase Transformer.

UNIT III	ANALOG ELECTRONICS	6

PN Junction Diodes, Zener Diode–Characteristics & Applications– Bipolar Junction Transistor, JFET, SCR, MOSFET, – Types, I-V Characteristics and Applications – Rectifier.

UNIT IV	DIGITAL ELECTRONICS	6

Review of number systems, Combinational logic (adder and subtractor) – representation of logic functions-SOP and POS forms, K-map representations and minimization using K-maps (up to 3 variables).

UNIT V	MEASUREMENTS AND INSTRUMENTATION	6
Functional elements of an instrument, Standards and calibration, Operating Principle, types- Moving Coil and Moving Iron meters, Instrument Transformers- CT and PT, DSO-Block Diagram		
Total : 30 PERIODS		

LAB COMPONENT

1. Verification of Ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Characteristics of PN and Zener Diodes
4. Design and analysis of Half wave and Full Wave rectifiers
5. Implementation of Binary Adder and Subtractor
6. Study of DSO

Total : 30 + 30 = 60 Periods

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply fundamental laws to DC electric circuits and demonstrate it experimentally.
CO2:	Explain the steady state AC circuits with RL, RC, and RLC circuits
CO3:	Identify the working principle and applications of electrical machines with experimental results
CO4:	Demonstrate the characteristics of various analog electronic devices
CO5:	Experiment with the basic concepts of digital electronics and demonstrate the implementation of Binary Adder and Subtractor
CO6:	Illustrate the operating principles of measuring instruments and demonstrate DSO for the basic measurements.

TEXT BOOKS:

1	Kothari D P and I.J Nagrath,—Basic Electrical and Electronics Engineering‖ , Second Edition, McGraw Hill Education,2020

2	Sedha R. S.,—A textbook book of Applied Electronics‖, S. Chand & Co.,2008
3	A.K. Sawhney, Puneet Sawhney _A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
REFERENCES:	
1	Kothari D P and I.J Nagrath, —Basic Electrical Engineering‖, Fourth Edition, Mc Graw Hill Education, 2019.
2	S.K. Bhattacharya —Basic Electrical and Electronics Engineering‖, Pearson Education, Second Edition, 2017.
3	Thomas L. Floyd,_ Digital Fundamentals', 11thEdition,Pearson Education,2017.
4	Albert Malvino, David Bates, _Electronic Principles, McGraw Hill Education; 7th edition, 2017.
5	Mahmood Nahvi and Joseph A. Edminister, —Electric Circuits‖, 86 Schaum 'Outline Series, McGraw Hill, 2002.
6	H.S. Kalsi, _Electronic Instrumentation' , Tata McGraw-Hill, New Delhi, 2010
7	James A. Svoboda, Richard C. Dorf,— Dorf's Introduction to Electric Circuits‖, Wiley, 2018.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	1	1	1	-	1	3	-	1
2	2	1	-	-	-	-	-	1	1	1	-	1	2	-	1
3	3	2	1	1	-	1	1	1	1	1	-	1	3	-	1
4	2	1	-	-	-	1	1	1	1	1	-	1	2	-	1
5	3	2	1	1	-	-	-	1	1	1	-	1	3	-	1
6	2	1	-	-	-	-	-	1	-	-	-	-	3	-	1
Overall Correlation	**3**	**2**	**1**	**1**	**-**	1	1	1	1	1	-	1	**3**	**-**	1

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

23ME211	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- Gain a solid foundation in the fundamental principles and concepts of engineering graphics, including conic sections, orthographic projection, isometric projection, section views and development of surfaces, perspective projection, and dimensioning.
- Develop graphic skills for communication of concepts, ideas and design of engineering products.
- Gain knowledge on drafting software to construct part models.
- Familiarize with existing national standard practices and conventions related to technical drawings.
- Enhance the ability to visualize objects in three dimensions and translate them into 2D representations.

UNIT I	PLANE CURVES	9+6

Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves.

LIST OF EXERCISES:

1. Drawing of a title block with necessary text, projection symbol and lettering using drafting software
2. Drafting of Conic curves - Ellipse, Parabola and Hyperbola

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACE	9+6

Orthographic projection - principles - Principal planes - First angle projection - projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (hexagonal and pentagonal planes

only) inclined to both the principal planes by rotating object method.

LIST OF EXERCISES:

1. Draw the projection of points when it is placed in different quadrants
2. Draw the projection of lines when it is placed in first quadrant
3. Draw the planes when it is placed in first quadrant.

UNIT III	PROJECTION OF SOLIDS AND FREE HAND SKETCHING	9+6

Projection of simple solids - hexagonal prism, pentagonal pyramid and cone inclined to the horizontal plane by rotating object method. Free Hand sketching: Visualization principles - Representation of Three Dimensional objects - Layout of views - Free hand sketching of multiple views from pictorial views of objects

LIST OF EXERCISES:

1. Practicing three dimensional modelling of simple objects.
2. Drawing of orthographic views from the given pictorial diagram

UNIT IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	9+6

Sectioning of hexagonal prism, pentagonal pyramid and cone when the cutting plane is inclined to the horizontal plane, Development of lateral surfaces of simple and sectioned solids – hexagonal prism and cone cut by a plane inclined to horizontal plane only.

LIST OF EXERCISES:

1. Draw the sectioned views of prisms and pyramids
2. Draw the development of hexagonal prism cut by a section plane inclined to the horizontal plane

UNIT V	ISOMETRIC PROJECTION	9+6
Principles of isometric projection - Isometric scale – Isometric view - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. **LIST OF EXERCISES:** 1. Drawing Isometric view and projection of simple solids. 2. Drawing three dimensional modeling of isometric projection of combination of solids.		
		TOTAL: 75 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Construct the conic curves, involutes and cycloids.	
CO2:	Develop and Sketch the orthographic projections of points, lines and plane surfaces.	
CO3:	Develop and Sketch the orthographic projections of simple solids.	
CO4:	Construct the projections of sectioned solids and development of the lateral surfaces of solids.	
CO5:	Develop and Sketch the isometric sections of solids.	
CO6:	Develop and Sketch the orthographic projection 2D and 3D objects using Auto CAD.	
TEXT BOOKS:		
1	Bhatt N.D. and Panchal V.M., ―Engineering Drawing‖, Charotar Publishing House, 53rd Edition, 2019.	
2	Basant Agarwal and Agarwal C.M.,―Engineering Drawing‖, McGraw Hill, 2nd Edition, 2019	
REFERENCES:		
1	Natrajan K.V., ―A Text Book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2018.	
2	Gopalakrishna K.R., ―Engineering Drawing‖ (Vol. I and II combined), Subhas Publications, Bangalore, 27th Edition, 2017.	

3	Luzzader, Warren.J. and Duff, John M., —Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4	Parthasarathy N. S. and Vela Murali, —Engineering Graphics‖, Oxford University, Press, New Delhi, 2015. 5. Shah M.B., and Rana B.C., —Engineering Drawing‖, Pearson Education India, 2nd Edition, 2009.
5	Venugopal K. and Prabhu Raja V., —Engineering Graphics", New Age International (P) Limited, 2008.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
2	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
3	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
4	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
5	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
6	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-
Overall Correlation	3	2	1	1	2	-	-	1	-	3	2	2	2	2	-

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

23ME221	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Familiarize students with basic engineering tools and equipment.
- Educate students on the importance of safety practices, including proper handling of equipment, adherence to safety protocols, and understanding potential hazards in the laboratory environment. Develop basic manufacturing and fabrication skills.
- Provide hands on training to the students in plumbing and woodworking.
- Provide hands on training to the students in welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.
- Demonstrate the wiring and measurement methods in common household electrical applications.
- Study the basic electronic components, gates and provide hands on training in soldering.

PART I	CIVIL ENGINEERING PRACTICES	15

PLUMBING WORK

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in households.
b) Preparation of plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

a) Sawing
b) Planning
c) Making of T-Joint, Mortise joint and Tenon joint and Dovetail joint.

WOOD WORK STUDY

a) Study of joints in door panels and wooden furniture
b) Study of common industrial trusses using models.

PART II	**MECHANICAL ENGINEERING PRACTICES**	**15**

WELDING WORK

a) Study of Welding and its tools.
b) Welding of Butt Joints, Lap Joints and Tee Joints by metal arc welding.
c) Study of Gas Welding.

BASIC MACHINING PRACTICE

a) Facing and Plain Turning
b) Taper Turning
c) Drilling and Tapping

SHEET METAL WORK

a) Forming and Bending
b) Making of a square Tray

MACHINE ASSEMBLY WORK

a) Study of Centrifugal Pump
b) Study of Air Conditioner

FOUNDRY PRACTICE

Demonstration on Foundry operations like mould preparation.

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Plan the pipeline layout for common household plumbing work.
CO2:	Make use of welding equipment and carpentry tool for making joints.
CO3:	Demonstrate on centrifugal pump, air conditioner and foundry operations.
CO4:	Demonstrate the electrical wiring connections for household applications and study the working of iron box and fan regulator.
CO5:	Identify the basic electronic components and explain the gates and soldering methods.
CO6:	Examine the performance and operation of CRO, LED TV and Smart phone.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
2	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
3	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
4	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
5	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
6	3	2	1	1	1	1	1	-	-	2	2	2	2	1	-
Overall Correlation	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**2**	**2**	**2**	**2**	**1**	**-**

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

23IT221	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To impart the basic concepts of data structures and algorithms.
- To be familiar with writing recursive methods.
- To implement operations on Linked List, Stack and Queues.
- To implement traversal operations of trees and graphs.
- To understand concepts about various algorithm design techniques, searching and sorting techniques.

PRACTICALS:

1. Program to find the largest and smallest number in an unsorted array.
2. Program to construct operations on a Singly linked list.
3. Program to implement operations on a doubly linked list.
4. Program to sort the elements using insertion sort.
5. Program to sort the elements using quick sort.
6. Program to sort the elements using merge sort.
7. Program to construct t a Stack using an array and Linked list.
8. Program to perform Queue using an array and Linked list.
9. Program to execute Circular Queue.
10. Program to convert an infix expression to postfix expression.
11. Program to achieve BFS and DFS
12. Program to implement N Queens problem.
13. Program to apply Binary Tree Traversal
14. Program to carry out Travelling Salesman Problem

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Discuss the concept of data structures through ADT including List, Stack and Queues.

CO2:	Explain basic concepts about stacks, queues, lists, trees and graphs.
CO3:	Apply and implement various tree traversal algorithms and ensure their correctness.
CO4:	Apply algorithms and develop algorithms through step-by-step approach in solving problems with the help of fundamental data structures.
CO5:	Build applications and justify use of specific linear data structures for various Applications.
CO6:	Apply binary data structures for various Applications.
TEXT BOOKS:	
1	Jean-Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Application", TMH, 2017.
2	Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition,2004.
REFERENCES:	
1	Larry R. Nyhoff, "ADTs, Data Structures, and Problem Solving with C++", Prentice Hall Edition, 2004
2	Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	-	1	-	1	1	1	-
2	2	1	-	-	1	-	-	-	-	1	-	1	2	1	-
3	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
4	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
5	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
6	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
Overall Correlation	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

23HS221	SOFT SKILLS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To help learners improve their interpersonal skills and critical thinking
- To familiarize learners with the attributes of a leader to enhance team performance
- To prepare students to face job interviews
- To help learners to know the importance of ethics in work place

UNIT I	INTERPERSONAL COMMUNICATION	

Basic communication- verbal and non-verbal communication; passive, assertive and aggressive communication; presentation skills; giving feedback and responding to feedback.

UNIT II	TEAM WORK AND LEADERSHIP	

Vision- setting realistic goals and objectives, collaboration, cooperation, dependability, empathy, sympathy, motivation, delegation of responsibilities, open mindedness, creativity, flexibility, adaptability, cross cultural communication and group dynamics.

UNIT III	TIME MANAGEMENT AND STRESS MANAGEMENT	

Effective Planning, Planning activities at macro and micro levels, setting practical deadlines and realistic limits/targets, punctuality, prioritizing activities, spending the right time on the right activity, positive attitude, emotional intelligence, self- awareness and regulation.

UNIT IV	CRITICAL THINKING AND WORK ETHICS	

Questioning, analysing, inferencing, interpreting, evaluating, solving problems, explaining, self-regulation, open-mindedness, conflict management- ethical dilemmas, appearance, attendance, attitude, character, organizational skills, productivity, respect.

UNIT V	INTERVIEW SKILLS AND RESUME BUILDING TECHNIQUES	
Telephonic interview, online interviews, f2f interviews, FAQ soft skills interview questions, drafting error-free CVs/ Resumes and Cover Letters, selecting the ideal format for resume, content drafting along with sequencing, art of representing one's qualifications and most relevant work history, video resume, website resume.		
TOTAL: PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Express their thoughts, opinions and ideas confidently to one or more people in spoken form	
CO2:	Develop evolving competences required for professional success	
CO3:	Demonstrate knowledge and skills in a group as team player and leader	
CO4:	Compose a comprehensive resume reflecting qualifications, exposure and achievements	
CO5:	Exhibit knowledge and skills confidently during job interviews	
CO6:	Demonstrate ethical and professional behaviour at workplace in all situations	
TEXT BOOKS:		
1	Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman & Shalini Upadhyay. Cengage	
REFERENCES:		
1	English for Job Seekers (Language and Soft Skills for the Aspiring) by Geetha Rajeevan, C.L.N. Prakash) Cambridge University Press pvt, Ltd.	
2	Business Benchmark by Norman Whitby. Cambridge University Press pvt, Ltd	

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
2	-	-	-	-	-	2	2	2	3	3	2	2	-	-	2
3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
6	-	-	-	-	-	-	-	3	3	3	-	-	-	-	3
Overall Correlation	-	-	-	-	-	2	2	2	3	3	2	2	-	-	**2**

Recommended by Board of Studies	**28-07-2023**		
Approved by Academic	**1st ACM**	**Date**	**09-09-2023**

SEMESTER –III

23MA202	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To develop student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science related courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures
- To understand the concepts and significance of Lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT I	LOGIC AND PROOFS	9+3

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

UNIT II	COMBINATORICS	9+3

Mathematical induction - The basics of counting - Well ordering - Strong 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	9+3

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

UNIT IV	ALGEBRAIC STRUCTURES	9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets –

Lagrange's theorem – Definitions and examples of Rings and Fields.		
UNIT V	**LATTICES AND BOOLEAN ALGEBRA**	**9+3**
Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Boolean Homomorphism.		
		TOTAL: 60 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply the concepts of propositional and predicate calculus to the given logical statements.
CO2:	Apply the idea of combinatorial techniques to various engineering problems.
CO3:	Find the solutions for technical problems using graphs.
CO4:	Apply the concepts and properties of algebraic structures in computational theory.
CO5:	Apply the lattice structure and its properties to engineering problems.
CO6:	Apply Boolean expressions in areas like computational theory.

TEXT BOOKS:	
1	Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2	Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES:	
1	Dr.P.Sivaramakrishnadas, Dr.C.Vijayakumari,‖ Discrete Mathematics‖ Pearson Publications.

2	Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5thEdition, Pearson Education Asia, Delhi, 2013
3	Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
4	Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
6	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23IT301	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain object oriented principles like abstraction, encapsulation, inheritance, and polymorphism and apply them for solving problems.
- To explain the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes.
- To explain the implementation of packages and interfaces.
- To explain the concepts of exception handling, multithreading and collection classes.
- To explain the design of Graphical User Interface using swing controls.

UNIT I	INTRODUCTION TO JAVA PROGRAMMING	9

Java Programming - Java Buzz words, Data types, variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting, Enumerated types, Control flow- block scope, conditional statements, loops, break and continue statements, arrays, simple java standalone programs, class, object, and its methods constructors, methods, static fields and methods, access control, this reference, overloading constructors, recursion, exploring string class, garbage collection.

UNIT II	INHERITANCE AND INTERFACE	9

Inheritance – Inheritance types, super keyword, preventing inheritance: final classes and methods. Polymorphism – method overloading and method overriding, abstract classes and methods. Interfaces- Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class. Packages- Defining, creating and accessing a package, importing packages.

UNIT III	EXCEPTION HANDLING AND MULTI THREADING	9
Exception Handling-Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses. Multithreading – Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem.		
UNIT IV	**COLLECTION FRAMEWORK, I/O, GENERIC PROGRAMMING**	**9**
Collection Framework in Java – Introduction to java collections, Overview of java collection framework, commonly used collection classes- Array List, Vector, Hash table, Stack, Lambda Expressions. Files- Streams- Byte streams, Character streams, Text input/output, Binary input/output, File management using File class. Generic Programming – Generic classes – generic methods.		
UNIT V	**EVENT HANDLING PROGRAMMING**	**9**
Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, simple Swing applications, Layout management – Layout manager types – border, grid and flow. Event Handling- Events, Event sources, Event classes, Event Listeners, Delegation event model, Examples: Handling Mouse and Key events, Adapter classes		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply the concepts of classes and objects to solve simple problems.
CO2:	Identify relationships among classes needed for a specific problem with interfaces and inheritance.

CO3:	Illustrate error handling techniques using exception handling and multithreading.
CO4:	Develop a Java programs with the concepts of a hierarchy of Java collection framework.
CO5:	Illustrate I/O streams and Generic programming to provide a solution to a given set of requirements.
CO6:	Apply the ability to employ various types of event handling using swing.

TEXT BOOKS:	
1	Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
2	Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015
REFERENCES:	
1	Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2	E. Balagurusamy , "Programming with Java", 7th Edition, Mc Grow Hill, 2023
3	Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.
4	R . Nageswara Rao, "Core Java: An Integrated Approach", Dreamtech Press. 2016.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	1	-	-	-	1	2	1	1
2	3	2	1	1	1	-	-	1	1	1	-	1	3	1	1
3	2	1	-	-	1	-	-	1	1	1	-	1	2	1	1
4	2	1	-	-	1	-	-	1	1	1	-	1	3	1	1
5	2	1	-	-	1	-	-	1	1	1	-	1	2	1	1
6	3	2	1	1	1	-	-	1	1	1	-	1	2	1	1
Overall Correlation	3	2	1	1	1	-	-	1	1	1	-	1	3	1	1

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23CS302	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

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 – Relational Calculus – SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL

UNIT II	DATABASE DESIGN	9

Mapping Entity-Relationship Model – ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III	TRANSACTION MANAGEMENT	9
Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling - Recovery System – Failure Classification – Recovery Algorithm.		
UNIT IV	**IMPLEMENTATION TECHNIQUES**	**9**
Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation – Query Optimization.		
UNIT V	**NOSQL DATABASE**	**9**
Overview of Distributed Databases – Data Fragmentation – Replication – NOSQL Database: Characteristics – CAP theorem – Outline of NOSQL Datastores: Column Oriented, Document, Key-Value and Graph Types – Applications – CRUD Operations.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the concepts of Database Management Systems and Apply SQL Queries Using Relational Algebra
CO2:	Apply conceptual modeling to real world applications and design database schemas
CO3:	Apply the knowledge of normalization theory to normalize database.
CO4:	Explain the concepts of Transaction Processing and maintain consistency of the database.
CO5:	Explain basic database storage structures, access techniques and query processing.
CO6:	Illustrate distributed, semi-structured and unstructured database systems.

TEXT BOOKS:	
1	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2019
2	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2021.
REFERENCES:	
1	C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
3	G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
4	Carlos Coronel, Steven Morris, Peter Rob, "Design Implementation and Management", Ninth Edition, Cengage Learning, 2011.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	1	-	-	-	2	1	1	2	2	1	-
2	3	2	1	1	1	-	-	-	2	1	1	2	3	1	-
3	3	2	1	1	1	-	-	-	2	1	1	2	3	1	-
4	2	1	-	-	-	-	-	-	2	1	1	1	2	-	-
5	2	1	-	-	-	-	-	-	1	1	-	1	2	-	-
6	2	1	-	-	1	-	-	-	-	1	-	2	2	1	-
Overall Correlation	3	2	1	1	1	-	-	-	2	1	1	2	3	1	-

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23HS301	UNIVERSAL HUMAN VALUES AND ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I	COURSE INTRODUCTION	9

Need, Basic Guidelines, Content and Process for Value Education - Understanding the need, basic guidelines, content and process for Value Education -Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations -Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority -Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

UNIT II	UNDERSTANDING HARMONY IN THE HUMAN BEING	9

Harmony in Myself- Understanding human being as a co-existence of the sentient 'I' and the material 'Body' -Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) -Understanding the characteristics and activities of 'I' and harmony in 'I' -Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity.

UNIT III	UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY	9
Harmony in Human-Human Relationship -Understanding Harmony in the family – the basic unit of human interaction - Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure satisfaction; Trust(Vishwas) and Respect as the foundational values of relationship -Understanding the meaning of Vishwas; Difference between intention and competence -Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship -Understanding the harmony in the society (society being an extension of family)-Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order- from family to world family.		
UNIT IV	**ENGINEERING ETHICS**	**9**
Senses of ‗Engineering Ethics‟ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		
UNIT V	**SAFETY, RESPONSIBILITY AND RIGHTS**	**9**
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination-Moral Leadership –Code of Conduct – Corporate Social Responsibility.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Understand the need of value education.
CO2:	Comprehend the difference between self and body.

CO3:	Understand the need to exist as an unit of Family and society.
CO4:	Understand Harmony at all levels.
CO5:	Apply the values acquired in the professional front.
CO6:	Identify appropriate technologies for ecofriendly production systems.
TEXT BOOKS:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 3.
2	Mike W. Martin and Roland Schinzinger, —Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2003.
3	Govindarajan M, Natarajan S, Senthil Kumar V. S, —Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004
REFERENCES:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology) 169 | Page .
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews.
7	Economy of Permanence - J C Kumarappa 8. Bharat Mein Angreji Raj – Pandit Sunderlal.
8	Rediscovering India - by Dharampal.
9	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
10	India Wins Freedom - Maulana Abdul Kalam Azad.
11	Vivekananda - Romain Rolland (English) 13. Gandhi - Romain Rolland (English).

12	Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.
13	Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases‖, Cengage Learning, 2009.
WEB SOURCES:	
1	www.onlineethics.org
2	www.nspe.org
3	www.globalethics.org

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
2	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
3	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
4	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
5	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
6	-	-	-	-	-	3	3	3	3	3	-	-	-	-	3
Overall Correlation	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23CS311	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

UNIT II	COMBINATIONAL LOGIC	9

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.

UNIT III	SYNCHRONOUS SEQUENTIAL LOGIC	9

Sequential Circuits - Storage Elements: Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits.

UNIT IV	ASYNCHRONOUS SEQUENTIAL LOGIC	9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V	MEMORY AND PROGRAMMABLE LOGIC	9

RAM – Memory Decoding – Error Detection and Correction - ROM

- Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.	
TOTAL: 45 PERIODS	
PRACTICAL EXERCISES : 30 PERIODS	
1. Design of adders and subtractors. 2. Design of code converters. 3. Design of Multiplexers & Demultiplexers. 4. Design of Encoders and Decoders. 5. Design of Magnitude Comparators 6. Design and implementation of counters using flip-flops 7. Design and implementation of shift registers.	
TOTAL: 45 +30 =75 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Solve K-map functions, Boolean algebra functions and simplification, procedures relevant to digital logic
CO2:	Analyse the combinational Logic circuit with adders and subtractors
CO3:	Examine the combinational Logic circuit with multiplexer, demultiplexer, encoder and decoder
CO4:	Infer a Synchronous Sequential Circuit
CO5:	Develop an Asynchronous Sequential Circuit
CO6:	Outline a logic gates using various memory and PLD's
TEXT BOOKS:	
1	M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2017.
2	G. K. Kharate, "Digital Electronics", Oxford University Press, 2010
REFERENCES:	
1	John F. Wakerly, "Digital Design Principles and Practices", Fifth Edition, Pearson Education, 2017.

2	Charles H. Roth Jr, Larry L. Kinney, "Fundamentals of Logic Design", Sixth Edition, CENGAGE Learning, 2013.
3	Donald D. Givone, "Digital Principles and Design", Tata Mc Graw Hill, 2003.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	-	1	-	-	2	1	-
2	3	2	1	1	1	-	-	-	-	1	-	-	3	1	-
3	3	2	1	1	2	-	-	-	2	1	-	-	3	1	-
4	3	2	1	1	2	-	-	-	2	1	-	-	3	1	-
5	2	1	-	-	1	-	-	-	2	1	-	-	2	1	-
6	2	1	-	-	1	-	-	-	-	1	-	-	2	1	-
Overall Correlation	**3**	**2**	**1**	**1**	**2**	-	-	-	**2**	**2**	-	-	**3**	**2**	-

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23IT311	ADVANCED ALGORITHMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To explain and apply the algorithm analysis techniques on searching and sorting networks.
- To explain string matching algorithms.
- To critically analyze the efficiency of graph algorithms.
- To explain different algorithm design techniques.
- To solve programming problems using state space tree.
- To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

UNIT I	INTRODUCTION	9

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties best case, Worst case and average case analysis. Recurrence relation: substitution method - Lower bounds. Searching: linear search, binary search and Interpolation Search-Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting Networks: Bitonic Sorting Networks, Merging Network, Sorting Network.

UNIT II	GRAPH ALGORITHMS	9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity. Minimum spanning tree: Kruskal's and Prim's algorithm. Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method. Matching: Maximum bipartite matching

UNIT III	ALGORITHM DESIGN TECHNIQUES	9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort. Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication

- Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.		
UNIT IV	**STATE SPACE SEARCH ALGORITHMS**	**9**
Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Graph colouring problem Branch and Bound : Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem.		
UNIT V	**NP-COMPLETE AND APPROXIMATION ALGORITHM**	**9**
Tractable and intractable problems: Polynomial time algorithms - Venn diagram representation – Non Deterministic algorithms - NP-hardness and NP-completeness - Problem reduction: TSP - 3 CNF problem. Approximation Algorithms: Bin Packing problem - Randomized Algorithms: concept and application - primality testing - randomized quick sort- Finding kth smallest number.		
	TOTAL: 45 PERIODS	

Searching and Sorting Algorithms

1. Implement Linear Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
3. Sort a given set of elements using the sorting networks methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

Graph Algorithms

1. Develop a program to implement graph traversal using Breadth First Search
2. Develop a program to implement graph traversal using Depth First Search
3. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
4. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
5. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
6. Compute the transitive closure of a given directed graph using Warshall's algorithm.

Algorithm Design Techniques

1. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
2. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

State Space Search Algorithms

Implement N Queens problem using Backtracking.

Approximation Algorithms Randomized Algorithms 1. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation. 2. Implement randomized algorithms for finding the kth smallest number. The programs can be implemented in C / C++ / Python.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Examine the efficiency of algorithms using various frameworks.
CO2:	Apply graph algorithms to solve problems and analyze their efficiency.
CO3:	Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
CO4:	Make use of the state space tree method for solving problems.
CO5:	Solve problems using approximation algorithms and randomized algorithms.
CO6:	Apply String matching algorithms to solve problems and analyze their efficiency.
TEXT BOOKS:	
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2	Ellis Horowitz, SartajSahni, SanguthevarRajasekaran Computer Algorithms/C++ Orient Blackswan, 2nd Edition, 2019.

REFERENCES:	
1	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.
3	S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	-	-	-	-	2	1	1	3	2	-
2	3	2	1	1	2	-	-	-	-	1	2	2	3	1	-
3	3	2	1	1	2	-	-	-	-	1	2	2	3	1	-
4	3	2	1	1	1	-	-	-	-	1	1	2	3	1	-
5	3	2	1	1	1	-	-	-	-	1	1	2	3	1	-
6	3	2	1	1	1	-	-	-	-	1	1	2	3	1	-
Overall Correlation	3	3	2	2	2	-	-	-	-	2	2	2	3	2	-

Recommended by Board of Studies	08-04-2023		
Approved by Academic	2nd ACM	Date	25-05-2025

23IT321	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Strengthen problem solving ability by using the characteristics of an object-oriented approach.
- Design applications using object-oriented features
- Handle Exceptions in programs.
- Write, compile, run and debug the programs
- To demonstrate the usage of object-oriented concepts both in C++ and JAVA.

