KCG

COLLEGE OF TECHNOLOGY

AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

REGULATIONS - 2023

CURRICULUM AND SYLLABI

(2023-2024)

B.E. COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY

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 CSE – CYBER SECURITY

The Department of Computer Science and Engineering (CYBER SECURITY) envisions developing highly skilled, sustainable, socially responsible and ethical cybersecurity professionals, researchers and entrepreneurs.

MISSION OF CSE – CYBER SECURITY

- To provide comprehensive education and hands-on training to develop the technical skills required for effective cyber security professionals.
- To raise awareness about cyber security issues and advocate for policies and practices that enhance the security of digital environments, while also fostering entrepreneurial development.
- To work and research alongside industry, government, and community partners to tackle real-world cybersecurity challenges and encourage best practices with a commitment to societal well-being.
- To support ongoing professional development and certification opportunities for students and practitioners to ensure they remain at the forefront of the cyber security field with the ethical grounding.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

The graduates will be able to :

PEO 1	Identify and assess security risks and vulnerabilities in various information and networks using core Cyber Security principles, practices, tools and technologies.
PEO 2	Evaluate the effectiveness of security systems by continuous learning about evolving threats and emerging technologies.
PEO 3	Exhibit skilled communication and collaboration, to work in multidisciplinary teams and explain complex cyber security concepts to others.
PEO 4	Have a solid ethical foundation and commit to respecting integrity, confidentiality, and privacy in all aspects of their career and entrepreneurship.

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	Demonstrate the ability to design, implement, and evaluate cyber security solutions for business and societal needs.
PSO 02	Exhibit professionalism in programming, hacking, malware analysis, and cyber forensics through hands-on expertise with relevant tools.
PSO 03	Apply logical thinking and ethical behaviour to analyze and solve complex real-world Cyber security problems.

INDEX

Sl.No	Description	Page No.
1	Curriculum	1
2	I Semester Syllabus	16
3	II Semester Syllabus	43
4	III Semester Syllabus	73
5	IV Semester Syllabus	100
6	V Semester Syllabus	126
7	VI Semester Syllabus	148
8	VII Semester Syllabus	167
9	VIII Semester Syllabus	179
10	Vertical 1 : Cyber Security And Data Privacy	182
11	Vertical 2 : Cyber Security Applications And Ethics	208
12	Vertical 3 : Computer Science	235
13	Vertical 4 : Full Stack Development	262
14	Vertical 5 : Emerging Technologies	291

KCG COLLEGE OF TECHNOLOGY
AUTONOMOUS
REGULATIONS 2023
B.E. COMPUTER SCIENCE AND ENGINEERING
CYBER SECURITY
CHOICE BASED CREDIT SYSTEM
CURRICULA 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	23HS122	General Clubs / Technical Clubs / NCC / NSS / Extension Activities	HSMC	0	0	2	2	1*
TOTAL				16	0	14	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	23CS201	Data Structures using C	PCC	3	0	0	3	3
5	23HS203	Tamils and Technology	HSMC	1	0	0	1	1
THEORY AND PRACTICALS								
6	23EE281	Basics 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	23CS221	Data Structures Using C Laboratory	PCC	0	0	4	4	2
10	23HS221	Soft 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- 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	23CS301	Object Oriented Programming	PCC	3	0	0	3	3
3	23CB301	Database Management Systems and Security	PCC	3	0	0	3	3
4	23HS301	Universal Human Values and Ethics	HSMC	3	0	0	3	3
THEORY AND PRACTICALS								
5	23CB311	Digital Principles and Computer Organization	PCC	3	0	2	5	4
6	23CS312	Design and Analysis of Algorithms	PCC	3	0	2	5	4
PRACTICALS								
7	23CS321	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
8	23CB321	Database Management Systems and Security 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	23CB401	Operating Systems and Security	PCC	3	0	0	3	3
3	23CB402	Cyber Security	PCC	3	0	0	3	3
4	23CS402	Artificial Intelligence	PCC	3	0	0	3	3
THEORY AND PRACTICALS								
5	23CB411	Computer Networking	PCC	3	0	2	5	4
6	23CS611	Internet Programming	PCC	3	0	2	5	4
PRACTICALS								
7	23CB421	Operating Systems and Security Laboratory	PCC	0	0	4	4	2
8	23CB422	Cyber Security Laboratory	PCC	0	0	4	4	2
9	23ES491	Aptitude and Logical Reasoning – 1	EEC	0	0	2	2	1*
TOTAL				18	1	14	33	25

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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	23CB501	Cryptography and Steganography	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	23CB511	Vulnerability Assessment and Penetration Testing	PCC	3	0	2	5	4
PRACTICALS								
7	23CB521	Cryptography and Steganography Lab	PCC	0	0	4	4	2
8	23CB522	Summer Internship	EEC	0	0	0	0	1
9	23CB523	Mini Project	EEC	0	0	3	3	2
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	23CB601	Engineering Secure Software Systems	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	23CB611	Malware Analysis	PCC	3	0	2	5	4
PRACTICALS								
7	23CB621	Project Work - Phase 1	EEC	0	0	4	4	2
8	23CB622	Technical Training	EEC	0	0	2	2	1
9	23CB623	Technical Seminar– 1	ESC	0	0	2	2	1
TOTAL				-	-	-	-	24

SEMESTER -VII

Sl. No.	Course Code	Course Title	Cate Gory	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	23CB701	Technical Comprehension	EEC	2	0	0	2	2
THEORY AND PRACTICALS								
5	23CB711	Cyber Forensics	PCC	3	0	2	5	4
PRACTICALS								
6	23CB721	Project Work – Phase 2	EEC	0	0	6	6	3
7	23CB722	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	23CB821/ 23CB822	Capstone Project / Internship cum project	EEC	0	0	20	20	10
TOTAL				0	0	20	20	10

TOTALCREDITS: 174

DEPARTMENT ELECTIVE COURSES: VERTICALS

VERTICAL 1: CYBER SECURITY & DATA PRIVACY

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23CB031	Ethical Hacking	DEC	2	0	2	4	3
2	23CB032	Digital and Mobile Forensics	DEC	2	0	2	4	3
3	23CB033	Social Network Security	DEC	2	0	2	4	3
4	23CB034	Security in Computing	DEC	2	0	2	4	3
5	23CB035	Applied Cryptography	DEC	2	0	2	4	3
6	23CB036	Privacy Preserving Data Mining	DEC	2	0	2	4	3
7	23CB037	Information Security Principles	DEC	2	0	2	4	3
8	23CB038	Intrusion Detection, Prevention and Key Management Techniques	DEC	2	0	2	4	3

VERTICAL 2 : CYBER SECURITY APPLICATIONS AND ETHICS

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23CB039	Machine Learning Security	DEC	2	0	2	4	3
2	23CB040	Security in IoT	DEC	2	0	2	4	3
3	23CB041	Mobile and Wireless Security	DEC	2	0	2	4	3
4	23CB042	Cyber physical system security	DEC	2	0	2	4	3
5	23CB043	Security in Cloud Computing	DEC	2	0	2	4	3
6	23CB044	Ethical practices in Open-Source Intelligence	DEC	3	0	0	3	3
7	23CB045	Cyber Crimes and Investigation procedures	DEC	3	0	0	3	3
8	23CB046	Behavioral Ethics in the Digital Realm	DEC	3	0	0	3	3

VERTICAL 3 : COMPUTER SCIENCE

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23CB047	Software Engineering Foundations and Practices	DEC	3	0	0	3	3
2	23CB048	Computational Theory	DEC	3	0	0	3	3
3	23CB049	Design of Compilers	DEC	3	0	0	3	3
4	23CB050	Object oriented Analysis and Design	DEC	3	0	0	3	3
5	23CB051	Software Testing principles	DEC	3	0	0	3	3
6	23CB052	Data Warehousing	DEC	3	0	0	3	3
7	23CB053	Fundamentals of Distributed Computing	DEC	3	0	0	3	3
8	23CB054	Principles of Human Computer Interaction	DEC	3	0	0	3	3

VERTICAL 4 : 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	23CB055	Secure Coding Practices for Full Stack Development	DEC	2	0	2	4	3
6	23CB056	DevSecOps: Integrating Security into Development	DEC	2	0	2	4	3
7	23CB057	Cloud Security Architecture for Full Stack Solutions	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 5 : EMERGING TECHNOLOGIES

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23AD043	Intelligent Robots	DEC	3	0	0	3	3
2	23CS040	AR VR Technology	DEC	2	0	2	4	3
3	23CS041	Game Development	DEC	2	0	2	4	3
4	23CS042	IoT based Smart Systems	DEC	2	0	2	4	3
5	23CB058	Cryptocurrency	DEC	2	0	2	4	3
6	23CB059	Quantum Cryptography	DEC	2	0	2	4	3
7	23CB060	Deep Learning Techniques	DEC	2	0	2	4	3
8	23CB061	Big Data Analytics and Security	DEC	2	0	2	4	3

OPEN ELECTIVE – EMERGING TECHNOLOGIES

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23OAE971	Aviation Management	OEC	3	0	0	3	3
2	23OAS971	Space Engineering	OEC	3	0	0	3	3
3	23OEC971	IoT concepts and applications	OEC	3	0	0	3	3
4	23OEC972	Fundamentals of Wearable Devices	OEC	3	0	0	3	3
5	23OEE971	Renewable Energy Technologies	OEC	3	0	0	3	3
6	23OEE973	Electric and Hybrid Vehicles	OEC	3	0	0	3	3
7	23OMA971	Resource Management Techniques	OEC	3	0	0	3	3
8	23OMT971	Foundation of Robotics	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+1***	**11**	**6**					**22**
Semester II	**4**	**7**	**9**	**5**			**1***	**25**
Semester III	**3**	**4**	**0**	**18**			**1***	**25**
Semester IV		**4**		**21**			**1***	**25**
Semester V			**2**	**9**	**6**	**3**	**3+1***	**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**	**64**	**18**	**9**	**21**	**174**

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	2	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	1

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**

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**		
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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	**1st ACM**	**Date**	**09-09-2023**

23CS201	DATA STRUCTURES USING C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of ADTs.
- To learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.
- To apply Tree and Graph structures.

UNIT I	LISTS	9

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists –Applications of lists – Polynomial ADT.

UNIT II	STACKS AND QUEUES	9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Queue ADT – Operations – Circular Queue –DeQueue – Applications of Queues.

UNIT III	TREE STRUCTURES	9

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT –Priority Queue (Heaps) – Binary Heap-Multiway Search Trees - B-Tree – B+ Tree.

UNIT IV	SORTING AND SEARCHING	9

Sorting – Bubble sort – Selection sort – Insertion sort –Merge Sort – Quick Sort –Shell sort —Radix sort. Searching – Linear Search – Binary Search.

UNIT V	GRAPH STRUCTURES	9

Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal –Depth-first traversal –– Bi-connectivity – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm.

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Make use of various linked list operations to solve the given problems
CO2:	Apply linear data structures stack and queue for real time applications.
CO3:	Utilize the non-linear data structure tree for real world applications
CO4:	Apply various sorting algorithms for the given scenario
CO5:	Apply various searching algorithms for the given scenario
CO6:	Apply graph algorithms for graph applications
TEXT BOOKS:	
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
2	Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007
REFERENCES:	
1	Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition,Pearson Education, 2015.
2	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
3	Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.

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	2	3	3	3	3	1	1
2	3	2	1	1	1	1	1	1	2	3	3	3	3	1	1
3	3	2	1	1	1	1	1	1	2	2	3	3	3	1	1
4	3	2	1	1	1	1	1	1	2	3	3	3	3	1	1
5	3	2	1	1	1	1	1	1	2	3	3	3	3	1	1
6	3	2	1	1	1	1	1	1	2	3	3	3	3	1	1
Overall Correlation	3	2	1	1	1	1	1	1	2	3	3	3	3	1	1

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

23EE281	BASIC ELECTRICAL, 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', 11th Edition, 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	**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	**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.

GROUP A (CIVIL and MECHANICAL)

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

GROUP B (ELECTRICAL & ELECTRONICS)

PART III	**ELECTRICAL ENGINEERING PRACTICES**	**15**

1. Residential House wiring using Switches, Fuse, Indicators, Lamp and Energy Meter.
2. Staircase Wiring.

3. Fluorescent Lamp Wiring with Introduction to CFL and LED Types. 4. Measurement of Energy using Single Phase Energy Meter. 5. Study of Iron Box Wiring and Assembly **6.** Study of Fan Regulator – Electronic Type		
PART IV	**ELECTRONICS ENGINEERING PRACTICES**	**15**
1. Study of Electronic components and equipment – Resistors, Colour coding measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO. 2. Study of logic gates AND, OR, EX-OR and NOT. 3. Generation of Clock Signal. 4. Soldering simple electronic circuits and checking continuity. 5. Study the elements of smart phone 6. Study of LED TV (Block diagram		
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							**26-07-2023**								
Approved							**1st ACM**			**Date**			**09-09-2023**		

23CS221	DATA STRUCTURES USING C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstras algorithm.
- To implement Prims algorithm
- To implement Sorting, Searching algorithms.

PRACTICALS:

1. Array implementation of Stack, Queue and Circular Queue ADTs.
2. Implementation of Singly Linked List.
3. Linked list implementation of Stack and Linear Queue ADTs.
4. Implementation of Polynomial Manipulation using Linked list.
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion.
6. Implementation of Heaps using Priority Queues.
7. Implementation of Linear Search and Binary Search.
8. Implementation of Insertion Sort and Selection Sort.
9. Implementation of Quick Sort.
10. Implementation of Binary Search Trees.
11. Implementation of Dijkstra's Algorithm.
12. Implementation of Prim's Algorithm.

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:	Construct linear data structure algorithms.															
CO2:	Develop applications using Stacks and Queue.															
CO3:	Develop applications using Linked lists.															
CO4:	Construct binary search tree algorithm.															
CO5:	Construct Prim's and Dijkstra's graph algorithms.															
CO6:	Analyze the various searching and sorting algorithms.															

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	-	-	3	2	-
3	3	3	3	2	2	-	-	-	-	1	-	1	3	2	-
4	3	2	1	1	2	-	-	-	-	1	-	-	3	2	-
5	3	2	1	1	2	-	-	1	-	1	-	-	3	2	1
6	3	3	2	2	2	-	-	1	-	1	-	-	3	2	1
Overall Correlation	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**3**	**2**	**1**

Recommended by Board of Studies	**28-07-2023**		
Approved	**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	5

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	5

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	5

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	5

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	5
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: 25 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							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**

23CS301	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION TO OOP AND JAVA	9

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

UNIT II	INHERITANCE, PACKAGES AND INTERFACES	9

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

UNIT III	EXCEPTION HANDLING AND MULTITHREADING	9

Exception handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a

Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication - Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.		
UNIT IV	**I/O, GENERICS, STRING HANDLING**	**9**
I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.		
UNIT V	**JAVAFX EVENT HANDLING, CONTROLS, COMPONENTS**	**9**
JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.		
		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:	Develop programs using packages and interfaces	
CO3:	Construct programs using inheritance concepts.	
CO4:	Apply exception handling mechanisms and multithreaded model to solve real world problems	
CO5:	Construct Java applications with I/O packages, string classes, Collections and generics concepts	
CO6:	Apply the concepts of event handling and JavaFX components and controls for developing GUI based application	

TEXT BOOKS:	
1	Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019
2	Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015
REFERENCES:	
1	Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 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	3	1	-
2	3	2	1	1	1	-	-	-	-	-	-	1	3	1	-
3	3	2	1	1	1	-	-	-	-	-	-	1	3	1	-
4	3	2	1	1	1	-	-	1	-	-	-	1	3	1	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	2	1	1	2	-	-	1	-	-	-	1	3	2	1

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

23CB301	DATABASE MANAGEMENT SYSTEMS AND SECUIRITY	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 need of storage in Database Management systems.
- To learn how to secure Database Management systems.

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	STORAGE AND QUERY PROCESSING	9
RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Query optimization using Heuristics and Cost Estimation.		
UNIT V	**DATABASE SECURITY**	**9**
Database Security: Security issues -SQL Injection –SQLi Attack Avenues and Types- DBMS Access control based on privileges – Role Based access control –Cascading authorization–Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.		
		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:	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4:	Explain the concepts of Transaction Processing and maintain consistency of the database.
CO5:	Explain the need of storage in Database Management systems.
CO6:	Learn how to secure Database Management systems.

TEXT BOOKS:	
1	Abraham Silberschatz, Henry F. Korth, S. Sudharshan,
2	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2021.

REFERENCES:	
1	Alfred Basta,Melisaa Zgola,Dana Bullaboy,Thomas L WhitLock Sr, "Database Security",Course Technology,Cenage Learning 2012.
2	C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
4	G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
5	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	2	3	2	1	-	-	-	2	1	1	2	2	1	-
2	3	1	3	1	1	-	-	-	2	1	3	2	3	1	-
3	3	2	3	2	1	-	-	-	2	1	-1	2	3	1	-
4	1	2	2	2	-	-	-	-	2	1	1	1	1	-	-
5	1	1	2	2	-	-	-	-	1	1	-	1	1	-	-
6	2	1	3	2	1	-	-	-	-	1	-	2	2	1	-
Overall Correlation	2	2	3	2	1	-	-	-	2	1	1	2	2	1	-

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

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

COURSE OBJECTIVES:

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence.
- To strengthen the self-reflection.
- To develop 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:	Explain the need of value education.	
CO2:	Interpret the difference between self and body.	

CO3:	Demonstrate the need to exist as a unit of Family and society.
CO4:	Classify Harmony at all levels.
CO5:	Apply the values acquired in the professional front.
CO6:	Identify appropriate technologies for ecofriendly production systems.
TEXT BOOKS:	
1	R R Gaur, R Sangal, G P Bagaria,Human Values and Professional Ethics, 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	**08-04-2024**		
Approved	**2nd ACM**	**Date**	**25-05-2024**

23CB311	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits.
- To learn the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and hazards.
- To learn the concept of various memories and I/O interfacing.

UNIT I	COMBINATIONAL LOGIC	9

Combinational Circuits – Karnaugh Map – Half and full Adder – Subtractors – Binary parallel adder - Magnitude Comparator – Decoder – Encoder – Multiplexers – Demultiplexers, Code converters

UNIT II	SYNCHRONOUS SEQUENTIAL LOGIC	9

Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, - Registers – Counters- Ripple counters

UNIT III	COMPUTER FUNDAMENTALS	9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA):– Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV	PROCESSOR	9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control –

Pipelining – Data Hazard – Control Hazards.		
UNIT V	**MEMORY AND PROGRAMMABLE LOGIC**	**9**
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – ROM-Programmable Logic Array-Programmable Array logic.		
		TOTAL: 45 PERIODS
PRACTICAL EXERCISES : 30 PERIODS		
1. Verification of Boolean theorems using logic gates. 2. Design and implementation of combinational circuits using gates for arbitrary functions. 3. Implementation of 4-bit binary adder/subtractor circuits. 4. Implementation of code converters. 5. Implementation of BCD adder, encoder and decoder circuits. 6. Implementation of functions using Multiplexers. 7. Implementation of the synchronous counters. 8. Implementation of a Universal Shift register. 9. Simulator based study of Computer Architecture		
		TOTAL: 45 +30 =75 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Develop digital fundamentals using number systems, logic gates, Boolean algebra and Karnaugh map.	
CO2:	Build various combinational circuits using logic gates.	
CO3:	Construct sequential circuits such as flip flops, counters and registers.	
CO4:	Interpret the functional units of computers, instruction set and addressing modes.	
CO5:	Explain the various functional units of processor, pipelining and hazards.	
CO6:	Compare the various memory concepts of the processor and programmable logic devices.	

TEXT BOOKS:	
1	M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2	David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
REFERENCES:	
1	Floyd T.L., "Digital Fundamentals", Charles E., Eleventh edition Pearson,2019.
2	Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 7th Edition, 2021.
3	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
4	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
5	William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, 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	1	-	2	3	1	-
2	3	2	1	1	1	-	-	-	2	1	-	-	3	1	-
3	2	2	-	-	1	-	-	-	2	1	-	2	2	1	-
4	2	2	-	-	1	1	-	-	3	2	-	2	2	1	-
5	2	1	-	-	1	-	1	-	2	1	-	-	2	1	-
6	2	1	-	-	1	1	-	-	2	1	-	2	3	1	-
Overall Correlation	3	2	1	1	2	1	1	-	3	2	-	2	3	2	-

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

23CS312	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques on searching and sorting algorithms
- To critically analyze the efficiency of graph algorithms
- To understand 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

Time and space complexity - Asymptotic Notations – Solving Recurrences: substitution method - Lower bounds - hash function - searching: linear search, binary search and Interpolation Search, String Matching: The naïve string - matching algorithm - Rabin-Karp algorithm - Sorting: Insertion sort, heap sort

UNIT II	GRAPH ALGORITHMS	9

Representations of graphs - Graph traversal: DFS - BFS - Minimum spanning tree: Kruskal's and Prim's algorithm - Shortest path: Bellman - Ford algorithm - Dijkstra's algorithm - Maximum flow: Flow networks - Ford-Fulkerson method - Maximum bipartite matching.

UNIT III	ADVANCED DESIGN AND ANALYSIS TECHNIQUES	9

Divide and Conquer methodology: Merge sort - Quick sort- Dynamic programming: Elements of dynamic programming - Matrix-chain multiplication - Multi stage graphs. Greedy Technique: Elements of the greedy strategy - Activity-selection problem - 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.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Sort a given set of elements using the Quick sort method 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. The elements can be read from a file or can be generated using the random number generator.
2. Implement a Merge Sort algorithm to sort a given set of elements 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. The elements can be read from a file or can be generated using the random number generator.
3. (A) Obtain the Topological ordering of vertices in a given digraph. (B) Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra's algorithm
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

7. (A) Print all the nodes reachable from a given starting node in a digraph using BFS method. (B) Check whether a given graph is connected or not using DFS method. 8. Find a subset of a given set S = {s1, s2,….., sN} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution. 9. 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. 10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm. 11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. 12. Implement N Queen's problem using Back Tracking.	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply recursive and non-recursive algorithms to solve problem.
CO2:	Apply appropriate framework to meet algorithm's efficiency.
CO3:	Apply graph algorithms to solve problems and analyze their efficiency.
CO4:	Solve problems using algorithm design techniques like divide and conquer, dynamic programming and greedy techniques.
CO5:	Apply State Space Tree Analysis for Problem-Solving.
CO6:	Solve problems using approximation algorithms and randomized algorithms

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	2	1	1	2	-	-	-	-	-	-	-	3	2	-
2	3	2	1	1	2	-	-	-	-	-	-	1	3	2	-
3	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
4	3	2	1	1	2	-	-	-	-	-	-	1	3	2	-
5	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
6	3	2	1	1	2	-	-	-	-	-	-	-	3	2	-
Overall Correlation	3	2	1	1	2	-	-	-	-	-	-	1	3	2	-

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

23CS321	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an 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 funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). 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 printArea( ) that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. 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 the cube of the number.

8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Develop java programs using object oriented programming concepts
CO2:	Construct the java program in inheritance concepts.
CO3:	Develop simple applications using object oriented concepts such as package, exceptions
CO4:	Solve multithreading, and generics concepts in Java programming
CO5:	Create GUIs and event driven programming applications for real world problems
CO6:	Construct and deploy web applications using Java

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**

23CB321	DATABASE MANAGEMENT SYSTEMS AND SECURITY 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 joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand attacks on databases and to learn to defend against the attacks on databases.
- To learn to store and retrieve encrypted data in 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. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
3. Query the database tables and explore sub queries and simple join operations.
4. Write user defined functions and stored procedures in SQL.
5. Create View and index for database tables with a large number of records.
6. Write program that use SQLi to authenticate as administrator, to get unauthorized access over sensitive data, to inject malicious statements into form field.
7. Write a program that will defend against the SQLi attacks given in the previous exercise.
8. Write queries to insert encrypted data into the database and to retrieve the data using decryption.

9.	Write queries to find all permissions and access control for all users in database.
10.	Implement Role Based access control in Database.
	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:	Construct simple and complex sub queries and join queries.
CO3:	Demonstrate advanced features such as stored procedures and triggers.
CO4:	Identify attacks on databases and to learn to defend against the attacks on databases.
CO5:	Implement to store and retrieve encrypted data in databases.
CO6:	Apply the concepts of encryption in Database.

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	1	3	2	2	3	-
2	3	3	3	3	3	-	-	-	1	2	3	3	2	1	-
3	3	3	2	2	3	-	-	-	1	1	1	3	2	3	-
4	1	3	3	3	3	-	-	-	1	1	3	2	3	1	-
5	3	2	2	2	3	-	-	-	2	2	3	1	3	1	-
6	3	3	3	3	3	-	-	-	1	2	2	1	1	2	-
Overall Correlation	3	3	3	2	3	-	-	-	2	1	3	2	2	2	-

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	**08-04-2024**		
Approved	**2nd ACM**	**Date**	**25-05-2024**

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
- 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**

23CB401	OPERATING SYSTEMS AND SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyse Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyse various memory management schemes.
- To describe Security and Protection Mechanism in operating systems.
- To describe the concepts of trusted OS design.

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	11

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	**SECURITY AND PROTECTION**	**8**
File System Interface – File Protection, File Sharing; Security - The Security Problem, Program Threats, System and Network Threats, Cryptography, User Authentication, Implementing Security Defenses; Protection – Goals, Principles, Protection Rings, Domain Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, Role-Based Access Control, Mandatory Access Control, Capability-Based Systems, Protection Improvement Methods, Language-Based Protection.		
UNIT V	**TRUSTED OS DESIGN**	**7**
Security in Operating Systems – Operating System Structure, Security Features, Protected Objects, Tools to Implement Security Functions; **Security in the Design of Operating Systems** – Simplicity of Design, Layered Design, Kernelized Design, Reference Monitor, Correctness and Completeness, Secure Design Principles, Trusted Systems, Trusted System Functions.		
		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:	Explain the concepts of securing the Operating Systems.	
CO5:	Explain the mechanisms to protect the Operating Systems.	
CO6:	Explain the concepts of designing a trusted operating system.	

TEXT BOOKS:	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018. (Units 1-4)
2	Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2018. (Unit 5)
REFERENCES:	
1	Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2	Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3	Trent Jaeger, "Operating System Security ", Springer Cham, Springer Nature Switzerland AG 2008 – ISBN – 978-3-031-01205-1.
4	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

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	1	1	2	2	1	-
2	3	2	1	1	1	-	-	1	1	1	1	2	3	1	-
3	3	2	1	1	1	-	-	1	1	1	1	2	3	1	-
4	2	1	1	1	1	-	-	1	1	1	1	1	1	-	-
5	3	2	1	1	1	-	-	1	1	1	-	1	1	-	-
6	2	1	1	1	1	-	-	1	1	1	-	2	2	1	-
Overall Correlation	2	1	1	1	1	-	-	1	1	1	1	2	2	1	-

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

23CB402	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To have a comprehensive understanding of the fundamental concepts of cybersecurity and its history.
- To familiarize with various types of cyber-attacks, attack vectors, and the principles of countermeasures used to mitigate security breaches.
- To equip with the skills to conduct reconnaissance and scanning techniques to assess vulnerabilities and discover potential security threats.
- To introduce to intrusion detection systems (IDS), their architecture, and the role of honeypots in identifying and analyzing cyber threats.
- To have hands-on knowledge of intrusion prevention systems (IPS).

UNIT I	INTRODUCTION	9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II	ATTACKS AND COUNTERMEASURES	9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III	RECONNAISSANCE	9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network

Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.		
UNIT IV	**INTRUSION DETECTION**	**9**
Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.		
UNIT V	**INTRUSION PREVENTION**	**9**
Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Explain the basics of cyber security, cybercrime and cyber law.
CO2:	Analyse different types of cyber-attacks and understand the techniques and tools used by cybercriminals to breach systems.
CO3:	Make use of tools to collect vital information about target systems, networks, and organizations.
CO4:	Build the advanced scanning techniques for network vulnerability analysis.
CO5:	Apply the intrusion detection systems (IDS).
CO6:	Construct and configure firewalls and intrusion prevention systems.

TEXT BOOKS:	
1	Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)

2	Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1).
REFERENCES:	
1	David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2	Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)
3	Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
4	William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015 (Units 4 and 5)
5	OWASP. OWASP Top Ten. https://owasp.org/www-project-top-ten/ , 2024. (Unit 1).

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	1	2	1	2	2	1	3
2	3	3	2	2	3	2	2	2	2	2	1	2	3	3	2
3	3	2	1	1	3	2	1	2	2	2	1	2	3	3	2
4	3	2	1	1	3	2	2	1	3	3	2	3	3	3	1
5	3	2	1	1	3	2	2	2	3	3	2	3	3	3	2
6	3	2	1	1	3	2	2	2	3	3	2	3	3	3	2
Overall Correlation	3	2	1	1	3	2	2	2	3	3	2	3	3	3	3

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

23CS402	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To understand the different ways of designing software agents.

UNIT I	INTRODUCTION	6

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II	PROBLEM SOLVING METHODS	12

Search Strategies: Uninformed search - Informed search - Heuristics Functions - Local Search Algorithms and Optimization Problems - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search

UNIT III	LOGICAL REASONING	10

First Order Predicate Logic: syntax and semantics – usage - knowledge representation - Inference in First order logic: Unification – Forward Chaining - Backward Chaining – Resolution.

UNIT IV	KNOWLEDE REPRESENTATION AND REASONING	9

Knowledge Representation: Ontological Engineering - Categories and Objects – Events - Mental Events and Mental Objects. Reasoning Systems for Categories - Reasoning with Default Information.

UNIT V	MULTI AGENT SYSTEMS	8

Architecture for Intelligent Agents - Agent communication –

Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Analyze the typical AI problems to identify the suitable Intelligent agents and apply the problem-solving approach on them.
CO2:	Implement and compare different search strategies to solve AI problems.
CO3:	Design and apply local search algorithms and constraint satisfaction techniques.
CO4:	Interpret the problem and represent it using first order predicate logic.
CO5:	Describe the ontological engineering and reasoning systems.
CO6:	Illustrate the architecture of Intelligent agents, agent communication and Multi agent systems.
TEXT BOOKS:	
1	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2	Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
3	Michael Wooldridge, "An Introduction to MultiAgent Systems". Second Edition, Chichester: Wiley, 2009.
4	Gerhard Weiss, "Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence". Cambridge: MIT Press, 1999.
REFERENCES:	
1	Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison Wesley Educational Publishers Inc., 2011.

2	M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)",Jones and Bartlett Publishers, Inc.; First Edition, 2008.
3	Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4	William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
5	David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

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

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

23CB411	COMPUTER NETWORKING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the basics of network components and protocols.
- To explore the concepts of Physical layer and Datalink layer.
- To learn to configure the routers and interfaces.
- To understand the IPv4 and IPv6 addressing.
- To learn the different types of Security attacks.
- To know to build a small network.

UNIT I	BASIC NETWORK CONNECTIVITY AND COMMUNICATIONS	9

Network Today: Network Components – Network Representations and Topologies – Common Types of Networks – Internet Connections – Reliable Networks – Network Trends – Security Threats and Solutions.

Basic Switch and End device configuration: IOS Access – IOS Navigation – The command structure – Basic device Configuration – Save configurations – Ports and Addresses – Configure IP addressing – Verify Connectivity

Protocols and Models: Introduction - The Rules – Protocols - Protocol Suites - Standards – Organizations - Reference Models - Data Encapsulation - Data Access

UNIT II	ETHERNET	9

Physical Layer: Introduction - Purpose of the Physical Layer - Physical Layer Characteristics - Copper Cabling - UTP Cabling - Fiber-Optic Cabling - Wireless Media

Number Systems: Introduction - Binary Number System - Hexadecimal Number System

Data Link Layer: Introduction - Purpose of the Data Link Layer – Topologies - Data Link Frame

Ethernet Switching: Introduction - Ethernet Frames - Ethernet

MAC Address - The MAC Address Table - Switch Speeds and Forwarding Methods		
UNIT III	**NETWORK COMMUNICATION**	**9**
Network Layer: Introduction - Network Layer Characteristics - IPv4 Packet - IPv6 Packet - Host Routing - Introduction to Routing Address Resolution: Introduction - MAC and IP – ARP - IPv6 Neighbor Discovery Basic Router Configuration: Introduction - Configure Initial Router Settings - Interfaces configuration - The Default Gateway configuration.		
UNIT IV	**IP ADDRESSING**	**9**
IPv4 Addressing: Introduction - IPv4 Address Structure - IPv4 Unicast, Broadcast, and Multicast - Types of IPv4 Addresses - Network Segmentation - Subnet an IPv4 Network - Subnet a Slash 16 and a Slash 8 Prefix - Subnet to Meet Requirements – VLSM - structured Design IPv6 Addressing: Introduction - IPv4 Issues - IPv6 Address Representation - IPv6 Address Types - GUA and LLA Static Configuration - Dynamic Addressing for IPv6 GUAs - Dynamic Addressing for IPv6 LLAs - IPv6 Multicast Addresses - Subnet an IPv6 Network ICMP: Introduction - ICMP Messages - Ping and Traceroute Tests		
UNIT V	**TRANSPORT AND APPLICATION LAYER**	**9**
Transport Layer: Introduction - Transportation of Data - TCP Overview - UDP Overview - Port Numbers - TCP Communication Process - Reliability and Flow Control - UDP Communication Application Layer: Introduction - Application, Presentation, and Session - Peer-to-Peer - Web and Email Protocols - IP Addressing Services - File Sharing Services Network Security Fundamentals: Introduction - Security Threats and Vulnerabilities - Network Attacks - Network Attack Mitigations - Device Security		

Build a Small Network: Introduction - Devices in a Small Network - Small Network Applications and Protocols - Scale to Larger Networks - Verify Connectivity - Host and IOS Commands - Troubleshooting Methodologies - Troubleshooting Scenarios

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1. Implement terminal Emulation Programs
2. Using Syntax Checker
    - Do basic Device Configuration
    - Verify Windows PC IP Configuration
    - Configure a Switch Virtual Interface
    - Configure the Default Gateway
3. Using Packet Tracer
    - Configure Initial Switch Settings
    - Implement Basic Connectivity
    - Investigate the TCP/IP and OSI Models in Action
    - View Wired and Wireless NIC Information
    - Examine the ARP Table
    - Verify IPv4 and IPv6 Addressing
    - Connect a Router to a LAN
    - Use Ping and Traceroute to Test Network Connectivity
    - Configure Secure Passwords and SSH
4. Install Wireshark
5. Use Wireshark to View Network Traffic.
6. Use Wireshark to Examine Ethernet Frames.
7. View Network Device MAC Addresses.
8. Navigate the IOS by Using Tera Term for Console Connectivity.
9. Test Network Latency with Ping and Traceroute.
10. Troubleshoot Connectivity Issues.

TOTAL:30 PERIODS

COURSE OUTCOMES:

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

CO1:	Construct the TCP/IP and OSI models and configure the switch, end device.
CO2:	Examine the Ethernet frames and view network device MAC addresses.

CO3:	Examine the ARP table and configure the basic routers and interfaces.
CO4:	Test for addressing the IPv4 and IPv6 and verify the network connectivity.
CO5:	Categorize the IP addressing, file sharing servicesand configure the network devices with SSH.
CO6:	Construct a small network and troubleshoot the connectivity issues.
TEXT BOOKS:	
1	Cisco Networking Academy. "Introduction to Networks Companion Guide (CCNAv7)."1st edition., Cisco Press, 2020. ISBN: 9780136633679
2	Allan Johnson, and Cisco Networking Academy. "Introduction to Networks Labs and Study Guide (CCNAv7) (Lab Companion)."1st edition., CISCO Press, 2020.
REFERENCES:	
1	James T. Kurose, Keith W. Ross. "Computer Networking: A Top-Down Approach". 8th Edition, Pearson, 2021. ISBN: 9780136681558.
2	Todd Lammle. "CCNA 200-301 Official Cert Guide", Volume 1. 1st Edition, Cisco Press, 2020. ISBN: 9780135792747.
3	Wendell Odom. "CCNA 200-301 Official Cert Guide", Volume 2. 1st Edition, Cisco Press, 2020. ISBN: 9780135792754.

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	2	3	3	1
2	3	3	2	2	3	2	1	1	2	2	1	2	3	3	1
3	3	3	2	2	3	2	1	1	2	2	1	2	3	3	1
4	3	3	2	2	3	2	2	1	3	2	1	3	3	3	1
5	3	3	2	2	3	3	2	1	3	3	2	2	3	3	1
6	3	2	1	1	3	3	2	2	3	3	2	2	3	3	2
Overall Correlation	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**

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

23CS611	INTERNET PROGRAMMING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand different Internet Technologies.
- To learn java-specific web services architecture
- To construct a basic website using HTML and Cascading Style Sheets.
- To build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- To develop server side programs using Servlets and JSP.

UNIT I	WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0	9

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

UNIT II	CLIENT SIDE PROGRAMMING	9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III	SERVER SIDE PROGRAMMING	9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies-Installing and Configuring Apache Tomcat Web Server- Database Connectivity: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV	PHP and XML	9
An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).		
UNIT V	**INTRODUCTION TO AJAX and WEB SERVICES**	**9**
AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.		
		TOTAL: 45 PERIODS

PRACTICALS:

1. Create a web page with the following using HTML (A) to embed a map in a web page (B) To fix the hot spots in that map (C) Show all the related Information when the hot spots are clicked.
2. Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages
2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
3. Write programs in Java using Servlets: (A) To invoke servlets from HTML forms (B) Session tracking using hidden form fields and Session tracking for a hit count.
4. Write programs in Java to create three-tier applications using servlets for conducting online examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

5. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart. **6.** Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. **7.** Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document. **8.** i. Validate the form using PHP regular expression. ii. Store the form data into database using PHP. **9.** Write a web service for finding what people think by asking 500 people's opinion for any consumer product.	
TOTAL:30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Construct a basic website using HTML and Cascading Style Sheets.
CO2:	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3:	Develop server side programs using Servlets and JSP.
CO4:	Construct simple web pages in PHP and to represent data in XML format.
CO5:	Develop an XML schemas, parsers and XSL
CO6:	Make use of AJAX and web services to develop interactive web applications

TEXT BOOKS:	
1	Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5th Edition, 2011
REFERENCES:	
1	Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.
2	Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition Wiley Publications, 2009.
3	Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4	Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5	UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

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	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	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	1	1	1	3	2	1
6	3	2	1	1	2	-	-	1	1	1	1	1	3	2	1
Overall Correlation	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**1**

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

23CB421	OPERATING SYSTEMS AND SECUTIRY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the basics of UNIX command and shell programming.
- To implement various CPU scheduling algorithms.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms.
- To implement Page Replacement Algorithms.
- To implement various memory allocation methods.
- To apply various access control mechanism.
- To evaluate vulnerability in computer systems.