EXERCISES:

I	**Programs to demonstrate the usage of Class, Operator Overloading and Friend Functions.**
1.	Write a C++ program to display Names, Roll No., and grade of 3 students who have appeared in the examination. Declare the class of name, roll no., and grade. Create an array of class objects. Read and display the contents of the array.
2.	Write a Program using copy constructor to copy data of anobject to another object.
3.	Write a program to design a class representing complex numbers and having the functionality of performing addition &multiplication of two complex numbers using operator overloading.
4.	Write a Program to design a class complex to represent complex numbers. The complex class should use an external function (use it as a friend function) to add two complex numbers. The function should return an object of type complex representing the sum of two complex numbers.
II	**Basics of Java and Exception Handling**
1.	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant

	Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
2.	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
3.	Write a Java program to implement user defined exception handling.
4.	Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
III	**The usage of Packages and Interfaces, Multithreaded programming, Generic Programming**
1.	Write a Java program to perform employee payroll processing using packages. In the java file, Emp.java creates a package employee and creates a class Emp. Declare the variables name, empid, category, bpay, hra, da, npay, pf, grosspay, incometax, and allowance. Calculate the values in methods. Create another java file Emppay.java. Create an object e to call the methods to perform and print values.
2.	Write a Java program to create an interface Shape with the getArea() method. Create three classes Rectangle, Circle, and Triangle that implement the Shape interface. Implement the getArea() method for each of the three classes.

3.	Write a java program that implements a multi-threaded application that has three threads. The first thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
4.	Write a java program to find the maximum value from the given type of elements using a generic function.
IV	**The usage of Event Driven Programming**
1.	Write a java program to draw lines, arcs, figures, images and text in different Fonts, styles and colours.
2.	Write a java program to create Frames using swing.
3.	Design a calculator using event-driven programming paradigm of Java with the following options. a. Decimal manipulations b. Scientific manipulations
4.	Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.
	TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Solve the problems using the characteristics of an object-oriented approach.
CO2:	Build applications using object-oriented features.
CO3:	Apply Java programs that make use of classes, packages and interfaces.
CO4:	Build and implement Java programs with exception handling and multithreading.
CO5:	Build an applications using file processing, generic programming and event handling.

CO6:	Apply swing components and solve the applications.														
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
2	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
3	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
4	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
5	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
6	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**-**
Recommended by Board of Studies							**08-04-2023**								
Approved by Academic							**2nd ACM**			**Date**			**25-05-2025**		

23CS322	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Write user defined functions and stored procedures in SQL.
6. Create View and index for database tables with a large number of records.
7. Write row level and statement level SQL Triggers.
8. Create Document, column and graph based data using NOSQL database tools.
9. Add Implement CRUD operation using NOSQL Database.
10. Develop a simple GUI based database application and incorporate all the above mentioned features

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Create databases with different types of key constraints.
CO2:	Create join queries and explore sub queries.
CO3:	Implement queries using aggregate functions.
CO4:	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO5:	Create and manipulate data using NOSQL database.
CO6:	Develop applications that require a Front-end Tool linked with database

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
2	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
3	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
4	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
5	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
6	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1
Overall Correlation	3	2	1	1	2	-	-	1	1	1	-	1	3	2	1

Recommended by Board of Studies	**08-04-2024**		
Approved	**2nd ACM**	**Date**	**25-05-2024**

23ES391	PRESENTATION SKILLS	L	T	P	C
		0	0	2	1*

COURSE OBJECTIVES:

- To help learners use brainstorming techniques for generating, organizing and outlining ideas.
- To familiarize learners with different speech structures by engaging them in watching speeches with great opening and closing
- To give practice on voice modulation and use of body language and eye contact for making captivating presentations
- To give hands on training on preparing presentation slides and using remote presentation tools
- To train students on responding to question and feedback with confidence.

UNIT I	BRAINSTORMING AND OUTLINING	6

Mind Mapping based on prior knowledge, collecting additional information from external resources, giving prompts to Generative AI tools seeking information, organizing ideas generated, knowing your audience.

UNIT II	STRUCTURING THE PRESENTATION	6

3 Ts of a presentation, writing effective introduction- Beginning the introduction with a hook (question, data, storytelling) and closing the introduction with the objective of the presentation. Structuring the body paragraphs -Choosing key ideas from the list of ideas generated during brainstorming. Substantiating ideas with examples, data, reasons and anecdotes. Summarizing the ideas for conclusion.

UNIT III	DELIVERY TECHNIQUES	6

Vocal variety, intonation, reducing filler words and improving articulation, inflection, engaging the audience. Body language- eye contact, gestures, movement on stage.

UNIT IV	USE OF TECHNOLOGICAL AIDS	6
Use of presentation software like MS Power Point, Google Slides etc, incorporating images, graphs, charts and videos, using interactive tools like quizzes and polls, using remote presentation tools like zoom, MS Teams, WebEx for screen sharing, virtual whiteboards and chat functionalities, incorporating AR/VR for more immersive presentations.		
UNIT V	**HANDLING QUESTIONS AND FEEDBACK**	**6**
Audience engagement through questions, PAR (Point, Answer, Redirect) strategy for structuring responses to questions. Understanding feedback process - Receiving, interpreting and evaluating constructively, active listening techniques for processing feedback, responding to feedback- acknowledging, clarifying and appreciating, Dealing with challenging feedback.		
		TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Construct ideas for presentation through mind mapping techniques
CO2:	Organize ideas and structure the presentation with captivating introduction, body paragraphs illustrated with examples and reasons and compelling conclusion
CO3:	Apply vocal variety and body language techniques to enhance delivery
CO4:	Prepare engaging presentations by integrating multimedia elements
CO5:	Demonstrate proficiency in delivering presentations in remote platforms utilizing various technological tools and strategies to engage audience in Virtual environments
CO6:	Exhibit active listening skills by responding to questions with clarity and confidence and incorporating constructive feedback for professional development

TEXT BOOKS:	
1	Nancy Duarte "Slide:ology: The Art and Science of Creating Great Presentations" O' Reilly Media.
2	Garr Reynolds "The Naked Presenter: Delivering Powerful Presentations with or Without Slides" New Riders.
REFERENCES:	
1	Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds" by Carmine Gallo.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
2	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
3	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
4	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
5	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
6	2	2	1	1	-	-	-	1	1	1	-	1	2	2	1
Overall Correlation	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**2**	**1**

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

SEMESTER –IV

23MA301	LINEAR ALGEBRA	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To test the consistency and solve system of linear equations
- To find the basis and dimension of vector space
- To obtain the matrix of linear transformation and its eigenvalues and eigenvectors
- To find orthonormal basis of inner product space and find least square approximation
- To find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

UNIT I	MATRICES AND SYSTEM OF LINEAR EQUATIONS	9+3

Matrices - Row echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method – Gauss Seidel Method

UNIT II	VECTOR SPACES	9+3

Vector spaces - Subspace - Linear independence and dependence – Linear Span - Basis and dimension – Maximal Linearly Independent Subsets.

UNIT III	LINEAR TRANSFORMATION	9+3

Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation – Invertibility and Isomorphisms – Dual Spaces.

UNIT IV	INNER PRODUCT SPACES	9+3

Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process – Adjoint of Linear operator – Normal and self adjoint operators – Unitary and orthogonal operators and their Matrices

UNIT V	EIGENVALUE PROBLEMS AND MATRIX DECOMPOSITION	9+3

Eigen value Problems - Power method, Jacobi rotation method - Singular value decomposition - QR decomposition – Generalized Inverse - Least square solution

	TOTAL: 60 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Solve the system of linear equations.
CO2:	Find the basis and dimension of vector space.
CO3:	Find the matrix of linear transformation and its eigenvalues and eigenvectors.
CO4:	Find orthonormal basis of inner product space.
CO5:	Find eigenvalues of a matrix using numerical techniques
CO6:	Find Matrix Decomposition using different techniques
TEXT BOOKS:	
1	Friedberg A.H, Insel A.J. and Spence L, "Linear Algebra", Prentice Hall of India, New Delhi, 2004.
2	Faires J.D. and Burden R., "Numerical Methods", Brooks/Cole (Thomson Publications), New Delhi, 2002.
REFERENCES:	
1	Kumaresan S, "Linear Algebra - A geometric approach", Prentice Hall of India, New Delhi, Reprint, 2010.
2	P.S.Das – "Numerical Analysis", Pearson Educations, New Delhi, 2002
3	Richard Branson, "Matrix Operations", Schaum's outline series, 1989.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
6	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-

Recommended by Board of Studies	**08-04-2024**		
Approved	**2nd ACM**	**Date**	**25-05-2024**

23IT401	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Apply the basic concepts of machine learning
- To analyze the principles and algorithms of supervised machine learning
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks
- Design and analyse machine learning experiments

UNIT I	INTRODUCTION TO MACHINE LEARNING	10

Definition of learning systems - Goals and applications of machine learning - Aspects to develop a Learning system: Training data, Concept representation - Function approximation - Learning Techniques - Supervised learning, unsupervised learning and Reinforcement learning.

UNIT II	SUPERVISED LEARNING	11

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 III	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, KNN, Anomaly Detection, Neural networks, Apriori algorithm.

UNIT IV	NEURAL NETWORKS	8

Perceptron - Multilayer perceptron, activation functions, network

training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.		
UNIT V	**DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS**	**9**
Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test, Case study.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Apply the machine learning concepts to solve real-world problems using machine learning algorithms.	
CO2:	Extend the fundamentals of machine learning.	
CO3:	Examine and implement supervised learning algorithms.	
CO4:	Identify ensembling methods and unsupervised learning techniques.	
CO5:	Discuss the fundamental understanding of deep learning apply them to simple tasks.	
CO6:	Make use of machine learning experiments for various models across different datasets.	
TEXT BOOKS:		
1	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.	
2	Tom M Mitchell, —"Machine Learning", Third Edition, Tata McGraw-Hill, 2017	

REFERENCES:	
1	Peter Flach, —"Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012
2	Jason Bell, —"Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014
3	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
5	Aman Kharwal, "Machine Learning Algorithms: Handbook", Clever Fox Publishing, 2023
6	Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley India Private Ltd, 2019

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	-	-	1	1	1	-	2	2	2	1
2	2	1	-	-	1	-	-	1	1	1	-	3	2	1	1
3	3	3	2	2	2	-	-	1	1	1	-	1	2	2	1
4	3	2	1	1	2	-	-	1	1	1	-	3	2	2	1
5	2	1	-	-	1	-	-	1	1	1	-	2	3	1	1
6	3	2	1	1	2	-	-	1	2	2	-	1		2	1
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**1**	**2**	**2**	**-**	**2**	**2**	**2**	**1**

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23CS401	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand processes and threads
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

UNIT I	INTRODUCTION	10

Introduction to Operating Systems – Views of Operating system, Computer System organization, Computer System Architecture; **Operating System Structures** – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods; **Processes** - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication – Shared Memory Systems, Message Passing Systems, **Threads** - Multithread Models.

UNIT II	PROCESS MANAGEMENT	9

CPU Scheduling – Basic Concepts, Scheduling criteria - Scheduling algorithms; **Process Synchronization** - The Critical-Section problem, Synchronization hardware, Mutex Locks, Semaphores, Monitors, Classical problems of synchronization; **Deadlock** – Deadlock Characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III	MEMORY MANAGEMENT	9

Main Memory – Address Binding, Logical and Physical Address

Space, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table; **Virtual Memory** - Demand Paging, Copy on Write, Page Replacement, Thrashing.		
UNIT IV	**STORAGE MANAGEMENT**	**8**
Mass Storage system –Disk Scheduling and Management; **I/O Systems** – I/O Hardware, Kernel I/O subsystem; File-System Interface - File concept, Access methods, Directory Structure, File system mounting - File Sharing and Protection; **File System Implementation** - File System Structure - Directory implementation - Allocation Methods - Free Space Management;		
UNIT V	**VIRTUAL MACHINES AND MOBILE OS**	**9**
Virtual Machines – Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
	After completion of the course, the students will be able to:	
CO1:	Explain operating system structures and various services provided by operating systems	
CO2:	Apply Process synchronization, process scheduling, and deadlocks concepts in the given scenario to solve the problems.	
CO3:	Apply algorithms and suitable techniques for memory management.	
CO4:	Apply disk scheduling algorithm and explain the management schemes for storage systems such as file and I/O systems.	
CO5:	Explain the concept of Virtual machines	
CO6:	Explain the functionalities of iOS and Android Operating Systems.	

TEXT BOOKS:	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
REFERENCES:	
1	Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3	Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
4	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
5	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
6	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-

Recommended by Board of Studies	08-04-2023		
Approved by Academic	2nd ACM	Date	25-05-2025

23IT402	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand a finite automaton for a given language.
- To understand the relation between grammar and language.
- To understand the basic principles of working of a compiler.
- To study about the type checking procedure during the compilation.
- To understand the storage structure of the running program.

UNIT I	AUTOMATA	9

Introduction to formal proof – Additional forms of proof – Inductive proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions- Equivalence and minimization of Automata.

UNIT II	REGULAR EXPRESSION (RE)	9

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages.

UNIT III	CONTEXT FREE GRAMMARS AND LANGUAGES	9

GRAMMAR FORMALISM: Regular grammars-Right linear and left linear grammars, Equivalence Between regular linear grammar and FA; Context Free Grammar, Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity,

Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs; Normal forms for CFGs - CNF and GNF, Closure properties of CFLs; Decision Properties of CFLs- Emptiness, Finiteness and Membership, Pumping lemma for CFLs.		
UNIT IV	**PUSH DOWN AUTOMATA (PDA)**	**9**
Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.		
UNIT V	**TURING MACHINES (TM)**	**9**
Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM, Computable functions, Types of Turing machines, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs, Post correspondence problem (PCP), Modified PCP.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Build a finite automaton for a specific language.	
CO2:	Discuss the regular expressions and its theorems.	
CO3:	Identify the basic properties of formal languages and grammars.	
CO4:	Examine regular, context-free and recursively enumerable languages.	
CO5:	Make use of grammars to produce strings from a specific language.	
CO6:	Identify the concepts relating to the theory of computation and computational models.	

TEXT BOOKS:	
1	J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2007.
2	Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2008
REFERENCES:	
1	J. Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata Mc Graw Hill, 2007.
2	Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
3	Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
4	Muneeswaran. K, "Compiler Design", Oxford University Press, 2012.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	-	-	-	-	-	-	-	2	1	-
2	2	1	-	-	1	-	-	-	-	-	-	-	3	1	-
3	3	2	1	1	1	-	-	-	-	-	-	-	3	1	-
4	3	3	2	2	1	-	-	-	-	-	-	-	3	1	-
5	3	2	1	1	1	-	-	-	-	-	-	-	3	1	-
6	3	2	1	1	1									1	
Overall Correlation	3	2	1	1	1	-	-	-	-	-	-	-	3	1	-

Recommended by Board of Studies	08-04-2023		
Approved by Academic	2nd ACM	Date	25-05-2025

23IT403	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain principles of computer organization and the basic architectural concepts.
- To know about basic organization, design, and programming of a simple digital computer.
- To explain the simple register transfer language to specify various computer operations.
- To explain about the computer arithmetic, instruction set design, microprogrammed control unit,
- To discuss about pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

UNIT I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT II	ARITHMETIC FOR COMPUTERS	9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Sub word Parallelism.

UNIT III	PROCESSOR AND CONTROL UNIT	9

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Types of Pipline - Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV	PARALLELISIM	9

Parallel processing challenges – Flynn's classification – SISD, SIMD, MISD MIMD, and Vector Architectures - Hardware

multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.		
UNIT V	**MEMORY & I/O SYSTEMS**	**9**
Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basics structure of computers, operations and instructions.
CO2:	Build arithmetic and logic unit.
CO3:	Illustrate pipelined execution and design control unit.
CO4:	Discuss parallel processing architectures.
CO5:	Explain the various memory systems and I/O communication.
CO6:	Examine virtual memory and paging techniques to manage large programs.

TEXT BOOKS:	
1	David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2	Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES:	
1	William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.

2	John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3	John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
4	Mano M. Moris, "Computer System Architecture", Pearson, 20219.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
3	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
5	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
6	3	3	2	2	-				-	-	-	-	3	-	-
Overall Correlation	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23IT411	WEB TECHNOLOGY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages.
- To design interactive web pages using Scripting languages.
- To develop web pages using XML/XSLT

UNIT I	WEBSITE BASICS AND HTML	9

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response Message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic n XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-Tables-Frames-Forms-HTML 5.0., DHTML.

UNIT II	CSS AND CLIENT SIDE SCRIPTING	9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers

UNIT III	INTRODUCTION TO PHP	9

Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening,

closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT IV	DOCUMENT OBJECT MODEL	9

DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling - Accommodating Noncompliant Browsers Properties of Window

UNIT V	XML	9

XML-Documents and Vocabularies-Versions and Declaration - Namespaces JavaScript and XML: Ajax-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS:

1. Create a web page with the following using HTML.
   a. To embed an image map in a web page.
   b. To fix the hot spots.
   c. Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.

Write programs in Java using Servlets:

1. Create a web page with the following using HTML.
   a. To embed an image map in a web page.
   b. To fix the hot spots.
   c. Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.

4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
    a. To invoke servlets from HTML forms.
    b. Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
    a. For conducting on-line examination.
    b. For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

TOTAL:30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Build simple web pages using markup languages like HTML and XHTML.
CO2:	Build dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3:	Examine server side web pages that have to process request from client side web pages.
CO4:	Build web data using XML and develop web pages using JSP.
CO5:	Make use of various web services and how these web services interact.
CO6:	Utilize XPATH web services and how these web services interact.

TEXT BOOKS:	
1	Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
REFERENCES:	
1	Robert. W. Sebesta, “Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
2	Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
3	Marty Hall and Larry Brown, ”Core Web Programming” Second Edition, Volume I and II, Pearson Education, 2001.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
2	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
3	3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
4	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
5	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
6	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
Overall Correlation	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23IT421	MACHINE LEARNING TECHNIQUES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To analyze the big data using various techniques
- To perform mining on streaming data
- To familiarize the framework to manage huge data with different tools like hadoop, spark
- To use big data for business applications with various hadoop integration tools
- Learn the basics of deep learning using neural networks

LIST OF EXPERIMENTS:

1. Basics of data analysis.
2. Extract the data from database using python.
3. Implement k-nearest neighbours classification using python
4. Work with neural networks.
5. Implementation of cluster analysis for given data.
6. Write a program to implement the naïve Bayesian classifier for a sample training data.
7. Set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
8. Implement linear regression using python.
9. Implement Naïve Bayes theorem to classify the English text.
10. Implement the finite words classification system using Back-propagation algorithm.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Demonstrate the ability to perform basic data analysis using statistical methods and visualization tools.
CO2:	Apply Python programming skills to extract and manipulate

	data from databases for analytical purposes.
CO3:	Implement and evaluate various supervised and unsupervised machine learning algorithms such as k-NN, Naïve Bayes, and clustering techniques.
CO4:	Design and implement linear regression models to identify relationships between variables and make predictions.
CO5:	Develop text classification systems using probabilistic models like Naïve Bayes and neural networks.
CO6:	Build and train neural networks using backpropagation and modern deep learning frameworks to solve classification problems.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
2	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
3	3	2	1	1	1	-	-	1	-	-	-	1	3	1	1
4	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
5	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
6	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**1**

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23CS421	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To install windows operating systems.
- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.
- To implement Deadlock Avoidance Algorithms.
- To be familiar with File Organization and File Allocation Strategies.
- To understand the working of virtual machines.

LIST OF EXPERIMENTS:

1. Installation of windows operating system.
2. Illustrate UNIX commands and Shell Programming.
3. Process Management using System Calls: Fork, Exit, Getpid, Wait, Close.
4. Write a C program to implement various CPU Scheduling Algorithms.
5. Write a C program to simulate the concept of Dining-Philosophers problem.
6. Write a C program to implement inter process communication.
7. Implement a C program to avoid Deadlock using Banker's Algorithm.
8. Write a C program to Implement the concept of threading.
9. Write a C program to Implement single level and two-level directory structure.
10. Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit
11. Write C programs to implement the various Page Replacement Algorithms.
12. Implement various disk scheduling algorithms.
13. Install any guest operating system like Linux using VMware

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply basic UNIX commands and shell programming
CO2:	Construct various CPU Scheduling Algorithms.
CO3:	Construct the concept of interprocess communication.
CO4:	Build various page replacement algorithms.
CO5:	Interpret operations on directories.
CO6:	Build Linux OS using VMware.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	3	2	1	1	2	2	-	1	3	3	1
2	3	2	1	1	3	2	1	1	2	2	-	1	3	3	1
3	3	2	1	1	3	2	1	1	2	2	-	1	3	3	1
4	3	2	1	1	3	2	1	1	2	2	-	1	3	3	1
5	2	1	-	-	3	2	1	1	2	2	-	1	2	3	1
6	3	2	1	1	3	2	1	1	2	2		1	3	3	1
Overall Correlation	3	2	1	1	3	2	1	1	2	2	-	1	3	3	1

Recommended by Board of Studies	**08-04-2023**		
Approved by Academic	**2nd ACM**	**Date**	**25-05-2025**

23ES491	APTITUDE AND LOGICAL REASONING –1	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To improve the problem solving and logical thinking ability of the students.
- To acquaint student with frequently asked questions and patterns in quantitative aptitude and logical reasoning.

UNIT I	**4**
Numbers, LCM, HCF, Averages, Ratio & Proportion, Mixtures & Allegation.	
UNIT II	**4**
Percentages, Time and work, Pipes and Cistern, coding and decoding.	
UNIT III	**4**
Time Speed Distance, Train, Boats and Streams, Analogy.	
UNIT IV	**4**
Data Interpretation (BAR,PIE,LINE), Seating arrangement.	
UNIT V	**4**
Simple Interest and Compound Interest, Profit loss and Discount, Partnership.	
TOTAL: 20 PERIODS	

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Analyse and solve complex problems, and foster critical thinking and logical reasoning skills.
CO2:	Solve fundamental mathematical problems, and enhance their computational skills and numerical ability.
CO3:	Develop strategies for tackling a variety of problem types, and encourage the use of multiple approaches to solve problems efficiently.
CO4:	Analyse and solve different data analysis problems for time and distance, and interpret data analysis for a case study.
CO5:	Derive information from graphs, and solve questions based on mathematical operations such as ratios, proportions, basic algebra, and statistical estimation.
CO6:	Solve questions in a fraction of a minute using shortcut methods

TEXT BOOK:	
1	Smith, John. "APTIPEDIA." 2nd ed., Wiley Publishers, 2020.
2	Agarwal, R.S. "Quantitative Aptitude." 2nd ed., S. Chand Publishing.
REFERENCES:	
1	Agarwal, R.S. "A Modern Approach to Verbal & Non-Verbal Reasoning." 2nd ed., S. Chand Publishing

Cos	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	-	-	2	1	1	2	1	2	3	1	-	3
2	2	3	3	-	-	2	-	1	3	2	2	3	2	1	3
3	3	3	3	-	-	2	-	1	2	2	2	3	2	-	3
4	2	3	2	3	-	2	1	2	3	3	2	3	1	2	3
5	3	2	2	-	1	3	-	2	2	3	3	3	3	1	3
6	3	3	3	3	2	3	1	3	3	2	3	3	3	1	3
Overall Correlation	3	3	3	1	1	3	1	2	3	3	3	3	2	1	3

Recommended by Board of Studies	08-04-2024		
Approved	2nd ACM	Date	25-05-2024

SEMESTER -V

23RE501	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To provide an overview on selection of research problem based on the Literature review
- To enhance knowledge on the Data collection and Analysis
- To outline the importance of ethical principles to be followed in Research work and IPR

UNIT I	INTRODUCTION TO RESEARCH FORMULATION	6

Meaning of research problem, Sources of research problem, Criteria- good research problem, and selecting a research problem, Scope and objectives of research problem. Defining and formulating the research problem - Necessity of defining the problem - Importance of literature review in defining a problem

UNIT II	LITERATURE REVIEW	6

Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis

UNIT III	DATA ANALYSIS	6

Execution of the research - Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Generalization and Interpretation

UNIT IV	REPORT, THESIS PAPER, AND RESEARCH PROPASAL WRITING	6

Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports –

Illustrations and tables - Bibliography, types of referencing, citations- index and footnotes, how to write report- Paper Developing,- Plagiarism- Research Proposal- Format of research proposal- a presentation - assessment by a review committee		
UNIT V	**INTELLECTUAL PROPERTY AND PATENT RIGHTS**	**6**
Ethical principles- Plagiarism, Nature of Intellectual Property - Patents, Designs, Trade and Copyright- patent search, Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of Patent Rights – Scope of Patent Rights, Geographical Indications		
TOTAL: 30 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Analyze the literature to identify the research gap in the given area of research.
CO2:	Identify and formulate the research Problem
CO3:	Analyze and synthesize the data using research methods and knowledge to provide scientific interpretation and conclusion.
CO4:	Prepare research reports and proposals by properly synthesizing, arranging the research documents to provide comprehensive technical and scientific report
CO5:	Conduct patent database search in various countries for the research problem identified.
CO6:	Apply ethical principles in research and reporting to promote healthy scientific practice

TEXT BOOKS:	
1	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.
2	Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

3	Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4	Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5	Wadehra, B.L. 2000. Law relating to patents, Trade Marks, Copy right designs and Geographical indications. Universal Law Publishing

REFERENCES:

1	Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2	Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3	Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4	Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
5	Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6	Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7	Satarkar, S.V., 2000. Intellectual property rights and copy right. ESS Publications.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	1	1	2	-	1	3	2	1
2	3	2	1	1	1	-	-	1	1	2	-	1	3	2	1
3	3	2	1	1	1	-	-	1	1	2	-	1	3	2	1
4	3	2	1	1	1	-	-	1	1	2	-	1	3	2	1
5	3	2	1	1	1	-	-	1	1	2	-	1	3	2	1
6	2	2	1	1	1	-	-	1	1	2	-	1	3	2	1
Overall Correlation	3	2	**1**	**1**	**1**	**-**	**-**	**1**	**1**	2	**-**	**1**	**3**	**2**	**1**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT501	COMPUTER NETWORKS AND COMMUNICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To focus on information sharing and networks.
- To introduce flow of data, categories of network, different topologies.
- To focus on different coding schemes.
- To brief the students regarding protocols and standards.
- To give a clear idea of signals, transmission media, errors in data communications.

UNIT I	FUNDAMENTALS AND LINK LAYER	9

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet – Protocol Layering – OSI Model – Physical Layer – Overview of Data and Signals1.

UNIT II	MEDIA ACCESS AND INTERNETWORKING	9

Introduction to Data Link Layer – Link layer Addressing – Error Detection and Correction– Medium Access Control – Ethernet (802.3) – Wireless LANs –Bluetooth –WiFi –Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP.

UNIT III	ROUTING	9

Routing – Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6.

UNIT IV	TRANSPORT LAYER	9

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) – Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control – Congestion avoidance.

UNIT V	DATA LINK LAYER AND PHYSICAL LAYER	9

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP – DNS- -Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer to Peer Networks – Need for Cryptography and Network Security – Firewalls.

	TOTAL: 45 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Discuss the categories and functions of various Data communication Networks.
CO2:	Develop various error detection techniques and network layer services.
CO3:	Explain the mechanism of Media access control in the data layer.
CO4:	Apply different routing algorithms in Network Layer
CO5:	Discuss the significance of various Flow control and Congestion control mechanisms.
CO6:	Explain the Functioning of various Application Layer Protocols.
TEXT BOOKS:	
1	Kurose James F, Keith W. "Computer Networking A Top-Down Approach." ,7th Edition, Pearson, 2016.
2	Behrouz A. Forouzan. "Data Communications and Networking." ,5th Edition McGraw-Hill Education, 2017.
REFERENCES:	
1	Bhusan Trivedi. "Data communication and Networks.", Oxford University Press, 2016.
2	Andrew S Tanenbaum. "Computer Networks.", 4th Edition, Pearson Education, 2002.
3	W. A. Shay. "Understanding Communications and Networks.", 3rd Edition, Cengage Learning, 2004.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	1	-	-	-	1	3	-	1
2	3	2	1	1	1	-	-	1	-	-	-	1	3	1	1
3	2	1	-	-	1	-	-	1	-	-	-	1	3	1	1
4	3	2	1	1	1	-	-	1	-	-	-	1	3	1	1
5	2	1	-	-	1	-	-	1	-	-	-	1	3	1	1
6	2	1	-	-	1	-	-	1	-	-	-	1	3	1	1
Overall Correlation	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**3**	**1**	**1**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT511	PRINCIPLES OF SOFTWARE ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand Software Engineering Process and Models.
- To perform software requirements analysis.
- To gain knowledge of the System Analysis and Design concepts using Design and Data flow model.
- To understand software testing and maintenance approaches.
- To work on the software metrics process.