LIST OF EXPERIMENTS:

1. Illustration of UNIX commands and Shell Programming.
2. Implementation of various CPU scheduling algorithms using C program.
3. Illustrate the inter process communication strategy.
4. Implementation of mutual exclusion by semaphore.
5. Implement dead lock avoidance and detection using C program.
6. C programs to implement threading.
7. Implementation of paging technique using C program.
8. C programs to implement the memory allocation methods.
9. C programs to implement the various page replacement algorithms.
10. C programs for the implementation of various access control mechanism.
11. Demonstrate SQL injection attack and its counter measures.
12. Implementation of Malware detection.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Implement Shell commands

CO2:	Implement Deadlock avoidance, Detection Algorithms.
CO3:	Implement CPU Scheduling Algorithm and Page replacement algorithms.
CO4:	Implement Inter-Process Communication and mutual exclusion by Semaphore.
CO5:	Implement access control techniques.
CO6:	Implement and demonstrate SQL injection and Malware detection.

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

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

23CB422	CYBER SECURITY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Understand and Apply Penetration Testing Techniques.
- Learn the Fundamentals of Social Engineering.
- Perform Wireless Network Attacks and Countermeasures.
- Conduct Information Gathering and Reconnaissance.
- Understand and Configure Network Defense Systems.

LIST OF EXPERIMENTS:

1. Simulate a cyber-attack on a system using tools like Metasploit to exploit a vulnerability and perform post-exploitation tasks (e.g., privilege escalation).
2. Use the OWASP ZAP (Zed Attack Proxy) to find vulnerabilities like Cross-Site Request Forgery (CSRF) or SQL Injection in a web application.
3. Create simulated phishing emails and social engineering attacks using Kali Linux or social engineering tools (e.g., Social-Engineer Toolkit).
4. Use tools like Aircrack-ng to perform attacks on wireless networks, such as WEP cracking or WPA/WPA2 password cracking.
5. Use tools like whois and theHarvester to gather information about domains, email addresses, and IP addresses.
6. Perform DNS zone transfers and use tools like dig to gather DNS-related information. Similarly, perform email server enumeration using tools like nslookup or smtp-user-enum.
7. Use Netcraft and other tools like nmap to extract detailed information about websites, their technologies, and hosting environments.
8. Use Nmap to perform various port scanning techniques (TCP Connect, SYN Scan, Stealth Scan, etc.) to identify open ports on a target machine.

9. Perform vulnerability scanning using Nessus or OpenVAS to identify security holes in a network. 10. Execute a ping sweep using tools like fping to discover active hosts on a network and perform SYN Stealth scans using Nmap. 11. Install and configure Snort as an Intrusion Detection System (IDS) on a test network and monitor network traffic for suspicious activity. 12. Set up a honeypot (using tools like Honeyd or Suricata) to capture and analyze attacker activity. 13. Analyze firewall and IDS logs using tools like Splunk or ELK stack to detect unusual patterns or intrusion attempts. 14. Set up different types of firewalls (packet-filtering, stateful inspection, proxy, etc.) on Linux (iptables) or Windows (Windows Firewall) to control traffic based on rules. 15. Set up and configure a Unified Threat Management (UTM) system or IPS, such as Suricata or Snort, to prevent network attacks. 16. Simulate various attack vectors (DoS, port scanning, malware) and test how firewalls and IPS systems respond to block or mitigate these attacks.
TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Examine the Vulnerability Assessment and Exploitation.
CO2:	Analyse and simulate social Engineering Attacks.
CO3:	Deduct the wireless Network Security.
CO4:	Construct Comprehensive Information Gathering and Network Reconnaissance.
CO5:	Examine IDS/IPS and Honeypot Technologies.
CO6:	Test and configure Firewalls and UTM Systems.

Cos	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	3	2	1	1	2	2	1	2	3	3	1
2	3	3	2	2	3	2	2	2	2	2	1	2	2	3	2
3	3	3	3	3	3	1	1	1	2	2	2	2	2	3	1
4	3	3	3	3	3	2	2	2	3	3	1	2	3	3	2
5	3	3	2	2	3	3	2	1	3	2	2	2	3	3	1
6	3	3	3	3	3	3	1	2	3	3	2	2	3	3	2
Overall Correlation	3	3	3	3	3	3	2	2	3	3	2	2	3	3	2
Recommended by Board of Studies							08-04-2024								
Approved							2nd ACM			Date			25-05-2024		

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. "An Introduction to Research Methodology." RBSA Publishers, 2002.
2	Kothari, C.R. "Research Methodology: Methods and Techniques." 2nd Edition, New Age International, 1990. 418 pages.

REFERENCES:	
1	Sinha, S.C., and Dhiman, A.K. "Research Methodology." 2 Volumes, Ess Ess Publications, 2002.
2	Trochim, W.M.K. "Research Methods: The Concise Knowledge Base." Atomic Dog Publishing, 2005. 270 pages.
3	Wadehra, B.L. "Law Relating to Patents, Trade Marks, Copyrights, Designs and Geographical Indications." Universal Law Publishing, 2000.
4	Day, R.A. "How to Write and Publish a Scientific Paper." Cambridge University Press, 1992.
5	Fink, A. "Conducting Research Literature Reviews: From the Internet to Paper." Sage Publications, 2009.
6	Leedy, P.D., and Ormrod, J.E. "Practical Research: Planning and Design." Prentice Hall, 2004.
7	Satarkar, S.V. "Intellectual Property Rights and Copyright." ESS Publications, 2000.

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	**3rd ACM**	**Date**	**30-11-2024**

23CB501	CRYPTOGRAPHY AND STEGANOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn to analyze the security of in-built cryptosystems.
- To know the fundamental mathematical concepts related to security.
- To develop cryptographic algorithms for information security.
- To comprehend the various types of data integrity and authentication schemes.
- To understand cyber-crimes and cyber security.

UNIT I	INTRODUCTION TO SECURITY	9

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and mechanisms –A model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II	SYMMETRIC CIPHERS	9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution

UNIT III	ASYMMETRIC CRYPTOGRAPHY	9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes –Partiality Testing – Factorization -Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm ASYMMETRIC KEY CIPHERS:

RSA cryptosystem – Key distribution – Key management –Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography.		
UNIT IV	**INTEGRITY AND AUTHENTICATION ALGORITHMS**	**9**
Authentication requirement – Authentication function – MAC – Hash function – Security of hashfunction: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST – Distribution of public keys – X.509 Certificates.		
UNIT V	**STEGANOGRAPHY**	**9**
Introduction to Steganography-Types of Steganography, Difference between Steganography and cryptography-Steganography Methods, Security and Detection in Steganography-Steganography Techniques in Images-Steganography Algorithms and Tools.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Describe fundamentals of networks security, security architecture threats and vulnerabilities.	
CO2:	Outline the different cryptographic operations of symmetric cryptographic algorithm.	
CO3:	Apply the different cryptographic operations of public key cryptography.	
CO4:	Build the various Authentication schemes to simulate different applications.	
CO5:	Construct various signature scheme using Digital signature standard.	
CO6:	Explain the various Steganography features.	

TEXT BOOKS:	
1	William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2	Nina God bole, SunitBelapure, "Cyber Security: Understanding Cybercrimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.
REFERENCES:	
1	Behrouz A. Ferouzan, Debden Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Grew Hill, 2015.
2	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition,Prentice Hall, New Delhi, 2015.

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

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

23CB511	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the ethics of hacking and the importance of ethical hacking, as well as develop knowledge and skills in vulnerability assessment and penetration testing.
- To comprehend and analyze various types of attacks in cybersecurity, Gain proficiency in using Metasploit for penetration testing.
- To develop management and reporting skills for penetration test. Explore and exploit vulnerabilities in operating systems.
- To gain knowledge of web application security vulnerabilities and acquire skills in vulnerability analysis.
- To develop skills in malware analysis and client-side browser exploits.

UNIT I	INTRODUCTION TO VULNERABILITY ASSESSMENT AND PENETRATION TESTING	9

Information Gathering Techniques - Active, Passive – Cyber Kill Chain - Understand adversaries' (TTP) Tactics, Techniques and Procedure in security, Vulnerability Assessment and Penetration Testing (VA/PT). Tools: Social Engineering Attacks - Physical Penetration Attacks - Insider Attacks - Knowledge base MITRE ATT&CK Enterprise / Mobile / ICS - Sources of Information Gathering - Approaches and Tools

UNIT II	METASPLOIT FRAMWORK	12

Metasploit Framework Modules - Auxiliary - Exploit - Payloads - Post - Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, HTTP + HTTPS - MySQL- PostgreSQL- SSH - WinRM - MSSQL-LDAP - Active Directory -

Going Further with Metasploit. Fake Authentication – Bypassing Firewalls – Evading Intruder Detection System		
UNIT III	**MANAGING A PENETRATION TEST**	**8**
Categories & Phases of Penetration Testing & Reports - Planning a penetration test, structuring a penetration test, execution of a penetration test, information sharing during a penetration test, reporting the results of a Penetration Test. Basic Linux Exploits: Stack Operations, Buffer Overflows, Local Buffer Overflow Exploits, Exploit Development Process. Windows Exploits: Compiling and Debugging Windows Programs, Writing Windows Exploits, Understanding Structured Exception Handling (SEH), Understanding Windows Memory Protections, Bypassing Windows Memory Protections.		
UNIT IV	**WEB APPLICATION SECURITY VULNERABILITIES**	**8**
Gaining Access – Escalation- Post Exploitation Server Side Attacks - Vulnerability Compliances using OWASP ZAP - Top web application security vulnerabilities, Injection vulnerabilities, cross-Site scripting vulnerabilities, OWASP Top Ten. Vulnerability Analysis: Passive Analysis, Source Code Analysis, Binary Analysis.		
UNIT V	**CLIENT-SIDE BROWSER EXPLOITS**	**8**
Client-side vulnerabilities, Internet explorer security concepts, history of client- side exploits and latest trends, finding new browser-based vulnerabilities heap spray to exploit, protecting from client-side exploit. Malware Analysis: Collecting Malware and Initial Analysis: Malware, Latest Trends in Honeynet Technology, Catching Malware: Setting the Trap, Initial Analysis of Malware.		
TOTAL: 45 PERIODS		

PRACTICALS:

1. Monitoring Network Traffic using Wireshark.
2. Host & Services discovery Open Ports and Services using Nmap – Zenmap – OpenVAS.
3. Internal Penetration Testing
    a) Mapping
    b) Scanning
    c) Gaining access through CVE's
    d) Sniffing POP3/FTP/Telnet Passwords
    e) ARP Poisoning
    f) DNS Poisoning
4. External Penetration Testing
    a) Evaluating external infrastructure
    b) Creating topological map identifying IP address of target
    c) Lookup domain registry for IP information
    d) Examining use of IPV6 at remote location
5. Vulnerability scanning with Nessus / Nikto
6. Web application assessment with Burp suite Community Edition HTTPs Repeater, Decoder, Sequencer, and Comparer.
7. Experiments on Metasploit Framework – SQL Injection, XSS, CSRF
8. Set up of Kali Linux in a Virtual machine and setup with DNS info and collection of local networks
9. Use password guessing tools to guess a password LOphtcrack, pwdump3, KerbCrack, John The Ripper, Brutus.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Evaluate the ethical considerations and legal implications in conducting ethical hacking activities using appropriate tools.
CO2:	Analyze and defend against social engineering, physical penetration, and insider attacks using automating penetration testing processes.

CO3:	Compare and report penetration tests effectively and develop and execute Linux and Windows exploits, bypassing memory protections.
CO4:	Analyze and mitigate web application security vulnerabilities and Conduct vulnerability analysis.
CO5:	Apply secure coding techniques and best practices across various stages of the software development lifecycle.
CO6:	Evaluate and protect against client-side browser exploits.
TEXT BOOKS:	
1	Stuttard, Dafydd, and Marcus Pinto. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws." 2nd Edition, Wiley, 2011.
2	Kennedy, David, Jim O'Gorman, Devon Kearns, and MatiAharoni. "Metasploit: The Penetration Tester's Guide." No Starch Press, 2011.
REFERENCES:	
1	Wylie, Phillip L., and Kim Crawley. "The PentesterBluePrint: Starting a Career as an Ethical Hacker." 2020, Wiley, United States.
2	Tiller, James S. "The Ethical Hack: A Framework for Business Value Penetration Testing." Auerbach Publications, CRC Press
3	Harper, Allen, Stephen Sims, and Michael Baucom. "Gray Hat Hacking: The Ethical Hacker's Handbook." 3rd Edition, Tata McGraw-Hill.
4	Zaid, Sabih. "Learn Ethical Hacking from Scratch: Your Stepping Stone to Penetration Testing." 2018, Packt Publishing Ltd, United Kingdom.
5	Atef, Mohamed. "Kali Linux for Ethical Hacking: Penetration Testing and Vulnerability Assessment for Network Security." 1st Edition, 2024, BPB Publications, India. ISBN: 978-93-55517-043.

6	Stuttard, Dafydd, and Marcus Pinto. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws." John Wiley & Sons, 2011.
7	Weidman, Georgia. "Penetration Testing: Hands-On Introduction to Hacking." 1st Edition, No Starch Press.
8	Wylie, Phillip L., and Kim Crawley. "The Pen Tester Blueprint: Starting a Career as an Ethical Hacker." 1st Edition, Wiley Publications.
9	MITRE. "MITRE ATT&CK: A Globally-Accessible Knowledge Base of Adversary Tactics and Techniques Based on Real-World Observations." https://attack.mitre.org/.

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

Recommended by Board of Studies	**08-11-2024**		
Approved	**3rd ACM**	**Date**	**30-11-2024**

23CB521	CRYPTOGRAPHY AND STEGANOGRAPHY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand and implement classical Cryptography Techniques
- To apply Transposition Techniques for Encryption.
- To master Modern Cryptographic Algorithms
- To explore Cryptographic Protocols and Security Mechanisms.

PRACTICALS

1. Write a program to implement the following cipher techniques to perform encryption and decryption
    a) Caesar Cipher
    b) Playfair Cipher
    c) Hill Cipher
2. Write a program to implement the following transposition techniques
    a) Rail fence technique –Row major transformation
    b) Rail fence technique - Column major transformation
3. Write a program to implement DES algorithm
4. Write a program to implement AES algorithm
5. Write a program to implement RSA Encryption algorithm
6. Write a code simulating ARP /RARP protocols.
7. Write a code simulating ARP /RARP protocols.
8. Write a program to implement the Diffie-Hellman Key Exchange mechanism. Consider one of the parties as Alice and the other party as bob.
9. Write a program to calculate the message digest of a text using the SHA-1 algorithm
10. Write a program to implement digital signature standard.
11. Hiding Data in Text using Whitespace-based Steganography.

TOTAL : 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply encryption and decryption algorithms such as Caesar Cipher, Playfair Cipher, and Hill Cipher, and demonstrate the ability to secure information through classical encryption techniques.
CO2:	Build transposition cipher techniques (Rail Fence) using row-major and column-major transformations to explore basic cryptographic methods for secure communication.
CO3:	Develop programs to implement modern symmetric encryption algorithms.
CO4:	Make use of the RSA encryption algorithm.
CO5:	Construct network security protocols.
CO6:	Analyse modern cryptographic mechanisms such as Diffie-Hellman Key Exchange, SHA-1 Message Digest, Digital Signature Standards, and Steganography for secure data transmission and authentication.

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	2	1	2	3	3	2	1
2	3	2	1	1	1	1	-	1	2	1	2	3	3	1	1
3	3	2	1	1	3	1	-	2	2	2	3	3	3	3	2
4	3	2	1	1	3	1	-	3	2	2	2	3	3	3	3
5	3	2	1	1	2	2	1	2	2	2	2	3	3	2	2
6	3	3	2	2	3	2	-	3	3	2	3	3	3	3	3
Overall Correlation	3	3	2	2	3	2	1	2	3	2	3	3	3	3	2

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

23CB522	SUMMER INTERNSHIP	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

- To provide students with practical exposure to the real-world cybersecurity industry environment by working with organizations or research labs on current cybersecurity challenges.
- To offer students hands-on experience with industry-standard cybersecurity tools and techniques such as Wireshark, Metasploit, and EnCase for ethical hacking, malware analysis, and network security.
- To develop students' abilities to analyze and solve complex cybersecurity issues, including risk management, threat detection, and mitigation, by applying theoretical concepts to practical scenarios.
- To enable students to design and implement security measures, tools, and solutions that address the real-world challenges faced by businesses or research organizations in cybersecurity.
- To cultivate ethical responsibility and professionalism in students when working with sensitive data and systems, ensuring compliance with cybersecurity laws, policies, and standards.

COURSE DESCRIPTION:

This **Summer Internship** provides students with exposure to real-world cybersecurity tasks in industry or research settings. Students will enhance their technical expertise by working with industry-standard tools, analyzing and solving security problems, and gaining experience in designing, implementing, and evaluating cybersecurity solutions. Emphasis is placed on ethical practices, professionalism, and effective communication, ensuring students are equipped to handle cybersecurity challenges in both business and societal contexts. This internship will also prepare students to work collaboratively in teams, manage projects, and continue learning throughout their careers.

Weekly Plan	
Week 1	Orientation and Introduction to Cybersecurity Practices
Week 2	Hands-on Activities and Practical Exposure
Week 3	Specialized Cybersecurity Domains
Week 4	Cybersecurity Governance and Reporting

FINAL REPORT & PRESENTATION

- **Report (60%)**
  - A comprehensive report that documents:
    - Daily/weekly activities and tasks.
    - Tools and techniques used.
    - Key learnings and challenges encountered.
    - Final assessment of the organization's security posture.
    - Future recommendations for improving cybersecurity.
- **Presentation (20%)**
  - A 15-20 minute presentation to summarize the work done, findings, and lessons learned.
  - The presentation should cover practical demonstrations (if possible) of cybersecurity tools or methodologies used during the internship.
- **Supervisor Feedback (20%)**
  - Feedback from the internship supervisor based on the intern's performance, initiative, technical skills, and professionalism.

Additional Guidelines:

- **Weekly Reporting**: Students must submit weekly progress reports to the course coordinator or faculty mentor to ensure consistent monitoring of internship progress.
- **Supervisor Meeting**: Regular interaction with the internship supervisor to discuss progress, challenges, and solutions.
- **Ethical Conduct**: Students are expected to maintain the highest ethical standards in all aspects of their internship, ensuring confidentiality and integrity.

TOTAL : 4 WEEKS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Demonstrate proficiency in cybersecurity tools such as Wireshark, Metasploit, EnCase, and other industry-standard tools used for ethical hacking, penetration testing, and cyber forensics.
CO2:	Analyze and mitigate security threats by identifying vulnerabilities in systems and networks, proposing solutions to safeguard organizational assets.
CO3:	Design cybersecurity strategies that align with the business and societal needs, incorporating secure coding, risk management, and compliance with security standards.
CO4:	Implement penetration testing and malware analysis methodologies to assess and improve the security of information systems.
CO5:	Apply ethical decision-making in cybersecurity tasks, ensuring adherence to laws, regulations, and ethical guidelines in handling sensitive data and responding to cyber incidents.
CO6:	Communicate cybersecurity findings and solutions effectively to both technical and non-technical stakeholders, demonstrating professionalism and clear reporting of security issues and their resolutions.

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

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

23CB523	MINI PROJECT	L	T	P	C
		0	0	3	2

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							**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

23CB601	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To help students to know the importance and need for software security.
- To help students to know about various attacks.
- To make students learn about secure software design.
- To familiarize with the risk management in secure software development.
- To understand the working of tools related to software security.