UNIT I	SOFTWARE PROCESS	9

Introduction-The software process-software Engineering Practice-A generic process model-prescriptive process models specialized process models. -Unified process-Personal and Team Process Models –process technology - product and process Agility-Agile Process-Extreme Programming (XP)-Other Agile Process models.

UNIT II	UNDERSTANDING REQUIREMENTS	9

Requirements Engineering -Establishing the Groundwork - Eliciting Requirements -Developing Use Cases - Building the Requirements Model -Negotiating Requirements - Validating Requirements-Requirements Analysis - Scenario-Based Modeling - UML Models That Supplement the Use Case -Data Modeling Concepts- Class-Based Modeling.

UNIT III	DESIGN CONCEPTS AND PRINCIPLES	9

Design within the Context of Software Engineering - The Design Process - Design -The Design Model - Software Architecture - Architectural Genres - Architectural Styles -Architectural Design – Assessing – Alternative Architectural Designs -Architectural Mapping Using Data Flow.

UNIT IV	TESTING	9

A Strategic Approach to Software Testing - Strategic Issues -Test Strategies for Conventional Software - Test Strategies for Object-Oriented Software - Test Strategies for Web Apps - Validation Testing –System- -The Art of Debugging- White Box Testing-Basis

Path Testing-Control Structure Testing-Black Box Testing-Model Based Testing-Object Oriented Testing Strategies-Object Oriented Testing Methods-Testing Concepts for Web Apps-The Testing Process.

UNIT V	SOFTWARE METRICS	9

The Management Spectrum - The People - The Product - The Process -The WHH Principle - Metrics in the Process and Project Domains - Software Measurement - Metrics for Software Quality - Integrating Metrics within the Software - Metrics for Small Organizations - Establishing a Software Metrics Program - Decomposition - Empirical Estimation Models - Specialized Estimation Techniques -The Make/Buy Decision.

TOTAL: 45 PERIODS

PRACTICALS:

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model according to the Requirement analysis.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Develop Software architecture for the Design process.
6. Develop Software architecture for the Data Flow model.
7. Implement the application and develop the test cases.
8. Implement debugging techniques to identify and correct any issues found during testing.
9. Implement the system as per detailed Design (Understand and apply metrics in the process and project domains and measure software quality).
10. Implement Software Metrics and Quality Measurement in a software development project.

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Compare various Software Development Lifecycle Models.
CO2:	Examine project management approaches as well as cost and schedule estimation strategies.
CO3:	Develop formal analysis on specifications.
CO4:	Make use of UML diagrams for analysis and design.
CO5:	Develop architectural styles and design patterns, and test the system
CO6:	Build relationships among objects.
TEXT BOOKS:	
1	Roger S. Pressman. "Software Engineering: A Practitioner's Approach.", Sixth Edition, Mc Graw-Hill International Edition, 2017.
2	Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli. "Fundamentals of Software Engineering.", 2nd edition, PHI Learning Pvt. Ltd., 2010.
REFERENCES:	
1	Bernd Bruegge and Allen H. Dutoit. "Object-Oriented Software Engineering: Using UML, Patterns and Java.", Third Edition, Pearson Education, 2009.
2	Craig Larman. "Applying UML and Patterns.", 3rd ed, Pearson Education, 2005.
3	Len Bass, Ingo Weber and Liming Zhu. "DevOps: A Software Architect's Perspective.", Pearson Education, 2016

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	-	2	3	1	3	3	1	-
2	3	3	2	2	1	-	-	-	1	2	1	3	3	2	-
3	3	2	1	1	1	-	-	-	3	1	1	3	3	1	-
4	3	2	1	1	3	-	-	-	3	3	1	2	3	3	-
5	3	2	1	1	3	-	-	-	2	2	1	2	3	2	-
6	2	1	-	-	3	-	-	-	2	2	1	2	3	3	-
Overall Correlation	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**3**	**3**	**3**	**-**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT521	COMPUTER NETWORKS AND COMMUNICATIONS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To introduce flow of data, categories of network, different topologies
- To focus on different coding schemes.
- Brief the students regarding protocols and standards.
- To give clear idea of signals, transmission media, errors in data communications
- To explain the performance of the network.

PRACTICALS

1. Applications using TCP sockets:
   i. Echo client and echo server
   ii. Chat
2. Write socket programs to simulate the operation of HTTP application layer and Web caching
3. Write socket programs to simulate the operation of DNS
4. Analyze the Network traffic using Packet Analyser (Wireshark) and understand the various protocol headers.
5. Simulation of flow control
6. Practice different network commands available in Windows and Linux Operating Systems and troubleshoot the network.
7. Configure the network devices such as Router, Switch, Hub, Bridge, and Repeater by simulation.
8. Simulation of Distance Vector/ Link State Routing algorithm
9. Performance evaluation of routing protocols using the simulation tool
10. Configuring client-server interaction using mininet with an SDN controller

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basic layers and its functions in computer networks.
CO2:	Discuss the basics of how data flows from one node to another.
CO3:	Examine routing algorithms.
CO4:	Describe protocols for various functions in the network.
CO5:	Examine the working of various application layer protocols.
CO6:	Explain the basics of network hardware devices.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	2	-	-	-	-	-	-	1	2	2	-
2	2	1	-	-	2	-	-	-	-	-	-	3	2	2	-
3	3	2	1	1	1	-	-	-	-	-	-	2	3	1	-
4	2	1	-	-	2	-	-	-	-	-	-	2	2	2	-
5	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-
6	2	1	-	-	2							2	2	2	
Overall Correlation	3	2	1	1	2	-	-	-	-	-	-	2	3	2	-

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT522	MINI PROJECT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- Encourage students to apply foundational theoretical knowledge to practical engineering problems.
- Develop collaborative and project management skills through teamwork and effective communication.
- Train students in basic research methodology, technical documentation, and presentation techniques to articulate project outcomes clearly.
- Enhance students' ability to systematically design, analyze, and evaluate simple prototypes or models.
- Prepare students for real-world engineering challenges and lay the foundation for multidisciplinary teamwork and problem-solving in advanced projects.

COURSE DESCRIPTION:

This course serves as an introductory platform for students to apply the foundational knowledge acquired from their core and interdisciplinary subjects in a practical setting. This course enables students to work on small-scale, department-relevant projects that focus on problem identification, basic design, and preliminary prototype development. With limited prior expertise, students will explore the process of translating theoretical concepts into tangible solutions, fostering creativity, teamwork, and critical thinking. The course emphasizes hands-on learning, communication, and project documentation, laying a strong foundation for advanced projects and professional challenges in later semesters.

PROJECT OUTLINE:

Week 1	Course Orientation and Topic Selection
Week 2	Problem Definition and Objective Setting

Week 3	Literature Review and Research
Week 4	First Review and Feedback
Week 5	Problem Refinement and Research Gap Identification
Week 6	Conceptual Design and Initial Approach
Week 7	Methodology and Project Planning
Week 8	Second Review and Project Evaluation
Week 9	Design Refinement and Testing
Week 10	Resource Identification and Budget Estimation
Week 11	Report Writing and Presentation Preparation
Week 12	Third Review Presentation and Submission of Thesis

EVALUATION:

- The progress of the mini project will be evaluated through three reviews, conducted by a committee appointed by the Head of the Department. A final project report must be submitted at the end of the semester. Evaluation will be based on oral presentation and the written report, assessed by internal examiners designated by the Head of the Department.
- The project should focus on topics from first three or four semester (whichever is applicable) subjects / industry demand topics, or futuristic technologies. It is recommended for Faculty of Aeronautical Engineering, Civil Engineering, and Mechanical Engineering students, the project should demonstrate an understanding of first principles of engineering.
- Similarly for students of Faculty of Computer Science Engineering, the project may involve programming using Python or C language. For Faculty of Electronics and Communication Engineering, the student project shall

incorporate appropriate techniques and systems relevant to the field. For the students of Faculty of Fashion Technology, the project based on material innovations, or technology in fashion is recommended. • The evaluation will focus on how well the project is structured, including clarity and logical flow in both oral presentations and written texts. • The relevance and innovation of the project will be assessed, particularly its potential to contribute to sustainability, innovation, and SDG-aligned goals. • The accuracy of English usage, including grammar, clarity, and coherence, will be reviewed in both oral and written communication to ensure effective delivery of technical content.	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply basic engineering principles to solve simple problems.
CO2:	Choose relevant sources to understand the current knowledge and identify areas to improve.
CO3:	Utilise basic tools and techniques to test simple solutions.
CO4:	Interpret the impact of engineering solutions on society and the environment.
CO5:	Combine in teams to plan and complete projects within given constraints.
CO6:	Develop comprehensive technical reports and deliver structured presentations to effectively convey project outcomes.

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
2	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
3	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
4	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
5	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
6	3	2	1	1	1	1	1	3	2	2	2	1	3	1	3
Overall Correlation	3	2	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**2**	**2**	**1**	**3**	**1**	**3**
Recommended by Board of Studies							**13-11-2024**								
Approved by Academic							**3rd ACM**			**Date**			**30-11-2024**		

23ES591	APTITUDE AND LOGICAL REASONING –2	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To improve the problem solving and logical thinking ability of the students.
- To acquaint the student with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews

UNIT I		**4**
Probability, Permutation & Combination, Algebra, Problems on ages		
UNIT II		**4**
Mensuration, Logarithms, inequalities and modulus, Syllogism		
UNIT III		**4**
Directions, logical sequence words, number series, Analytical Reasoning		
UNIT IV		**4**
Blood relation, Clock and Calendar, Picture puzzles		
UNIT V		**4**
Data sufficiency, cube and cuboids, odd man out		
	TOTAL: 20 PERIODS	

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply concepts of probability, permutation, and combination to solve real-world problems.
CO2:	Solve algebraic problems and age-related problems using logical approaches and techniques.
CO3:	Analyze and solve problems in mensuration, logarithms, and inequalities.
CO4:	Interpret and solve problems related to directions, logical sequence, and number series.
CO5:	Identify and solve problems in logical reasoning such as syllogism, blood relations, clock and calendar.
CO6:	Identify and solve problems in logical reasoning such as syllogism, blood relations, clock and calendar.

TEXT BOOK:	
1	Smith, John. "APTIPEDIA." 2nd ed., Wiley Publishers, 2020.
2	Agarwal, R.S. "Quantitative Aptitude." 2nd ed., S. Chand Publishing.
REFERENCES:	
1	Agarwal, R.S. "A Modern Approach to Verbal & Non-Verbal Reasoning." 2nd ed., S. Chand Publishing.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	3	2	2	2	1	3	1	2	3	2	2
2	3	2	2	2	3	2	3	2	1	2	1	2	3	2	3
3	3	3	2	2	2	2	2	2	1	3	1	2	3	3	2
4	2	3	2	1	2	3	1	2	3	3	2	3	2	2	3
5	2	3	3	2	2	2	2	3	2	2	2	3	3	3	3
6	3	3	2	2	3	2	3	3	2	2	1	2	3	3	2
Overall Correlation	3	3	3	2	3	3	3	3	2	3	2	3	3	3	3

Recommended by Board of Studies	13-11-2024		
Approved	3rd ACM	Date	30-11-2024

SEMESTER –VI

23IT601	CRYPTOGRAPHY AND SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basic categories of threats to computers and networks
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various symmetric key cryptographic algorithms.
- Describe public-key cryptosystem
- Describe various message authentication models.
- Understand Intrusions and intrusion detection

UNIT I	INTRODUCTION	10

Overview of Cryptography and Its Applications - Secure Communications - Cryptographic Applications - Classical Cryptosystems - Shift Ciphers - Affine Ciphers - The Vigenère Cipher - Substitution Ciphers - Sherlock Holmes - The Playfair and ADFGX Ciphers - Enigma - Basic Number Theory - The Extended Euclidean Algorithm - The Chinese Remainder Theorem - Modular Exponentiation - Fermat's Theorem and Euler's Theorem - Primitive Roots.

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	9

Block Cipher and Data Encryption Standards: Block Cipher Principles, Data Encryption Standards, the Strength of DES. Advanced Encryption Standards: Evaluation Criteria for AES, the AES Cipher.

UNIT III	PUBLIC KEY CRYPTOGRAPHY	9

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	**SECURITY PRACTICE AND SYSTEM SECURITY**	**8**
Electronic Mail security – PGP, S/MIME – IP security – Web Security – System Security: Intruders – Malicious software – viruses – Firewalls.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Infer basic security attacks and services.
CO2:	Illustrate confidentiality, integrity, authentication and availability concepts
CO3:	Make use of symmetric key algorithms for cryptography
CO4:	Make use of asymmetric key algorithms for cryptography and apply the knowledge of Key Management techniques
CO5:	Utilize the Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
CO6:	Examine the issues and structure of Authentication Service and Electronic Mail Security

TEXT BOOKS:	
1	Wade Trappe and Lawrence C. Washington. "Introduction to Cryptography with Coding Theory.", 3rd edition, Pearson, 2020
2	William Stallings. "Cryptography and Network Security: Principles and Practice.", 8th edition, Pearson Education, India, 2020.

REFERENCES:	
1	Charlie Kaufman. "Network Security: Private Communication in a Public World.", 2nd edition, Prentice Hall of India, 2002.
2	Atul Kahate. "Cryptography and Network Security.", 2nd edition, Tata Mc Grawhill, 2008.
3	Robert Bragg, Mark Rhodes. "Network Security: The complete reference.", Tata Mc Grawhill, 2004.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-	-	-	2	1	3	3	2	-	-
2	2	1	-	-	-	-	-	-	2	1	3	3	2	-	-
3	3	2	1	1	-	-	-	-	-	-	1	-	3	-	-
4	3	2	1	1	-	-	-	-	-	-	1	-	3	-	-
5	3	3	1	1	-	-	1	-	-	-	1	-	3	-	-
6	3	3	2	2	1	1	1	1	1	1	1	1	3	1	1
Overall Correlation	3	2	1	1	1	1	1	1	1	1	2	1	3	1	1

Recommended by Board of Studies	13-11-2024		
Approved by Academic	3rd ACM	Date	30-11-2024

23CE611	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	1	4

COURSE OBJECTIVES:

- To provide basic knowledge on environment impact assessment
- To create an awareness on the pollutants in the environment
- To familiarize the student with the technology for restoring the environment.
- Applying the technology for producing ECO safe products
- To develop simple climate models and evaluate climate changes using models

UNIT I	INTRODUCTION TO ENVIRONMENT IMPACT ASSESSMENT	9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework

UNIT II	MOVEMENT OF POLLUTANTS IN ENVIRONMENT	9

Concepts of diffusion and dispersion, point and area source pollutants, pollutant dispersal; Gaussian plume model, hydraulic potential, Darcy's equation, types of flow, turbulence. Concept of heat transfer, conduction, convection; concept of temperature, lapse rate (dry and moist adiabatic); mixing heights, laws of thermodynamics; concept of heat and work, Carnot engine, transmission of electrical power, efficiency of turbines, wind mills and hydroelectric power plants.

UNIT III	ECOLOGICAL RESTORATION	9

Wastewater treatment: anaerobic, aerobic process, methanogenesis, treatment schemes for waste water: dairy, distillery, tannery, sugar, antibiotic industries; solid waste treatment: sources and management (composting, vermiculture

and methane production, landfill. hazardous waste treatment).		
UNIT IV	**ECOLOGICALLY SAFE PRODUCTS AND PROCESSES**	**9**
Biofertilizers, microbial insecticides and pesticides, bio-control of plant pathogen, Integrated pest management; development of stress tolerant plants, biofuel; mining and metal biotechnology: microbial transformation		
UNIT V	**CLIMATE CHANGE MODELS**	**9**
Constructing a climate model – climate system modeling – climate simulation and drift – Evaluation of climate model simulation – regional (RCM) – global (GCM) – Global average response to warming –climate change observed to date		
TOTAL: 60 PERIODS		

LIST OF EXPERIMENTS

a. Determination of Bio fuel parameters such as flash point and fire point.
b. Determination of density of biofuels.
c. Determination of BOD/COD in water.
d. Simulating the RCM and GCM model for different geographic conditions.
e. Measurement of Pollutant in environment by Gaussian Plume model.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain the importance of the process of Environmental impact assessment and its types.
CO2:	Illustrate the chemical processes and pollutant chemistry
CO3:	Identify the methods to solve environmental problems
CO4:	Apply the knowledge to develop ecofriendly products.
CO5:	Construct the various simple climate models for simulation
CO6:	Apply the climate model simulation to monitor climate change

TEXT BOOKS:	
1	David .E Neelin "Climate Change and Modelling", Cambridge University Press, California 2012.
2	Evans, G.G. & Furlong, J. 2010. Environmental Biotechnology: Theory and Application (2nd edition). Wiley-Blackwell Publications.
3	Pani, B. 2007. Textbook of Environmental Chemistry. IK international Publishing House
4	N.S. Raman , A.R. Gajbhiye & S.R. Khandeshwar, Environmental Impact Assessment, 2014,IK International Pvt Ltd.
REFERENCES:	
1	Carson (1907-1964). Environment Conservation-book
2	Encyclopaedia of Environmental Issues by Craig W. Allin &Probe.
3	Encyclopaedia of Environmental studies by William Ashworth.
4	Climate Change and Climate Modeling- Kindle Edition.
5	Environmentally- Friendly Product development - Eberhand Abile ,Reiner Anderl,2005

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	2	1	-	-	-	-	-	2	-	-
2	3	2	1	1	-	3	2	-	-	-	-	1	3	-	-
3	3	2	1	1	-	3	2	-	-	-	-	1	3	-	-
4	3	2	1	1	-	3	2	-	-	-	-	1	3	-	-
5	3	2	1	1	-	3	2	-	-	-	-	1	3	-	-
6	3	2	1	1	-	3	2	-	-	-	-	1	3	-	-
Overall Correlation	**3**	**2**	**1**	**1**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**-**

Recommended by Board of Studies	**07-11-2024**		
Approved	**3rd ACM**	**Date**	**30-11-2024**

23IT611	IoT AND ITS APPLICATIONS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IOT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario

UNIT I	8 - BIT EMBEDDED PROCESSOR	9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling

UNIT II	EMBEDDED C PROGRAMMING	9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III	IOT AND ARDUINO PROGRAMMING	9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV	IOT COMMUNICATION AND OPEN PLATFORMS	9

IoT Communication Models and APIs – IoT Communication

Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.		
UNIT V	**APPLICATIONS DEVELOPMENT**	**9**
Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.		
		TOTAL: 45 PERIODS

PRACTICALS:

1. Write 8051 Assembly Language experiments using a simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write Basic and arithmetic Programs Using Embedded C.
5. Introduction to Arduino platform and programming
6. Introduction to Raspberry PI platform and python programming
7. Explore different communication methods with IoT devices (Zigbee, GSM, and Bluetooth)
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Setup a cloud platform to log the data
11. Log Data using Raspberry PI and upload to the cloud platform
12. Design an IOT based system

TOTAL:30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain the architecture of embedded processors.
CO2:	Develop embedded C programs.
CO3:	Build simple embedded applications.

CO4:	Compare the communication models in IOT
CO5:	Develop IoT applications using Arduino/Raspberry Pi /open platform.
CO6:	Build simple IOT applications.
TEXT BOOKS:	
1	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay. "The 8051 Microcontroller and Embedded Systems.", Pearson Education, Second Edition, 2014
2	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things.", CISCO Press, 2017.
REFERENCES:	
1	Michael J. Pont. "Embedded C", Pearson Education, 2007.
2	Wayne Wolf. "Computers as Components: Principles of Embedded Computer System Design.", Elsevier, 2006.
3	Andrew N. Sloss, D. Symes, C. Wright. "Arm System Developer's Guide.", Morgan Kauffman Elsevier, 2006.
4	Arshdeep Bahga, Vijay Madisetti. "Internet of Things – A hands-on approach.", Universities Press, 2015.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	2	1	3	2	2	1	-
2	3	2	1	1	2	-	-	-	1	2	3	1	2	2	-
3	3	2	1	1	3	-	-	-	3	3	1	1	3	2	-
4	2	1	-	-	3	-	-	-	2	3	3	1	1	1	-
5	3	2	1	1	2	-	-	-	1	3	1	2	1	3	-
6	3	2	1	1	1	-	-	-	1	1	1	1	1	1	-
Overall Correlation	3	2	1	1	2	-	-	-	2	2	2	2	2	2	-

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT621	PROJECT WORK PHASE-1	L	T	P	C
		0	0	4	2

COURSE DESCRIPTION:

This course provides an opportunity for students to apply their engineering knowledge to solve real-world problems through project-based learning. Students, working in groups with maximum of 4 under faculty supervision, undertake a comprehensive project addressing an approved topic. The course focuses on fostering collaboration, research, and practical skills, culminating in a detailed Phase 1 project report and oral presentations. Regular reviews ensure consistent progress and adherence to academic standards.

COURSE OBJECTIVES:

- Encourage students to apply theoretical knowledge to practical engineering problems.
- Develop collaborative and project management skills through teamwork.
- Train students in research methodology, technical documentation, and presentation skills.
- Enhance students' ability to design, analyze, and evaluate solutions systematically.
- Prepare students for real-world engineering challenges and multidisciplinary teamwork

PROJECT OUTLINE:

Week 1	Orientation and course overview. Formation of project teams and approval of topics by HoD.
Week 2	Initial meeting with supervisors. Define problem statement and objectives
Week 3	Literature review: Research methodologies and topic-specific studies.
Week 4	Zeroth Review.

Week 5	Refinement of literature review and identification of research gaps.
Week 6	Identification of Base Paper.
Week 7	First Review.
Week 8	Conceptual design discussions and brainstorming solutions.
Week 9	Narrowing done on the exact work.
Week 10	Completion of first stage of the Project.
Week 11	Development of detailed conceptual design and methodology.
Week 12	Incorporation of feedback and refinement of design and methodology.
Week 13	Second Review.
Week 14	Compilation of Phase 1 results, report writing, and presentation preparation.
Week 15	Final Viva Voce Presentations.

Individual meetings will be set up on a need's basis in conjunction with developing work

EVALUATION:

- The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A phase 1 project report is required to be submitted at the end of the semester. Evaluation is based on oral presentation and the phase 1 project report jointly by internal examiners constituted by the Head of the Department.
- Evaluate how effectively the project is structured and communicated in both oral presentations and written texts, emphasizing logical flow and coherence.
- Evaluate the relevance and innovation of practical resources or prototypes developed, focusing on their potential to support sustainability, innovation, and SDG-aligned goals.

- Review the accuracy of English usage, including grammar, clarity, and coherence in oral and written communication, ensuring effective delivery of technical content.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Develop feasible solutions by analyzing complex engineering problems using foundational knowledge, mathematics, and science.
CO2:	Survey literatures to identify gaps, define research questions, and propose designs and methods for solving engineering problems.
CO3:	Make use of modern tools to check the feasibility of the solutions effectively.
CO4:	Evaluate societal and environmental impacts of solutions while incorporating sustainability and ethical practices.
CO5:	Combine in teams to plan, manage, and lead projects within professional and economic constraints.
CO6:	Formulate technical reports, deliver presentations, and engage in lifelong learning to adapt to new technologies.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
2	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
3	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
4	3	2	2	2	1	1	2	3	3	3	3	3	3	1	3
5	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
6	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
Overall Correlation	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT622	TECHNICAL TRAINING	L	T	P	C
		0	0	2	1

PREAMBLE:

The course 'Technical Training' is intended to enable a B.E./B.Tech. graduate to practice, learn, apply and prepare report about the training undergone. The learner shall be trained in the latest technology in relevant Industry preferably in computer-oriented platform. This course can help the learner to experience training and learn practical skills for the relevant domain. Learner should also be able to present his learning through PPT and report articulating his level of learning about the specific training.

COURSE OBJECTIVES:

- To equip students with practical skills and real-world experience in technical domains, enabling them to effectively apply theoretical knowledge to hands-on applications.
- To develop competencies in working with industry-relevant tools and software technologies.
- To foster teamwork, problem-solving, and technical skills through innovative technologies

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Identify specific domain from the enrolled branch and to get training preferable in computer-oriented platform.
CO2:	Survey and apprehend the learning modules in the training program and to become expert in the specific domain.

CO3:	Apply theoretical learning in the practical environment and enhance the skillset of learner.
CO4:	Estimate the learning using available data.
CO5:	Defend a presentation about the learning done in the specified skillset.
CO6:	Construct a technical report about the training.

GUIDELINES:

- More than one training program may be given depending on availability and interest of the students. One training coordinator may be appointed for the same.
- Training coordinator shall provide required input to their students regarding the selection of training topic.
- Choosing a Training topic: The topic for a Technical Training should be current and broad based rather than very specific area of interest. It should also be outside the present syllabus. It's advisable to choose a training topic to be computer oriented as the resources for the same may be readily available. Every student of the program should be involved and assessed.
- Head of Department shall approve the selected training topic by the second week of the semester. Training may be assessed based on the ability to apply the skillset in a practical domain.

EVALUATION PATTERN:

Training Coordinator:

50 marks (Training Manual – 40 (Each student shall maintain a Training Manual and the Coordinator shall monitor the progress of the training work on a weekly basis and shall

approve the entries in the Training Manual during the weekly meeting with the student), Attendance – 10,).

Presentation of Application:

Candidate should apply the skillset attained in training. 20 marks to be awarded by the Examiners (Clarity of presentation – 5, Interactions – 10, Quality of the slides – 5).

Report about Application:

30 marks to be awarded by the Examiners (check for technical content, overall quality, templates followed, adequacy of application of the skillset etc.).

Training duration – 30 Hours

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	2	1	-	-	-	-	3	3	-	-
2	3	3	2	1	-	2	1	-	-	-	-	3	3	-	-
3	3	3	3	3	3	-	-	1	-	2	-	3	3	3	1
4	3	3	3	2	2	-	-	1	-	3	-	3	3	2	1
5	3	3	3	2	1	2	-	2	-	2	-	2	3	1	2
6	3	3	3	3	2	2	-	2	-	3	-	3	3	2	2
Overall Correlation	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**-**	**3**	**-**	**3**	**3**	**2**	**2**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT623	TECHNICAL SEMINAR – 1	L	T	P	C
		0	0	2	1

PREAMBLE:

The course 'Technical Seminar' is intended to enable a B.E./B. Tech graduate to read, understand,present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar coordinator. This course can help the learner to experience how a presentation can be made about a selected academic document and empower her/him to prepare a technical report.

COURSE OBJECTIVES:

- To do Literature surveys in a selected area of study
- To understand an academic document from the literature and to give a presentation about it
- To prepare a technical report.

GUIDELINES:

- The Department shall form an Internal Assessment Committee (IAC) for the seminar with academic coordinator for that program as the Chairperson and seminar coordinator as member. During the seminar presentation of a student, all members of IAC shall be present.
- Formation of IAC shall be completed within a week after the End Semester Examination (or last working day) of the previous semester.
- Seminar Coordinator shall provide required input to their students regarding the selection of topic/ paper.
- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than very specific research work, beyond the syllabus. Every member of the project team could choose or be assigned

Seminar topics that covers various aspects linked to the Project area.

- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IAC. The IAC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

EVALUATION PATTERN

Seminar Coordinator:

40 marks (Background Knowledge – 10 (The coordinator shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).
(Seminar Diary – 10 (Each student shall maintain a seminar diary and the coordinator shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation:

40 marks to be awarded by the IAC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report:

20 marks to be awarded by the IAC (check for technical content, overall quality, templates followed, adequacy of references etc.).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Identify academic documents from the literature which are related to her/his areas of interest.
CO2:	Survey and apprehend an academic document from the literature which is related to her/ his areas of interest.
CO3:	Compile a presentation about an academic document.
CO4:	Estimate the Contents using available literature.
CO5:	Defend a presentation about an academic document.
CO6:	Construct a technical report.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	2	2	1	1	2	3	3	2	2	3	2	2
2	3	3	3	1	2	1	1	2	3	3	2	2	3	2	2
3	3	3	2	2	2	1	1	1	3	3	1	1	3	2	2
4	3	3	2	1	1	1	2	2	3	3	2	1	3	2	2
5	3	3	2	1	1	1	1	2	2	2	2	2	3	1	2
6	3	3	2	1	1	1	1	2	2	2	2	2	3	1	2
Overall Correlation	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

SEMESTER – VII

23IT701	COMPREHENSION	L	T	P	C
		2	0	0	2

PURPOSE:

To provide a complete review of the topics covered in the previous semesters, to ensure that a comprehensive understanding of the subjects is achieved. The student will be tested as per the guidelines given by national level examinations like GATE, TANCET etc. It will also help students to face job interviews and competitive examinations.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Analyse the phenomena involved in the concerned problem and solve them.
CO2:	Apply principles to new and unique circumstances.
CO3:	Estimate concepts and principles of concerned branch of engineering.
CO4:	Distinguish between facts and opinion in the engineering field.
CO5:	Deduct cause-and-effect relationships of any relationship.
CO6:	Interpret data from charts and graphs and judge the relevance of information.

GUIDELINES:

- The Department shall form an Internal Assessment Committee for the Comprehension with Academic coordinator for that class as the Comprehension Instructor and Class coordinator as member.
- Instructor shall provide required input to their students regarding the overview of all topics covered in the previous semesters.
- Periodic tests can be conducted to assess students.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	1	-	2	1	-	-	-	-	1	3	-	-
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
3	3	3	3	3	3	-	-	3	-	3	-	3	3	3	3
4	3	2	1	1	2	-	-	1	-	3	-	3	3	2	1
5	3	3	3	2	1	2	-	2	-	2	-	2	3	1	2
6	3	3	3	2	1	2	-	2	-	2	-	2	3	1	2
Overall Correlation	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**-**	**3**	**-**	**3**	**3**	**3**	**2**
Recommended by Board of Studies							**13-11-2024**								
Approved by Academic							**3rd ACM**			**Date**			**30-11-2024**		

23IT711	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- Explain two and three dimensional concepts and their applications
- Identify all techniques related to modern graphics programming concepts
- Identify the media used in multimedia systems and to assess their relative advantages and disadvantages relative to both user and system points of view.
- Explain the interaction problems introduced by multimedia (e.g., compression and synchronization).

UNIT I	PRIMITIVES	6

Output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives –Two dimensional Geometric transformation - Two dimensional viewing – Line, Polygon, Curve and Text clipping algorithms.

UNIT II	CONCEPTS	6

Parallel and Perspective projections - Three dimensional object representation– Polygons, Curved lines, Splines, Quadric Surfaces, - Visualization of data sets - 3D transformations – Viewing -Visible surface identification.

UNIT III	GRAPHICS PROGRAMMING	6

Color Models – RGB, YIQ, CMY, HSV – Animations – General Computer Animation, Raster, Keyframe - Graphics programming using OPENGL / Blender – Basic graphics primitives – Drawing three dimensional objects.

UNIT IV	MULTIMEDIA BASICS	6

Introduction and definitions – applications - elements - Compression – Types of compressions -Lossless, Lossy – Video compression – Image Compression – Audio compression - Data and file format.

UNIT V	MULTIMEDIA SYSTEMS	6

Multimedia Authoring Systems – Hypermedia Design considerations – User Interface Design – Object Display and Play back issues- Hypermedia Messaging- Distributed Multimedia Systems – Components – multimedia Object Servers – Managing Distributed Objects.

TOTAL: 45 PERIODS

PRACTICALS:

1. To implement Bresenham's algorithms for line, circle and ellipse drawing
2. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing using 2D Animation software
3. To perform 3D Transformations such as translation, rotation and scaling. 3D viewing, 3D transformations using 3D Animation software.
4. Developing interactive multimedia Applications- Authoring a 2D presentation: (storyboard, design layout, collect the content, Presentation) using 2 D animation software.
5. Creating simple 3D animations and visualizations.
6. 2D Animation – To create Interactive animation using any animation software
7. Image Editing and Manipulation - Basic Operations on image using any image editing software, creating gif animated images, Image optimization
8. Create a storyboard and script for an animation.
9. Complete a computer animation demonstrating the use of the basic elements and principles of art and design to communicate specific ideas, moods or feelings.
10. Manipulate and synchronize the sound to the animation.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain the concepts of display devices and Line drawing algorithms.

CO2:	Model the different types of clipping algorithms and two dimensional transformations.
CO3:	Apply the concepts of 3D display methods, transformation and viewing in computer graphics.
CO4:	Build the surface detection methods, dither techniques, rendering and illumination Models.
CO5:	Apply the multimedia system concepts and techniques with the algorithms
CO6:	Explain the basic programming with the 2D and 3D concepts.

TEXT BOOKS:

1	Donald Hearn, M. Pauline Baker, "Computer Graphics – C Version", second edition, Pearson Education, 2004.
2	Prabhat K Andleigh, Kiran Thakrar, "Multimedia systems design", PHI, 2007.

REFERENCES:

1	F.S.Hill, "Computer Graphics using OPENGL" , Second edition, Pearson Education,2003.
2	Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2004.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	2	-	2	1	1	1	-
2	3	2	1	1	2	-	-	-	2	-	2	2	3	2	-
3	3	2	1	1	3	-	-	-	3	-	2	2	3	2	-
4	3	2	1	1	1	-	-	-	3	-	2	2	3	2	-
5	3	2	1	1	3	-	-	-	3	-	2	1	3	2	-
6	2	1	-	-	3	-	-	-	3	-	2	1	3	2	-
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**3**	**-**	**2**	**2**	**3**	**2**	**-**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT721	PROJECT WORK PHASE-2	L	T	P	C
		0	0	4	3

COURSE DESCRIPTION:

Project Phase 2 is a continuation of Project Phase 1, focusing on implementing the proposed methodology through fabrication, simulation, or experimental validation. Students will refine their designs, validate test problems, and commission setups for final testing. This phase emphasizes hands-on application, calibration, and demonstration of results, culminating in a final presentation and report submission.

COURSE OBJECTIVES:

- Implement the proposed methodology to address engineering problems identified in Phase 1.
- Develop and fabricate prototypes or simulate solutions for the selected project integrating theoretical knowledge with practical application across hardware and software systems.
- Validate solutions through testing ensuring reliability and performance in both physical and virtual environments.
- Enhance problem-solving and critical thinking skills by troubleshooting and optimizing either experiment setups or software code to improve results.
- Prepare a research manuscript or applying for patent grant either for design or research.

PROJECT OUTLINE:

Week 1	Review of Phase 1 outcomes and refinement of proposed methodology.
Week 2	Material procurement/ software setup for simulation, and initiation of fabrication/simulation work.
Week 3	Intermediate fabrication/simulation work and initial testing or calibration, troubleshooting challenges.

Week 4	Second Review.
Week 5	Validation of test problem or refinement of prototype/simulation
Week 6	Optimisation of the test setup or solution trials, Data curation / uncertainty analysis
Week 7	Final testing of setup or simulation outcomes, Validation of Data .
Week 8	Third Review
Week 9	Demonstration of the solution with high level of data accuracy and precision.
Week 10	Compilation of Phase 2 results, report writing, and presentation preparation.
Week 11	Preparing or publishing of research article/ Filing or Grant of Patent
Week 12	Final Viva Voce Presentations.

Individual meetings will be set up on a need's basis in conjunction with developing work

EVALUATION:

- The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
- Assess the depth of understanding demonstrated in the project's conceptualization and the ability to answer questions during public presentations.

• Publication of Research article in indexed journal or Patent award is necessary at the end of completion of the project.	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply appropriate methodologies to implement solutions for complex engineering problems identified in phase -1 using hardware / software or both systems.
CO2:	Develop existing functional prototypes or simulations models by integrating theoretical and practical knowledge.
CO3:	Evaluate solutions ensuring compliance with design specifications.
CO4:	Appraise the performance of solutions by refining designs or improving algorithms for enhanced outcomes.
CO5:	Collaborate effectively with team members to plan, manage, and execute engineering projects adhering to ethical principles and professional standards.
CO6:	Prepare technical reports, impactful presentations that communicate solutions effectively.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
2	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
3	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
4	3	2	2	2	1	1	2	3	3	3	3	3	3	1	3
5	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
6	3	2	2	2	1	2	2	3	3	3	3	3	3	1	3
Overall Correlation	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

23IT722	TECHNICAL SEMINAR – 2	L	T	P	C
		0	0	2	1

PREAMBLE:

The course 'Technical Seminar 2' is intended to be continuation of Technical Seminar 1. It enables a B.E./B. Tech graduate to read, understand, present and prepare report about higher level academic document. The selected topic should be outside the given syllabus. The learner shall search in the literature / current affairs including mass media, print media, peer reviewed journals, conference, books, project reports etc., and identify an appropriate topic/paper/thesis/report in her/his area of interest, in consultation with her/his seminar coordinator. This course can help the learner to experience how a higher-level presentation can be made about a selected academic document and empower her/him to prepare a technical report.

COURSE OBJECTIVES:

- To do Literature surveys in a selected area of study
- To understand an academic document from the literature and to give a presentation about it
- To prepare a technical report.

GUIDELINES:

- The Department shall form an Internal Assessment Committee (IAC) for the seminar with academic coordinator for that program as the Chairperson and seminar coordinator as member. During the seminar presentation of a student, all members of IAC shall be present.
- Formation of IAC shall be completed within a week after the End Semester Examination (or last working day) of the previous semester.
- Seminar Coordinator shall provide required input to their students regarding the selection of topic/ paper.

- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than very specific research work, beyond the syllabus. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.
- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IAC. The IAC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

EVALUATION PATTERN

Seminar Coordinator:

40 marks (Background Knowledge – 10 (The coordinator shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).

(Seminar Diary – 10 (Each student shall maintain a seminar diary and the coordinator shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation:

40 marks to be awarded by the IAC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report:

20 marks to be awarded by the IAC (check for technical content, overall quality, templates followed, adequacy of references etc.).

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify academic documents from the literature which are related to her/his areas of interest.
CO2:	Survey and apprehend an academic document from the literature which is related to her/ his areas of interest.
CO3:	Compile a presentation about an academic document.
CO4:	Estimate the Contents using available literature.
CO5:	Defend a presentation about an academic document.
CO6:	Construct a technical report.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	2	2	1	1	2	3	3	2	2	3	2	2
2	3	3	3	1	2	1	1	2	3	3	2	2	3	2	2
3	3	3	2	2	2	1	1	1	3	3	1	1	3	2	2
4	3	3	2	1	1	1	2	2	3	3	2	1	3	2	2
5	3	3	2	1	1	1	1	2	2	2	2	2	3	1	2
6	3	3	2	1	1	1	1	2	2	2	2	2	3	1	2
Overall Correlation	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

SEMESTER –VIII

23IT821	CAPSTONE PROJECT	L	T	P	C
		0	0	20	10

COURSE DESCRIPTION:

Prerequisites:

i) Team segregation.
ii) Identification of Project Guide.
iii) Identification of Area of Interest.
iv) Literature Review on the chosen area of interest.

Zeroth Review needs to be completed in the previous semester by the project coordinator

The *Capstone Project* ***(CP)*** provides an opportunity for students to engage in high-level inquiry focusing on an area of specialization within the engineering field. Capstone projects will be investigative, practice-centered. All capstones aim to bridge theory and practice and are aimed to have an impact on the professional life of students

The aim of the course is to facilitate the development of your *Capstone Projects.* Students are encouraged to apply and expend knowledge gained on teaching and learning throughout the Bachelor of Engineering Education program as part of this process

COURSE OBJECTIVES:

The Capstone Project should demonstrate the depth and extent of knowledge of students

During this course, students will

- Investigate and evaluate prominent literature connected to your CP.
- Present a clearly articulated investigative framework, while situating projects within established academic

practices and/ or ideas.

- Develop and create practical resources (either computational or experimental) for the concerned area of interest in engineering field.
- Offer inquiry-based argumentation for development in the concerned area within engineering field.
- Summarize the findings in the form of report, documentation and presentation

PROJECT OUTLINE:

Week 1	Identification problem.
Week 2	Literature review.
Week 3	Preliminary work.
Week 4	First review.
Week 5	Completion of first stage of the Project methodology.
Week 6	Development.
Week 7	Testing & Validation.
Week 8	Second review.
Week 9	Repeatability.
Week 10	Report correction and Documentation
Week 11	Third review-Submission of paper for conference/journal
Week 12	Thesis Correction and Submission

Individual meetings will be set up on a need's basis in conjunction with developing work

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Take part in challenging practical problems and find solutions by formulating proper methodology.
CO2:	Plan research methodology to tackle a specific problem.
CO3:	Construct extensive study on particular research projects.
CO4:	Develop experimental and computational studies on innovative research projects.
CO5:	Estimate incremental study on existing research projects.
CO6:	Take part in real life engineering challenges and propose appropriate solutions.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	3	2	3	3	2	3	2	3	2	3	2	3	3	2	3
3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3
4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3
6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Correlation	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Recommended by Board of Studies	**13-11-2024**		
Approved by Academic	**3rd ACM**	**Date**	**30-11-2024**

VERTICAL 1: CLOUD COMPUTING

23IT031	DISTRIBUTED COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- To implement security Mechanisms for Distributed Systems

UNIT I	INTRODUCTION	6

Introduction: Relation to Computer System Components – Message -Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions –A Model of Distributed Computations and Communication Networks - Logical Clocks – Scalar Time and Vector Time - Message Ordering and Group Communication - Causal Order and Total Order - Global State and Snapshot Recording Algorithms.

UNIT II	LOGICAL TIME AND GLOBAL STATE	6

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks - Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program - Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III	DISTRIBUTED MUTEX AND DEADLOCK	6
Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm –– Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.		
UNIT IV	**CONSENSUS AND RECOVERY**	**6**
Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm - Algorithm for Asynchronous Checkpointing and Recovery		
UNIT V	**FAULT TOLERANCE AND SECURITY**	**6**
Types of Faults and Failure Models - Fault Detection and Failure Recovery Techniques - Byzantine Fault Tolerance (BFT) - Replication Strategies for Fault Tolerance - Network Partitioning and Partition Tolerance - Security Mechanisms - Intrusion Detection and Prevention - Data Privacy and Confidentiality - Checkpointing and Logging - Self-Stabilization and Resilient Algorithms - Partition Tolerance and CAP Theorem - Blockchain Security.		
		TOTAL: 30 PERIODS

PRACTICALS:	
1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS. 2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs. 3. Install Google App Engine. Create hello world app and other simple web applications using python/java. 4. Use GAE launcher to launch the web applications. 5. Use fault injection techniques (e.g., Chaos Monkey) to simulate failures in a distributed environment. 6. Develop a small-scale MapReduce application (e.g., word count, log processing). 7. Implement a mini version of a distributed file system (similar to HDFS or GFS). **8.** Simulate load-balancing techniques (e.g., round robin, least connections) across multiple servers.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply the concept of computation and communication models of distributed systems.
CO2:	Apply the issues of synchronization.
CO3:	Experiment with virtualization of hardware resources and Docker.
CO4:	Develop the concept of distributed mutual exclusion and distributed deadlock detection techniques.
CO5:	Develop fault detection and failure recovery techniques.
CO6:	Apply security mechanisms.
TEXT BOOKS:	
1	George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems: Concepts and Design", Pearson Publishers, 2011.

2	James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
REFERENCES:	
1	James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2	Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach", CRC Press, 2014

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	-	2	3	1	3	3	1	-
2	3	2	1	1	1	-	-	-	1	2	1	3	3	2	-
3	3	2	1	1	1	-	-	-	3	1	1	3	3	1	-
4	3	2	1	1	3	-	-	-	3	3	1	2	3	3	-
5	3	2	1	1	3	-	-	-	2	2	1	2	3	2	-
6	2	1	-	-	3	-	-	-	2	2	1	2	3	3	-
Overall Correlation	3	2	1	1	2	-	-	-	3	3	2	3	3	2	-

23IT032	CLOUD SERVICES MANAGEMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.
- To Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services

UNIT I	CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE	6

Cloud Architecture: System Models for Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II	CLOUD DEPLOYMENT ENVIRONMENT	6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT III	CLOUD SERVICE MANAGEMENT FUNDAMENTALS	6

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

UNIT IV	CLOUD SERVICES STRATEGY	6
Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture		
UNIT V	**CLOUD SERVICE MANAGEMENT**	**6**
Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. 2. Find a procedure to transfer the files from one virtual machine to another virtual machine. 3. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version) 4. Install Hadoop single node cluster and run simple applications like word count. 5. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control 6. Create a Cost-model for a web application using various services and do Cost-benefit analysis 7. Create alerts for usage of Cloud resources 8. Create Billing alerts for your Cloud Organization 9. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one.		
TOTAL: 30 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the design challenges in the cloud.
CO2:	Develop and deploy services on the cloud and set up a cloud environment.
CO3:	Build and automate business solutions using cloud technologies.
CO4:	Explain the cloud service strategies including management framework and cloud policies.
CO5:	Solve the real world problems using Cloud services and technologies
CO6:	Explain security challenges in the cloud environment.
TEXT BOOKS:	
1	Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2017.
2	Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013.
REFERENCES:	
1	Praveen Ayyappa, "Economics of Cloud Computing" LAP Lambert Academic Publishing, 2013.
2	Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", Morgan Kaufmann Publisher, 2013.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	3	-	-	-	2	2	3	1	3	3	-
2	3	2	1	1	2	-	-	-	2	2	3	3	2	3	-
3	3	2	1	1	3	-	-	-	2	2	1	2	2	3	-
4	2	1	-	-	3	-	-	-	2	2	3	2	3	3	-
5	3	2	1	1	3	-	-	-	3	1	3	2	3	2	-
6	2	1	-	-	3				3	1	3	2	3	2	
Overall Correlation	3	2	1	1	3	-	-	-	3	2	3	2	3	3	-

23IT033	VIRTUALIZATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basic concepts of networks.
- To explore various technologies in the wireless domain.
- To study about 4G and 5G cellular networks.
- To learn about Network Function Virtualization.
- To understand the paradigm of Software defined networks.

UNIT I	INTRODUCTION TO VIRTUALIZATION	6

Virtualization and cloud computing – Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization – partial virtualization – Paravirtualization-Types of Hypervisors.

UNIT II	SERVER AND DESKTOP VIRTUALIZATION	6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.

UNIT III	NETWORK FUNCTIONS VIRTUALIZATION	6

Virtual Machines –NFV benefits-requirements – architecture-NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN.

UNIT IV	STORAGE VIRTUALIZATION	6

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.

UNIT V	VIRTUALIZATION TOOLS	6
VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box – IBM PowerVM- Google Virtualization- Case study.		
		TOTAL: 30 PERIODS
PRACTICALS EXCERCISES:		
1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE 2. Create, Manage, Configure and schedule snapshots. 3. Desktop Virtualization using Chrome Remote Desktop. 4. Create type 2 virtualization on ESXI 6.5 server. 5. Create a VLAN in CISCO packet tracer. 6. Install KVM in Linux. 7. Create Nested Virtual Machine (VM under another VM)		
		TOTAL: 30 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Build a Virtualization network.	
CO2:	Apply the virtualization techniques.	
CO3:	Illustrate the Network function Virtualization.	
CO4:	Develop SDN based applications.	
CO5:	Explain the concepts of storage virtualization.	
CO6:	Build a Nested VM and explain about Virtualization tools.	
TEXT BOOKS:		
1	Cloud computing a practical approach – Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010	
2	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011	
REFERENCES:		
1	P Chris Wolf, Erick M. Halter. "Virtualization: From the Desktop to the Enterprise". APress, 2005.	

2	P James E. Smith, Ravi Nair. "Virtual Machines: Versatile Platforms for Systems and Processes".Elsevier/Morgan Kaufmann, 2005.
3	David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	-	-	-	1	3	1	1
2	3	2	1	1	2	-	-	1	-	-	-	1	3	1	1
3	2	1	-	-	2	-	-	1	-	-	-	1	3	1	1
4	3	2	1	1	2	-	-	1	-	-	-	1	3	2	1
5	2	1	-	-	1	-	-	1	-	-	-	1	3	1	1
6	3	2	1	1	2	-	-	1	-	-	-	1	3	2	1
Overall Correlation	3	2	1	1	2	-	-	2	-	-	-	2	3	2	2

23IT034	CLOUD DATABASE MANAGEMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the fundamental concepts of cloud database management.
- Explore various cloud database services and their features.
- Learn to design, deploy, and manage databases in the cloud.
- Gain insights into security and compliance aspects of cloud databases.
- Develop skills to optimize and troubleshoot cloud databases.

UNIT I	INTRODUCTION TO CLOUD DATABASE MANAGEMENT	6

Basics of cloud computing-Cloud database architecture-Types of cloud databases (SQL, NoSQL, NewSQL)-Cloud database service models (DBaaS)- Benefits and challenges of cloud databases.

UNIT II	CLOUD DATABASE SERVICES	6

Overview of major cloud database providers (AWS, Azure, Google Cloud)- Comparing cloud database services (Amazon RDS, Azure SQL Database, Google Cloud SQL)-Features and pricing models-Use cases for different cloud database services-cloud database platforms.

UNIT III	DESIGNING AND DEPLOYING CLOUD DATABASES	6

Database design principles for the cloud-Data modelling and schema design-Deployment strategies and automation-Backup and recovery in cloud databases-High availability and disaster recovery.

UNIT IV	SECURITY AND COMPLIANCE IN CLOUD DATABASES	6

Security principles for cloud databases-Data encryption (at rest and in transit)-Identity and access management-Compliance standards (GDPR, HIPAA, etc.)-Auditing and monitoring

UNIT V	OPTIMIZATION AND TROUBLESHOOTING OF CLOUD DATA	6

Performance tuning techniques-Indexing and query optimization-Scaling databases (vertical and horizontal scaling)-Monitoring and diagnostics tools-Common troubleshooting scenarios and solutions

TOTAL: 30 PERIODS

PRACTICALS EXPERIMENTS:

1. Create Amazon AWS EC2 Linux instance with conceptual understanding of SSH client software protocol and keys.
2. Create Amazon AWS EC2 Windows server instance with conceptual understanding of RDP (Remote Desktop Protocol).
3. Create cloud storage Bucket using Amazon Simple Storage Service (S3). Perform the following operations:
4. Create a folder within a S3 Bucket.
5. Upload content to S3
6. Create a cloud storage Bucket using Amazon Simple Storage Service (S3). Perform the following operations:
7. Change permissions to allow public access of contents.
8. Set MetaData on an S3 Bucket.
9. Delete an S3 Bucket and its content.
10. Launch and connect to an Amazon Relational DataBase (RDS) Service using MySQL
11. Launch and connect to an Amazon Relational DataBase (RDS) Service using Oracle.
12. Launch and connect to an Amazon Relational DataBase (RDS) Service using postgre SQL DataBase engines.
13. Launch and connect to an Amazon Relational DataBase (RDS) Service using SQL Server.

TOTAL : 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply the fundamental concepts and architecture of cloud databases.
CO2:	Explain the features and benefits of different cloud database services.
CO3:	Summarize the process of designing and deploying databases in the cloud.
CO4:	Explain the security and compliance considerations for cloud databases.
CO5:	Illustrate the techniques for optimizing cloud database performance.
CO6:	Interpret common troubleshooting methods for cloud database issues.
TEXT BOOKS:	
1	Thomas Erl . "Cloud Computing: Concepts, Technology & Architecture.", Prentice Hall, 1st Edition, 2013.
2	Carlos Coronel, Steven Morris. "Database Systems: Design, Implementation, and Management (with Cloud Computing and Data Storage Integration).", Cengage Learning, 2020.
REFERENCES:	
1	Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Wiley, 1st Edition, 2014.
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly Media, 1st Edition, 2009.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	1	-	1	1	1	2	1	1
2	2	1	-	-	1	-	-	1	-	1	1	1	3	1	1
3	2	1	-	-	1	-	-	1	-	1	1	1	3	1	1
4	2	1	-	-	1	-	-	1	-	1	1	1	3	1	1
5	2	1	-	-	1	-	-	1	-	1	1	1	3	1	1
6	2	1	-	-	1	-	-	1	-	1	1	1	3	1	1
Overall Correlation	3	2	1	1	2	-	-	2	-	2	2	2	3	2	2

23IT035	STORAGE TECHNOLOGIES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I	STORAGE SYSTEMS	6

Introduction to Information Storage: Digital data and its types - Information storage - Key characteristics of data center and Evolution of computing platforms - Information Lifecycle Management - Third Platform Technologies: Cloud computing and its essential characteristics - Cloud services and cloud deployment models - Big data analytics - Social networking and mobile computing - Characteristics of third platform infrastructure and Imperatives for third platform transformation - Data Center Environment: Building blocks of a data center - Compute systems and compute virtualization and Software-defined data center.

UNIT II	INTELLIGENT STORAGE SYSTEMS AND RAID	6

Components of an intelligent storage system, - Components, addressing, and performance of hard disk drives and solid-state drives – RAID - Types of intelligent storage systems - Scale-up and scale-out storage Architecture.

UNIT III	STORAGE NETWORKING TECHNOLOGIES	6

Block-Based Storage System - File-Based Storage System - Object-Based and Unified Storage - Fibre Channel SAN: Software-defined networking - FC SAN components and architecture - FC SAN topologies - link aggregation, and zoning - Fibre Channel over

Ethernet SAN: Components of FCoE SAN - FCoE SAN connectivity - Converged Enhanced Ethernet - FCoE architecture.

UNIT IV	BACKUP, ARCHIVE AND REPLICATION	6

Introduction to Business Continuity - Backup architecture - Data deduplication - Cloud-based and mobile device backup - Data archive - Compute based, storage-based, and network-based replication - Data migration, - Disaster Recovery as a Service (DRaaS).

UNIT V	SECURING STORAGE INFRASTRUCTURE	6

Information security goals - Storage security domains - Threats to a storage infrastructure - Security controls to protect a storage infrastructure - Governance, risk, and compliance - Storage infrastructure management functions - Storage infrastructure management processes.

TOTAL: 30 PERIODS

PRACTICALS: LIST OF EXPERIMENTS

1. For any storage documentation, plan storage requirements based on performance and cost considerations such as Fibre Channel.
2. Install the iSCSI target feature and create/configure an iSCSI target.
3. Self-directed remote lab for advanced HPE storage solutions.
4. Design backup, recovery, and archive strategies for various customer scenarios.
5. Create a persistent disk and attach it to a virtual machine.
6. Create a storage bucket and upload objects to the bucket using google cloud console.
7. Create folders and subfolders in the bucket using google cloud console.
8. Make objects in a storage bucket publicly accessible using google cloud console.
9. Create an Image-backed Dataset from a Node-local Dataset.
10. Create a Remote Dataset and use it on a Single Node.