UNIT I	NEED OF SOFTWARE SECURITY	9

Software assurance and Software security – Threats to software security – Sources of software insecurity – Benefits of detecting software security – Properties of secure software – Influencing the security properties of software.

UNIT II	SECURE SOFTWARE DESIGN AND ARCHITECTURE	10

Requirements engineering for secure software – SQUARE process model – Requirements elicitation and prioritization – Security architecture - Software security practices for Architecture and Design: Architectural Risk Analysis – Software security knowledge for Architecture and Design: Security Principles, Security Guidelines, and Attack Patterns.

UNIT III	SECURITY RISK MANAGEMENT	9

Risk management life cycle – Risk profiling – Risk exposure factors – Risk evaluation and mitigation – Risk assessment techniques – Threat and vulnerability management – Security risk reviews.

UNIT IV	SECURE CODING AND TESTING	9

Code analysis – Coding practices – Software security testing –

Security testing considerations throughout the SDLC – Security failures – Examples of functional and attacker perspectives for security analysis – System complexity drivers and security – Deep technical problem complexity – Security controls and services.		
UNIT V	**SECURE PROJECT MANAGEMENT**	**9**
Governance and security – Adopting an enterprise software security framework – Security and project management – Maturity of practice.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify the need for software security.
CO2:	Apply security principles in software development.
CO3:	Explain the extent of risks in software systems.
CO4:	Demonstrate the concepts of secure coding and security testing.
CO5:	Identify the various aspects of security analysis and services.
CO6:	Make use of the procedure of adopting secure project management.

TEXT BOOKS:	
1	Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, "Software Security Engineering", Addison-Wesley, 1st Edition, United States, 2008 (Unit – 1, 2, 4 & 5).
2	Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", Syngress, Illustrated Edition, United States, 2011 (Unit – 3).

REFERENCES:	
1	Chris Wysopal, Lucas Nelson, Dino Dai Zovi, Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws", Addison-Wesley Professional, 1st Edition, India, 2006.

2	Jason Grembi, "Developing Secure Software", Cengage Learning, 1st Edition, India, 2009.
3	Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Packt Publishing, Kindle Edition, India, 2012.
4	Bryan Sullivan, Vincent Liu, "Web Application Security, A Beginner's Guide", Osborne / McGraw Hill, 1st Edition, United States, 2012.

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	1	3	3	2	2	2	3	2	3
2	3	2	1	1	3	2	1	3	3	2	2	3	3	3	3
3	2	1	-	-	2	2	1	3	3	2	2	3	2	2	3
4	2	1	-	-	3	2	1	3	3	3	2	3	2	3	3
5	3	2	1	1	3	3	2	3	3	2	2	3	3	3	3
6	3	2	1	1	2	3	2	3	3	3	3	3	3	2	3
Overall Correlation	3	2	1	1	3	3	2	3	3	3	3	3	3	3	3

Recommended by Board of Studies	**13-11-2024**		
Approved	**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

1. Determination of Bio fuel parameters such as flash point and fire point.
2. Determination of density of biofuels.
3. Determination of BOD/COD in water.
4. Simulating the RCM and GCM model for different geographic conditions.
5. 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**

23CB611	MALWARE ANALYSIS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To introduce the fundamentals of malware, types and its effects.
- To enable to identify and analyse various malware types by static analysis.
- To enable to identify and analyse various malware types by dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

UNIT I	INTRODUCTION TO MALWARE AND BASIC ANALYSIS	9

Definition of Malware, Types of Malware (Viruses, Worms, Trojans, Ransomware, Spyware, Rootkits), Malware Propagation Mechanisms.

Goals of Malware Analysis, Malware Analysis Techniques, Basic Static analysis Techniques and tools, Malware analysis in Virtual Machines, Basic dynamic analysis and tools.

UNIT II	STATIC MALWARE ANALYSIS	12

IDA PRO : Loading an Executable, The IDA Pro Interface, using Cross References, Analyzing Functions, Using Graphing options, Enhancing Disassembly, Extending IDA with Plug ins.

Analysing Malicious Windows programs: Windows API, Windows Registry, Networking APIs, Following Running Malware, Kernel Vs User mode.

UNIT III	DYNAMIC MALWARE ANALYSIS	8

Live malware analysis, Dead malware analysis, Analyzing traces of malware, system calls, API calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

UNIT IV	MALWARE FUNCTIONALITY	8
Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection		
UNIT V	**ANDROID MALWARE ANALYSIS**	**8**
Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies.		
		TOTAL: 45 PERIODS

PRACTICALS:

1. Experimentation on Initial Infection Vectors and Malware Discovery.
2. Implementation on Sandboxing Malware and Gathering Information From Runtime Analysis.
3. Implementation on Portable Executable (PE32) File Format.
4. Implementation on Executable Metadata and Executable Packers.
5. Experimentation on Malware Self - Defense, Compression, and Obfuscation Techniques.
6. Experimentation on Malware behaviour analysis.
7. Experimentation on analyzing Malicious Microsoft Office and Adobe PDF Documents.
8. Experimentation on Mobile malware analysis.
9. Experimentation on Packing and Unpacking of malware.
10. Experimentation on Rootkit AntiForensics and Covert Channels.
11. Experimentation on Modern Rootkit Analysis.
12. Experimentation on Malware traffic analysis.
13. Implementation of real time applications for the following malware analysis
    - **a.** Static analysis of malwares
    - **b.** Dynamic analysis of malwares.
    - **c.** Classification of malwares based on their behaviour.
    - **d.** Usage of tools to classify malware

	e. Advanced malware analysis **f.** Android malware analysis **g.** Applying antivirus tools in various applications **h.** Malware report documentation
	TOTAL: 30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify and classify different types of malwares.
CO2:	Apply basic static analysis techniques to analyze malware.
CO3:	Make use of tools like Process Monitor and Wireshark to perform dynamic malware analysis.
CO4:	Analyze the functionality of malware, including persistence mechanisms and privilege escalation.
CO5:	Evaluate Android malware analysis using both static and dynamic analysis techniques.
CO6:	Identify network-based attacks by comprehensive malware traffic analysis.
TEXT BOOKS:	
1	Michael Sikorski and Andrew Honig, "Practical Malware Analysis" by No Starch Press, 2012,ISBN: 9781593272906
2	Bill Blunden, "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.
REFERENCES:	
1	Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
2	Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3	Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O'Reilly, 2015.
4	Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.

5	Victor Marak , 'Windows Malware Analysis Essentials", Packt Publishing, 2015.

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

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

23CB621	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	**3rd ACM**	**Date**	**30-11-2024**

23CB622	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	**08-11-2024**		
Approved	**3rd ACM**	**Date**	**30-11-2024**

23CB623	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: 20 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**		
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SEMESTER – VII

23CB701	TECHNICAL 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							**3rd ACM**			**Date**			**30-11-2024**		

23CB711	CYBER FORENSICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the fundamentals of cyber forensics and its role in investigating cyber crimes.
- To gain knowledge of different types of cybercrimes and their investigation techniques.
- To acquire skills in handling, preserving, and analyzing digital evidence.
- To understand the legal and ethical issues surrounding cyber forensics and digital investigations.
- To familiarize with various digital forensics tools and techniques for data recovery and evidence analysis.

UNIT I	INTRODUCTION TO CYBER FORENSICS	8

Overview of Cyber Forensics: Definition, Scope, History and Evolution of Cyber Forensics - Cyber Forensics in Crime Investigation - Role of Cyber Forensics Experts

Cyber Crimes: Types of Cyber Crimes (Hacking, Data Breaches, Fraud, etc.) - Techniques Used by Cyber Criminals - Legal Aspects of Cybercrime - Cyber Forensics Tools Overview

UNIT II	CYBER FORENSICS INVESTIGATIONS AND EVIDENCE COLLECTION	9

Cybercrime Investigation Process: Phases of a Cybercrime Investigation -Evidence Handling and Preservation - Seizure, Documentation, and Chain of Custody. Digital Evidence: Types of Digital Evidence (Data, Metadata, Logs) - Evidence Collection from Different Devices (PCs, Smartphones, Cloud Storage) - Tools for Evidence Collection (FTK Imager, EnCase) - Ethical Issues in Evidence Collection

UNIT III	DATA RECOVERY AND ANALYSIS	9

Data Recovery Techniques: Disk and File Recovery - Recovery of Deleted Data (File Carving) - Recovering Encrypted and Damaged

Data.

Forensic Analysis: Forensic Analysis of Hard Drives and Storage Media - Analyzing Volatile Memory (RAM) - Using Forensic Software (Autopsy, X1 Search) - Forensic Analysis of Mobile Devices.

UNIT IV	LEGAL ASPECTS OF CYBER FORENSICS	7

Cyber Laws and Regulations: Indian IT Act 2000 and Amendments - Global Cybercrime Laws and Regulations (GDPR, HIPAA, etc.) - Laws Governing Digital Evidence

Legal Procedures in Cyber Forensics: Chain of Custody and Admissibility of Digital Evidence -Testifying in Court as a Cyber Forensics Expert - Digital Evidence in Criminal Cases

UNIT V	TOOLS AND TECHNIQUES IN CYBER FORENSICS	12

Digital Forensics Tools: Open-Source Tools: Autopsy, FTK Imager, The Sleuth Kit - Commercial Tools: EnCase, X1, AccessData Forensic Toolkit

Network Forensics: Capturing and Analyzing Network Traffic (Wireshark, tcpdump) - Investigating Network Attacks (DDoS, MITM, DNS Spoofing)

Cloud Forensics: Forensics in the Cloud - Investigating Cloud Storage and Data Breaches.

TOTAL: 45 PERIODS

PRACTICALS:

1. Demonstrate how to set up and use FTK Imager and Autopsy in a simulated environment.
2. Collect digital evidence from a hard drive using FTK Imager and document the process.
3. Use dd and FTK Imager to create forensic images of storage devices.
4. Use forensic tools to recover deleted files from NTFS file systems.
5. Investigate the impact and potential sources of the data

	breach using EnCase's features 6. Use Wireshark to capture and analyze live network traffic. 7. Perform forensic analysis on a USB or external storage device to recover deleted files. 8. Extract data from an Android device using forensic tools and identify key evidence for investigation. 9. Investigate and analyze cloud-based evidence for signs of data manipulation or breaches. 10. Extract and analyze email headers and metadata to trace the origin and authenticity of an email. 11. Use Splunk to analyze logs from different sources (web servers, firewalls, etc.). 12. Evaluate the legal significance of the forensic evidence and report findings and create a comprehensive forensic report suitable for presentation in court.
	TOTAL: 30 PERIODS:
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the concepts of cyber forensics, cybercrimes, and explain the various techniques used in cyber investigations.
CO2:	Categorize different types of cybercrimes such as hacking, data breaches, and online frauds.
CO3:	Analyze digital evidence and use forensics tools to recover, preserve, and examine data from different digital devices.
CO4:	Apply appropriate procedures for evidence handling, including seizure, chain of custody, and documentation.
CO5:	Identify the legal aspects of cyber forensics, including laws governing cybercrimes, evidence handling, and privacy issues.
CO6:	Make use of the industry-standard cyber forensics tools for data recovery, analysis, and reporting.
TEXT BOOKS:	
1	Nelson, Bill, Amelia Phillips, and Christopher Steuart.

	"Guide to Computer Forensics and Investigations." 5th ed. Cengage Learning, 2018.
2	Brock, Larry W. "Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom." Syngress, 2013.
REFERENCES:	
1	Mahalik, Heather, and Satish Bommisetty. "Practical Mobile Forensics." 3rd ed. Packt Publishing, 2021.
2	Marcella, Albert Jr., and Frederick C. Shreves. "Cyber Forensics: Understanding Information Security Investigations." 2nd ed. Pearson, 2013.
3	EC-Council. Computer Forensics: Investigating Network Intrusions and Cybercrime. 4th ed. Pearson, 2019.
4	Holt, Thomas J., and Adam M. Bossler. Cybercrime and Digital Forensics: An Introduction. Routledge, 2015.
5	Sammons, John. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics. Syngress, 2012.
6	Davidoff, Sherri, and Jonathan Ham. Network Forensics: Tracking Hackers Through Cyberspace. Addison-Wesley, 2009.
7	Meissner, John L., and Fred D. McKenna. The Forensic Examination of Digital Evidence: A Guide for Law Enforcement and First Responders. 2nd ed. Wiley, 2013.

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

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

23CB721	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	**3rd ACM**	**Date**	**30-11-2024**

23CB722	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	**3rd ACM**	**Date**	**30-11-2024**

SEMESTER -VIII

23CB821	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	**3rd ACM**	**Date**	**30-11-2024**

VERTICAL 1 - CYBER SECURITY AND DATA PRIVACY

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:

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	-

23CB032	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

UNIT I	INTRODUCTION TO DIGITAL FORENSICS	6

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II	DIGITAL CRIME AND INVESTIGATION	6

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III	DIGITAL FORENSIC READINESS	6

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV	IOS FORENSICS	6

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V	ANDROID FORENSICS	6

Android basics – Key Codes – ADB – Rooting Android – Boot

Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling
TOTAL: 30 PERIODS
PRACTICAL EXERCISES:
1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image. 2. Data extraction from call logs using Sleuth Kit. 3. Data extraction from SMS and contacts using Sleuth Kit. 4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups. 5. Process and parse records from the iOS system. 6. Extract installed applications from Android devices. 7. Extract diagnostic information from Android devices through the adb protocol. **8.** Generate a unified chronological timeline of extracted records.
TOTAL:30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the concepts of digital forensics.
CO2:	Analyze digital crimes and conduct investigations.
CO3:	Analyze variours forensic investigations readiness.
CO4:	Evaluate and extract digital evidence from iOS devices.
CO5:	Evaluate and extract digital evidence from Android devices.
CO6:	Utilize various forensic tools.

TEXT BOOKS:	
1	Andre Arnes, "Digital Forensics", Wiley, 2018.
2	Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

REFERENCES:	
1	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	-	-	-	1	1	3	3	2	1	-
2	3	3	2	2	3	-	-	-	2	2	1	2	3	3	-
3	3	3	2	2	1	-	-	-	3	2	1	1	3	1	-
4	3	3	3	3	3	-	-	-	1	3	3	2	3	3	-
5	3	3	3	3	2	-	-	-	2	3	2	3	3	2	-
6	3	2	1	1	2	-	-	-	2	2	2	2	3	2	-
Overall Correlation	3	3	2	2	2	-	-	-	2	3	2	3	3	2	-

23CB033	SOCIAL NETWORK SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To develop semantic web related simple applications.
- To explain Privacy and Security issues in Social Networking.
- To explain the data extraction and mining of social networks.
- To discuss the prediction of human behavior in social communities.
- To describe the Access Control, Privacy and Security management of social networks.

UNIT I	FUNDAMENTALS OF SOCIAL NETWORKING	6

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT II	SECURITY ISSUES IN SOCIAL NETWORKS	6

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT III	EXTRACTION AND MINING IN SOCIAL NETWORKING DATA	6

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

UNIT IV	PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES	6
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, Neo4j : Nodes, Relationships, Properties		
UNIT V	**ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT**	**6**
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
1. Design own social media application 2. Create a Network model using Neo4j 3. Read and write Data from Graph Database 4. Find "Friend of Friends" using Neo4j 5. Implement secure search in social media 6. Create a simple Security & Privacy detector		
TOTAL:30 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Evaluate semantic web related simple applications.	
CO2:	Solve Privacy and Security issues in Social Networking.	
CO3:	Explain the data extraction and mining of social networks.	
CO4:	Identify the prediction of human behavior in social communities.	
CO5:	Develop the applications of social networks.	
CO6:	Analyse various access control strategies.	

TEXT BOOKS:	
1	Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2	BorkoFurht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
REFERENCES:	
1	David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.
2	Baton, Jérôme, and Rik Van Bruggen. "Learning Neo4j 3.x:" Second Edition. Packt Publishing, 2017.
3	Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
4	Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.
5	GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking –Techniques and applications", First Edition, Springer, 2011.
6	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet,2008.
7	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved userModeling", IGI Global Snippet, 2009.
8	John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web‖, Springer, 2009.

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

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:

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	-

23CB035	APPLIED CRYPTOGRAPHY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamental principles and concepts of cryptography.
- To learn the basics of number theory and its applications in cryptographic algorithms.
- To explore the structure and security of symmetric key encryption
- To understand the workings and security of stream ciphers and their real- world applications.
- To study the principles of public key cryptography, including key exchange and digital signatures.
- To analyse cryptographic hash functions, message authentication codes (MACs), and cryptographic applications.

UNIT I	INTRODUCTION TO CRYPTOGRAPHY AND NUMBER THEORY BASICS	6

Overview of Cryptography - Basic Concepts-Plaintext and Ciphertext, Encryption and Decryption - Cryptographic Protocols Modular Arithmetic-Basics and Properties - Modular Exponentiation - Prime Numbers - Properties and Distribution - Prime Testing Algorithms, Greatest Common Divisor (GCD)- Euclidean Algorithm, Extended Euclidean Algorithm - Chinese Remainder Theorem-Statement and Proof - Applications in Cryptography.

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	6

Block Ciphers-DES (Data Encryption Standard)Structure - Operation, and Security Analysis - AES (Advanced Encryption Standard) – Structure - Key Expansion, and Security Analysis - Modes of Operation - Electronic Codebook (ECB) - Cipher Block Chaining (CBC) - Output Feedback (OFB) - Cipher Feedback (CFB) - Counter (CTR) - Double and Triple Encryption- Techniques and Their Security Implications.

UNIT III	STREAM CIPHERS	6
Encryption and Decryption with Stream Ciphers-Basic Principles and Applications - Shift-Register Based Stream Ciphers-Linear Feedback Shift Registers (LFSRs) - Nonlinear Feedback Shift Registers (NLFSRs) - Currently Used Stream Ciphers- Examples and Applications (e.g., RC4, Salsa20, ChaCha)		
UNIT IV	**PUBLIC KEY CRYPTOGRAPHY**	**6**
RSA Algorithm - Key GeneratioN – Encryption , Decryption, and Security - ElGamal Encryption – Algorithm – Security and Applications, Diffie- Hellman Key Exchange – Protocol - Security and Applications. Elliptic Curve Cryptography (ECC) – Basics - Key Exchange and Digital Signatures. Practical Digital Signatures-Digital Signature Algorithm (DSA) - RSA Digital Signatures - Elliptic Curve Digital Signature Algorithm (ECDSA)		
UNIT V	**HASH FUNCTIONS, MACS, AND CRYPTOGRAPHIC APPLICATIONS**	**6**
Hash Functions – Properties - One-way, Collision Resistant, Preimage Resistant, Examples: MD5, SHA-1, SHA-256, SHA-3, Message Authentication Codes (MAC)-HMAC (Hash-based Message Authentication Code),CMAC (Cipher-based Message Authentication Code),Side Channel Analysis-Power Analysis Techniques, Timing Analysis Techniques, Cryptographic Applications.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
1. Install and configure cryptographic libraries such as OpenSSL or PyCryptodome. 2. Implement modular arithmetic and the Euclidean algorithm for GCD 3. Encrypt and decrypt messages using DES and AES 4. Implement and analyze ECB, CBC, OFB, CFB, CTR, and GCM modes of operation		

5. Encrypt and decrypt messages using a stream cipher like RC4. 6. Generate RSA key pairs and implement RSA encryption, decryption, and digital signatures 7. Perform the Diffie-Hellman key exchange to establish a shared secret. 8. Implement point addition and scalar multiplication on elliptic curves, and ECDSA 9. Compute hash values using MD5 and SHA-256, and implement HMAC for message authentication 10. Measure execution time of cryptographic operations and analyze timing variations for side channel analysis	
TOTAL:30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the core principles of cryptography and the distinction between symmetric and asymmetric encryption.
CO2:	Apply number theory concepts such as modular arithmetic and the Chinese remainder theorem in cryptographic algorithms.
CO3:	Apply symmetric encryption techniques like DES and AES and their different modes of operation.)
CO4:	Construct stream ciphers using shift registers and evaluate their security for practical applications.
CO5:	Demonstrate proficiency in public key cryptosystems such as RSA, ElGamal, and Elliptic Curve Cryptography for secure communication.
CO6:	Analyze cryptographic hash functions and MACs for secure message authentication and analyze cryptographic applications for vulnerabilities.
TEXT BOOKS:	
1	Stallings, William. "Cryptography and Network Security: Principles and Practice". 7th edition., Pearson, 2016.