TOTAL : 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
CO2:	Illustrate the usage of advanced intelligent storage systems and RAID
CO3:	Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
CO4:	Examine the different role in providing disaster recovery and remote replication technologies
CO5:	Utilize the security needs and security measures to be employed in information storage management
CO6:	Model the backup, archiving with regard to recovery and business continuity.
TEXT BOOKS:	
1	EMC Corporation, "Information Storage and Management", Wiley, India,2012
2	Jon Tate., Pall Beck., Hector Hugo Ibarra., Shanmuganathan Kumaravel and Libor Miklas, "Introduction to Storage Area Networks", Ninth Edition, IBM - Redbooks, 2017.
REFERENCES:	
1	Hubbert Smith , "Data Center Storage", First Edition, Auerbach Publications, 2019

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	3	-	-	-	1	1	1	3	3	2	-
2	2	1	-	-	3	-	-	-	3	2	3	2	2	3	-
3	2	1	-	-	2	-	-	-	3	1	1	2	2	3	-
4	3	3	2	2	2	-	-	-	1	1	3	1	3	2	-
5	3	2	1	1	2	-	-	-	1	2	3	1	3	2	-
6	3	2	1	1	1	-	-	-	2	2	2	2	2	2	-
Overall Correlation	3	2	1	1	3	-	-	-	2	2	3	2	3	2	-

23IT036	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I	FUNDAMENTALS OF CLOUD SECURITY CONCEPTS	6

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II	SECURITY DESIGN AND ARCHITECTURE FOR CLOUD	6

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies – Data Protection strategies: Data retention, deletion and archiing procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III	ACCESS CONTROL AND IDENTITY MANAGEMENT	6

Access control requirements for Cloud infrastructure - User

Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.		
UNIT IV	**CLOUD SECURITY DESIGN PATTERNS**	**6**
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.		
UNIT V	**MONITORING, AUDITING AND MANAGEMENT**	**6**
Proactive activity monitoring - Incident Response, monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management		
		TOTAL: 30 PERIODS
PRACTICALS EXERCISES:		
LIST OF EXPERIMENTS 1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim 2. Simulate resource management using cloud sim 3. Simulate log forensics using cloud sim 4. Simulate a secure file sharing using a cloud sim 5. Implement data anonymization techniques over the simple dataset (masking, k- anonymization, etc) 6. Implement any encryption algorithm to protect the images 7. Implement any image obfuscation mechanism 8. Implement a role-based access control mechanism in a specific scenario.		

9. Implement an attribute-based access control mechanism based on a particular scenario 10. Develop a log monitoring system with incident management in the cloud	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Utilize the cloud concepts and fundamentals.
CO2:	Explain the security challenges in the cloud.
CO3:	Make use of cloud policy and Identity and Access Management.
CO4:	Experiment with various risks and audit and monitoring mechanisms in the cloud.
CO5:	Analyze the various architectural and considerations for security in the cloud.
CO6:	Illustrate the privacy issues in cloud environment
TEXT BOOKS:	
1	Raj Kumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing", Wiley, 2013.
2	Dave shackleford, "Virtualization Security: Protecting Virtualized Environments", Sybex, 2013.
REFERENCES:	
1	Mark C. Chu-Carroll, "Code in the Cloud", CRC Press, 2011.
2	Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", McGraw-Hill Education, 2013.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	-	1	1	1	3	3	3	-
2	2	1	-	-	1	-	-	-	2	2	3	2	3	3	-
3	3	2	1	1	2	-	-	-	3	1	1	2	2	3	-
4	3	2	1	1	3	-	-	-	3	2	3	3	1	1	-
5	3	3	2	2	1	-	-	-	2	3	3	2	2	3	-
6	2	1	-	-	1	-	-	-	2	3	3	2	2	3	-
Overall Correlation	3	2	1	1	2	-	-	-	3	2	3	3	3	3	-

23IT037	STREAM PROCESSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To Introduce Data Processing terminology, definition & concepts
- To Define different types of Data Processing
- To Explain the concepts of Real-time Data processing
- To Select appropriate structures for designing and running real-time data services in a business environment
- To Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I	FOUNDATIONS OF DATA SYSTEMS	6

Introduction to Data Processing - Stages of Data processing - Data Analytics, Batch Processing - Stream processing - Data Migration - Transactional Data processing, Data Mining - Data Management Strategy - Storage, Processing - Integration - Analytics - Benefits of Data as a Service – Challenges.

UNIT II	REAL-TIME DATA PROCESSING	6

Introduction to Big data - Big data infrastructure - Real-time Analytics - Near real-time solution - Lambda architecture - Kappa Architecture - Stream Processing, Understanding Data Streams - Message Broker - Stream Processor - Batch & Real-time ETL tools - Streaming Data Storage.

UNIT III	DATA MODELS AND QUERY LANGUAGES	6

Relational Model - Document Model - Key-Value Pairs - NoSQL - Object-Relational Mismatch - Many to-One and Many-to-Many Relationships - Network data models, Schema Flexibility - Structured Query Language - Data Locality for Queries - Declarative Queries - Graph Data models - Cypher Query Language - Graph Queries in SQL, The Semantic Web - CODASYL, SPARQL.

UNIT IV	EVENT PROCESSING WITH APACHE KAFKA	6
Apache Kafka - Kafka as Event Streaming platform - Events, Producers - Consumers, Topics - Partitions, Brokers - Kafka APIs - Admin API - Producer API - Consumer API - Kafka Streams API - Kafka Connect API.		
UNIT V	**REAL-TIME PROCESSING USING SPARK STREAMING**	**6**
Structured Streaming - Basic Concepts, Handling Event-time and Late Data - Fault-tolerant Semantics - Exactly-once Semantics - Creating Streaming Datasets - Schema Inference - Partitioning of Streaming datasets - Operations on Streaming Data - Selection, Aggregation - Projection - Watermarking - Window operations - Types of Time windows - Join Operations – Deduplication.		
TOTAL: 30 PERIODS		

PRACTICALS EXERCISES:

1. Install MongoDB
2. Design and Implement Simple application using MongoDB
3. Query the designed system using MongoDB
4. Create a Event Stream with Apache Kafka
5. Create a Real-time Stream processing application using Spark Streaming
6. Build a Micro-batch application
7. Real-time Fraud and Anomaly Detection
8. Real-time personalization, Marketing, Advertising

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply the applicability and utility of different streaming algorithms.
CO2:	Apply current research trends in data-stream processing.
CO3:	Analyze the suitability of stream mining algorithms for data stream systems.

CO4:	Build stream processing systems, services and applications.
CO5:	Solve problems in real-world applications that process data streams.
CO6:	Solve problems in Event Processing with Apache Kafka
TEXT BOOKS:	
1	Karau, Holden, and Matei Zaharia. "Learning Spark: Lightning-Fast Data Analytics." 2nd Edition. O'Reilly Media, 2023.
2	Wampler, Dean, and Jason Decremer. "Programming Scala: Scalability = Functional Programming + Objects." 3rd Edition. O'Reilly Media, 2023.
REFERENCES:	
1	Gualtieri, Mike, et al. "Streaming Data: Understanding the Real-Time Pipeline." 1st Edition. O'Reilly Media, 2023.
2	Shukla, Bhavuk, and Pradeep Pujari. "Stream Processing with Apache Kafka." Apress, 2023.
3	Akidau, Tyler, Slava Chernyak, and Reuven Lax. "Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing." 1st Edition. O'Reilly Media, 2018.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	1	2	1	3	2	2	1	1
2	3	2	1	1	2	-	-	1	1	2	3	1	2	2	1
3	3	3	2	2	3	-	-	1	3	3	1	1	3	2	1
4	3	2	1	1	3	-	-	1	2	3	3	1	1	1	1
5	3	2	1	1	2	-	-	1	1	3	1	2	1	3	1
6	3	2	1	1	1	-	-	1	1	1	1	1	1	1	1
Overall Correlation	3	3	2	2	2	-	-	2	2	2	2	2	2	2	2

23IT038	CLOUD WEB SERVICES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Introduction to cloud computing and Amazon web services.
- Understanding and using EC2 instances.
- Deploying and managing applications on AWS cloud.
- Using AWS security services.
- Implementing the networking concepts on AWS cloud.
- Analyze the requirements for developing and migrating applications to Web and Cloud Services.

UNIT I	INTRODUCTION TO CLOUD COMPUTING AND AMAZON WEB SERVICES	6

Introduction to Cloud Computing - Cloud Service Delivery Models (IAAS, PAAS, SAAS) - Cloud Deployment Models (Private, Public, Hybrid and Community) - Introduction to Amazon Web Services - Why Amazon? Use Cases - AWS Storage Options - AWS Compute Options - AWS Database Options - AWS Workflow Automation and Orchestration Options - AWS Systems Management and Monitoring Options - AWS Virtual Private Cloud Introduction, Pricing Concepts.

UNIT II	INTRODUCTION TO EC2	6

Introduction To EC2 - Instance Types And Uses - Auto scaling Instances - Amazon Machine Images (AMIS) - Modifying Existing Images - Creating New Images of Running Instances - Converting An Instance Store AMI To An EBS AMI - Instances Backed By Storage Types - Elastic IPS - Elastic Load Balancing.

UNIT III	WEB APPLICATIONS AND SECURITY	6

Introduction to Elastic Beanstalk - Deploying Scalable Application On AWS - Selecting And Launching An Application Environment - Provisioning Application Resources with Cloud formation - Introduction to Cloud Lookout - Describe Amazon Cloud Watch metrics and alarms - AWS Messaging Services Introduction to

AWS Security - Describe Amazon Identity and Access Management (IAM) - AWS Directory Service - AWS Key Management Service.		
UNIT IV	**STORAGE**	**6**
Amazon Storage - S3 Storage Basics - Buckets and Objects - Creating A Web Server Using S3 Endpoints - Managing Voluminous Information with EBS - Glacier Storage Service - Describe Amazon Dynamo - Understand key aspects of Amazon RDS - Launch an Amazon RDS instance		
UNIT V	**NETWORKING**	**6**
Introduction to AWS Networking - Access Control Lists (ACLs) - Setting Up a Security Group- Setting Up VPC And Internet Gateway- Setting Up A VPN- Setting Up A Customer Gateway For VPN- Setting Up Dedicated Hardware For VPC-Route53 for DNS System - Cloud front.		
		TOTAL: 30 PERIODS

PRACTICALS EXERCISES:

1. Study of CloudSim, set up CloudSim environment.
2. Virtual Machine (VM) creation, Running VMs on CloudSim.
3. Allocate different Cloudlets to VMs and Data Centers using different Cloud based scheduling algorithms
4. Create different Data Centers, VM allocation and provisioning on Data Centers, and analysis of outcomes
5. Assigning cloudlets and analysing the scheduling parameters for various scenarios
6. Apply and evaluate the performance of various Cloud based Web Services

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain the process of cloud computing and Amazon web services.
CO2:	Summarize the concept of EC2
CO3:	Apply knowledge on Deploying and managing applications

	on AWS
CO4:	Interpret the use of AWS security service
CO5:	Explain the networking concepts on AWS
CO6:	Interpret the migrate applications to Web and Cloud Services.
TEXT BOOKS:	
1	Joe Baron, Hisham Baz , Tim Bixler , Biff Gaut , Kevin E. Kelly , Sean Senior , John Stamper , "AWS Certified Solutions Architect Official Study Guide: Associate Exam, John Wiley and Sons Publications, 2017
2	Cloud Computing: A Hands-On Approach Book by Arshdeep Bahga and Vijay K. Madisetti,CreateSpace Independent Publishing Platform,2013
REFERENCES:	
1	Yohan Wadia , "AWS Certified Solutions Architect Official Study Guide: Associate Exam, John Packt Publishing, 2016
2	Bernald Golden, "Amazon Web Services for Dummies", John Wiley & Sons, 2013

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	2	-	-	2	1	1	1	2	2	2	2
2	2	1	-	-	1	-	-	-	2	1	1	2	2	3	-
3	3	2	1	1	2	1	1	-	1	2	1	3	2	2	-
4	2	1	-	-	2	-	-	-	1	1	2	2	3	3	-
5	2	1	-	-	2	-	-	-	1	1	1	2	2	2	-
6	2	1	-	-	2	-	-	-	1	1	1	2	2	2	-
Overall Correlation	3	**2**	1	1	2	1	1	1	2	2	2	2	2	2	-

VERTICAL 2: FULL STACK DEVELOPMENT

23CS031	JAVA FULL STACK DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand and familiarize with JavaScript and NodeJS environments.
- To learn about NoSQL database and basics of MongoDB.
- To acquire knowledge of the ReactJS frontend.
- To acquire knowledge of the ExpressJS backend.
- To acquire knowledge of how to develop and create real time web applications.

UNIT I	INTRODUCTION TO JAVA SCRIPT	6

Introduction to JavaScript- Brief history of NodeJS and its alternatives- Installing and setting up NodeJS environment - Introduction to NPM package manager and registry - Introduction to callbacks and events -File system access and handling streams- Introduction to common utility modules (OS, Path).

UNIT II	INTRODUCTION TO NOSQL DATABASE WITH MONGODB	6

Introduction to NoSQL -Benefits and disadvantages of NoSQL databases -Introduction to MongoDB - Installing and setting up MongoDB environment -Data model design (Embedded and Normalized) -Database manipulation (Create, Drop, Create and Drop Collections) -Document manipulation (Insert, Delete, Update, Query (Limit, Sort, Aggregation)) -Projection Introduction and setting up Mongoose ORM -Handling models and queries with Mongoose.

UNIT III	FRONTEND DEVELOPMENT WITH REACT JS	6

Introduction to ReactJS -Installation and creating a basic React application -Introduction to JSX- Components and props- State and lifecycle -Events and effects -Conditional rendering - Introduction to HTTP requests and fetch -Making HTTP GET and POST requests- Handling data from API.

UNIT IV	BACKEND DEVELOPMENT WITH EXPRESS JS	6
Introduction to ExpressJS- Separating the tasks of frontend and backend -Installing and setting up ExpressJS environment- Introduction to APIs -Routing and URL building -Error handling- Project directory structuring - Handling form data and request data -Handling and serving files -Authentication using session keys- Handling request of multiple methods and their placement (GET, POST, DELETE, PATCH) -Documenting an API.		
UNIT V	**CREATING A FULL STACK WEB APPLICATION**	**6**
React page with input fields -Extracting and validating data from input field(s)- Making a HTTP request with data from input field(s) Using Mongoose with an ExpressJS application -Inserting document with data from HTTP request -Writing, handling URL query parameters and using its values to write queries with Mongoose -Displaying data returned from backend- Handling errors in API requests.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Develop a Life Line – A Health Assistance Web Application 2. Develop Employee Timesheet Management System 3. Build Paytm clone Page 4. Build Portfolio page 5. Creating a simple College website using HTML, CSS, and JS. 6. Develop a Hospital Management System **7.** Develop an Online Banking Application		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain concepts of JavaScript and its environment.	
CO2:	Apply NoSQL databases and develop deeper into it using MongoDB and performing basic database operations in it.	

CO3:	Apply the concepts of JSX and ReactJS to display and manipulate data in a webpage and to make basic HTTP requests and handle them.
CO4:	Compare the roles of frontend and backend, and to work with ExpressJS.
CO5:	Develop complete API and interact with it from the ReactJS frontend.
CO6:	Develop and create real time web applications.

TEXT BOOKS:	
1	Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
2	Bradshaw, Shannon., Brazil, Eoin., Chodorow, MongoDB: The Definitive Guide: United States: O'Reilly Media, 2019.
3	Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015.
4	Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills" APress; 1st ed. Edition (20 November 2018).
REFERENCES:	
1	'Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
2	Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.
3	Nicholas S. Williams, "Professional Java for Web Applications", Wrox Press, 2014.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	3	-	-	1	-	-	-	1	2	3	1
2	3	2	1	1	1	-	-	1	-	-	-	2	3	1	1
3	3	2	1	1	2	-	-	1	-	-	-	2	3	2	1
4	3	2	1	1	2	-	-	1	-	-	-	1	2	2	1
5	3	2	1	1	2	-	-	1	-	-	-	1	3	2	1
6	3	2	1	1	2	-	-	1	-	-	-	1	3	2	1
Overall Correlation	3	3	1	1	2	-	-	1	-	-	-	2	3	2	1

23CS032	MOBILE APP DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the need and characteristics of mobile applications
- To design the right user interface for mobile applications.
- To understand the design issues in the development of mobile applications
- To understand the development procedure for mobile applications forms
- To develop mobile applications using various tools and platform

UNIT I	INTRODUCTION TO ANDROID OS	6

Android: An Open Platform for Mobile Development- Introducing the Open Handset Alliance- Introducing the Development Framework- Developing for Android-Developing for Mobile and Embedded Devices- Android Development Tools-Introducing the Application Manifest File -The Android Application Lifecycle.

UNIT II	BUILDING USER INTERFACE AND INTENT CREATIONS	6

Fundamental Android UI Design- Android User Interface Fundamentals- Introducing Layouts- The Android Widget Toolbox- Introducing Intents- Creating Intent Filters and Broadcast Receivers- Using Internet Services-Connecting to Google App Engine.

UNIT III	DATABASES AND CONTENT PROVIDERS	6

Introduction on SQLite- Working with SQLite Databases- Creating Content Providers Native Android Content Providers- Introducing Services -Using Background Threads- Using Alarms- Creating and Using Menus and Action Bar Action Items.

UNIT IV	LOCATION-BASED SERVICES AND WIRELESS SERVICES	6
Using Location-Based Services-Using the Emulator with Location-Based Services-Selecting a Location Provider- Finding Your Current Location- Using Bluetooth-Managing Network and Internet Connectivity- Managing Wi-Fi.		
UNIT V	**TELEPHONY AND SMS, PUBLISHING APPLICATIONS**	**6**
Using Telephony - Introducing SMS and MMS - Distributing Applications-Introducing the Google Play - Getting Started with Google Play-Publishing Applications.		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Develop an application using Android development environment
CO2:	Develop mobile application development frameworks and tools
CO3:	Build a mobile application that manages Database operations
CO4:	Develop location based services and wireless environments
CO5:	Develop Telephony Applications for introducing SMS and MMS
CO6:	Develop applications based on Android OS
TEXT BOOKS:	
1	Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
REFERENCES:	
1	Reto Meier, "Professional Android 4 Application Development", Wiley, First Edition, 2012
2	Zigurd Mednieks, Laird Dornin, G. Blake Mike, Masumi Nakamura, "Programming Android", O'Reilly, 2ndEdition, 2012.
3	Alasdair Allan, "iPhone Programming", O'Reilly, First Edition, 2010.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	-	-		1	3	2	1
2	3	2	1	1	2	1	-	1	1	-	1	1	3	2	1
3	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
4	3	2	1	1	2	1	-	1	-	1	1	1	3	2	1
5	3	2	1	1	2		-	1	-	-	-	1	3	2	1
6	3	2	1	1	2	1	-	1	1	-	1	1	3	2	1
Overall Correlation	3	3	1	1	2	1	-	1	1	-	1	1	3	2	1

23CS033	UI AND UX DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX.
- To understand the need for UI and UX.
- To understand the various Research Methods used in Design.
- To explore the various Tools used in UI & UX.
- To create a wireframe and prototype.

UNIT I	FOUNDATIONS OF DESIGN	6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II	FOUNDATIONS OF UI DESIGN	6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

UNIT III	FOUNDATIONS OF UX DESIGN	6

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV	WIREFRAMING, PROTOTYPING AND TESTING	6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V	RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE	6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Designing a Responsive layout for an societal application
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wireflow diagram for application using open source software
5. Exploring various open source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Brainstorming feature for proposed product
8. Defining the Look and Feel of the new Project
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
10. Identify a customer problem to solve.
11. Conduct end-to-end user research - User research, creating personas, Ideation Process (User stories, Scenarios), Flow diagrams, Flow Mapping.
12. Sketch, design with popular tool and build a prototype and perform usability testing and Identify improvements.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Build UI for user Applications.
CO2:	Apply UX design in any product or application.
CO3:	Apply UX Skills in product development.

CO4:	Apply Sketching principles.
CO5:	Develop Wireframe and Wireflows.
CO6:	Develop Prototype Testing for High-Fidelity Mockups.
TEXT BOOKS:	
1	Joel Marsh, "UX for Beginners", O'Reilly, 2022 Edition
2	Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly,2020.
REFERENCES:	
1	Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition, O'Reilly 2020.
2	Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3	Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015
4	Jenifer Tidwell, Charles Brewer, and Aynne Valencia, "Designing Interfaces: Patterns for Effective Interaction Design" O'Reilly Media ,2020.
5	https://www.nngroup.com/articles/
6	https://www.interaction-design.org/literature.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	1	3	3	2	1	3	1	1
2	3	2	1	1	2	-	-	1	1	2	2	2	3	2	1
3	3	2	1	1	2	-	-	-	2	3	1	2	3	2	1
4	3	2	1	1	1	-	-	1	3	2	1	3	3	1	1
5	3	2	1	1	1	-	-	1	2	1	1	1	3	1	1
6	3	2	1	1	1	-	-	1	2	1	1	1	3	1	1
Overall Correlation	3	2	1	1	2	-	-	1	3	2	2	2	3	2	1

23CS034	MERN STACK WEB DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand MERN stack architecture
- To enrich the knowledge of different JavaScript libraries and frameworks
- To understand how Javascript libraries can be used in front end and backend process
- To understand NoSQL databases
- To build web applications using MERN Stack

UNIT I	INTRODUCTION TO MERN STACK	6

MERN Stack Overview, Modular Architecture, MERN support for modular architecture- Component-Based Frontend Development- Modular Server-Side Development - Separation of Concerns- Dependency Management- Testing and Deployment, Benefits/Features of Using Modular Architecture in MERN App.

UNIT II	JAVA SCRIPT AND ECMA SCRIPT	6

JavaScript Fundamentals, Grammar and types, Control flow and error handling, Loops, Function, Objects, Arrays, Promises,ES6 Let and const, Template literals, Arrow Function, Default parameter, Async Await.

UNIT III	BACKEND DEVELOPMENT USING Node.js AND Express.js with MONGO DB	6

Node.js overview, Node.js - basics and setup, Node.js console, Node.js command utilities,Node.js modules, concepts,Node.js events, database access ,Node.js with Express.js, Express.js Request/Response,Express.js Get, Express.js Post,Express.js Routing, Express.js Cookies,Express.js File Upload, Middleware,Express.js Scaffolding, Template, Migration of data into MongoDB, MongoDB with Node.js, Services offered by MongoDB.

UNIT IV	FRONTEND DEVELOPMENT with ReactJS	6
Introduction to React: Components, Props, and State, JSX Syntax, Functional Components vs. Class Components; Advanced React Concepts: React Hooks: useState, useEffect, useContext. Component Lifecycle and State Management, Forms and Controlled Components, React Router and Single Page Applications (SPA): Setting up React Router for Navigation, Building a Single Page Application with Multiple Routes.		
UNIT V	**CREATING A WEB APPLICATION USING MERN STACK**	**6**
Integrating Frontend and Backend, State Management with Redux, Deployment of Apps, Authentication and Security, WebSocket and Real-Time Applications, Performance Optimization.		
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Create a simple calculator application using React.js
2. Create a simple login form using React.js
3. Write a node.js program to replace strings using Regular expression.
4. Create http server interacting with client using Node.js
5. Perform CRUD operations using MongoDB
6. Build migration of data using MongoDB
7. Create a REST backend API Using Express
8. Build an web application using React, Node, Express and MongoDB.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply the basic components of MERN stack architecture.
CO2:	Apply the basic fundamentals of javascript and ECMA Script.
CO3:	Build robust server-side applications with Node.js and Express.js.

CO4:	Build and interacting with MongoDB databases.
CO5:	Construct dynamic and responsive user interfaces using React.js.
CO6:	Develop a full stack application using MERN stack.
TEXT BOOKS:	
1	Nabendu Biswas ,"Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS ", Orange Education ,2023
2	Herbert Schildt, "The Complete Reference-Java", Tata Mcgraw- Hill Edition, Eighth Edition, 2014.
REFERENCES:	
1	Adam Freeman," Mastering Node.js Web Development: Go on a comprehensive journey from the fundamentals to advanced web development with Node.js", Packt Publishing, 2024.
2	Greg Lim ," Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App", Kindle Edition, 2021.
3	Shama Hogue," Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js",second edition , Packt Publishing2020.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	-	-	1	-	-	1	2	3	-	1
2	3	2	1	1	-	-	-	1	-	-	1	2	3	-	1
3	3	2	1	1	3	-	-	1	-	-	1	2	3	3	1
4	3	2	1	1	3	-	-	1	-	-	1	2	3	3	1
5	3	2	1	1	3	-	-	1	-	-	1	2	3	3	1
6	3	2	1	1	3	-	-	1	-	-	1	2	3	3	1
Overall Correlation	3	2	1	1	3	-	-	1	-	-	1	2	3	3	1

23CS035	DEVOPS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- To illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I	INTRODUCTION TO DEVOPS	6

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II	COMPILE AND BUILD USING MAVEN & GRADLE	6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build usingGradle

UNIT III	CONTINUOUS INTEGRATION USING JENKINS	6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV	**CONFIGURATION MANAGEMENT USING ANSIBLE**	**6**
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible		
UNIT V	**BUILDING DEVOPS PIPELINES USING AZURE**	**6**
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Builda sample code, Modify azure-pipelines.yaml file.		
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Create Maven Build pipeline in Azure.
2. Run regression tests using Maven Build pipeline in Azure.
3. Install Jenkins in Cloud.
4. Create CI pipeline using Jenkins.
5. Create a CD pipeline in Jenkins and deploy in Cloud.
6. Create an Ansible playbook for a simple web application infrastructure.
7. Build a simple application using Gradle.
8. Build Devops Pipelines using Azure.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain different actions performed through Version control tools like Git.
CO2:	Apply Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
CO3:	Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO4:	Develop Pipeline in Jenkins and deploy in cloud.
CO5:	Apply Automated Continuous Deployment.
CO6:	Construct configuration management using Ansible.

TEXT BOOKS:

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

REFERENCES:

1	Mitesh Soni ,"Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure", BPB Publications, 2020
2	Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", Midwestern Mac, LLCFirst Edition, 2015.
3	David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Createspace Independent PubSecond Edition, 2016.
4	https://www.jenkins.io/user-handbook.pdf

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
3	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
4	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
5	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
6	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
Overall Correlation	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2

23CS036	WEB APPLICATION SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

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

UNIT I	FUNDAMENTALS OF WEB APPLICATION SECURITY	6

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

UNIT II	SECURE DEVELOPMENT AND DEPLOYMENT	6

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

UNIT III	SECURE API DEVELOPMENT	6

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

UNIT IV	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	6

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

UNIT V	HACKING TECHNIQUES AND TOOLS	6

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

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Install wireshark and explore the various protocols
   a) Analyze the difference between HTTP vs HTTPS
   b) Analyze the various security mechanisms embedded with different protocols.
2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation
   a) GET
   b) PUSH
   c) POST
   d) DELETE
4. Install Burp Suite to do following vulnerabilities:
   a) SQL injection
   b) cross-site scripting (XSS)
5. Attack the website using Social Engineering method

	TOTAL: 30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basic concepts of web application security and the need for it.
CO2:	Identify the process for secure development and deployment of web applications.
CO3:	Develop the skill to design and develop Secure Web Applications that use Secure APIs.
CO4:	Apply vulnerability assessment and penetration testing.
CO5:	Develop the skill to think like a hacker.
CO6:	Apply hachers tool like Comodo, OpenVAS, Nexpose.
TEXT BOOKS:	
1	Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc
2	Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3	Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.
REFERENCES:	
1	Michael Cross, "Developer's Guide to Web Application Security", Syngress Publishing, Inc., 2007.
2	Ravi Das and Greg Johnson, "Testing and Securing Web Applications", Taylor & Francis Group, LLC, 2021,
3	Prabath Siriwardena," Advanced API Security", Apress Media LLC, USA, 2020.
4	Malcom McDonald, "Web Security for Developers", No Starch Press, Inc, 2020,

5	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams "Grey Hat Hacking: The Ethical Hacker's Handbook", The McGraw-Hill Companies,Third Edition, 2011,

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-		-	-	-	-	-	-	2	-	-
2	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
3	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
5	3	2	1	1	1	-	-	1	-	1	-	-	3	1	1
6	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
Overall Correlation	3	2	1	1	2	-	-	1	-	1	-	1	3	2	1

23CS037	ADVANCED JAVA PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the advanced concepts in J2SE.
- To understand server side programming using Servlet.
- To learn the Java server pages and implementation.
- To understand the Model View Controller Architecture.
- To learn to develop web-based applications using struts hibernate Frameworks.

UNIT I	INTRODUCING JAVA ENTERPRISE EDITION	6

Enterprise Java, Basic Application Structure, Using Web Containers, Creating Servlets, Configuring Servlets, Understanding HTTP methods, Using Parameters and Accepting Form Submissions, Using Init parameters, File Uploading, JDBC.

UNIT II	JAVA SERVER PAGES	6

Creating JSPs, Using Java within JSP, Combining Servlets and JSPs, maintaining State using Sessions, JSP Custom Tag Library, Integrating Servlets and JSP: Model View Controller Architecture.

UNIT III	STRUTS FRAMEWORK	6

Introduction to Struts – Building a Simple Struts Application – Understanding Model, View and Controller Layer- Overview of Tiles.

UNIT IV	JAVA SERVER FACES (JSF)	6

Introduction to Java Server Faces (JSF)- JSF Application Architecture – Building a simple JSF Application – JSF Request Processing Lifecycle – The Facelets View Declaration Language – User Interface Component Model- JSF Event Model.

UNIT V	SPRING FRAMEWORK AND HIBERNATE	6

MVC pattern for Web Applications, Spring Framework, Understanding Application Context, Bootstrapping Spring

framework, Configuring Spring framework, Data Persistence, Object/relational Mapping, Hibernate ORM, Mapping Entities to Tables.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Deploy a basic web application on a web container like Apache Tomcat.
2. Develop a servlet to handle file uploads.
3. Implement a simple application combining servlets and JSPs.
4. Implement session management in JSP.
5. Develop a simple form-based application using Struts.
6. Develop JSP pages as the view layer in Struts.
7. Develop a simple form-based application using JSF.
8. Develop JSF views using Facelets.
9. Implement the MVC pattern using Spring MVC.
10. Implement database operations using spring and Hibernate.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Apply the advanced Java concepts to solve complex problems.
CO2:	Develop server side programs using Servlets and JSP.
CO3:	Develop an application using Java Server Faces and Struts Framework.
CO4:	Apply cutting-edge frameworks in web application development.
CO5:	Develop a web application using Hibernates.
CO6:	Develop a web application using Spring framework.

TEXT BOOKS:	
1	Anil Hemrajani, "Agile Java Development with Spring, Hibernate and Eclipse", Sams Publishing, 2006.
2	Herbert Schildt, "The Complete Reference-Java", Tata Mcgraw- Hill Edition, 2022.
REFERENCES:	
1	Christian Bauer, Gavin King, Gary Gregory, "Java Persistence with Hibernate", Manning Publications, 2015.
2	Craig Walls, "Spring in Action", Manning Publications, 2014.
3	Ed Burns, Chris Schalk, "JavaServer Faces 2.0, The Complete Reference", McGraw-Hill Publishers, 2010.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	-	-	1	-	-	-	1	3	2	1
2	3	2	1	1	2	-	-	1	1	-	-	1	3	2	1
3	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
4	3	2	1	1	2		-	1	1	-	-	1	3	2	1
5	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
6	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
Overall Correlation	3	3	1	1	3	1	-	1	1	1	1	1	3	3	1

23CS038	PYTHON FULL STACK DEVELOPMENT WITH MACHINE LEARNING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn foundational backend development concepts using Python's Flask for API development
- To integrate advanced backend features to ensure secure, efficient, and scalable APIs.
- To build and train machine learning models using Scikit-Learn, focusing on data preprocessing, model evaluation, and tuning
- To integrate machine learning models within backend APIs to enable real-time predictions
- To deploy machine learning applications on Render with CI/CD pipelines and monitoring for production stability

UNIT I	PYTHON FOR BACKEND DEVELOPMENT	6

Backend Fundamentals and REST API Concepts – RESTful architecture, HTTP methods (GET, POST, PUT, DELETE), resource-based endpoint design, best practices for REST API design; **Flask Essentials –** Setting up Flask, routing and request handling, working with JSON, custom error handling; **Building CRUD APIs:** Implementing create, read, update, and delete operations using Flask-Introduction to database interactions using SQLite or in-memory data handling for testing.

UNIT II	ADVANCED BACKEND TECHNIQUES	6

API Security and Authentication – JWT authentication, Flask-JWT-Extended, role based access control;
Data Processing and Serialization – Handling large datasets in FLASK, using JSON and XML data serialization formats;
Implementing Caching and Redis– Introduction to Redis, Flask-

Redis integration, managing cache expiry and invalidation.		
UNIT III	**MACHINE LEARNING FUNDAMENTALS**	**6**
Types of Machine Learning – Supervised, unsupervised, and reinforcement learning, Supervised Learning Models; **Data Preprocessing and Feature Engineering–** Data cleaning techniques, Scaling and Normalization, Feature Selection and Engineering; **Building Machine Learning Models –** Linear regression and decision trees, Random Forest and SVM; **Model Evaluation and Optimization –** Metrics for evaluation, cross-validation techniques, hyperparameter tuning.		
UNIT IV	**MACHINE LEARNING MODEL INTEGRATION**	**6**
Exposing ML Models through APIs - Creating prediction endpoints in Flask, Formatting input data for predictions and handling JSON requests; **Data Processing for Model Inference -** Data Formatting and Validation , Batch Processing for Efficiency: **Optimizing and Scaling Model Serving-** Techniques for faster inference, asynchronous processing for handling large volumes of requests; **Monitoring and Logging Predictions** - Logging incoming prediction requests and analyzing data distribution, Health Checks and Error Tracking.		
UNIT V	**DEPLOYMENT AND PRODUCTION READINESS**	**6**
Render Deployment Essentials– Setting up a Render account and deploying Flask applications, Environment Configuration; **Preparing ML Models for Deployment**- Packaging models and dependencies for production, Creating Docker containers for scalable deployments; **CI/CD with GitHub Actions -** Setting up GitHub Actions for automated builds and deployments,		

Monitoring and Logging for Production APIs- Real-time Logging, Error Handling and Alerting.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Basic CRUD API Creation: Develop a CRUD API for managing a library of books with operations for adding, viewing, editing, and deleting records.
2. Implementing JWT Authentication: Set up JWT authentication to secure the library API.
3. Using Redis Caching: Add Redis caching to cache frequently accessed endpoints, such as the "View All Books" endpoint
4. Data Cleaning and Feature Engineering: Clean a housing dataset and create engineered features to improve predictive performance.
5. Model Building and Evaluation: Train a classification model using a dataset, evaluating it with accuracy and F1 score metrics.
6. Model Prediction API: Develop a Flask API to serve predictions from a trained ML model.
7. Prediction Logging: Set up basic logging to track incoming requests and analyze prediction patterns.
8. Deploying Flask API on Render: Deploy a Flask-based API on Render, including environment configuration and monitoring setup.
9. CI/CD Setup with GitHub Actions: Automate deployment of the API with CI/CD, ensuring consistent updates on each code commit

Mini Projects

1. Book Recommendation API: Build an API using Flask that

provides book recommendations based on genre and author. Integrate data validation to ensure API requests have the required fields.

2. User Profile API with JWT and Redis: Create a Flask API where users can view and update their profiles. Implement JWT-based authentication and use Redis to cache user data for improved performance.
3. Movie Rating Predictor: Develop a regression model to predict user ratings for movies based on genre, director, and other features. Tune the model using cross-validation to optimize accuracy.
4. Spam Detection API: Develop an API using a pre-trained spam detection model to classify messages. Implement logging to track prediction accuracy over time.
5. Sentiment Analysis API with CI/CD on Render: Develop and deploy a sentiment analysis API, set up CI/CD on Render to automate redeployment, and implement monitoring.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Design and implement RESTful APIs using Python and Flask framework.
CO2:	Apply authentication, authorization, and caching mechanisms to secure and optimize backend applications.
CO3:	Preprocess data and build machine learning models using Scikit-Learn for regression and classification tasks.
CO4:	Integrate trained machine learning models into Flask APIs for real-time prediction and analysis.
CO5:	Monitor and log backend systems to ensure robustness and performance in API services.

CO6:	Deploy full-stack machine learning applications using Render and GitHub Actions with CI/CD practices
TEXT BOOKS:	
1	Miguel Grinberg, Flask Web Development, 2nd Edition, O'Reilly Media, 2018.
2	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly, 2019.
3	Sebastian Raschka, Python Machine Learning, 3rd Edition, Packt Publishing, 2019.
REFERENCES:	
1	Mark Bates, Programming Flask, Pragmatic Bookshelf, 2022.
2	Jason Brownlee, Machine Learning Mastery With Scikit-Learn, 2021.
3	GitHub Docs: https://docs.github.com/
4	Flask Docs: https://flask.palletsprojects.com/
5	Render Docs: https://render.com/docs

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-		-	-	-	-	-	-	2	-	-
2	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
3	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
4	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
6	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
Overall Correlation	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1

VERTICAL 3: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

23AD040	NATURAL LANGUAGE PROCESSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Explain fundamental tasks in NLP, including syntax, semantics, and pragmatics, along with associated challenges.
- Explore word-level syntax through N-grams, smoothing techniques.
- Explain context-free grammars and parsing techniques.
- Demonstrate linguistic meaning using first-order predicate calculus, syntax-driven semantic analysis, word sense disambiguation.
- Examine language generation frameworks and machine translation approaches.
- Analyze discourse structures, reference resolution, and the architecture of conversational agents for effective natural language communication.

UNIT I	OVERVIEW AND MORPHOLOGY	6

Introduction – Models -and Algorithms - -Regular Expressions Basic Regular Expression Patterns – Finite State Automata Understand the wireless sensor network principles. Morphology - Inflectional Morphology - Derivational Morphology. Finite-State Morphological Parsing -- Porter Stemmer.

UNIT II	WORD LEVEL AND SYNTACTIC ANALYSIS	6

N-grams Models of Syntax - Counting Words - Unsmoothed N-grams. Smoothing- Back-off Deleted Interpolation – Entropy - English Word Classes - Tag sets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging.

UNIT III	CONTEXT FREE GRAMMARS	6
Context Free Grammars for English Syntax- Context-Free Rules and Trees -Understand the network simulation tools. Sentence-Level Constructions–Agreement – Sub Categorization, Parsing – Top-down – Early Parsing -feature Structures – Probabilistic Context-Free Grammars.		
UNIT IV	**SEMANTIC ANALYSIS**	**6**
Representing Meaning-Meaning Structure of Language-First Order Predicate Calculus Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis - Semantic Attachments -Syntax-Driven Analyzer. Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval.		
UNIT V	**LANGUAGE GENERATION AND DISCOURSE ANALYSIS**	**6**
Discourse -Reference Resolution - Text Coherence -Discourse Structure – Coherence. Dialog and Conversational Agents - Dialog Acts – Interpretation -Conversational Agents. Language Generation–Architecture-Surface Realizations - Discourse Planning. Machine Translation -Transfer Metaphor– Interlingua – Statistical Approaches		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Implement basic text preprocessing steps such as tokenization, lowercasing, removing punctuation and stop word removal. 2. Build an N-gram language model using a text corpus, calculate probabilities, and generate text. 3. Use regular expressions to find patterns in text, such as identifying dates, phone numbers, or specific words.		

4. Implement part-of-speech tagging on a text corpus using NLTK's pre-trained POS tagger. 5. Perform word sense disambiguation using WordNet to identify the correct meaning of ambiguous words. 6. Implement syntactic parsing using a context-free grammar and visualize the resulting parse tree. 7. Use a pre-trained NER model to identify and classify named entities like names, locations, and dates in text. 8. Implement a basic morphological parser to analyze word structures and identify morphemes, including prefixes, suffixes, and roots. 9. Build a simple sentiment analysis model to classify text as positive, negative, or neutral using a predefined dataset and basic machine learning techniques.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Outline the internal structure of a word of the natural language.
CO2:	Apply N-grams rules to identify word patterns.
CO3:	Explain the context free grammar.
CO4:	Compare and contrast the meaning of the word.
CO5:	Utilize syntax driven semantic analysis.
CO6:	Demonstrate automatic machine translation procedure.
TEXT BOOKS:	
1	C. Manning and H. Schutze, Statistical Natural, "Foundations of Language Processing. C", 1st Edition, MIT Press Cambridge, MA:1999
2	Daniel Jurafsky and James H Martin," Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008

REFERENCES:	
1	Bharati A., Sangal R., Chaitanya, "Natural language processing: a Paninian perspective", 1st Edition, PHI, 2000.
2	Siddiqui T., Tiwary U. S. "Natural language processing and Information retrieval", 1st Edition, OUP, 2008.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	1	-	2	-	1	-	1	2	-	2
2	3	2	1	1	1	2	-	3	-	1	-	-	3	1	3
3	2	1	-	-	1	2	-	3	-	1	-	-	2	1	3
4	2	1	-	-	1	2	-	3	-	1	-	-	2	1	3
5	3	2	1	1	-	3	3	3	3	3	3	-	3	-	3
6	2	1	-	-	-	3	3	3	3	2	3	-	2	-	3
Overall Correlation	**3**	**2**	**1**	**1**	**1**	**3**	**1**	**3**	**1**	**2**	**1**	**1**	**3**	**1**	**3**

23AD045	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the core principles of Exploratory Data Analysis (EDA)
- Utilize various EDA tools and techniques to perform descriptive statistics, data transformation, and time series analysis.
- Analyze univariate, bivariate, and multivariate data using appropriate statistical and visualization methods to understand relationships and patterns.
- Implement 2D and 3D data visualization techniques
- Design interactive visualizations for text and document data

UNIT I	THE FUNDAMENTALS OF EXPLORATORY DATA ANALYSIS	6

Overview of EDA – Identifying Data quality – Missing values – Irregular Cardinality – Outliers – handling data Quality - Describing Data, Preparing Data Tables, Understanding Relationships - Identifying and Understanding Groups, Building Models from Data.

UNIT II	EDA TOOLS AND DESCRIPTIVE STATISTICS	6

Significance of EDA - Comparing EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids for EDA - EDA with Personal Email - Data Transformation - Descriptive Statistics - Grouping Datasets Correlation - Time Series Analysis.

UNIT III	UNIVARIATE, BIVARIATE, MULTIVARIATE DATA ANALYSIS	6

Univariate Data Analysis - Bivariate Association - Regression Analysis - Cluster Analysis - Visualization Design Principles – Tables - Univariate Data Visualization -

Bivariate Data Visualization - Multivariate Data Visualization - Visualizing Groups - Dynamic Techniques.		
UNIT IV	**DATA VISUALIZATION (2D / 3D)**	**6**
Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Stylesheets - Three-Dimensional Plots - Geographic Data with Basemap - Visualization with Seaborn.		
UNIT V	**INTERACTIVE DATA VISUALIZATION**	**6**
Text and Document Visualization - Levels of Text Representations -Single Document Visualizations - Document Collection Visualizations- Interaction Concepts and Techniques - Designing Effective Visualizations - Comparing and Evaluating Visualization Techniques - Visualization Systems - Systems based on Data Type - Systems based on Analysis Type - Text Analysis and Visualization - Modern Integrated Visualization Systems.		
		TOTAL: 30 PERIODS
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Generate the data quality report in terms of identifying missing values, irregular cardinality and outliers for an insurance company. 2. Descriptive feature identification for predicting a target feature by visualizing relationships. 3. Data preparation for Exploration using normalization, binning and sampling methods. 4. Design and create data visualizations. 5. Conduct exploratory data analysis using visualization.		

6. Craft visual presentations of data for effective communication. 7. Use knowledge of perception and cognition to evaluate visualization design alternatives. 8. Design and evaluate color palettes for visualization based on principles of perception. 9. Apply data transformations such as aggregation and filtering for visualization. 10. Develop data exploration and visualization for an application - Mini Project	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Illustrate fundamentals of exploratory data analysis and its commonly used techniques.
CO2:	Apply statistical concepts to analyze data and explore the tools used for EDA.
CO3:	Develop multivariate data visualization and analysis.
CO4:	Interpret results of exploratory data analysis using stylesheets
CO5:	Build and Implement visualization techniques in web for applications
CO6:	Apply exploratory data analysis methods using Python.
TEXT BOOKS:	
1	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",1st Edition, Packt Publishing, 2020.
2	Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 1st Edition, December 2016.
REFERENCES:	
1	Thomas Cleff , "Exploratory Data Analysis in Business and Economics", Springer International, 2013.

2	Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.
3	Glenn J. Myatt, Wayne P. Johnson," Making Sense Of Data I", John Wiley & Sons, 2nd Edition, 2014.
4	Claus O. Wilke, "Fundamentals of Data Visualization", 1st Edition, O'reilly publications, 2019
5	Andy Kirk," Data Visualisation: A Handbook for Data Driven Design", Second Edition, Sage Publications Ltd, 2020.
6	Mike Kahn, "Data Exploration and Preparation with BigQuery: A practical guide to cleaning, transforming, and analyzing data for business insights", 1st Edition, Kindle Edition, Packt Publishing, 2023.
7	Dursun Delen, "Predictive Analytics: Data Mining, Machine Learning and Data Science for Practitioners", 1st Edition, Pearson Business Analytics Series, 2021.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	2	1	1	1	-	1	3	2	1	1
2	3	2	1	1	1	2	1	1	1	-	1	3	3	1	1
3	3	2	1	1	1	2	1	1	1	-	1	3	3	1	1
4	2	1	-	-	1	2	1	1	1	-	1	3	2	1	1
5	3	2	1	1	1	2	1	1	1	-	1	3	3	1	1
6	3	2	1	1	1	2	1	1	1	1	1	3	3	1	1
Overall Correlation	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**3**	**3**	**1**	**1**

23AD046	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understanding Fundamental Concepts Knowledge Engineering.
- Develop Logical Reasoning Skills
- Explore Semantic Networks and Ontologies
- Apply Advanced Reasoning Techniques
- Integrate Knowledge Representation with AI Systems

UNIT I	INTRODUCTION	9

Introduction: Definition and Importance, Types of Knowledge: Declarative Knowledge, Procedural Knowledge, Meta-Knowledge, Historical Background: Evolution of Knowledge Representation in AI, Key Concepts: Ontology, Epistemology, and the Role of Logic in Knowledge Representation, Applications: Real-world Examples and Applications in AI Systems.

UNIT II	LOGIC-BASED REPRESENTATION	9

Propositional Logic: Syntax, Semantics, and Inference, First-Order Logic (FOL): Syntax and Semantics, Quantifiers, and Inference Mechanisms, Resolution and Unification: Techniques and Algorithms, Knowledge Bases: Structure, Creation, and Querying, Automated Reasoning: Tools and Techniques for Logical Inference.

UNIT III	SEMANTIC NETWORKS AND FRAMES	9

Semantic Networks: Concepts, Nodes, Arcs, and Types of Relationships, Frame-Based Systems: Definition, Structure, and Examples, Inheritance: Types, Mechanisms, and Issues, Conceptual Graphs: Basics and Usage in Representing Knowledge, Applications: Use Cases in Natural Language Processing and Expert Systems

UNIT IV	ONTOLOGIES AND DESCRIPTION LOGICS	9
Ontologies: Definition, Components, and Development Processes, Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation, Description Logics: Basics, Syntax, Semantics, and Reasoning, Ontology Engineering: Tools, Methodologies, and Best Practices, Case Studies: Real-world Applications and Success Stories.		
UNIT V	**ADVANCE TOPICS IN KNOWLEDGE REPRESENTATION**	**9**
Probabilistic Reasoning: Bayesian Networks and Markov Models, Temporal and Spatial Representation: Methods and Applications, Non-Monotonic Reasoning: Default Logic, Circumscription, and Belief Revision, learning from Knowledge: Integrating Machine Learning with Knowledge Representation, Ethical and Practical Considerations: Challenges, Limitations, and Future Trends in Knowledge Representation in AI		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain Knowledge Representation Techniques.
CO2:	Solve complex AI problems through logical inference.
CO3:	Identify uncertainty in AI systems effectively.
CO4:	Develop Ontologies and represent domain-specific knowledge in AI applications.
CO5:	Construct Knowledge Representation in AI Systems.
CO6:	Apply Ethical and Practical Considerations to develop AI systems.
TEXT BOOKS:	
1	Stuart Russell, Peter Norvig. Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021.

2	John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000
3	Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
4	Michael Genesereth, Nils J. Nilsson. Logical Foundations of Artificial Intelligence. Morgan Kaufmann, 1987.
REFERENCES:	
1	Dean Allemang, James Hendler. Semantic Web for the Working Ontologist, 2nd Edition, Morgan Kaufmann, 2011.
2	Judea Pearl. Probabilistic Reasoning in Intelligent Systems, 2nd Edition, Morgan Kaufmann, 1988.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	1	-	-	-	1	2	-	1
2	3	2	1	1	-	-	-	1	-	-	-	1	3	-	1
3	3	2	1	1	-	-	-	1	-	-	-	1	3	-	1
4	3	2	1	1	-	2	3	1	2	1	1	2	3	-	1
5	3	2	1	1	-	1	-	2	-	-	-	2	3	-	2
6	3	2	1	1	-	1	2	3	-	-	-	2	3	-	3
Overall Correlation	**3**	**2**	**1**	**1**	**-**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**3**	**--**	**2**

23IT039	DATA SCIENCE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION	6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.

UNIT II	DESCRIBING DATA	6

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

UNIT III	DESCRIBING RELATIONSHIPS	6

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

UNIT IV	PYTHON LIBRARIES FOR DATA WRANGLING	6

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

tables.

UNIT V	DATA VISUALIZATION	6

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

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

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

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the data science process
CO2:	Compare different types of data description for data science process
CO3:	Apply knowledge on relationships between data
CO4:	Make use of the Python Libraries for Data Wrangling
CO5:	Apply Visualization Libraries in Python to interpret and explore data
CO6:	Analyze different plots for basic exploratory data analysis
TEXT BOOKS:	
1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3	Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", Second Edition, 2022.
4	Joel Grus, "Data Science From Scratch: First Principles with Python", Second Edition, 2019.
REFERENCES:	
1	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
2	Newell, Allen. "Unified Theories of Cognition." Harvard University Press, 1990.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	2	-	-	1	1	1	1	2	2	2	1
2	2	1	-	-	1	-	-	1	2	1	1	2	2	3	1
3	3	2	1	1	2	1	1	1	1	2	1	3	2	2	1
4	3	2	1	1	2	-	-	2	1	1	2	2	3	3	2
5	3	2	1	1	2	-	-	1	1	1	1	2	2	2	1
6	3	3	2	2	2	-	-	1	1	1	1	2	2	2	1
Overall Correlation	3	2	1	1	2	1	1	2	2	2	2	3	3	3	2

23IT040	DEEP LEARNING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of deep neural networks
- To understand CNN of architectures of deep neural networks
- To understand the concepts of Artificial Neural Networks
- To learn the basics of Data science in Deep learning
- To learn about applications of deep learning in AI and Data Science.

UNIT I	DEEP NETWORKS BASICS	6

Probability Distributions – Gradient based Optimization - Linear Algebra: Scalars -- Vectors -- Matrices and tensors – Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks.

UNIT II	CONVOLUTIONAL NEURAL NETWORKS	6

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers -- Gradient Computation.

UNIT III	DEEP LEARNING ALGORITHMS FOR AI	6

Artificial Neural Networks – Linear Associative Networks – Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks- Autoencoders.

UNIT IV	DATA SCIENCE AND DEEP LEARNING	6

Fundamentals of Data science and responsibilities of a data scientist - life cycle of data science – Data science tools - Data

modeling, and featurization - How to work with data variables and data science tools - How to visualize the data.		
UNIT V	**APPLICATIONS OF DEEP LEARNING**	**6**
Object detection and classification -RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting - building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Design a single unit perceptron for classification of a linearly separable binary dataset without using pre-defined models. Use the Perceptron() from sklearn.

a. Identify the problem with single unit Perceptron. Classify using Or-, And- and Xor-ed data and analyze the result.

2. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. Vary the activation functions used and compare the results.
3. Build a Deep Feed Forward ANN by implementing the Backpropagation algorithm and test the same using appropriate data sets. Use the number of hidden layers >=4.
4. Design and implement an Image classification model to classify a dataset of images using Deep Feed Forward NN. Record the accuracy corresponding to the number of epochs. Use the MNIST, CIFAR-10 datasets.
5. Design and implement a CNN model (with 2 layers of convolutions) to classify multi category image datasets. Record the accuracy corresponding to the number of epochs. Use the MNIST, CIFAR-10 datasets.

6. Design and implement a CNN model (with 4+ layers of convolutions) to classify multi category image datasets. Use the MNIST, Fashion MNIST, CIFAR-10 datasets. Set the No. of Epoch as 5, 10 and 20. Make the necessary changes whenever required. Record the accuracy corresponding to the number of epochs. Record the time required to run the program, using CPU as well as using GPU in Colab.
7. Design and implement a CNN model (with 2+ layers of convolutions) to classify multi category image datasets. Use the concept of padding and Batch Normalization while designing the CNN model. Record the accuracy corresponding to the number of epochs. Use the Fashion MNIST/MNIST/CIFAR10 datasets.
8. Design and implement a CNN model (with 4+ layers of convolutions) to classify multi category image datasets. Use the concept of regularization and dropout while designing the CNN model. Use the Fashion MNIST datasets. Record the Training accuracy and Test accuracy corresponding to the following architectures:
    a. Base Model
    b. Model with L1 Regularization
    c. Model with L2 Regularization
    d. Model with Dropout
    e. Model with both L2 (or L1) and Dropout
9. Use the concept of Data Augmentation to increase the data size from a single image.
10. Design and implement a CNN model to classify CIFAR10 image dataset. Use the concept of Data Augmentation while designing the CNN model. Record the accuracy corresponding to the number of epochs.

	TOTAL: 30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basics in deep neural networks.
CO2:	Apply Convolution Neural Network for image processing.
CO3:	Explain the basics of Artificial Intelligence using deep learning.
CO4:	Apply deep learning algorithms for data science.
CO5:	Apply deep learning algorithms for variety applications.
CO6:	Discuss a real world application using suitable deep neural networks.
TEXT BOOKS:	
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville. "Deep Learning.", MIT Press, 2016.
2	Stone, James. "Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019.
REFERENCES:	
1	Vance, William. "Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science.",2019.
2	Wani, M.A., Raj, B., Luo, F., Dou."Deep Learning Applications.", Volume 3, Springer Publications,2022.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	1	-	-	-	1	2	1	1
2	3	2	1	1	2	-	-	1	1	1	1	1	2	2	1
3	3	2	1	1	1	-	-	1	1	1	1	1	2	1	1
4	3	2	1	1	1	-	-	1	1	1	1	1	2	1	1
5	3	2	1	1	1	-	-	1	1	1	1	1	3	1	1
6	2	1	-	-	2	-	-	1	-	-	-	1	2	2	1
Overall Correlation	3	2	1	1	2	-	-	2	1	1	1	2	3	2	2

23IT041	COGNITIVE SYSTEMS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop a product idea.
- To understand about how Big Data can play vital role in Cognitive Computing.
- To know about the business applications of Cognitive Computing.
- To get into all applications of Cognitive Computing

UNIT I	FOUNDATION OF COGNITIVE COMPUTING	6

Foundation of Cognitive Computing: cognitive computing as a new generation - the uses of cognitive systems - system cognitive - understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system - building the corpus - bringing data into cognitive system - machine learning - hypotheses generation and scoring - presentation and visualization services.

UNIT II	NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS	6

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web - Applying Natural language technologies to Business problems - Representing knowledge in Taxonomies and Ontologies: Representing knowledge - Defining Taxonomies and Ontologies - knowledge representation - models for knowledge representation - implementation considerations.

UNIT III	BIG DATA AND COGNITIVE COMPUTING	6

Relationship between Big Data and Cognitive Computing: Dealing with human-generated Big data - analytical data warehouses,

Hadoop, data in motion and streaming data - integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing - using advanced analytics to create value - Impact of open source tools on advanced analytics.

UNIT IV	BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING	6

Knowledge meaning to business - Difference with a cognitive systems approach - Meshing data together differently - Using business knowledge to plan for the future - Answering business questions in new ways - Building business specific solutions , Making cognitive computing a reality - Cognitive application changing the market - The process of building a cognitive application: defining the objective and domain - Understanding the intended users and their attributes - questions and exploring insights - Training and testing.