2	Schneier, Bruce. "Applied Cryptography: Protocols, Algorithms, and Source Code in C". 2nd edition., Wiley, 1996.
REFERENCES:	
1	Paar, Christof, and Jan Pelzl. "Understanding Cryptography: A Textbook for Students and Practitioners". 2nd ed., Springer, 2010.
2	Menezes, Alfred J., Paul C. van Oorschot, and Scott A. Vanstone. "Handbook of Applied Cryptography". CRC Press, 1997.

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	-	-	3	1	-
3	3	2	1	1	-	-	-	-	1	1	-	-	3	-	-
4	3	2	1	1	1	-	-	-	1	1	-	-	3	1	-
5	2	1	-	-		-	-	-			-	-	2		-
6	3	3	2	2	1	-	-	-	1	1	-	-	3	1	-
Overall Correlation	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**1**	**-**

23CB036	PRIVACY PRESERVING IN DATA MINING	L	T	P	C
		2	0	2	4

COURSE OBJECTIVES:

- To understand the concepts of privacy preserving Data Mining models and algorithms.
- To understand the concepts of Data Anonymization Methods and its Measures.
- To evaluate and appraise the solution designed for Multiplicative Perturbation.
- To formulate, Design and Implement the solutions for Utility-based Privacy Preserving Data.

UNIT I	INTRODUCTION	6

Introduction – Privacy-Preserving Data Mining Algorithms - The Randomization Method - Group Based Anonymization - Distributed Privacy-Preserving Data Mining.

UNIT II	INTERFACE CONTROL METHODS	6

Interface Control Methods Introduction - A Classification of Microdata Protection Methods - Perturbative Masking Methods - NonPerturbative Masking Methods -Synthetic Microdata Generation -Trading off Information Loss and Disclosure Risk.

UNIT III	MEASURES AND METHODS	6

Measure of Anonymity Data Anonymization Methods - A Classification of Methods - Statistical Measure of Anonymous - Probabilistic Measure of Anonymity - Computational Measure of Anonymity - reconstruction Methods for Randomization - Application of Randomization.

UNIT IV	METRICS EVALUATION	6

Multiplicative Perturbation - Definition of Multiplicative Perturbation - Transformation Invariant Data Mining Models - Privacy Evaluation for Multiplicative Perturbation - Attack Resilient Multiplicative Perturbation - Metrics for Quantifying

Privacy Level - Metrics for Quantifying Hiding Failure - Metrics for Quantifying Data Quality.		
UNIT V	**PRIVACY PRESERVING METHODS**	**6**
Utility-Based Privacy-Preserving Data Types of Utility-Based Privacy Preserving Methods - Utility-Based Anonymization Using Local Recording - The Utility-Based Privacy Preserving Methods in Classification Problems - Anonymization Merginal: Injection Utility into Anonymization Data Sets.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
1. Identify frequent itemsets and generate association rules from transactional data. 2. Reduce the dimensionality of the data while preserving as much variance as possible. Principal Component Analysis (PCA) 3. Predict a continuous variable based on one or more predictor variables.(Linear Regression) 4. Classify data points based on the majority class of their nearest neighbors. (K-NN) 5. Build a model that predicts the value of a target variable based on several input variables. (Decision Tree) **6.** Partition the data into k clusters where each data point belongs to the cluster with the nearest mean.(K-Means)		
TOTAL:30 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain the various datamining algorithms.	
CO2:	Demonstrate various interface control methods available in mining.	
CO3:	Choose the various Measurements and methods in Datamining.	

CO4:	Apply the concepts to calculate various metrics.
CO5:	Classify the preserving methods of datamining.
CO6:	Explain about the Anonymization dataset and its uses.
TEXT BOOKS:	
1	Aggarwal, Charu C., and S. Yu, editors. "Privacy-Preserving Data Mining: Models and Algorithms". Springer, 2008.
2	Aggarwal, Charu C. "Data Mining: The Textbook". 1st ed., Springer, 2015.
REFERENCES:	
1	Han, Jiawei, and Micheline Kamber. "Data Mining: Concepts and Techniques". 3rd ed., Elsevier, 2012.
2	Vaidya, Jaideep, Michael Zhu, and Christopher W. Clifton. "Privacy-Preserving Data Mining". Springer, 2006.

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

23CB037	INFORMATION SECURITY PRINCIPLES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand basics of Information Security.
- To know the legal, ethical, and professional issues in Information Security.
- To know the aspects of risk management.
- To become aware of various standards in this area.
- To know the technological aspects of Information Security.

UNIT I	INTRODUCTION	6

History, what is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, Introduction- SDLC-SDLC Methodologies-Requirements -System Design-Implementation-Testing-Deployment-Maintenance and support

UNIT II	SECURITY INVESTIGATION	6

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT III	SECURITY ANALYSIS	6

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.

UNIT IV	LOGICAL DESIGN	6

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT V	PHYSICAL DESIGN	6

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.

	TOTAL: 30 PERIODS
PRACTICAL EXERCISES:	
1. Create a virtual machine (VM) environment to simulate an information system. Identify and secure key components such as hardware, software, and network infrastructure. (Use VMware, VirtualBox). 2. Develop a simple security feature (e.g., authentication) using an agile SDLC methodology. Use project management tools to simulate the planning, design, and testing phases with integrated security features. (Use JIRA, Trello) 3. Create and apply security policies such as confidentiality, integrity, and availability for a small organization. Define access controls and security mechanisms. 4. Set up an LDAP server and implement an access control matrix. Configure permissions and test access control enforcement within an organization. (VMware, VirtualBox, Apache Directory Studio) 5. Capture and analyze packets on a network to detect suspicious activity. Use Wireshark's filtering tools to identify unauthorized data transmission and possible vulnerabilities. 6. Use RiskWatch to assess the risk in a sample IT system. Identify potential vulnerabilities, threats, and perform a risk assessment. **7.** Use OpenSSL to generate cryptographic keys and encrypt/decrypt messages. Use GPG to implement file and email encryption techniques.	
	TOTAL:30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Interpret the basics of information security.
CO2:	Illustrate the legal, ethical, and professional issues in

	information security.
CO3:	Identify the aspects of risk management.
CO4:	Build various standards in the Information Security System.
CO5:	Explain security policies and protocols to implement such policies.
CO6:	Analyze and implement Security Techniques.
TEXT BOOKS:	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security," Vikas Publishing House, New Delhi, 2003.
2	Stamp, Mark. Information Security: Principles and Practice. 3rd ed., Wiley, 2018.
REFERENCES:	
1	Charles P. Pfleeger, " Security in Computing" Pearson Education 5th Edition.
2	Micki Krause, Harold F. Tipton, "Handbook of Information Security Management," Vol 1-3 CRC Press LLC, 2004.
3	Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed," Tata McGrawHill, 2003.
4	Matt Bishop, "Computer Security Art and Science," Pearson/PHI, 2002.
5	Certified Information Systems Security Professional, Study Guide by Ed Tittle, Mike Chapple, James Michael Stewart, 6th Edition, Sybex Publication, 06 July 2012.

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
2	2	1	-	-	1	3	-	3	1	1	1	2	2	1	3
3	3	2	1	1	2	1	1	1	2	2	1	3	3	2	1
4	3	2	1	1	1	2	1	2	1	1	-	2	3	1	2
5	2	1	-	-	3	2	2	1	2	2	3	3	2	3	1
6	3	3	2	2	2	2	2	3	2	1	2	2	3	2	3
Overall Correlation	3	2	1	1	2	2	1	2	2	2	2	3	3	2	2

23CB038	INTRUSION DETECTION, PREVENTION AND KEY MANAGEMENT TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the core concepts and mechanisms involved in intrusion detection and prevention.
- To learn about the key management techniques essential for maintaining secure communication.
- To analyse various architectures of intrusion detection systems and key management schemes.
- To explore practical applications, tools, and techniques for intrusion detection and prevention.
- To understand the role of risk quantification and Return on Investment (ROI) in security decisions.
- To examine the legal, organizational, and standardization aspects of intrusion detection and prevention systems.

UNIT I	INTRODUCTION	6

Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anamoly detection – specification-based detection – hybrid detection Theoretical Foundations of Detection: Taxonomy of anomaly detection system – fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine – Evolutionary computation – Association rules – Clustering

UNIT II	ARCHITECTURE AND IMPLEMENTATION	6

System Architectures-Centralized – Distributed – Cooperative Intrusion Detection - Tiered architecture.

UNIT III	KEY MANAGEMENT TECHNIQUES	6

Key Management in Security- Importance, Types of keys: symmetric and asymmetric. Key lifecycle: generation, distribution, storage, usage, and destruction. Key Management Protocols- Diffie-Hellman Key Exchange, Public Key Infrastructure (PKI), Key Distribution Centers (KDCs).Risk

Quantification and ROI- Threat Briefing,Quantifying risk, Return on Investment (ROI)		
UNIT IV	**APPLICATIONS AND TOOLS**	**6**
Tool Selection and Acquisition Process - Bro Intrusion Detection – Prelude Intrusion Detection - Cisco Security IDS - Snorts Intrusion Detection – NFR security		
UNIT V	**LEGAL ISSUES AND ORGANIZATIONS STANDARDS**	**6**
Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.		
TOTAL: 45 PERIODS		

PRACTICAL EXERCISES:

1. Configure and run open-source Snort and write Snort signatures.
2. Configure and run open-source Zeek to provide a hybrid traffic analysis framework.
3. Understand TCP/IP component layers to identify normal and abnormal traffic.
4. Use open-source traffic analysis tools to identify signs of an intrusion.
5. Comprehend the need to employ network forensics to investigate traffic to identify a possible intrusion.
6. Use Wireshark to carve out suspicious file attachments.
7. Write tcpdump filters to selectively examine a particular traffic trait.
8. Craft and analyze packets using Scapy.
9. Use the open-source network flow tool SiLK to find network behavior anomalies.
10. Use your knowledge of network architecture and hardware to customize placement of IDS sensors and sniff traffic off the wire.

TOTAL : 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the fundamentals of intrusion detection, prevention techniques, and key management principles.
CO2:	Analyse and implement architectures for intrusion detection systems, including centralized, distributed, and cooperative systems.
CO3:	Develop key management schemes such as symmetric and asymmetric key management, key distribution protocols, and lifecycle management.
CO4:	Apply various intrusion detection tools, including Snort, Zeek, and other open- source IDS systems for traffic analysis and anomaly detection.
CO5:	Analyze and apply legal standards related to intrusion detection and prevention, including issues related to evidence and due care.
CO6:	Measure the security risks and quantify the Return on Investment (ROI) in terms of implementing security measures and tools.
TEXT BOOKS:	
1	Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2	Carl Enrolf, Eugene Schultz, Jim Mellander, "Intrusion detection and Prevention", McGraw Hill, 2004.
REFERENCES:	
1	Paul E. Proctor, "The Practical Intrusion Detection Handbook ", Prentice Hall, 2001.
2	Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007.
3	Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

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
2	3	3	2	2	1	3	-	3	1	1	1	2	3	1	3
3	3	2	1	1	2	1	1	1	2	2	1	3	3	2	1
4	3	2	1	1	1	2	1	2	1	1	-	2	3	1	2
5	3	3	2	2	3	2	2	1	2	2	3	3	3	3	1
6	3	3	3	3	2	2	2	3	2	1	2	2	3	2	3
Overall Correlation	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**

VERTICAL 2 -CYBER SECURITY APPLICATIONS AND ETHICS

23CB039	MACHINE LEARNING SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts of machine learning (ML) and its applications in real-world systems.
- To understand the vulnerabilities in AI models and explore various security concerns related to machine learning.
- To investigate common attacks on machine learning models, such as adversarial attacks, data poisoning, and model inversion.
- To explore defense mechanisms for safeguarding machine learning models against potential threats.
- To provide hands-on experience with tools and techniques for securing AI models and data used in ML-based systems.

UNIT I	INTRODUCTION TO MACHINE LEARNING AND SECURITY	6

Overview of machine learning techniques: Supervised, unsupervised, and reinforcement learning -Applications of machine learning: Natural language processing (NLP), computer vision, autonomous systems - Overview of AI model deployment and integration into real-world systems - Introduction to machine learning security - the importance of safeguarding models - Security concerns and challenges in deploying machine learning models.

UNIT II	VULNERABILITIES IN MACHINE LEARNING MODELS	6

Threats to machine learning models: Data leakage, model inversion, and overfitting - Common attacks on machine learning systems: Evasion attacks, poisoning attacks, and membership inference-Exploiting vulnerabilities in training datasets: Data poisoning attacks and their impact on model performance -

Adversarial examples - their role in machine learning model insecurity.		
UNIT III	**ADVERSARIAL ATTACKS AND DEFENSES**	**6**
Adversarial attacks: Definition, types (white-box, black-box), and techniques - Algorithms for generating adversarial examples: Fast Gradient Sign Method (FGSM), DeepFool, and others - Impact of adversarial attacks on model accuracy and robustness - Defensive techniques for adversarial attacks: Adversarial training, input preprocessing, and detection mechanisms - Exploring the trade-offs between model accuracy and robustness.		
UNIT IV	**SECURING MACHINE LEARNING MODELS**	**6**
Techniques for model security: Model watermarking, model verification, and secure model sharing -Differential privacy in machine learning: Ensuring data privacy and security during training -Model robustness: Regularization techniques, noise injection, and dropout -Secure data handling: Securing the training data pipeline and maintaining the integrity of model input - Ethical implications of securing AI models		
UNIT V	**CASE STUDIES AND PRACTICAL APPLICATIONS**	**6**
Real-world case studies of attacks on machine learning systems - Defense strategies used in industry and academia to secure AI models - Exploring tools for detecting adversarial examples and mitigating attacks - Best practices for securing machine learning models in production environments -Future challenges and research directions.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
1. Implement a simple machine learning model (e.g., a decision tree or neural network) and evaluate its vulnerability to adversarial attacks. 2. Explore data poisoning attacks by manipulating training		

datasets and assessing the impact on model performance.

3. Generate adversarial examples using the Fast Gradient Sign Method (FGSM) and evaluate the model's robustness.
4. Implement adversarial training to defend against adversarial attacks and measure its effectiveness.
5. Apply different model robustness techniques (e.g., dropout, L2 regularization) to increase model stability.
6. Implement a defense strategy against data poisoning by identifying and filtering out harmful data points in the training set.
7. Perform model inversion attacks to extract private information from a machine learning model.
8. Implement differential privacy techniques to ensure privacy while training machine learning models on sensitive data.
9. Use a tool to detect adversarial inputs and test its ability to filter out adversarial examples.
10. Explore model watermarking techniques to detect unauthorized use of a trained machine learning model.

TOTAL:30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basics of machine learning algorithms and their applications in various domains.
CO2:	Identify security vulnerabilities in machine learning models and datasets.
CO3:	Analyze common attacks on machine learning systems, including adversarial attacks and data poisoning.
CO4:	Develop defensive strategies to protect machine learning models from attacks and malicious interference.
CO5:	Evaluate and apply techniques such as adversarial training, model robustness, and secure data handling.

CO6:	Make use of tools to detect, mitigate, and recover from security breaches in machine learning systems.
TEXT BOOKS:	
1	Mohammed, Anish. "Machine Learning Security Principles and Practices". 1st edition. Wiley, 2020.
2	Goodfellow, Ian, and Nicolas Papernot. "Adversarial Machine Learning". 1st edition. MIT Press, 2018.
3	Ng, Andrew. "Machine Learning Yearning". 1st edition. DeepLearning.AI, 2018.
4	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep Learning". 1st ed. MIT Press, 2016.
REFERENCES:	
1	Wu, Shuang, and Heng Yin. "Security and Privacy in Machine Learning". 1st edition. Springer, 2021.
2	Russell, Stuart, and Peter Norvig. "Artificial Intelligence: A Modern Approach.", 4th edition. Pearson, 2020.
3	Murphy, Kevin P. "Machine Learning: A Probabilistic Perspective.", 1st edition. MIT Press, 2012.
4	Stamp, Mark. "Deep Learning Security: Challenges and Solutions", 1st edition. CRC Press, 2020.
5	Kumari, Ananya. "Practical Machine Learning Security". 1st edition. Apress, 2021.

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	2	2	1	2	2	2	2
2	3	2	1	1	2	3	1	3	3	2	2	3	3	3	3
3	3	3	2	2	3	2	2	3	3	2	2	3	3	3	3
4	3	2	1	1	3	3	1	3	3	3	2	3	3	3	3
5	3	3	3	3	3	3	1	3	3	2	2	3	3	3	3
6	3	2	1	1	3	3	2	3	3	3	2	3	3	3	3
Overall Correlation	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**

23CB040	SECURITY IN IoT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To assess IoT security risks.
- To implement appropriate security mechanisms.
- Get familiar with Security protocols.
- Explore cloud/edge infrastructures.
- To keep up with emerging security trends in the IoT domain.

UNIT I	INTRODUCTION TO IoT AND SECURITY CHALLENGES	6

Overview of IoT -Definition, architecture, and components of IoT – IoT applications and domains (smart homes, healthcare, industrial IoT, etc.)-Security Challenges in IoT -Security vs. Privacy in IoT- Unique security challenges (limited resources, heterogeneity, scalability) -IoT Attack Surface and Threats- Attack vectors and types (DoS, physical attacks, side-channel attacks)

UNIT II	IoT DEVICE SECURITY	6

Device Authentication and Identity Management -Secure boot and firmware integrity- Lightweight authentication protocols -Secure Storage and Key Management :-Key generation, distribution, and storage challenges- Public key infrastructure (PKI) in IoT- Access Control Mechanisms- Access control models (role-based, attribute-based).

UNIT III	NETWORK SECURITY IN IoT	6

IoT Communication Protocols and Security Protocols: MQTT, CoAP, and HTTP(S)- Security features and vulnerabilities in each protocol -Encryption and Data Protection Lightweight encryption algorithms :-End-to-end encryption for resource-constrained devices -Intrusion Detection and Prevention in IoT Networks :-IDS/IPS for IoT networks, Challenges in implementing IDS/IPS on IoT devices.

UNIT IV	CLOUD AND EDGE SECURITY FOR IoT	6
IoT Cloud Security- Data storage and processing in the cloud-Cloud-specific security risks and mitigation (data breaches, DDoS) -Edge and Fog Computing Security:- Distributed security models for edge/fog, Data offloading and security policies at the edge - IoT Data Privacy and Regulatory Compliance:- GDPR, HIPAA, and other regulatory standards, Privacy-preserving techniques and anonymization.		
UNIT V	**EMERGING TRENDS IN IoT SECURITY**	**6**
Blockchain and Decentralized Security for IoT :-Blockchain for secure IoT transactions, Benefits and limitations of blockchain in IoT -Artificial Intelligence and Machine Learning for IoT Security:- AI/ML for anomaly detection, Behavioral analysis and automated threat response.		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

1. Set up a basic IoT network using Arduino.
2. Use a network scanner like Nmap to scan and identify IoT devices on a network
3. Use MQTT with username/password authentication to establish secure communication between devices.
4. Implement role-based access control (RBAC) on an IoT device using simple code.
5. Implement and secure MQTT communication with TLS on an IoT network.
6. Use Wireshark or Snort to capture and analyze traffic from IoT devices.
7. Use AWS IoT or Google Cloud IoT Core to store and manage IoT data.
8. Use a blockchain platform (e.g., Ethereum) to create a simple decentralized application (DApp) for tracking device access and transactions.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the unique security challenges associated with IoT devices and networks.
CO2:	Identify vulnerabilities in IoT architectures and understand potential threats to IoT systems.
CO3:	Develop secure authentication, authorization, and encryption techniques.
CO4:	Apply security protocols for IoT communication, including secure handling of data at the network and application levels.
CO5:	Analyze security policies for IoT cloud and edge infrastructures, addressing privacy concerns and regulatory compliance.
CO6:	Apply emerging technologies such as blockchain and machine learning for advanced IoT security.
TEXT BOOKS:	
1	Hu, Fei. "Internet of Things Security: Principles and Practice." 1st Edition, CRC Press, 2017. ISBN: 978-1498739542.
2	Gupta, Brij B., and Ankur Gupta. "IoT Security Issues." 1st Edition, CRC Press, 2021. ISBN: 978-1032084897.
REFERENCES:	
1	Woungang, Isaac, Sherali Zeadally, and N. Meghanathan. "IoT Security: Advances in Authentication." 1st Edition, Springer, 2020. ISBN: 978-3030467839.
2	Hu, Fei. "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations." 1st Edition, CRC Press, 2018. ISBN: 978-1498723190.

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	3	2	2	1	-	-	1	-	1	-	-	3	1	1
6	3	2	1	1	1	-	-	1	-	1	-	1	3	1	1
Overall Correlation	3	2	1	1	1	-	-	1	-	1	-	1	3	2	1

23CB041	MOBILE AND WIRELESS SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To familiarize with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks
- To Gain knowledge and understanding of the various ways in which wireless networks can be attacked and tradeoffs in protecting networks.
- To understand the broad knowledge of the state-of-the-art and open problems in wireless and mobile security.
- To explore the various security issues involved in cloud computing.
- To explore the various security issues related to GPRS and 3G.

UNIT I	FOUNDATIONS OF MOBILE COMMUNICATION	6

Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

UNIT II	MOBILE SECURITY	6

Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications.

UNIT III	SECURING WIRELESS NETWORKS	6

Application Level Security in Cellular Networks: Generations of

Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.

UNIT IV	ADHOC NETWORK SECURITY	6

Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions.Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.

UNIT V	SECURITY IN ANDROID	6

Data Center Operations - Security challenge, implement "Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1. Study of different wireless network components and features of any one of the Mobile Security Apps.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
4. Study of different types of vulnerabilities for hacking a websites / Web Applications.
5. Analysis the Security Vulnerabilities of E-commerce services.
6. Analysis the security vulnerabilities of E-Mail Application
7. Study of different wireless network components and features of any one of the Mobile Security Apps.

	TOTAL:30 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Infer knowledge on wireless and mobile network security and its relation to the new security based protocols.
CO2:	Apply proactive and defensive measures to counter potential threats, attacks and intrusions.
CO3:	Explain about the security framework of android.
CO4:	Build secured wireless and mobile networks that optimism accessibility whilst minimizing vulnerability to security risks.
CO5:	Analyse the different types of vulnerability feature of Mobile.
CO6:	Make use of the tools for security applications in Android.
TEXT BOOKS:	
1	Pallapa Venkataram, Satish Babu: "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010.
2	Frank Adelstein, K.S.Gupta : "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.
REFERENCES:	
1	Randall k. Nichols, Panos C. Lekkas : "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006.
2	Bruce Potter and Bob Fleck : "802.11 Security" , 1st Edition, SPD O'REILLY 2005.
3	James Kempf: "Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols", 1st Edition, Cambridge University Press, 2008.

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

23CB042	CYBER PHYSICAL SYSTEM SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the concepts of Cyber Physical Systems (CPS) and their role in modern technologies.
- To identify the security challenges specific to CPS, including vulnerabilities and threats.
- To explore the application of cryptographic and security techniques in the protection of CPS.
- To analyze the various attack vectors and countermeasures for securing CPS.
- To design and implement secure solutions for CPS applications.

UNIT I	INTRODUCTION TO CYBER PHYSICAL SYSTEMS	6

Overview of Cyber Physical Systems (CPS) - Architectural Components of CPS - Applications of CPS in Industry (IoT, Smart Grids, Autonomous Vehicles, etc.) - Challenges in CPS Design and Development - Introduction to Security Concerns in CPS.

UNIT II	SECURITY RISKS AND VULNERABILITIES IN CPS	6

Understanding Vulnerabilities in CPS Environments - Types of Attacks on CPS: Network Attacks, Physical Attacks, and Data Attacks - Threat Models for CPS - Security Requirements for CPS - Case Studies of Attacks on CPS (e.g., Stuxnet)

UNIT III	CRYPTOGRAPHIC METHODS AND SECURITY PROTOCOLS	6

Cryptographic Methods for CPS Security - Public Key Infrastructure (PKI) - Authentication Protocols - Data Integrity and Confidentiality in CPS - Security Protocols for Wireless Networks and IoT Devices.

UNIT IV	COUNTERMEASURES AND SECURITY IN CPS NETWORKS	6
Designing Secure CPS Networks - Intrusion Detection Systems (IDS) for CPS - Anomaly Detection and Behavior Analysis - Mitigation Strategies for CPS Vulnerabilities - Security in CPS Communication Protocols		
UNIT V	**DESIGNING SECURE CPS APPLICATIONS**	**6**
Security in the Design and Implementation of CPS - Risk Assessment and Risk Management in CPS - Evaluation of Security Measures in CPS Applications - Securing Industrial Control Systems (ICS).		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

1. Model and simulate CPS using MATLAB/simulink
2. Perform simple Threat Modeling for CPS
3. Demonstrate Encryption and Decryption Techniques in CPS using Cryptographic Algorithms.
4. Perform the simulation of Cyber Attacks on CPS Networks
5. Demonstrate the application of Intrusion Detection Systems in CPS
6. Perform Vulnerability Assessment in IoT-based CPS
7. Implement Secure Communication Protocols for CPS
8. Implement Authentication Mechanisms for CPS Applications

TOTAL:30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the architecture and components of Cyber Physical Systems (CPS).
CO2:	Identify security risks, vulnerabilities, and threats in CPS environments.
CO3:	Apply cryptographic techniques and security protocols to secure CPS applications.

CO4:	Utilize the security of CPS networks and propose countermeasures to mitigate vulnerabilities.
CO5:	Examine the effectiveness for secure systems for CPS.
CO6:	Analyze the impact of cyber-attacks on physical systems and suggest methods for threat detection and response.
TEXT BOOKS:	
1	Mayer, Robert. "Cyber-Physical Systems: Security and Privacy Issues." 1st Edition, Wiley, 2020.
2	Liu, Shuang, and Daniele Rizzo. "Designing Secure Cyber-Physical Systems." 1st Edition, Springer, 2021.
REFERENCES:	
1	Sutton, Michael, and Nicole D. Smith. "Advanced Cyber-Physical Security: Emerging Threats and Mitigation Strategies." 1st Edition, Elsevier, 2022.
2	Wang, Yi, et al. "Cyber-Physical Systems Security: Fundamentals, Threats, and Countermeasures." 1st Edition, CRC Press, 2020.
3	Bertino, E., Sandhu, R., and Sandhu, D. "Cyber-Physical System Security: Threats and Countermeasures." 1st Edition, CRC Press, 2021.
4	He, Haibo, and Xiang Liu. "Security in Cyber-Physical Systems: Techniques, Tools, and Applications." 1st Edition, Springer, 2019.
5	Borenstein, J., Herlihy, M., and Korzun, D. "Cyber-Physical Systems: A Security and Privacy Perspective." 1st Edition, Elsevier, 2020.
6	Zhou, W., and Li, F. "Cyber Security for Smart Cities and Cyber-Physical Systems." 1st Edition, Wiley, 2019.
7	Hassan, R., and Bhattacharya, S. "Principles of Cyber-Physical Systems Security." 1st Edition, Wiley, 2021.

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	0	1	2	1	2
2	3	2	1	1	1	1	0	2	1	1	1	2	3	1	2
3	3	2	1	1	3	2	1	3	2	2	1	3	3	3	3
4	3	2	1	1	2	1	1	2	2	1	1	3	3	2	2
5	3	3	2	2	3	2	1	1	2	2	3	3	3	3	1
6	3	3	2	2	2	2	0	2	1	2	1	2	3	2	2
Overall Correlation	3	3	2	2	2	2	1	2	2	2	2	3	3	2	2

23CB043	SECURITY IN CLOUD COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand cloud computing architecture and the shared responsibility model in security.
- To explore various security challenges specific to cloud environments.
- To learn techniques for securing data, applications, and networks in cloud platforms.
- To examine compliance, identity management, and access control for cloud security.
- To analyse incident response, risk management, and disaster recovery strategies in cloud computing.

UNIT I	INTRODUCTION TO CLOUD SECURITY FUNDAMENTALS	6

Overview of Cloud Computing: Cloud models (public, private, hybrid), and service models (IaaS, PaaS, SaaS). Security Challenges in Cloud: Multi-tenancy, data privacy, data location, data breaches, and insider threats. Shared Responsibility Model: Division of security responsibilities between cloud providers and customers. Cloud Security Architectures: Security architecture for AWS, Azure, and Google Cloud.

UNIT II	DATA SECURITY IN CLOUD	6

Data Security and Privacy: Data lifecycle, data classification, data protection mechanisms. **Encryption Techniques**: Symmetric and asymmetric encryption, key management. **Data Loss Prevention (DLP)**: Strategies to prevent data leakage. **Secure Data Storage**: Techniques and tools for secure storage in cloud environments.

UNIT III	APPLICATION AND NETWORK SECURITY IN CLOUD	6

Application Security: Secure software development for cloud applications, secure APIs. **Network Security in Cloud**: Firewalls,

Intrusion Detection Systems (IDS), and Virtual Private Clouds (VPCs). **Web Application Security**: Cloud-based web security, protecting against threats such as SQL injection and XSS. **Cloud Security Tools**: Introduction to cloud-native security tools and third-party solutions

UNIT IV	COMPLIANCE, IDENTITY, AND ACCESS MANAGEMENT	6

Compliance in Cloud: Standards like GDPR, HIPAA, and ISO/IEC 27017. Identity and Access Management (IAM): Role-based access control (RBAC), Single Sign-On (SSO), and Multi-Factor Authentication (MFA). Access Control Models: Role-based and attribute-based access control for cloud resources. Identity Federation: Integrating cloud identity with enterprise identity solutions.

UNIT V	INCIDENT RESPONSE, RISK MANAGEMENT, AND DISASTER RECOVERY	6

Incident Response in Cloud: Planning, monitoring, and responding to security incidents. **Risk Management**: Identifying, assessing, and mitigating risks in cloud environments. **Disaster Recovery**: Backup strategies, recovery models, and testing disaster recovery plans. **Cloud Security Standards**: Overview of standards and frameworks like CSA, NIST, and ENISA

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1. Case study on shared responsibility models across major cloud providers.
2. Hands-on activity to review cloud infrastructure and identify potential security gaps.
3. Implementing encryption for data stored in the cloud.
4. Configuring and testing Data Loss Prevention (DLP) policies on a cloud platform.
5. Configuring firewalls and VPCs in a cloud environment.
6. Conducting a vulnerability assessment on a cloud-hosted

web application. 7. Setting up IAM policies and roles for cloud resources. 8. Configuring SSO and MFA in a cloud environment. 9. Developing an incident response plan for a cloud infrastructure. 10. Configuring backup and disaster recovery settings in a cloud service.	
TOTAL:30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify and describe the security challenges unique to cloud computing and evaluate the shared responsibility model.
CO2:	Apply techniques for data security, including encryption and secure data storage, in cloud environments.
CO3:	Examine various methods for ensuring application and network security in cloud services.
CO4:	Make use of the tools for compliance requirements, access control, and identity management systems for cloud security.
CO5:	Develop strategies for incident response and risk management specific to cloud infrastructures.
CO6:	Evaluate cloud security standards and implement disaster recovery strategies for cloud environments.
TEXT BOOKS:	
1	Mather, Tim, Subra Kumaraswamy, and Shahed Latif. "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance." 1st Edition, O'Reilly Media, 2009.
2	Winkler, Vic (J.R.). "Securing the Cloud: Cloud Computer Security Techniques and Tactics." 1st Edition, Syngress, 2011

REFERENCES:	
1	Samani, Raj, Jim Reavis, and Brian Honan. "CSA Guide to Cloud Computing: Implementing Cloud Privacy and Security." 1st Edition, Syngress, 2015.
2	Kumar, Saurabh. "Cloud Computing: Insights into New-Era Infrastructure." 1st Edition, Wiley India, 2011.
3	Winkler, J.R. (Vic). "Securing the Cloud: Cloud Computing Security Techniques and Tactics." 1st Edition, Syngress, 2011.
4	Krutz, Ronald L., and Russell Dean Vines. "Cloud Security: A Comprehensive Guide to Secure Cloud Computing." 1st Edition, Wiley, 2010

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

23CB044	ETHICAL PRACTICES IN OPEN SOURCE INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand OSINT Principles and Ethical Considerations.
- To learn the Legal Framework for OSINT.
- To learn to implement OSINT Tools and Techniques Responsibly.
- To assess the Impact of OSINT on Personal and Corporate Privacy.
- To promote Ethical Decision-Making in OSINT Practices.

UNIT I	INTRODUCTION TO OPEN SOURCE INTELLIGENCE (OSINT)	9

Definition and scope of OSINT - The role of OSINT in cybersecurity, investigations, and intelligence gathering - Ethical and legal frameworks governing OSINT - Overview of OSINT tools and techniques

UNIT II	LEGAL AND ETHICAL IMPLICATIONS IN OSINT	9

Data privacy laws: GDPR, CCPA, and other global regulations - Ethical guidelines for OSINT practitioners - Case studies: ethical breaches in OSINT use - Legal challenges and responsible OSINT practices

UNIT III	OSINT TOOLS AND TECHNIQUES	9

Popular OSINT tools: Maltego, Shodan, Google Dorks, etc. - Techniques for gathering information from public sources: social media, websites, forums, etc. - Hands-on use of OSINT tools for gathering, analyzing, and verifying data - Threat analysis and data validation in OSINT

UNIT IV	OSINT FOR INVESTIGATIONS AND SECURITY	9

OSINT for cybersecurity investigations - Using OSINT to uncover

vulnerabilities and threats - Security assessments and audits using OSINT - Real-world case studies on using OSINT for criminal investigations		
UNIT V	**ETHICAL DECISION-MAKING IN OSINT**	**9**
Ethical dilemmas in OSINT collection and analysis - Balancing security and privacy in OSINT practices - Decision-making frameworks in ethical OSINT use - Strategies for mitigating the risks of unethical OSINT practices		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the core principles of OSINT, including its tools, techniques, and ethical implications.
CO2:	Identify and analyze the ethical and legal challenges associated with the collection and use of open-source intelligence.
CO3:	Apply OSINT tools in a lawful and ethical manner to gather and process publicly available information.
CO4:	Demonstrate awareness of the impact of OSINT on personal privacy and corporate security.
CO5:	Develop strategies for mitigating the risks associated with unethical OSINT practices.
CO6:	Apply the ethical implications of using OSINT for security, investigations, and intelligence purposes.

TEXT BOOKS:	
1	Omand, David, Gill, Peter, and Fairbairn, Tim. Principles of Cyber Intelligence: A Practical Guide to Open Source Intelligence (OSINT). London: Springer, 2020.
2	Albanese, Salvatore. Open Source Intelligence Techniques: Resources for Searching and Analyzing Online Information. 7th ed. New York: CreateSpace Independent Publishing Platform, 2020.

REFERENCES:	
1	Miller, Robert, and Sweeney, Mark. Open Source Intelligence and the Cybersecurity Threat Landscape. New York: Wiley, 2021.
2	Zettelmeyer, Stefan, and Becerra, Carlos. OSINT Investigations: The Guide to Using Open Source Intelligence for Security and Investigative Purposes. London: Routledge, 2022.
3	Buchanan, Eric, and Rowland, Kevin. The Essential Guide to OSINT: From Data Privacy Laws to Ethical Dilemmas. New York: Elsevier, 2021.
4	Lanza, Dave. The Dark Web and OSINT: Using Open Source Intelligence for Cybersecurity and Legal Investigations. 2nd ed. Boston: Academic Press, 2023.

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

23CB045	CYBER CRIMES AND INVESTIGATION PROCEDURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the Fundamentals of Cybercrime.
- To familiarize with Legal and Ethical Standards in Cybercrime Investigations.
- To equip Students with Digital Evidence Collection Skills.
- To enhance Understanding of Network and Mobile Device Forensics,
- To address Emerging Cybercrime Threats and Investigation Techniques.

UNIT I	INTRODUCTION TO CYBER CRIME	9

Introduction to Cyber Crime – History and Evolution– Categories of Cyber Crime– The Role of Social Engineering in Cyber Crime– Impact of Cyber Crime on Society– Cyber criminals and their Motivations– Legal Frameworks and Cyber Crime Laws– Cyber Crime Investigation and Forensic Techniques– Emerging Trends and Future Directions in Cyber Crime

UNIT II	CYBER CRIME INVESTIGATION FUNDAMENTALS	9

Cyber Crime and Digital Forensics – Ethical Frameworks – Cyber Crime Investigation Methodology – Digital Evidence Collection and Preservation – Network Forensics and Log Analysis – Malware Analysis and Reverse Engineering – Incident Response and Incident Management – Investigating Cyber Crimes in Cloud and Virtual Environments – Future Challenges in Cybercrime Investigation

UNIT III	DIGITAL EVIDENCE COLLECTION AND ANALYSIS	9

Introduction to Digital Evidence – Legal Considerations – Tools and Techniques – Preservation and Chain of Custody – Forensic Imaging and Data Duplication – File System Analysis and Data

Recovery – Network Forensics and Traffic Analysis – Mobile Device Forensics – Data Analysis and Reporting		
UNIT IV	**CYBER CRIME INVESTIGATION PROCEDURES AND PRACTICES**	**9**
Incident Response and Initial Assessment – Evidence Identification and Collection Techniques – Chain of Custody and Evidence Preservation – Forensic Analysis and Examination Techniques – Reporting and Documentation of Findings – Collaboration with Law Enforcement and Legal Teams – Future-Proofing Cyber Investigation Practices.		
UNIT V	**FUTURE CHALLENGES IN CYBERCRIME INVESTIGATION**	**9**
Cyber Crime in Artificial Intelligence (AI) and Machine Learning (ML) Systems – Crypto currency and Block chain Forensics – Investigating Cybercrimes on the Dark Web – IOT and Smart Device Forensics – Cloud Forensics and Virtual Environments – Cyber security in Critical Infrastructure and Industrial Control Systems (ICS) – Social Media and Cyber Harassment Investigations – Quantum Computing and Its Impact on Cyber security – Policy and Regulatory Developments in Cybercrime		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain Cyber Crime and the impact of cybercrime on society.	
CO2:	Explain Cyber Crime investigation fundamentals.	
CO3:	Summarize digital evidence collection analysis.	
CO4:	Identify Cyber Crime investigation procedures and practises.	
CO5:	Explain challenges in cybercrime investigation.	
CO6:	Identify future trends in cybercrime investigation.	