UNIT V	APPLICATION OF COGNITIVE COMPUTING	6

Building a cognitive health care application: Foundations of cognitive computing for healthcare - Building on a foundation of big data analytics - Cognitive applications across the health care eco system - Using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Build a simple cognitive system that can process text input and generate insights. Use Watson's Natural Language Understanding (NLU) API to analyze text data.
2. Create a basic neural network to classify images or text. Experiment with training the model and observe how it learns from data.

3. Set up a Hadoop cluster, upload a large dataset, and perform basic Map Reduce operations to analyze the data. 4. Perform advanced data analysis on a big dataset using Spark. Implement machine learning algorithms to predict trends or classify data. 5. Analyze a case study where cognitive computing disrupted a traditional business model. Discuss the benefits and challenges faced during the implementation 6. Develop a cognitive customer support chatbot that can understand and respond to customer queries using Watson Assistant. 7. Create user personas, define the domain, and design the application interface. 8. Create a cognitive simulation tool that presents medical scenarios to trainees and provides feedback based on data patterns and best practices.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain applications in Cognitive Computing.
CO2:	Implement Natural language API.
CO3:	Develop a Hadoop Cluster to Perform Map Reduce operations.
CO4:	Apply the process of taking a product to market.
CO5:	Build an application involved in cognitive domain.
CO6:	Summarize the foundation of big data analytics.
TEXT BOOKS:	
1	Vijay V Raghavan, Venkat N.Gudivada, VenuGovindaraju, C.R. Rao. "Cognitive Computing: Theory and Applications: (Handbook of Statistics 35).", Elsevier publications, 2016

2	Judith Hurwitz, Marcia Kaufman, Adrian Bowles. "Cognitive Computing and Big Data Analytics.", Wiley Publications, 2015
REFERENCES:	
1	Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences.", The MIT Press, 1999.
2	Noah D. Goodman, Joshua B. Tenenbaum. "Probabilistic Models of Cognition.", The ProbMods Contributors, Second Edition, 2016.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
3	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
4	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
5	3	2	1	1	3	-	-	2	-	-	-	-	3	3	2
6	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**2**

23IT042	BIG DATA ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the fundamental concepts of Big Data.
- Apply MapReduce algorithms to distributed file systems
- Explore various Big Data technologies and understand workflow management
- Implement streaming analytics techniques for processing and analyzing stream data
- Analyze recommender systems and social network mining techniques

UNIT I	INTRODUCTION TO BIG DATA	6

Introduction to Big Data - Need for processing Big Data – Need for analytics- Characteristics of big data, Domain-specific examples of big data, Big Data Stack – Introduction to Hadoop – Setting up of Hadoop.

UNIT II	MAPREDUCE AND NEW SOFTWARE STACK	6

Distributed File System – MapReduce, algorithms using MapReduce - Extensions to MapReduce – Communication-cost model – Complexity Theory for MapReduce -Overview of Spark.

UNIT III	BIG-DATA TECHNOLOGY OVERVIEW	6

Big Data Collection Systems – Apache Flume – Big data Storage – HDFS Systems – Pig and Hadoop – Grunt – Data Model – pig Latin – Hive Overview – Hive QL – Overview of HBase - Overview of Workflow – Workflow and Scheduling using Apache Oozie - Introduction to NoSQL Databases – Basics of MongoDB.

UNIT IV	STREAMING ANALYTICS AND LINK ANALYSIS	6

Introduction to Stream analytics – Stream data model – Sampling Data – filtering streams – Count distinct elements in a stream,

Counting ones, Estimating moments – Decaying windows – Link Analysis – PageRank Computation – Market Basket model – Limited pass algorithms for Frequent Item sets.		
UNIT V	**RECOMMENDER SYSTEMS AND SOCIAL NETWORK MINING**	**6**
Advertising on the Web – Online Algorithms – Matching problem – Adwords problem and Implementation – recommendation systems – Collaborative filtering – Dimensionality reduction – Mining Social Network graphs – Clustering of social network graphs – Partitioning of graphs – Simrank – Counting Triangles – Neighborhoods properties of Graphs.		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Study : Installation and Setting up Hadoop
2. Write a map reduce program to compute and measure the runtime and study its scaling behaviour for the following:
    a. Compute descriptive statistics such as mean, median, mode, standard deviation from a large dataset.
    b. Compute box-plots and histograms of all the numerical variables in a large multi -variate dataset.
    c. Compute correlation metrics between pairs of all the numerical variables in a large multi - variate dataset.
    d. Perform clustering of a large multi-variate dataset.
    e. Perform classification of a large multi-variate dataset into two or more classes.
3. Write a spark program to compute and measure the runtime and study its scaling behaviour for the following:

a. Box-plots and histograms of all the numerical variables in a large dataset. b. Perform classification in a large dataset. c. Perform regression in a large dataset. 4. Write, run and debug Map reduce programs a. To analyse and build models from streaming data efficiently using systems like Apache Spark. b. To analyse and build models from non-streaming data efficiently using systems like Apache Spark. 5. Use graph dataset and perform the following: a. Perform basic analysis such as calculating node degree centrality, identifying important nodes using between-ness centrality. b. Find communities by using graph clustering.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basics of Big Data.
CO2:	Develop MapReduce program to compute and measure the runtime and
CO3:	Apply HDFS concepts and interfacing with HDFS.
CO4:	Apply Big Data Technology, Tools, and Algorithms.
CO5:	Analyze the stream data and Link analysis.
CO6:	Apply big data in Recommender systems.
TEXT BOOKS:	
1	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Third Edition, Cambridge University Press, New Delhi.2014
2	Arshdeep Bagha and Vijay Madisetti, "Big Data Science & Analytics - A Hands-on Approach", New Delhi, 2016.

REFERENCES:	
1	Sadalage, Pramod J. “NoSQL distilled”, 2013
2	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4	Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5	Alan Gates, "Programming Pig", O'Reilley, 2011.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	1	-	-		-	1				1	2	-	1
2	3	2	1	1	2		-	1	1			1	3	2	1
3	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
4	3	2	1	1	2		-	1	1			1	3	2	1
5	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
6	3	2	1	1	2	1	-	1	1	1	1	1	3	2	1
Overall Correlation	3	3	1	1	3	1	-	1	1	1	1	1	3	3	1

23IT043	DATA MINING AND WAREHOUSING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand data warehouse concepts, architecture, business analysis and tools.
- To understand data pre-processing and data visualization techniques.
- To study algorithms for finding hidden and interesting patterns in data.
- To understand and apply various classification and clustering techniques using tools.
- Apply data mining techniques for real-world problem solving.

UNIT I	BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING	6

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II	DATA MINING INTRODUCTION	6

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques Issues –applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III	DATA MINING - FREQUENT PATTERN ANALYSIS	6

Mining Frequent Patterns, Associations and Correlations – Mining

Methods- Pattern - Evaluation Method –Pattern Mining in Multilevel, Multi-Dimensional Space –Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns - Mining associations in real time data sets using WEKA / R.		
UNIT IV	**CLASSIFICATION**	**6**
Decision Tree Induction - Bayesian Classification – Rule Based Classification Classification by Backpropagation – Support Vector Machines –– Lazy Learners – Model Evaluation and Selection- Techniques to improve Classification Accuracy - Classification of real time data sets using WEKA / R.		
UNIT V	**CLUSTERING**	**6**
Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods – Clustering real time data sets using WEKA/R.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Experiments: Build Data Warehouse and Explore WEKA a. Build a Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration tool, Pentoaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.). b. Identify source tables and populate sample data c. Design multi-dimensional data models namely Star, snowflake and Fact constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, Manufacturing, Automobile, etc.).		

d. Write ETL scripts and implement using data warehouse tools
e. Perform various OLAP operations such slice, dice, roll up, drill up and pivot
f. Explore visualization features of the tool for analysis like identifying trends etc.
g. List the attribute names and they types
h. Number of records in each dataset
i. Identify the class attribute (if any)
j. Plot Histogram
k. Determine the number of records for each class.
l. Visualize the data in various dimensions

2. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
   a. Explore various options available in Weka for preprocessing data and apply (like Discretization Filters, Resample filter, etc.) on each dataset
   b. Load each dataset into Weka and run Aprori algorithm with different support and confidence values. Study the rules generated.
   c. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm.
   d. Study the rules generated. Derive interesting insights and observe the effect of discretization in the rule generation process.
3. Demonstrate performing classification on data sets
   a. Load each dataset into Weka and run Id3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.

b. Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix and derive Accuracy, F-measure, TPrate, FPrate, Precision and Recall values. Apply cross-validation strategy with various fold levels and compare the accuracy results.

4. Demonstrate performing clustering on data sets
   a. Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
   b. Load each dataset into Weka and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
   c. Plot RoC Curves
5. Demonstrate performing Regression on data sets
   a. Load each dataset into Weka and build Linear Regression model. Study the clusters formed. Use Training set option. Interpret the regression model and derive patterns and conclusions from the regression results.
   b. Use options cross-validation and percentage split and repeats running the Linear Regression Model. Observe the results and derive meaningful results.
   c. Explore Simple linear regression technique that only looks at one variable.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Build a Data warehouse system and perform business analysis with OLAP tools.

CO2:	Apply suitable pre-processing and visualization techniques for data analysis.
CO3:	Apply frequent pattern for data analysis.
CO4:	Apply appropriate classification for data analysis.
CO5:	Apply appropriate clustering techniques for data analysis.
CO6:	Apply Data mining techniques for association rule mining techniques
TEXT BOOKS:	
1	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2	Inmon W H, Krishnan K, "Building the Data Lakehouse", Morgan Kaufmann Publishers, Boston, 2023.
REFERENCES:	
1	Tan P N, Steinbach M, Kumar V, "Introduction to Data Mining", Pearson Education, London, 2024.
2	Han J, Kamber M, Pei J, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, San Francisco, 2023.
3	Kimball R, Ross M, "The Data Warehouse Toolkit", John Wiley & Sons, New York, 2023
4	Aggarwal C C, "Data Mining: The Textbook", Springer International, Switzerland, 2022
5	Inmon W H, "Building the Data Warehouse", John Wiley & Sons, New Jersey, 2015

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	2	-	-	1	3	-	-	3	2	1	1
2	3	2	1	1	3	-	-	1	2	-	-	3	2	2	1
3	3	2	1	1	-	-	-	-	-	-	2	3	1	1	-
4	3	2	1	1	-	-	-	1	-	-	-	2	1	3	1
5	3	2	1	1	-	1	-	1	-	-	-	2	2	2	2
6	3	2	1	1	-	2	-	-	-	-	2	2	2	2	-
Overall Correlation	3	2	2	2	1	1	-	1	1	-	2	3	2	2	2

VERTICAL 4: NETWORK & SECURITY

23EC049	NETWORK ESSENTIALS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Concept of network communication
- Importance of standards and protocols in network communications
- Configuration of an integrated wireless router and wireless client to connect securely to the internet.
- Connecting wireless PC clients to a wireless router
- Concept to build a simple computer network using Cisco devices and troubleshoot basic network connectivity issues.

UNIT I	BASICS OF NETWORKING	6

The Fundamentals of Internet Connectivity - PC Basics - Overview of High-Speed and Dialup Connectivity - Web Browsers and Plug-Ins - Networking Terminology - Analogies That Describe Digital Bandwidth.

UNIT II	INTRODUCTION TO NETWORK SIMULATION AND COMMUNICATION	6

Network Simulation using Packet Tracer: Packet Tracer Network Simulator - Networking Models - Network Topologies - Wireless Communications.

UNIT III	INTRODUCTION TO NETWORK ADDRESSING	6

Introduction to TCP/IP: Comparing the OSI Reference Model Layers and the TCP/IP Reference Model Layers, Internet Architecture - IP Addresses: IPv4 Addressing, IP Address Classes, Reserved IP Addresses, Public and Private Addresses, Introduction to Subnetting, IPv4 Versus IPv6 - IP Address Assignment, Acquisition, and Hierarchy: Obtaining an Internet Address, Static Assignment of an IP Address, Address Resolution Protocol, RARP IP Address Assignment

UNIT IV	INTRODUCTION TO TRANSPORT LAYER	6
Transport Layer Services - Understanding the TCP/IP Transport Layer: Flow Control, Session Establishment, Maintenance, and Termination Overview, Three-Way Handshake. Windowing: Acknowledgment, TCP, UDP, TCP and UDP Port Numbers.		
UNIT V	**INTRODUCTION ROUTER TROUBLESHOOTING**	**6**
Introduction to Network Testing - Troubleshooting Router Issues Using the show interface and show interfaces Commands - Troubleshooting Routing Issues Using the show CDP neighbors Command - Troubleshooting Routing Issues Using show IP route and show IP protocol - Troubleshooting Router Connections Using the show controllers serial Command.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Making of cross cable and straight cable. 2. Configuration of switches and routers 3. Creation of different Topologies using switches and Routers for Connecting Computers 4. Transferring data in an established Computer Network using addressing schemes. 5. Creation of a simple Local Area Network. 6. Routing Protocols. 7. Simulation of unicast and multicast routing protocols		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain the Basic concepts of Networking	
CO2:	Illustrate about the various types of cabling used in the networking	
CO3:	Interpret the various addressing scheme used in networking	
CO4:	Explain the basic of Transport Layer	

CO5:	Summarize the basic of Network Security
CO6:	Make use of the configuration to troubleshoot the devices
TEXT BOOKS:	
1	Cisco Networking Academy Program CCNA 1 and 2 Companion Guide, third Edition by CISCO Press
2	Cisco Certified Network Associate Study Guide Seventh Edition, Todd Lammle, SYBEX
REFERENCES:	
1	Beasley, J.S. and Nilkaew, P., 2018. Networking Essentials: A CompTIA Network+ N10-007 Textbook. Pearson IT Certification
2	McMillan, T., 2015. Cisco networking essentials. John Wiley & Sons, 2nd Edition

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
2	2	1	-	1	3	2	1	2	2	2	-	2	3	3	3
3	2	1	-	1	3	2	1	2	2	2	-	2	3	3	3
4	2	1	-	1	3	2	1	2	2	2	-	2	3	3	3
5	2	1	-	1	3	2	1	2	2	2	-	2	3	3	3
6	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3
Overall Correlation	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3

23EC050	NETWORK ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the Network Models and datalink layer functions.
- To understand routing in the Network Layer.
- To explore methods of communication and congestion control by the Transport Layer.
- To study the Network Security Mechanisms.
- To learn various hardware security attacks and their countermeasures.

UNIT I	NETWORKING TODAY	6

Networking – Components, types, Internet Connections, Requirements of a reliable network, Network Components, Network Representations and Topologies, Common Types of Networks, Internet Connections, Reliable Networks, Network Trends, Network Security.

UNIT II	BASIC SWITCH AND END DEVICE CONFIGURATION	6

Cisco IOS Access, IOS Navigation, The Command Structure, Basic Device Configuration, Save Configurations, Ports and Addresses, Configure IP Addressing, Verify Connectivity.

UNIT III	PROTOCOLS AND MODELS	6

The Rules, Protocols, Protocol Suites, Standards Organizations, Reference Models, Data Encapsulation, Data access.

UNIT IV	ETHERNET SWITCHING	6

Ethernet Frames, Ethernet MAC Address, The MAC Address Table, Switch Speeds and Forwarding Methods.

UNIT V	ADDRESS RESOLUTION	6

Introduction, MAC and IP, Packet Tracer—Identify MAC and IP Addresses, ARP, Video—ARP Request, Video—ARP Role in Remote Communications, IPv6 Neighbor Discovery, IPv6 Neighbor Discovery—Address Resolution.

	TOTAL: 30 PERIODS
PRACTICAL EXERCISES:	
LIST OF EXPERIMENTS 1. Basic Switch and End Device Configuration and examine the ARP Table - ILM 2. Create network and assign Static IP address to the host using Supernetting and subnetting. 3. Design a network using VLANs, Wireless LANs and InterVLAN routing. 4. Design a simple firewall for host and network. 5. Configure and troubleshoot redundancy on a switched network using EtherChannel. 6. Simulation of Transport Layer Protocols and analysis of congestion control techniques in network.	
	TOTAL: 30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basic of IOS Commands to configure the devices using CLI
CO2:	Interpret the usage of various transmission medium used in the connectivity
CO3:	Make use of the IP Addressing scheme to implement the VLSM Scheme, Subnetting to interconnect various active ports of routers
CO4:	Summarize the various protocols used in transport layer
CO5:	Interpret the protocols used in the Application Layer.
CO6:	Make use of the security features to configure the devise to enhance the security as well to protect from the threats.
TEXT BOOKS:	
1	Introduction to Networks Companion Guide (CCNAv7), CISCO Press
2	Juniper, 'Distinguished Network Engineering Book SET', Wiley, 2011

REFERENCES:	
1	CCNA 200-301, Volume 1 Official Cert Guide, WENDELL ODOM, CCIE No. 1624 Emeritus, CISCO Press
2	Keshav, 'An Engineering Approach To Computer Networking: ATM Networks, The Internet, And The Telephone Network', Pearson Education, 1997
3	Jason Edelman, Scott S. Lowe, Matt Oswalt, 'Network Programmability and Automation Skills for the Next-Generation Network Engineer', O'Reilly Media, 2018
4	Stallings, 'Computer Networking With Internet Protocols And Technology', Pearson Education, 2003

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
2	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
3	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3
4	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
5	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
6	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3
Overall Correlation	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3

23EC051	SWITCHING, ROUTING, AND WIRELESS ESSENTIALS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Student will understand a switch functionality and able to configure VLANs.
- Students will gain knowledge of dynamic host configuration protocols, understand LAN security concepts.
- Students will study switch security issues and methods to address them. Understand Wireless LAN concepts and providing wireless security.
- Students will study routing concepts and perform static routing configurations.

UNIT I	BASIC DEVICE CONFIGURATION	6

Configure a Switch with Initial Settings, Configure Switch Ports, Secure Remote Access, Basic Router Configuration, Verify Directly Connected Networks.

UNIT II	SWITCHING CONCEPTS	6

Frame Forwarding, Collision and Broadcast Domains, Overview of VLANs, VLANs in a Multi-Switched Environment, VLAN Configuration, VLAN Trunks.

UNIT III	SWITCH SECURITY CONFIGURATION	6

Implement Port Security, Mitigate VLAN Attacks, Mitigate DHCP Attacks, Mitigate ARP Attacks, Mitigate STP Attacks

UNIT IV	ROUTING CONCEPTS	6

Path Determination, Packet Forwarding, IP Routing Table, Static and Dynamic Routing.

UNIT V	WIRELESS LAN	6

Introduction to Wireless, WLAN Components, WLAN Operation, CAPWAP Operation, WLAN Threats, Secure WLANs.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:	
LIST OF EXPERIMENTS 1. Basic Switch and Router Configuration using console mode 2. Configure VLANs and Trunking 3. Implementation of VLANs and Trunking 4. Configure Router-on-a-Stick Inter-VLAN Routing 5. Troubleshoot Inter-VLAN Routing 6. Implement the Inter VLAN Routing	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain how Layer 2 switches forward data
CO2:	Explain how STP enables redundancy in a Layer 2 network.
CO3:	Make use of DHCPv4 to operate across multiple LANs
CO4:	Explain how to configure DTP and native VLAN to mitigate VLAN attacks
CO5:	Summarize the operation of SLAAC.
CO6:	Interpret how a router processes packets when a static route is configured
TEXT BOOKS:	
1	Switching, Routing, and Wireless Essentials v7.0 (SRWE) Companion Guide, Cisco Press
2	James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021
REFERENCES:	
1	CCNA 200-301, Volume 1 Official Cert Guide, WENDELL ODOM, CCIE No. 1624 Emeritus, CISCO Press
2	Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022
3	Wendell Odom, CCNA Routing and Switching 200-125 Official Cert Guide, CISCO press, 1st edition

4	Bruce Hartpence, 'Packet Guide to Routing and Switching', O'Reilly Media, Inc. 2011

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	**-**	**-**	3	2	1	2	2	2	-	2	3	3	3
2	2	1	**-**	**-**	3	2	1	2	2	2	-	2	3	3	3
3	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3
4	2	1	**-**	**-**	3	2	1	2	2	2	-	2	3	3	3
5	2	1	**-**	**-**	3	2	1	2	2	2	-	2	3	3	3
6	2	1	**-**	**-**	3	2	1	2	2	2	-	2	3	3	3
Overall Correlation	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3

23EC052	ENTERPRISE NETWORKING, SECURITY AND AUTOMATION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Work with routers and switches using OSPF in point-to-point and multi-access networks.
- Mitigate threats and enhance network security using access control lists and security
- Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer.
- Understand virtualization, SDN, and how APIs and configuration management tools enable network automation.

UNIT I	SINGLE-AREA OSPFV2	6

OSPF Features and Characteristics- OSPF Packet- OSPF Operations- OSPF Router ID- Point-to-Point OSPF Networks- Multi access OSPF Networks- Modify Single-Area OSPFv2- Default Route Propagation- Verify Single-Area OSPFv2.

UNIT II	NETWORK SECURITY CONCEPTS	6

Current State of Cyber security- Threat Actors- Threat Actors Tool- Malware- Common Network Attacks- IP Vulnerabilities and Threats- TCP and UDP Vulnerabilities- IP Services- Network Security Best Practices- Cryptography.

UNIT III	ACL CONCEPTS	6

Purpose of ACLs- Wildcard Masks in ACLs- Guidelines for ACL Creation- Types of IPv4 ACLs- ACLs for IPv4 Configuration- Configure Standard IPv4 ACLs-Modify IPv4 ACLs- Secure VTY Ports with a Standard IPv4 AC- Configure Extended IPv4 ACLs NAT for IPv4.

UNIT IV	WAN, VPN, IPSEC AND QOS	6

Wan Concepts- Purpose of WANs- VPN Technology- Types of VPNs- IPsec- Network Transmission Quality- Traffic Characteristics- QoS Models.

UNIT V	NETWORK TROUBLESHOOTING AND VIRTUALIZATION	6
Network Documentation- Troubleshooting Process- Troubleshooting Tools- Cloud Computing – Virtualization.		
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Configure Single-Area OSPFv2
2. Explore DNS Traffic
3. Configure and Verify Extended IPv4 ACLs
4. Configure NAT for IPv4
5. Investigate the Broadband distribution and analyse the access options for the Scenarios.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain how single-area OSPF operates in both point-to-point and broadcast multi access networks.
CO2:	Summarize network security concepts with respect to TCP and UDP vulnerabilities
CO3:	Illustrate the ACL and NAT and its types in IPv4
CO4:	Make use of NAT services on the edge router to provide IPv4 address scalability
CO5:	Interpret how VPNs and IPsec secure site-to-site and remote access connectivity
CO6:	Summarize how network automation is enabled through Restful APIs and configuration management tools.

TEXT BOOKS:

1	Enterprise Networking, Security, and Automation Course Booklet (CCNAv7), CISCO Press
2	Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012

REFERENCES:	
1	CCNA 200-301, Volume 1 Official Cert Guide, WENDELL ODOM, CCIE No. 1624 Emeritus, CISCO Press
2	Pallapa Venkataram, Satish Babu, Wireless and Mobile Network Security, First Edition, Tata McGraw Hill, 2010
3	Markus Schumacher, Security Patterns: Integrating Security and Systems Engineering, Wiley Software Pattern Series, 2010
4	Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
2	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
3	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
4	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3
5	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
6	2	1	-	-	3	2	1	2	2	2	-	2	3	3	3
Overall Correlation	3	2	1	1	3	2	1	2	2	2	-	2	3	3	3

23EC053	NETWORK DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To inspire the students to learn the various switching technologies
- To design the networks for various categories
- To introduce the purpose of management of the network systems

UNIT I	SWITCHING TECHNOLOGIES	9

Switching technologies, multiplexing, circuit switching, packet switching X.25, frame relax, SMDs ATM, B-ISDN, traffic matrix, traffic pattern calculations, performance issues of packet networks, delay, availability and reliability.

UNIT II	NETWORK DESIGN FOR ACCESS	9

Network Design for Access: Campus network design, leased line and radio modems, DDR & ISDN Access Network design, X.25 remote access network design, Frame-relay interfaces & traffic shaping VSAT & WLAN network design.

UNIT III	NETWORK DESIGN FOR BACKBONE	9

Network Design for Backbone: Identification & selection of internetworking devices, CISCO routers & Nortel switches, EIGRP.

UNIT IV	NETWORK DESIGN FOR CONVERGENCE	9

Network Design for convergence: UDP broadcasts, IP Networks for Voice, Data, Video, Fax, Soft & hard design examples for IP Technology networks, network design for digital video broadcast.

UNIT V	DATA NETWORK MANAGEMENT SYSTEMS	9

Data Network Management Systems: Managing IP, ICMP, TCP, UDP, X.25 reporting Ethernet traffic, managing bridges & routers. Microsoft & HP, NMS Tools. Case Studies: selected from design, architecture & topology areas of internetworks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the various switching techniques use in the network design
CO2:	Interpret the network design for the access
CO3:	Summarize the network design process employed for the backbone system
CO4:	Explain the process involved in the design process for the convergence networks
CO5:	Interpret the Various data processing tools used in Network Design
CO6:	Explain the various managing schemes used in the Network Design
TEXT BOOKS:	
1	Data Network Design; D L Spolin, Mc-Graw Hill, 1993
2	Network Design & Case Studies "CISCO Systems Inc." CISCO Press, 1993
REFERENCES:	
1	Feit , 'SNMP GDE Networking Management', Mc-Graw Hill Inc., 1995
2	Jeff Doyle, Jennifer Dehaven Carroll 'Routing TCP/IP', CISCO systems, 2001
3	Designing Cisco Network Service Architectures (ARCH) Foundation Learning Guide: (CCDP ARCH 642-874) 3rd Edition
4	Tim Szigeti, Christina Hattingh, Al Gore, 'End-to-End QoS Network Design: Quality of Service in LANs, WANs, and VPNs (Networking Technology)', 1st Edition, Cisco Press

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	1	1	1	3	2	1	2	3	2	2
2	2	1	-	-	2	1	1	2	2	1	3	3	3	2	2
3	2	1	-	-	2	1	1	2	2	3	1	2	3	3	2
4	2	1	-	-	1	3	1	2	3	2	1	1	3	3	2
5	2	1	-	-	2	1	1	3	2	2	1	2	3	2	2
6	2	1	-	-	3	3	1	3	2	3	1	2	3	3	2
Overall Correlation	2	1	-	-	2	2	1	3	3	3	2	2	3	3	2

23CB031	ETHICAL HACKING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I	INTRODUCTION	6

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II	FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS	6

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III	ENUMERATION AND VULNERABILITY ANALYSIS	6

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment

Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded OS.

UNIT IV	SYSTEM HACKING	6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT V	NETWORK PROTECTION SYSTEMS	6

Access Control Lists - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva'sMaltego.
5. Information gathering using tools like Robtex
6. Scan the target using tools like Nessus
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage
    - FOCA : http://www.informatica64.com/foca.aspx.

• Nessus: http://www.tenable.com/products/nessus. • Wireshark : http://www.wireshark.org. • Armitage : http://www.fastandeasyhacking.com. • Kali or Backtrack Linux, Metasploitable, Windows XP	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the basic concepts of computer based vulnerabilities.
CO2:	Make use of the tools for foot printing, reconnaissance and scanning methods.
CO3:	Experiment with the enumeration and vulnerability analysis methods.
CO4:	Explain the hacking options available in Web and wireless applications.
CO5:	Analyze and choose the options for network protection.
CO6:	Make use of tools to perform ethical hacking to expose the vulnerabilities.
TEXT BOOKS:	
1	Simpson, Michael T., Kent Backman, and James E. Corley. "Hands-On Ethical Hacking and Network Defense." Course Technology, Delmar Cengage Learning, 2010.
2	Engebretson, Patrick. "The Basics of Hacking and Penetration Testing." SYNGRESS, Elsevier, 2013.
REFERENCES:	
1	Stuttard, Dafydd, and Marcus Pinto. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws." 2011.
2	Seitz, Justin. "Black Hat Python: Python Programming for Hackers and Pentesters." 2014.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	1	-	-	-	2	1	1	2	2	1	-
2	3	2	1	1	2	-	-	-	3	2	2	2	3	2	-
3	3	2	1	1	2	-	-	-	1	1	1	3	3	2	-
4	2	1	-	-	3	-	-	-	3	2	1	2	2	3	-
5	3	3	2	2	3	-	-	-	3	1	1	1	3	3	-
6	3	2	1	1	2	-	-	-	2	1	1	2	3	2	-
Overall Correlation	3	2	1	1	3	-	-	-	3	2	2	2	3	3	-

23CB034	SECURITY IN COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand security design principles.
- To learn secure programming techniques.
- To know the standard algorithms used to provide confidentiality, integrity and authenticity in web application.
- To understand the security requirements in operating systems.
- To learn about the emerging security applications.