TEXT BOOKS:	
1	James, Joshua I., and Frank Breitinger. "Digital Forensics and Cyber Crime: Principles and Practice." 1st Edition, 2019.
2	Sammons, John. "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics." 1st Edition, 2015.
REFERENCES:	
1	Akhgar, Babak, Andrew Staniforth, and Francesca Bosco. "Cyber Crime and Cyber Terrorism Investigator's Handbook." 1st Edition, 2014.
2	Hayes, Darren R. "Practical Guide to Computer Forensics Investigations." 1st Edition, 2014.
3	Holt, Thomas J., Adam M. Bossler, and Kathryn C. Seigfried-Spellar. "Cybercrime and Digital Forensics: An Introduction." 1st Edition, 2017.

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

23CB046	BEHAVIORAL ETHICS IN THE DIGITAL REALM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the Fundamentals of Behavioural Ethics in a Digital Context.
- To understand Ethical Dilemmas in Emerging Technologies.
- To understand the Ethical Implications of Digital Platforms and Social Media.
- To understand Digital Privacy, Security, and Legal Frameworks.
- To understand of Ethical Challenges in Technology.

UNIT I	INTRODUCTION TO BEHAVIORAL ETHICS IN THE DIGITAL ERA	9

Overview of Behavioural Ethics – Digital Transformation & Ethical Implications – Psychology of Ethical Decision-Making- Social Media & Ethics- Digital Identity and Privacy.

UNIT II	ETHICAL CHALLENGES IN EMERGING TECHNOLOGIES	9

AI and Machine Learning – Autonomous Systems - Big Data & Surveillance - Blockchain and Cryptocurrency - Ethics of Algorithmic Decision Making

UNIT III	ETHICAL DILEMMAS IN DIGITAL PLATFORMS	9

Social Media Ethics – Cyberbullying and Harassment - Data Monetization and User Consent - Influencer Culture and Ethics - The Ethics of Content Moderation

UNIT IV	DIGITAL PRIVACY AND SECURITY	9

Privacy in the Digital Age - Data Protection Laws and Ethics – Cyber security Ethics - Digital Footprint and Consent - Digital Divide and Access to Technology

UNIT V	THE FUTURE OF BEHAVIORAL ETHICS IN A DIGITAL SOCIETY	9
Ethical Implications of Digital Futures – Ethical Frameworks for Technology Designers - Corporate Social Responsibility in Tech - Education and Awareness - Global Perspectives on Digital Ethics		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain key concepts and ethical principles related to digital technologies.
CO2:	Illustrate major ethical dilemmas in digital platforms, privacy, and emerging technologies.
CO3:	Summarize the impact of digital technologies on ethical decision-making and behaviour.
CO4:	Identify the ethical implications of data collection, surveillance, and algorithmic biases.
CO5:	Apply ethical principles for digital ethical dilemmas in case studies.
CO6:	Explain ethical frameworks to assess solutions to privacy and cybersecurity challenges in digital environments.

TEXT BOOKS:	
1	Agle, Bradley D., David A. Jones, Michael W. Johnson, and Adolfo Villafiorita. "Behavioral Ethics in Organizations." 1st Edition, CRC Press, 2014.
2	Quinn, Michael J. "Ethics for the Information Age." 8th Edition, Pearson, 2022.

REFERENCES:	
1	Kroes, Peter, and Anthonie Meijers. "The Ethics of Technology: A Geometrical Approach to the Philosophy of Technology." 1st Edition, Springer, 2015. ISBN 978-9401773921.

2	Howard, Don, and Alison C. E. S. T. Harvey. "Digital Ethics: Research and Practice." 1st Edition, Routledge, 2019. ISBN 978-0367332675.
3	Zuboff, Shoshana. "The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power." 1st Edition, PublicAffairs, 2019. ISBN 978-1610395694.
4	Coeckelbergh, Mark. "AI Ethics." 1st Edition, MIT Press, 2020. ISBN 978-0262538654.
5	O'Rourke, Kevin H. "Ethics in the Age of Technology." 1st Edition, Oxford University Press, 2022. ISBN 978-0190916835.

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

VERTICAL 3 - COMPUTER SCIENCE

23CB047	SOFTWARE ENGINEERING PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals of software engineering, including life cycle models, project management, and software quality assurance.
- Learn and apply various software design methodologies to develop robust, scalable, and maintainable software systems
- Develop skills in software testing and validation to ensure software quality and functionality.
- Gain hands-on experience with modern tools and techniques for effective software development, such as version control, debugging, and profiling tools.
- Understand real-world problems and propose software solutions with a focus on meeting functional and non-functional requirements while maintaining ethical and professional standards.

UNIT I	INTRODUCTION TO SOFTWARE ENGINEERING	9

Introduction to Software Engineering: Definition and significance , Software crisis and the need ,Phases in the software lifecycle, Relationship between software engineering and other engineering disciplines Software Development Life Cycle (SDLC) Models: Waterfall model, Iterative and incremental models, V-Model - Spiral model - Agile methodologies (Scrum, Extreme Programming) Software Process Models: Characteristics and comparisons of process models -Tailoring software process models to project needs - Software Quality Assurance: Principles of software quality -Software metrics and models for estimation - Quality control vs quality assurance.

UNIT II	SOFTWARE DESIGN AND ARCHITECTURE	9

Principles of Software Design: Design process and principles

(abstraction, modularity, hierarchy) - Cohesion and coupling in design Software Design Methodologies: Structured design - Object-Oriented Design (OOD) and UML diagrams - Data-flow diagrams (DFD) and Entity-relationship diagrams (ERD) Design Patterns: Introduction to design patterns and types (Creational, Structural, Behavioral) - Common patterns: Singleton, Factory, Observer, Adapter, etc. Software Architecture: Architectural styles and patterns (client-server, layered architecture, microservices).		
UNIT III	**SOFTWARE TESTING AND QUALITY ASSURANCE**	**9**
Software Testing Fundamentals: Importance, Phases of testing, Levels of testing Testing Strategies and Techniques : Black-box testing and white-box testing – Regression testing, performance testing, and stress testing Defect Management and Bug Tracking Defect life cycle - Bug tracking tools (Jira, Bugzilla) - Reporting and managing software defects Software Quality Assurance (SQA): Techniques for ensuring software quality-- Metrics for quality evaluation (defect density, test coverage, reliability) -Continuous improvement processes (CMMI, Six Sigma)		
UNIT IV	**SOFTWARE PROJECT MANAGEMENT**	**9**
Software Project Management Fundamentals: Overview, Defining project goals, scope, and deliverables, Stakeholder management Estimation and Planning: Estimation techniques- Function point analysis, use case points, Project scheduling - Gantt charts, PERT diagrams, Critical Path Method (CPM) Risk Management: Identifying and managing risks in software projects, Risk mitigation strategies, Risk management tools Configuration Management and Version Control : Version control systems (Git, Subversion) - Branching, merging, and pull requests -Continuous Integration/Continuous Delivery (CI/CD) pipelines.		

UNIT V	ADVANCED SOFTWARE ENGINEERING TOPICS	9
Software Maintenance and Re-engineering: Types of software maintenance - Software re-engineering and reverse engineering - Legacy systems and their management Security in Software Engineering: Secure Software Development Lifecycle (SSDLC) - Principles of secure coding -Security testing and vulnerability management Software Deployment and Continuous Integration (CI): Software deployment models (cloud-based, on-premises) - Continuous integration tools (Jenkins, Travis CI, CircleCI) - Deployment strategies: Blue-Green, Canary releases, rolling deployments Ethical Issues in Software Engineering: Ethical considerations in software development - Professional responsibilities of a software engineer -Legal and societal implications of software (e.g., data privacy, intellectual property)		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Demonstrate a clear understanding of software engineering principles, methodologies, and life cycle models.	
CO2:	Apply software design patterns and architectural principles to create scalable and maintainable software systems.	
CO3:	Develop and implement effective software testing strategies to ensure software reliability and quality.	
CO4:	Solve the software projects effectively by applying project management tools and techniques.	
CO5:	Apply the industry-standard tools for version control, debugging, and software maintenance.	
CO6:	Analyze ethical and professional issues in software engineering and make decisions that align with industry standards.	

TEXT BOOKS:	
1	Sommerville, Ian. "Software Engineering." 10th Edition, Addison-Wesley, 2015.
2	Pressman, Roger S. "Software Engineering: A Practitioner's Approach." 8th Edition, McGraw-Hill, 2005.
REFERENCES:	
1	Boehm, Barry W. "Software Engineering Economics." Prentice-Hall, 1981.
2	Brooks, Frederick P. "The Mythical Man-Month: Essays on Software Engineering." Anniversary Edition, Addison-Wesley, 1995.
3	Larman, Craig. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process." 3rd Edition, Prentice-Hall, 2005.
4	Beizer, Boris. "Software Testing Techniques." 2nd Edition, Van Nostrand Reinhold, 1990.
5	IEEE. "IEEE Standard for Software Engineering - Software Life Cycle Processes." IEEE, 2017.
6	Schach, Stephen R. "Software Engineering: Principles and Practice." 8th Edition, McGraw-Hill, 2011.
7	McConnell, Steve. "Code Complete: A Practical Handbook of Software Construction." 2nd Edition, Microsoft Press, 2004.

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

23CB048	COMPUTATIONAL THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the foundational principles of computation, including automata theory, formal languages, and computational complexity.
- Learn and design various computational models, such as finite automata, pushdown automata, and Turing machines, and understand their capabilities and limitations.
- Examine the concepts of decidability, computability, and complexity to evaluate the solvability of computational problems.
- Explore the relationships between different classes of languages and automata, including regular languages, context-free languages, and recursively enumerable languages.
- Understand formal methods in problem-solving and algorithm design, understanding how theory informs practical computational tasks.

UNIT I	INTRODUCTION TO AUTOMATA THEORY	9

Basic Concepts of Computation - Definition of Automata, Formal Language, and Grammars - Classification of Languages (Regular, Context-Free, Recursive, etc.) -Chomsky Hierarchy of Languages Deterministic Finite Automata (DFA) - Formal Definition of DFA - Language Acceptance by DFA - Properties and Minimization of DFA Non-Deterministic Finite Automata (NFA) -Definition and Conversion of NFA to DFA -Equivalence of NFA and DFA

UNIT II	REGULAR LANGUAGES AND REGULAR EXPRESSIONS	9

Regular Expressions - Definition and Construction of Regular Expressions -Equivalence of Regular Expressions and Finite Automata - Operations on Regular Expressions (Union,

Concatenation, Kleene Star) Regular Languages - Closure Properties of Regular Languages -Pumping Lemma for Regular Languages -Applications of Regular Languages -Lexical analysis and string matching algorithms		
UNIT III	**CONTEXT-FREE LANGUAGES AND PUSHDOWN AUTOMATA**	**9**
Context-Free Grammars (CFG) - Definition and Derivations - Chomsky Normal Form and Greibach Normal Form - Parsing of Context-Free Languages (LL, LR Parsing) Pushdown Automata (PDA) - Definition of PDA - Equivalence of CFGs and PDAs - PDA and Language Acceptance Pumping Lemma for Context-Free Languages - Pumping Lemma and its applications to Context-Free Languages		
UNIT IV	**TURING MACHINES AND COMPUTABILITY**	**9**
Turing Machines (TM) - Formal Definition - Variations of Turing Machines (Multi-Tape, Non-Deterministic Turing Machines)- Church-Turing Thesis and its implications Decidability and Computability-Decidable vs. Undecidable Problems -Halting Problem and its implications Reducibility and Undecidability - Rice's Theorem and its applications - Examples of Undecidable Problems		
UNIT V	**COMPUTATIONAL COMPLEXITY**	**9**
Complexity Classes - P, NP, NP-Complete, NP-Hard Classes and their relationship - Cook-Levin Theorem and NP-Completeness Time and Space Complexity - Big-O, Big-Ω, and Big-Θ Notations - Space Complexity and PSPACE Complexity of Some Problems - Examples of NP-Complete Problems (e.g., Traveling Salesman Problem, SAT) -Approximation Algorithms and Heuristics		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Demonstrate the fundamental concepts of automata theory	

	and formal languages, including the classification of languages and automata.
CO2:	Analyze and Design the deterministic and non-deterministic finite automata, and apply regular expressions to model languages.
CO3:	Apply pushdown automata to model context-free languages and grammars.
CO4:	Illustrate the turing machines and their significance in computability and decidability.
CO5:	Analyze the complexity of computational problems, using the classes P, NP, and NP-Complete, and apply these concepts to real-world problems.
CO6:	Apply formal methods and the theory of computation to solve practical problems related to language recognition, parsing, and problem-solving in the field of cybersecurity
TEXT BOOKS:	
1	Sipser, Michael. "Introduction to the Theory of Computation." 3rd Edition, Cengage Learning, 2012.
2	Hopcroft, John E., Rajeev Motwani, and Jeffrey D. Ullman. "Introduction to Automata Theory, Languages, and Computation." 3rd Edition, Addison-Wesley, 2006.
REFERENCES:	
1	Kozen, Dexter. "Automata and Computability." Springer, 1997.
2	Ullman, Jeffrey D. "Introduction to Automata Theory, Formal Languages, and Computation." 1st Edition, Addison-Wesley, 1989.
3	Arora, Sanjeev, and Boaz Barak. "Computability and Complexity Theory." 2nd Edition, Springer, 2009.
4	Goldrei, David. "Propositional and Predicate Calculus: A Model of Argument." Routledge, 1996.
5	Linz, Peter. "An Introduction to Formal Languages and Automata." 6th Edition, Jones & Bartlett Learning, 2011.

6	Papadimitriou, Christos H. "Computational Complexity." Addison-Wesley, 1994.
7	Lewis, Harry R., and Christos H. Papadimitriou. "Elements of the Theory of Computation." 2nd Edition, Prentice Hall, 2002.

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	2	1	3	2	1	2
2	3	3	2	2	1	2	1	2	2	1	2	3	3	1	2
3	3	2	1	1	1	2	1	2	3	1	2	3	3	1	2
4	2	1	-	-	1	2	1	2	3	2	2	3	2	1	2
5	3	3	2	2	2	3	2	3	3	2	3	3	3	2	3
6	3	2	1	1	2	3	2	3	3	2	3	3	3	2	3
Overall Correlation	3	2	1	1	2	2	2	3	3	2	3	3	3	2	3

23CB049	DESIGN OF COMPILERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the principles and components involved in the design and implementation of compilers.
- To explore the various phases of a compiler, including lexical analysis, syntax analysis, semantic analysis, optimization, and code generation.
- To learn the design and implementation techniques for lexical analyzers, parsers, and syntax-directed translation.
- To develop skills in optimizing code for better performance, considering both space and time complexities.
- To gain practical experience in building a simple compiler using standard tools and techniques.

UNIT I	INTRODUCTION TO COMPILERS	9

Definition and role of a compiler -Phases of a compiler: lexical analysis, syntax analysis, semantic analysis, optimization, and code generation -Compiler construction tools and techniques -Introduction to lexical analysis and finite automata -Overview of language processing systems

UNIT II	LEXICAL ANALYSIS	9

Role and function of a lexical analyzer - Regular expressions and finite automata -Design and construction of a lexical analyzer - Lexical analysis tools (e.g., Lex) - Error handling in lexical analysis

UNIT III	SYNTAX ANALYSIS	9

Role and function of a syntax analyzer - Context-free grammars and syntax trees -Parsing techniques: LL, LR, and SLR parsers - Top-down and bottom-up parsing strategies -Parsing algorithms and parsing tools (e.g., Yacc)

UNIT IV	SEMANTIC ANALYSIS AND SYNTAX DIRECTED TRANSLATION	9

Role of semantic analysis in compiler design - Symbol tables, type checking, and scope management - Syntax-directed translation and intermediate representations - Abstract syntax trees (ASTs) - Type systems and type inference.		
UNIT V	**CODE GENERATION AND OPTIMIZATION**	**9**
Code generation techniques: target machine, instruction selection, and register allocation -Intermediate code generation (e.g., Three-address code) -Optimization techniques: loop optimization, inlining, constant folding, and dead code elimination - Code generation tools and techniques -Overview of modern compiler construction and advanced topics in compiler optimization		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain about front end and back end phases of compilation process and passes of compiler
CO2:	Construct a lexical analyzer for a sample language using LEX tool
CO3:	Develop a Parser using different parsing algorithms.
CO4:	Construct Syntax Directed Translation Scheme (SDT) for semantic rules and apply intermediate code generation algorithm to generate code sequence
CO5:	Explain run time environment and issues in code generation
CO6:	Apply the Code Optimization Techniques to improve the performance of the code.

TEXT BOOKS:	
1	Aho, Alfred V., Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman. "Compilers: Principles, Techniques, and Tools." 2nd ed. Boston: Addison-Wesley, 2006.
2	Sebesta, Robert W. "Programming Languages: Concepts and Constructs". 2nd ed. Boston: Addison-Wesley, 1996.

REFERENCES:	
1	Ullman, Jeffrey D. "Elements of Compiler Design." 1st ed. Cambridge, MA: Cambridge University Press, 1999.
2	Dragon, Jeffrey D. "Compilers: Principles and Practice", 1st ed. Boston: Addison-Wesley, 1978.
3	Knuth, Donald E. "The Art of Computer Programming: Volume 1, Fundamental Algorithms." 3rd ed. Boston: Addison-Wesley, 1997.
4	Muchnick, Stephen S. "Advanced Compiler Design and Implementation ", San Francisco: Morgan Kaufmann, 1997.
5	Appel, Andrew W. "Modern Compiler Implementation in C/Java/ML", 2nd ed. Cambridge: Cambridge University Press, 2002.
6	Fischer, Carl K., and Richard J. LeBlanc. "Crafting a Compiler". Boston: Benjamin-Cummings, 1991.
7	Louden, Kenneth C. "Compiler Construction: Principles and Practice." 1st ed. Boston: Benjamin-Cummings, 1997.

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

23CB050	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts of object-oriented analysis and design (OOAD) and how they are used to model and design software systems.
- To understand the principles of object-oriented programming, including inheritance, polymorphism, encapsulation, and abstraction, and how they influence system design.
- To learn the methodologies for modeling and representing real-world entities using class diagrams, interaction diagrams, and state diagrams.
- To understand and apply the Unified Modeling Language (UML) for software system design and specification.
- To enhance problem-solving skills by designing object-oriented solutions for real-world applications and analyzing the effectiveness of the design.

UNIT I	INTRODUCTION TO OBJECT-ORIENTED ANALYSIS AND DESIGN	9

Overview of Object-Oriented Paradigm -Characteristics of object-oriented systems: Encapsulation, Inheritance, Polymorphism, Abstraction -Benefits and challenges of OOAD -Comparison between structured analysis and object-oriented analysis Object-Oriented Analysis vs. Design -Overview of analysis and design process -Phases in object-oriented software development: Requirements gathering, analysis, design, and implementation.