UNIT I	SECURITY DESIGN PRINCIPLES	6

Security Goals – Secure System Design – Understanding Threats – Designing in Security –Convenience and Security – Security in Software Requirements – Security by Obscurity – Secure Design Principles – Defense in Depth – Diversity in Defense – Securing the Weakest Link – Failsafe Stance.

UNIT II	SECURE PROGRAMMING TECHNIQUES	6

Worms and Other Malware – Buffer Overflows – Client State Manipulation – SQL Injection Password Security – Cross Domain Security in Web Applications – Attack Patterns – Preventing XSRF – Preventing XSSI - Preventing XSS.

UNIT III	WEB APPLICATIONS SECURITY	6

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

UNIT IV	SECURITY IN OPERATING SYSTEMS	6

Introduction - Security in the Design of OS – Rootkit- Windows Security – Windows Protection System – Windows Authorization – Windows Security Analysis – Windows Vulnerabilities –

Address Space Layout Randomizations.		
UNIT V	**EMERGING TOPICS IN SECURITY**	**6**
Internet of Things- Medical Devices - Mobile Phones- Security in the Internet of Things-Economics-Making a Business Case - Quantifying Security -Current Research and Future Directions- Electronic Voting Fair Election - Critical Issues - Cyber Warfare - Examples of Cyber Warfare		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack
3. Implement Cross Site Scripting and Prevent XSS.
4. Understanding Malwares working and detection
5. Implement Hacking windows - Windows login password.
6. Implement Hacking windows - Accessing restricted drives.
7. Install wire shark and explore the various protocols
   a. Analyze the difference between HTTP vs HTTPS.
   b. Analyze the various security mechanisms embedded with different protocols.
8. Identify the vulnerabilities using OWASP ZAP tool
9. Installation of rootkits and study about the variety of options

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1:	Explain fundamental security goals and principles in system design.
CO2:	Identify and mitigate risks from malware, including worms and buffer overflows.
CO3:	Develop skills in conducting security audits and managing vulnerabilities in web applications.
CO4:	Apply best practices for password security and cross-domain security in web applications.
CO5:	Develop a secure operating system.

CO6:	Analyze case studies and examples of cyber warfare to understand its impact and strategies.
TEXT BOOKS:	
1	Charles P. Pfleeger, Shari Lawrence P fleeger and Jonathan Margulies, "Security in Computing", Fifth Edition, Pearson Education, 2015.
2	William Stallings, "Cryptography and Network Security: Principles and Practices", Sixth Edition, Pearson Education, 2014.
REFERENCES:	
1	Neil Daswani, Christoph Kern, and Anita Kesavan, "Foundations of Security: What Every Programmer Needs to Know", Frist Edition, A press, 2007.
2	Bruce Schneier, "Applied Cryptography Protocols, Algorithms and Source Code in C", Second Edition, John Wiley and Sons Inc., 2006.
3	Matt Bishop, "Computer Security: Art and Science", First Edition, Addison Wesley, 2002.
4	Georgia Weidman, "Penetration Testing: A Hands-on Introduction to Hacking", 2nd edition, 2014.
5	N. Asokan, Lucas Davi, Alexandra Dmitrienko, Stephan Heuser, Kari Kostianen, Elena Reshetova, Ahmad-Reza Sadeghi, "Mobile Platform Security", First Edition, Morgan and Claypool Publishers Series, 2014.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	-	1	2	2	1	2	-	-
2	3	2	1	1	-	-	-	-	-	2	2	-	3	-	-
3	3	2	1	1	2	-	-	-	1	-	1	2	3	2	-
4	3	2	1	1	2	-	-	-	-	2	2	1	3	2	-
5	3	2	1	1	2	-	-	-	2	2	2	1	3	2	-
6	3	3	2	2	3	-	-	-	2	-	2	2	3	3	-
Overall Correlation	3	2	1	1	2	-	-	-	1	2	2	2	3	2	-

23CS039	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Blockchain
- To learn Different protocols and bitcoin consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT I	INTRODUCTION TO BLOCKCHAIN	6

Blockchain- Public Ledgers-Blockchain as Public Ledgers - Block in a Blockchain, Transactions-The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II	BITCOIN AND CRYPTOCURRENCY	6

A basic crypto currency-Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III	BITCOIN CONSENSUS	6

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,Monopoly Problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV	HYPERLEDGER FABRIC & ETHEREUM	6

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V	BLOCKCHAIN APPLICATIONS	6

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain

Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Demonstrate the emerging abstract models for Blockchain Technology.
CO2:	Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
CO3:	Explain the conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
CO4:	Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
CO5:	Apply transactions and requests against blockchain networks.
CO6:	Develop applications in supply chain management,small cities,banking etc.
TEXT BOOKS:	
1	Bashir and Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing, 2020,
2	Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2015.
REFERENCES:	
1	Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder,"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016.
3	Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4	Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packet Publishing,2018

5	Saravanan Krishnan , Valentina Emilia Balas," Handbook of Research on Blockchain Technology",Elsevier Inc. ISBN: 9780128198162, 2020.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	-	1	-	-	2	2	1	-
2	3	2	1	1	1	-	-	-	2	-	-	2	3	1	-
3	2	1	-	-	2	-	-	-	3	-	-	2	2	2	-
4	3	2	1	1	3	-	-	-	3	-	-	2	3	3	-
5	3	2	1	1	1	-	-	-	3	-	-	2	3	1	-
6	3	2	1	1	1	-	-	-	3	-	-	2	3	1	-
Overall Correlation	3	2	1	1	2	-	-	-	3	-	-	3	3	2	-

VERTICAL 5 : SOFTWARE ENGINEERING

23IT044	SOFTWARE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals of object modeling.
- Learn the unified process phases.
- Prepare the requirements for various case studies.
- Appreciate the idea behind Design Patterns in handling common problems faced during building an application.
- To practice object modeling using UML

UNIT I	INTRODUCTION	9

Introduction to OOAD; typical activities / workflows / disciplines in OOAD, Introduction to iterative development and the Unified Process, Introduction to UML; mapping disciplines to UML artifacts, Introduction to Design Patterns – goals of a good design, Introducing a case study & MVC architecture.

UNIT II	INCEPTION	9

Artifacts in inception, understanding requirements – the FURPS model, Understanding Use case model – introduction, use case types and formats, writing use cases – goals and scope of a use case, elements / sections of a use case, Use case diagrams, Use cases in the UP context and UP artifacts, identifying additional requirements, Writing requirements for the case study in the use case model.

UNIT III	ELABORATION	9

System sequence diagrams for use case model, Domain model: identifying concepts, adding associations, adding attributes, Interaction Diagrams, Introduction to GRASP design Patterns, Design Model: Use case realizations with GRASP patterns, Design Class diagrams in each MVC layer Mapping Design to Code, Design class diagrams for case study and skeleton code.

UNIT IV	DESIGN PATTERNS	9
Fabrication, Indirection, Singleton, Factory, Facade, Publish-Subscribe.		
UNIT V	**UML DIAGRAMS**	**9**
State-Chart diagrams, Activity diagrams, Component Diagrams, Deployment diagrams, Object diagrams. Advanced concepts in OOAD: Use case relationships, Generalizations Domain Model refinements, Architecture, Packaging model elements.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain UML notations Apply UML Use Case Notations to applications.
CO2:	Explain apply unified process in software development
CO3:	Discuss the best use of Object-Oriented concepts for creating truly OOP
CO4:	Describe design patterns for better class and object composition.
CO5:	Explain the concepts of Model refinement and diagrams.
CO6:	Explain Design Patterns in handling common problems.

TEXT BOOKS:	
1	Craig Larman , "Applying UML and patterns" by Pearson, 2005
2	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

REFERENCES:	
1	Martin Fowler, "UML distilled", Addison Wesley, Third Edition 2003.
2	Eric Freeman, "Head-First Design Patterns", O'Reilly, 2004.
3	Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML2 Toolkit " Wiley India Edition, Year 2003.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	1	-	1	-	1	2	-	1
2	3	2	1	1	-	-	-	1	-	1	-	1	3	-	1
3	3	2	1	1	-	-	-	1	-	1	-	1	3	-	1
4	3	2	1	1	-	-	-	1	-	1	-	1	3	-	1
5	3	2	1	1	-	-	-	1	-	1	-	1	3	-	1
6	3	2	1	1	-	-	-	1	-	1	-	1	3	-	1
Overall Correlation	3	2	2	2	-	-	-	2	-	2	-	2	3	-	2

23IT045	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand why the architectural design of software is important
- To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
- To understand the basic notions of a web service, web service standards, and service oriented architecture;
- To understand the different stages of testing from testing during development of a software system

UNIT I	PHASES AND LIFE CYCLE MODELS OF SOFTWARE DEVELOPMENT	9

Software Engineering – importance – emergence - Phases of software development - Feasibility study, Requirement Analysis, Design, Implementation, Testing, and Maintenance phases Software Life Cycle Models - Classical waterfall, Iterative, prototyping, Spiral, and Agile - Compare Life cycle models.

UNIT II	REQUIREMENTS ANALYSIS AND DESIGN	9

Requirement Analysis – Analysis process, Requirements specification, desirable characteristics of an SRS, structure of an SRS document, Data Flow Diagrams - Role of Software Architecture and Architecture Views - Planning for a Software Project Software Design - Software design concepts - Function Oriented Design and its Complexity Metrics - Object Oriented Design and its Complexity Metrics - Detailed Design.

UNIT III	SYSTEM DEPENDABILITY AND SECURITY	9

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability –

Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design.		
UNIT IV	**SOFTWARE PROJECT MANAGEMENT**	**9**
Software Project Management Framework - methods to estimate project time and cost, Resource Management, Identification, Analysis, mitigation, and monitoring of Project Risks - Ensuring Project quality and quality management, Configuration Management, Change management, CMMI, different levels and need of accreditation.		
UNIT V	**SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT**	**9**
Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Identify appropriate process models based on the Project requirements	
CO2:	Understand the importance of having a good Software Architecture.	

CO3:	Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
CO4:	Understand the basic notions of a web service, web service standards, and service-oriented architecture;
CO5:	Be familiar with various levels of Software testing.
CO6:	Understand the importance of having a good Safety Engineering Processes
TEXT BOOKS:	
1	Bob Hughes, Mike Cotterell, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011
2	Adolfo Villafiorita, "Introduction to Software Project Management", CRC Press 2014
REFERENCES:	
1	Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
2	Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
3	Software Architecture In Practice, 3 rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	3	-	-	3	2	2	3	1	1	3	3
2	3	3	2	3	2	-	-	2	2	2	3	3	2	3	2
3	3	3	3	2	3	-	-	2	2	2	1	2	2	3	3
4	2	3	3	3	3	-	-	2	2	2	3	2	3	3	2
5	3	3	3	3	3	-	-	2	3	1	3	2	3	2	3
6	3	3	3	3	3			3	3	1	3	2	3	2	2
Overall Correlation	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**3**	**2**	**3**	**3**	**3**

23IT046	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the guidelines for user interface.
- To learn the foundations of Human Computer Interaction.
- To understand the process of Evaluation of Interaction Design.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCL.

UNIT I	FOUNDATIONS OF HCI	9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies.

UNIT II	DESIGN & SOFTWARE PROCESS	9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III	MODELS AND THEORIES	9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV	MOBILE HCI	9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V	WEB INTERFACE DESIGN	9
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain the basic concepts and foundations of HCI.	
CO2:	Explain interactive design process rules and evaluation techniques.	
CO3:	Develop different cognitive and communication models of HCI.	
CO4:	Explain the ways to produce interactive content on dynamic and static web.	
CO5:	Explain the elements of mobile HCI design, Tools and /architecture.	
CO6:	Explain HCI implications for designing effective web interfaces.	
TEXT BOOKS:		
1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.	
2	Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009.	
REFERENCES:		
1	D. R. Olsen, "Human Computer Interaction", Cengage Learning.	
2	Helen Sharp, Jennifer Preece, Yvonne Rogers, "Interaction Design", Wiley, 2017.	

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	2	-	1	-	1	-	1	2	1	2
2	2	1	-	-	1	2	-	1	-	2	-	1	2	1	2
3	3	2	1	1	1	2	-	1	-	2	-	1	3	1	2
4	2	1	-	-	1	2	-	1	-	2	-	1	2	1	2
5	2	1	-	-	1	2	-	1	-	2	-	1	2	1	2
6	3	2	-	-	2	2	-	2	-	2	-	2	3	2	2
Overall Correlation	3	1	1	1	1	2	-	1	-	2	-	2	2	2	2

23IT047	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basic tenets of software quality and quality factors.
- Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components.
- Understand of how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.

UNIT I	INTRODUCTION TO SOFTWARE QUALITY	9

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall‟s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT II	SQA COMPONENTS AND PROJECT LIFE CYCLE	9

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT III	SOFTWARE QUALITY INFRASTRUCTURE	9

Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software

change control – Configuration management audit - Documentation control – Storage and retrieval.		
UNIT IV	**SOFTWARE QUALITY MANAGEMENT & METRICS**	**9**
Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.		
UNIT V	**STANDARDS, CERTIFICATIONS & ASSESSMENTS**	**9**
Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain concepts in software development life cycle.	
CO2:	Illustrate their capability to adopt quality standards.	
CO3:	Explain the metrics available to measure the quality of software products.	
CO4:	Relate the concepts in preparing the quality plan & documents.	
CO5:	Explain the Use of various testing methods.	
CO6:	Explain the various Quality standards and certifications	
TEXT BOOKS:		
1	Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.	

2	Irappa A. Dhotre, Dr. Sunil Sudam Khatal, Dr. Monika Dhananjay Rokade, Dr. Uday Chandrakant Patkar, "Software Testing and Quality Assurance", Technical Publications, January 2022
REFERENCES:	
1	Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2	Mordechai Ben-Menachem, "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 1997.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	-	-	1	-	1	-	1	2	-	-
2	3	2	1	-	-	-	-	1	-	1	-	1	3	-	-
3	3	2	1	-	-	-	-	1	-	1	-	1	3	-	-
4	3	2	1	-	-	-	-	1	-	1	-	1	3	-	-
5	3	2	1	-	-	-	-	1	-	1	-	1	3	-	-
6	3	2	1	-	-	-	-	1	-	1	-	1	3	-	-
Overall Correlation	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**2**	**3**	**-**	**-**

23IT048	AGILE METHODOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To obtain practical knowledge of agile development frameworks and be able to distinguish between agile and traditional project management methodologies
- To Examine various metrics for adopting agile software engineering
- Describe how a unit tests is executed from beginning to end.
- Identify the approaches, tools and scenarios to introduce Agile to your organization effectively
- To design automated build tools, version control and continuous integration

UNIT I	FUNDAMENTALS OF AGILE	9

The Genesis of Agile- Introduction and background- Agile Manifesto and Principles- Overview of Scrum- Extreme Programming- Feature Driven development- Lean Software Development- Agile project management- Design and development practices in Agile projects- Test Driven Development- Continuous Integration- Refactoring- Pair Programming- Simple Design- User Stories- Agile Testing- Agile Tools.

UNIT II	AGILE SCRUM FRAMEWORK	9

Introduction to Scrum- Project phases- Agile Estimation- Planning game- Product backlog- Sprint backlog- Iteration planning- User story definition- Characteristics and content of user stories- Acceptance tests and Verifying stories Project velocity- Burn down chart- Sprint planning and retrospective- Daily scrum- Scrum roles – Product Owner Scrum Master- Scrum Team- Scrum case study- Tools for Agile project management.

UNIT III	AGILE TESTING	9

The Agile lifecycle and its impact on testing- Test-Driven

Development (TDD)- xUnit framework and tools for TDD Testing user stories - acceptance tests and scenarios- Planning and managing testing cycle- Exploratory testing- Risk based testing- Regression tests- Test Automation- Tools to support the Agile tester		
UNIT IV	**AGILE SOFTWARE DESIGN AND DEVELOPMENT**	**9**
Agile design practices- Role of design Principles including Single Responsibility Principle- Open Closed Principle Liskov Substitution Principle- Interface Segregation Principles- Dependency Inversion Principle in Agile Design- Need and significance of Refactoring- Refactoring Techniques- Continuous Integration- Automated build tools- Version control.		
UNIT V	**INDUSTRY TRENDS**	**9**
Market scenario and adoption of Agile- Agile ALM- Roles in an Agile project- Agile applicability- Agile in Distributed teams- Business benefits- Challenges in Agile- Risks and Mitigation- Agile projects on Cloud- Balancing Agility with Discipline- Agile rapid development technologies.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify the fundamentals of agile and scrum framework.
CO2:	Apply design principles and refactoring to achieve Agility.
CO3:	Reduce the risks in Test driven approach in agile projects
CO4:	Implement a real software project that implements agile execution techniques
CO5:	Deploy a firm basis for adopting agile methodology, regardless of the industry.
CO6:	Deploy a firm basis for adopting agile methodology, regardless of the professional sector.

TEXT BOOKS:	
1	Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", Pearson, 21 Mar2008.
2	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 25 Oct 2002.
REFERENCES:	
1	Alistair Cockburn, "Agile Software Development: The Cooperative Game", Addison Wesley, 19 Oct 2006.
2	Mike Cohn Publisher, "User Stories Applied: For Agile Software", Addison Wesley, 1 Mar2004

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	-	-	1	2	1	3	2	2	1	-
2	3	2	1	1	2	-	-	1	1	2	3	1	2	2	-
3	3	3	2	2	3	-	-	1	3	3	1	1	3	2	-
4	3	2	1	1	3	-	-	1	2	3	3	1	1	1	-
5	3	2	1	1	2	-	-	1	1	3	1	2	1	3	-
6	3	2	1	1	1	-	-	1	1	1	1	1	1	1	-
Overall Correlation	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**-**

23IT049	SOFTWARE REQUIREMENTS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To perform a comprehensive feasibility analysis
- To lead a software project planning process, to include determining deliverables; effort, schedule and cost estimation; resource allocation; risk management; quality and plan management.
- To Apply the principles and processes of software engineering project enactment
- To perform software project reviews and evaluations according to best practices.

UNIT I	SOFTWARE REQUIREMENTS: WHAT AND WHY?	9

Software Engineering – importance – emergence - Phases of software development - Feasibility study, Requirement Analysis, Design, Implementation, Testing, and Maintenance phases Essential Software Requirement- Good practices for requirement engineering- Improving requirements processes- Software Requirements and Risk Management.

UNIT II	SOFTWARE REQUIREMENTS ENGINEERING	9

Requirements elicitation- Requirement analysis documentation, review, elicitation techniques, analysis models, software quality attributes- Risk reduction through prototyping, setting requirements priorities, verifying requirements quality, software requirements modelling- Use case modelling, Analysis model, dataflow diagrams, state transition diagram, class diagram, object analysis, problem frames.

UNIT III	SOFTWARE REQUIREMENTS MANAGEMENT	9

Requirements management principles and practices- Requirement attributes, change management process- Requirement traceability matrix- Links in requirements chain Requirement management

tool, benefits of requirement management tools, commercial requirement management tools- Rational Requisite pro- Caliber-RM, Implementing requirement management automation.		
UNIT IV	**SOFTWARE PROJECT MANAGEMENT**	**9**
Software Project Management Framework - methods to estimate project time and cost, Resource Management, Identification, Analysis, mitigation, and monitoring of Project Risks - Ensuring Project quality and quality management, Configuration Management, Change management, CMMI, different levels and need of accreditation.		
UNIT V	**SOFTWARE ESTIMATION**	**9**
Components of software estimation, software estimation models, Problems associated with estimation, Key project factors that influence estimation- Size estimation- two views of sizing, Function point analysis, Mark II FPA, full function point, LOC estimation, conversions between size measures.- What is productivity, estimation factors, approaches to effort and schedule estimation- COCOMO II, Putnam estimation model- Algorithmic models, cost estimation, software estimation tools, desirable features of software estimation tools- IFPUG, USC's COCOMO II, SLIM (Software Lifecycle Management) tools.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the Knowledge about software requirements.
CO2:	Utilize requirement elicitation techniques and prototyping.
CO3:	Summarize the knowledge about requirement management, their principles and practices.
CO4:	Make use of case modelling and different data diagrams.
CO5:	Utilize the software in terms of size, cost, effort and schedule
CO6:	Explain the importance of having a good Safety Engineering Processes

TEXT BOOKS:	
1	Swapna Kishore, Rajesh Naik, “Software Requirements and Estimation”, 1st Edition, Tata McGraw Hill, 2001.
2	Phillip A. Laplante, "Requirements Engineering for Software and Systems", Second Edition, CRC Press, 2013.
REFERENCES:	
1	Karl E. Weigers, “Software Requirements”, 2nd Edition, Microsoft Press, 2003.
2	Ian K. Bray, “An Introduction to Requirements Engineering”, Addison Wesley, 2002.
3	Ian F. Alexander, Richard Stevens, “Writing better requirements”, Addison-Wesley, 2002.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	3	-	-	-	2	2	3	1	1	3	-
2	3	2	1	1	2	-	-	-	2	2	3	3	2	3	-
3	2	1	-	-	3	-	-	-	2	2	1	2	2	3	-
4	3	2	1	1	3	-	-	-	2	2	3	2	3	3	-
5	3	2	1	1	3	-	-	-	3	1	3	2	3	2	-
6	2	1	-	-	3	-	-	-	3	1	3	2	3	2	-
Overall Correlation	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**3**	**2**	**3**	**2**	**3**	**3**	**-**

23IT050	SOFTWARE RELIABILITY METRICS AND MODELS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn different definitions of software quality
- Know different notions of defects and classify them
- Understand the basic techniques of data collection and how to apply them
- Learn software metrics that define relevant metrics in a rigorous way.
- Gain confidence in ultra-high reliability.

UNIT I	INTRODUCTION TO SOFTWARE RELIABILITY	9

Basic Concepts – Failure and Faults – Environment – Availability –Modeling –uses – requirements reliability metrics – design & code reliability metrics – testing reliability metrics.

UNIT II	SOFTWARE RELIABILITY MODELING	9

Concepts – General Model Characteristic – Historical Development of models – Model Classification scheme – Markovian models – General concepts – General Poisson Type Models – Binomial Type Models – Poisson Type models – Fault reduction factor for Poisson Type models.

UNIT III	COMPARISON OF SOFTWARE RELIABILITY MODELS	9

Comparison Criteria – Failure Data – Comparison of Predictive Validity of Model Groups – Recommended Models – Comparison of Time Domains – Calendar Time Modeling – Limiting Resource Concept – Resource Usage model – Resource Utilization – Calendar Time Estimation and confidence Intervals.

UNIT IV	FUNDAMENTALS OF MEASUREMENT	9

Measurements in Software Engineering – Scope of Software

metrics – Measurements theory – Goal based Framework – Software Measurement Validation.		
UNIT V	**MEASURING SOFTWARE PRODUCT**	**9**
Measurement of Internet Product Attributes – Size and Structure – External Product Attributes – Measurement of Quality – Software Reliability: Measurement and Prediction.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the different definitions and dimensions of software quality and their implications for software development.
CO2:	Identify different types of software defects and classify them effectively, demonstrating an understanding of their impact on quality.
CO3:	Apply basic data collection techniques to gather and analyze information related to software quality.
CO4:	Apply relevant software metrics to evaluate and improve software quality throughout the development lifecycle.
CO5:	Utilize the skills and knowledge necessary to implement practices that ensure ultra-high reliability in software systems.
CO6:	Summarize fundamental quality assurance principles into their software development practices, fostering a culture of quality throughout the development lifecycle.

TEXT BOOKS:	
1	Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2	Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:	
1	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

3	Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4	Alan Gates, "Programming Pig", O'Reilley, 2011.

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	1	-	-	1	2	2	3	1	1	1	1
2	2	1	-	-	1	-	-	1	2	2	3	3	2	1	1
3	3	2	1	1	2	-	-	2	2	2	1	2	2	2	2
4	3	2	1	1	2	-	-	2	2	2	3	2	3	2	2
5	3	2	1	1	2	-	-	2	3	1	3	2	3	2	2
6	2	1	-	-	1			1	3	1	3	2	3	1	1
Overall Correlation	3	2	1	1	2	-	-	2	3	2	3	2	3	2	2

23IT051	SOFTWARE ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand and apply object-oriented design techniques
- Develop and evaluate software architectures
- Select and use appropriate architectural styles
- Select and use appropriate software design patterns

UNIT I	INTRODUCTION	9

Overview of Software development methodology and software quality model- different models of software development and their issues-introduction to software architecture- evolution of software architecture, software components and connectors-common software architecture frameworks - Architecture business cycle – architectural patterns – reference model.

UNIT II	SOFTWARE ARCHITECTURE MODELS	9

Structural models, framework models, dynamic models, process models. Architectures styles: dataflow architecture, pipes and filters architecture, call-and return architecture, data-centered architecture, layered architecture, agent based architecture, Micro-services architecture, Reactive Architecture, Representational state transfer architecture etc.

UNIT III	SOFTWARE ARCHITECTURE TECHNOLOGIES	9

Software Architecture Description Languages (ADLs), Struts, Hibernate, Node JS, Angular JS, J2EE – JSP, Servlets, EJBs; middleware: JDBC, JNDI, JMS, RMI and CORBA etc. Role of UML in software architecture.

UNIT IV	SOFTWARE ARCHITECTURE ANALYSIS AND DESIGN	9

Requirements for architecture and the life-cycle view of architecture design and analysis methods, architecture-based economic analysis: Cost Benefit Analysis Method (CBAM),

Architecture Tradeoff Analysis Method (ATAM). Active Reviews for Intermediate Design (ARID), Attribute Driven Design method (ADD), architecture reuse, Domain –specific Software architecture.		
UNIT V	**SOFTWARE ARCHITECTURE DOCUMENTATION**	**9**
Principles of sound documentation, refinement, context diagrams, variability, software interfaces. Documenting the behavior of software elements and software, systems, documentation package using a seven-part template.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain about software architecture for large scale software systems.	
CO2:	Interpret major software architectural styles, design patterns, and frameworks.	
CO3:	Illustrate software architecture using various documentation approaches and architectural description languages.	
CO4:	Explain architectural alternatives for a problem and select among them.	
CO5:	Make use of well-understood paradigms for designing new system.	
CO6:	Summarize about Software Architecture documentation.	
TEXT BOOKS:		
1	Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Pearson Education Asia.	
2	R. Taylor, N. Medvidovic, E. Dashofy, "Software Architecture – Foundations, Theory, and Practice", Wiley India.	
REFERENCES:		
1	Christine Hofmeister, Robert Nord, Dilip Soni, "Aoolied Software Architecture", Addision-Wesley-Pearson Educations.	

2	Dikel, D.Met Al, "Software Architecture: Organizational Principles and Pattern", Prentice Hall.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-	-	1	-	3	-	1	3	-	1
2	2	1	-	-	-	-	-	1	-	3	-	1	3	-	1
3	2	1	-	-	-	-	-	1	-	3	-	1	3	-	1
4	2	1	-	-	-	-	-	1	-	-	-	1	2	-	1
5	3	2	1	1	-	-	-	1	-	-	-	1	2	-	1
6	2	1	-	-	-	-	-	1	-	-	-	1	2	-	1
Overall Correlation	3	2	1	1	-	-	-	2	-	2	-	2	3	-	2