UNIT II	OBJECT-ORIENTED DESIGN PRINCIPLES AND MODELS	9

Key Object-Oriented Design Principles: SOLID principles - Single responsibility, Open/Closed, Liskov substitution, Interface segregation, Dependency inversion, Coupling, Cohesion, and

Encapsulation -Introduction to UML (Unified Modeling Language): Use case diagrams, Class diagrams, Object diagrams, Sequence and Collaboration diagrams, Activity and State diagrams.		
UNIT III	**OBJECT-ORIENTED ANALYSIS USING UML**	**9**
Requirements Gathering and Use Case Analysis:Use Case diagrams and actors, Identifying system requirements and functionality using use cases -Domain Model and Class Modeling: Class diagrams: Classes, attributes, methods, and associations, Relationship types: Generalization, Aggregation, Composition, and Association, Object Modeling: Object Interaction and behavior modeling using interaction diagrams -Communication and Sequence Diagrams for object interactions.		
UNIT IV	**DESIGN PATTERNS AND PRINCIPLES**	**9**
Introduction to Design Patterns: Overview and types of design patterns: Creational, Structural, Behavioral - Example patterns: Singleton, Factory, Observer, Strategy, Composite -Object-Oriented Design Principles and Best Practices: Design for maintainability, flexibility, and scalability - Refactoring and improving designs -Avoiding common design mistakes Applying Design Patterns in Real-World Systems: Case studies of applying design patterns.		
UNIT V	**OBJECT-ORIENTED DESIGN AND IMPLEMENTATION**	**9**
From Design to Implementation: Translating UML diagrams into code (class structure, inheritance, polymorphism) - Object creation and management -Software Quality and Testing in Object-Oriented Design: Unit testing in OO systems -Mocking, Stubbing, TDD (Test-Driven Development) -Refactoring and code reviews Performance considerations in OO design: Optimization techniques and trade-offs in OO systems -Managing system complexity and ensuring reusability.		

	TOTAL: 45 PERIODS
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the key principles of object-oriented analysis and design, including abstraction, encapsulation, inheritance, and polymorphism.
CO2:	Develop and model systems using UML diagrams, including use case diagrams, class diagrams, sequence diagrams, and activity diagrams.
CO3:	Apply object-oriented analysis of real-world problems and translate them into object-oriented models.
CO4:	Make use of object-oriented programming languages and frameworks to implement object-oriented designs using.
CO5:	Apply design patterns to improve the flexibility, scalability, and maintainability of object-oriented systems.
CO6:	Examine and refactor object-oriented designs for better performance, maintainability, and reuse.
TEXT BOOKS:	
1	Booch, Grady, James Rumbaugh, and Ivar Jacobson. "The Unified Modeling Language User Guide". 2nd ed. Boston: Addison-Wesley, 2005.
2	Jacobson, Ivar, Grady Booch, and James Rumbaugh. "Object-Oriented Software Engineering: A Use Case Driven Approach", Boston: Addison-Wesley, 1999.
REFERENCES:	
1	Pressman, Roger S. "Software Engineering: A Practitioner's Approach", 8th ed. New York: McGraw-Hill, 2005.
2	Gamma, Erich, Richard Helm, Ralph Johnson, and John Vlissides. "Design Patterns: Elements of Reusable Object-Oriented Software", Boston: Addison-Wesley, 1994.
3	McDonald, R. J. "Object-Oriented Analysis and Design with Applications", 2nd ed. Reading, MA: Addison-Wesley, 1997.

4	Coad, Peter, and Edward Yourdon. "Object-Oriented Design: Object-Oriented Modeling and Design", Englewood Cliffs, NJ: Prentice Hall, 1991.
5	Rumbaugh, James, Michael Blaha, William Premerlani, Frederick Eddy, and William Lorensen. "Object-Oriented Modeling and Design", Englewood Cliffs, NJ: Prentice Hall, 1991.
6	Larman, Craig. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd ed. Upper Saddle River, NJ: Prentice Hall, 2004.
7	Fowler, Martin. "UML Distilled: A Brief Guide to the Standard Object Modeling Language", 3rd ed. Boston: Addison-Wesley, 2003.

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

23CB051	SOFTWARE TESTING PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and principles of software testing.
- To provide hands-on knowledge of various software testing techniques and methodologies.
- To help students develop skills to design effective test cases and identify software defects.
- To ensure students understand the lifecycle of software testing and quality assurance.
- To enable students to integrate testing in the software development life cycle (SDLC) and Agile methodologies.

UNIT I	INTRODUCTION TO SOFTWARE TESTING	9

Overview of Software Testing - Importance and Benefits of Software Testing - Software Development Life Cycle (SDLC) and Testing Life Cycle - Role of Testing in Quality Assurance -Types of Testing (Manual vs Automated)

UNIT II	TESTING METHODOLOGIES AND TECHNIQUES	9

Black-box Testing, White-box Testing, and Grey-box Testing - Equivalence Class Partitioning and Boundary Value Analysis - Exploratory Testing -Regression Testing -Acceptance Testing

UNIT III	TEST DESIGN AND TOOLS	9

Test Case Design Techniques - Test Data Preparation-Test Execution and Result Evaluation - Introduction to Automated Testing Tools (e.g., Selenium, QTP) -Performance and Load Testing.

UNIT IV	SOFTWARE TESTING TYPES AND STRATEGIES	9

Unit Testing, Integration Testing, System Testing - Smoke Testing,

Sanity Testing -User Acceptance Testing (UAT) -Alpha and Beta Testing -Test Planning and Test Strategy		
UNIT V	**ADVANCED SOFTWARE TESTING CONCEPTS**	**9**
Risk-Based Testing - Test Automation Frameworks -Continuous Integration (CI) and Continuous Testing - Security Testing and Vulnerability Assessment -Ethics in Software Testing and Professionalism		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain and apply fundamental software testing concepts and principles.
CO2:	Develop effective test cases using various testing techniques and tools.
CO3:	Examine software quality using manual and automated testing methods.
CO4:	Identify and report software defects and provide detailed test reports.
CO5:	Illustrate the integration of testing within SDLC and Agile frameworks.
CO6:	Apply ethical behaviour and professionalism in the practice of software testing.

TEXT BOOKS:	
1	Beizer, Boris. "Software Testing Techniques". 2nd ed. New York: Van Nostrand Reinhold, 1990.
2	Kaner, Cem, Jack Falk, and Hung Q. Nguyen. "Testing Computer Software". 2nd ed. New York: Wiley, 1999.

REFERENCES:	
1	Pressman, Roger S. "Software Engineering: A Practitioner's Approach". 9th ed. New York: McGraw-Hill, 2014.

2	Ammann, Paul, and Jeff Offutt. " Introduction to Software Testing. ", 2nd ed. Cambridge: Cambridge University Press, 2016.
3	Jorgensen, Paul C." Software Testing: A Craftsman's Approach. ", 4th ed. Boca Raton, FL: CRC Press, 2013.
4	Sebesta, Richard W." Programming Languages: Concepts and Constructs. ", 3rd ed. Boston: Addison-Wesley, 2000.
5	Sommerville, Ian. " Software Engineering.", 10th ed. Boston: Addison-Wesley, 2015.
6	Myers, Glenford J. "The Art of Software Testing", 3rd ed. Hoboken, NJ: Wiley, 2011.
7	Black, Rex. "Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing", 3rd ed. New York: Wiley, 2009.

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	1	1	2	2	2	3	2
2	3	2	1	1	3	3	1	2	2	2	2	2	3	3	2
3	3	3	2	2	3	2	1	3	2	1	2	2	3	3	3
4	3	2	1	1	3	1	2	2	1	2	2	3	3	3	2
5	2	1	-	-	3	3	1	3	2	2	2	1	2	3	3
6	3	2	1	1	1	1	2	1	3	3	2	3	3	1	1
Overall Correlation	3	2	1	1	3	2	2	3	2	2	2	3	3	3	3

23CB052	DATAWAREHOUSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and architecture of Data Warehousing.
- To provide hands-on experience in designing, developing, and managing Data Warehouses.
- To understand various Data Modeling techniques used in Data Warehousing.
- To develop skills in Extract, Transform, Load (ETL) processes and data integration.
- To explore various tools and technologies used for implementing Data Warehouses in a business context.

UNIT I	INTRODUCTION TO DATA WAREHOUSING	9

Definition of Data Warehousing -Components of a Data Warehouse: Data Source, ETL, Data Warehouse, Data Marts - Data Warehouse Architecture - Types of Data Warehouses - OLAP vs OLTP Systems

UNIT II	DATA WAREHOUSE DESIGN	9

Data Warehouse Design Steps - Star Schema and Snowflake Schema - Fact Tables and Dimension Tables - Data Modeling Concepts - Designing for Performance

UNIT III	EXTRACT, TRANSFORM, LOAD (ETL) PROCESS	9

Introduction to ETL ETL Architecture and Tools - Data Extraction Techniques -Data Transformation Rules and Techniques - Data Loading Strategies

UNIT IV	DATA MINING AND OLAP TECHNOLOGIES	9

Introduction to OLAP (Online Analytical Processing) - OLAP Cube Design - Data Mining in Data Warehousing - Data Mining Techniques for Pattern Recognition -Applications of OLAP and Data Mining.

UNIT V	DATA WAREHOUSING TOOLS AND CASE STUDIES	9
Popular Data Warehousing Tools: Informatica, Microsoft SQL Server, Oracle Data Warehouse - Case Studies in Data Warehousing -Real-time Applications of Data Warehouses in Industries - Issues and Challenges in Data Warehousing.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the concept of Data Warehousing and its components.
CO2:	Develop Data Warehouses using appropriate schemas and data models.
CO3:	Apply ETL processes to extract, transform, and load data effectively.
CO4:	Apply OLAP and Data Mining techniques in Data Warehousing.
CO5:	Make use of popular tools and technologies to develop and manage Data Warehouses.
CO6:	Apply Data Warehousing concepts to solve real-world business and technological problems.

TEXT BOOKS:	
1	Inmon, William H. "Building the Data Warehouse". 4th ed. Wiley, 2005.
2	Kimball, Ralph, and Margy Ross. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling". 3rd ed. Wiley, 2013.

REFERENCES:	
1	Agrawal, Rajeev, and Sunita Gupta. "Data Warehousing and Mining: Concepts, Methodologies, Tools, and Applications." 1st ed. Idea Group Publishing, 2005.
2	Thuraisingham, Bhavani. "Data Mining: Techniques and Applications for Cyber Security". CRC Press, 2021.

3	Golfarelli, M., and S. Rizzi. "Data Warehouse Design: Modern Principles and Methodologies". McGraw-Hill, 2009.
4	Sarda, Niraj. "Data Warehousing in the Age of Big Data". Elsevier, 2014.
5	Linstedt, Dan, and Michael Olschimke. "The Data Vault: A Methodology for Enterprise Data Modeling". 1st ed. Morgan Kaufmann, 2015.
6	Dutt, B. "Data Warehousing and OLAP". 1st ed. Prentice Hall, 2006.
7	Sanders, William H. "Database Systems: A Practical Approach to Design, Implementation, and Management". 5th ed. Pearson, 2017.

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
2	3	2	1	1	1	2	1	2	-	1	-	3	3	1	2
3	3	2	1	1	1	1	1	2	-	1	-	2	3	1	2
4	3	2	1	1	-	2	1	2	-	1	-	3	3	-	2
5	3	2	1	1	1	2	2	2	-	1	-	3	3	1	2
6	3	2	1	1	1	2	3	3	-	2	-	3	3	1	3
Overall Correlation	3	3	1	1	1	2	2	2	-	2	-	3	3	1	2

23CB053	FUNDAMENTALS OF DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and models of distributed computing.
- To provide a comprehensive understanding of the architecture, components, and protocols in distributed systems.
- To explore the various challenges faced in the design, implementation, and management of distributed systems.
- To equip students with hands-on experience in the design and development of distributed applications.
- To analyze security, fault tolerance, and scalability issues in distributed systems.

UNIT I	INTRODUCTION TO DISTRIBUTED COMPUTING	9

Definition and Characteristics of Distributed Systems - Types of Distributed Systems: Client-Server, Peer-to-Peer, Cloud Computing - Key Concepts: Transparency, Scalability, Fault Tolerance, Concurrency - Communication in Distributed Systems: RPC, RMI, Message Passing - Examples of Distributed Systems: Cloud, P2P, Distributed Databases

UNIT II	DISTRIBUTED SYSTEM ARCHITECTURE	9

Layered Architecture of Distributed Systems - Communication Protocols: TCP/IP, HTTP, and Message Queuing - Distributed Objects and Remote Method Invocation (RMI) - Distributed File Systems (DFS): NFS, AFS - Middleware and Services in Distributed Systems

UNIT III	SYNCHRONIZATION AND COORDINATION	9

Clock Synchronization: Logical and Physical Clocks - Global State and Snapshots - Mutual Exclusion Algorithms - Coordination and Consistency Models: Locks, Barriers, and Consensus Algorithms - Distributed Deadlock Detection and Recovery

UNIT IV	FAULT TOLERANCE AND SCALABILITY	9
Fault Tolerance in Distributed Systems - Replication Techniques: Primary-Backup, Quorum-Based Replication - Reliability Models and Recovery Algorithms - Scalability Challenges in Distributed Systems - Load Balancing Techniques in Distributed Systems		
UNIT V	**DISTRIBUTED SYSTEMS SECURITY AND CASE STUDIES**	**9**
Security Issues in Distributed Systems: Authentication, Authorization, Confidentiality - Cryptographic Protocols for Secure Communication in Distributed Systems - Case Studies in Distributed Computing: Google File System, Hadoop, Cloud Computing, and Blockchain - Future Trends in Distributed Computing - Ethical Issues in Distributed Systems and Cyber Security.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Explain the fundamental concepts, models, and characteristics of distributed computing systems.
CO2:	Summarize distributed architectures and protocols for communication.
CO3:	Illustrate and analyze synchronization, coordination, and mutual exclusion techniques.
CO4:	Experiment with fault tolerance mechanisms and scalability challenges in distributed systems.
CO5:	Apply security techniques and strategies to ensure confidentiality, integrity, and availability in distributed systems.
CO6:	Develop real-world distributed applications and analyze case studies of successful distributed systems.

TEXT BOOKS:	
1	Tanenbaum, Andrew S., and Maarten Van Steen. "Distributed Systems: Principles and Paradigms". 2nd ed. Pearson, 2007.

2	Coulouris, George, Jean Dollimore, Tim Kindberg, and Gordon Blair. "Distributed Systems: Concepts and Design". 5th ed. Addison-Wesley, 2011.
REFERENCES:	
1	Andrews, Gregory R. Foundations of Multithreaded, "Parallel, and Distributed Programming". 1st ed. Addison-Wesley, 2000.
2	Stallings, William. "Distributed Operating Systems and Algorithm Analysis". 3rd ed. Pearson, 2014.
3	van Renesse, Robbert, and Peter R. Pietzuch. "Distributed Systems: Concepts and Design". 1st ed. Springer, 2003.
4	Hennessy, John L., and David A. Patterson. "Computer Architecture: A Quantitative Approach. " 5th ed. Morgan Kaufmann, 2011.
5	Kurose, James F., and Keith W. Ross. "Computer Networking: A Top-Down Approach. " 7th ed. Pearson, 2016.
6	Birman, Kenneth P." Building Secure and Reliable Systems: Best Practices for Designing, Implementing, and Maintaining Systems. " O'Reilly, 2021.
7	Milojicic, Dejan, and Felix Oppedijk. " Cloud Computing: Principles and Paradigms". Wiley, 2011.

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

23CB054	PRINCIPLES OF HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and principles of Human-Computer Interaction (HCI).
- To understand the impact of user-centered design and usability in interface development.
- To explore different input/output devices and techniques for effective human-computer interaction.
- To equip students with the ability to evaluate and apply usability testing and design principles.
- To develop skills in designing user interfaces for a variety of applications, with an emphasis on accessibility and inclusivity

UNIT I	INTRODUCTION TO HUMAN-COMPUTER INTERACTION	9

Definition and Scope of HCI - Interdisciplinary Nature of HCI: Computer Science, Psychology, Design - Evolution of HCI: From Command-Line to Graphical User Interfaces (GUIs) - Importance of User-Centered Design (UCD) - Human Capabilities and Limitations

UNIT II	DESIGNING INTERFACE AND USER EXPERIENCE	9

Principles of User Interface Design: Affordance, Mapping, Feedback, Constraints - Interaction Styles: Command-Line, Menu-Based, Graphical, Voice-Based – User Interface Design Process: Requirement Analysis, Prototyping, and Iteration - Visual Design Elements: Typography, Color, Layout, Icons -Interaction Design Patterns and Best Practices

UNIT III	INPUT/OUTPUT DEVICES AND TECHNIQUES	9

Types of Input Devices: Keyboard, Mouse, Touchscreen, Gesture-

Based Interfaces -Types of Output Devices: Displays, Audio Output, Haptic Feedback - Emerging Input/Output Techniques: Eye Tracking, Brain-Computer Interfaces, Augmented Reality (AR) - Interaction with Mobile Devices, Wearables, and Virtual Reality (VR) - Multimodal Interaction and Adaptive Systems		
UNIT IV	**USABILITY AND EVALUATION METHODS**	**9**
Usability Testing: Types of Usability Tests, Heuristic Evaluation, Think-Aloud Protocol - User Feedback: Surveys, Interviews, and Focus Groups - Cognitive Walkthroughs - Performance Metrics: Task Success Rate, Time on Task, User Satisfaction - Accessibility Guidelines and Universal Design Principles		
UNIT V	**ADVANCED TOPICS AND CURRENT TRENDS IN HCI**	**9**
HCI in Mobile and Web Applications - Affective Computing and Emotion Recognition in HCI - Assistive Technology and Accessibility for Differently-Abled Users - Social, Ethical, and Privacy Issues in HCI - Future Trends in HCI: AI, Ubiquitous Computing, HCI in Healthcare, and Smart Environments		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
After completion of the course, the students will be able to:		
CO1:	Explain the basic concepts and principles of Human-Computer Interaction.	
CO2:	Demonstrate knowledge of user-centered design and its impact on usability and user experience.	
CO3:	Apply appropriate design principles for developing effective user interfaces across multiple platforms.	
CO4:	Examine the usability and accessibility of existing systems and suggest improvements.	
CO5:	Develop an understanding of emerging input/output techniques and their applications in HCI.	
CO6:	Analyze and address ethical, social, and privacy concerns in the development of interactive systems.	

TEXT BOOKS:	
1	Dix, Alan, Janet Finlay, Gregory Abowd, and Russell Beale. "Human-Computer Interaction", 3rd ed. Pearson, 2004.
2	Shneiderman, Ben, and Catherine Plaisant. "Designing the User Interface: Strategies for Effective Human-Computer Interaction ". 5th ed. Addison-Wesley, 2010.
REFERENCES:	
1	Norman, Donald A. "The Design of Everyday Things ". Revised and expanded ed. Basic Books, 2013.
2	Galitz, Wilbert O. "The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques ", 3rd ed. Wiley, 2007.
3	Lazar, Jonathan, Jinjuan Heidi Feng, and Harry Hochheiser. "Research Methods in Human-Computer Interaction ", Wiley, 2010.
4	Preece, Jenny, Helen Sharp, and Yvonne Rogers. "Interaction Design: Beyond Human-Computer Interaction ". 4th ed. Wiley, 2015.
5	Winograd, Terry. "Bringing Design to Software ",Addison-Wesley, 1996.
6	Hartson, R. R., and Partha S. Pyla. "The UX Book: Process and Guidelines for Ensuring a Quality User Experience ", Morgan Kaufmann, 2012.
7	Hewett, T. T., et al. "The Context of Human-Computer Interaction ", 1st ed. Addison-Wesley, 1992.

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

VERTICAL 4: 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, 11th 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

23CB055	SECURE CODING PRACTICES FOR FULL STACK DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To gain an understanding of core security principles such as secure development practices, cryptography, and the OWASP Top 10 vulnerabilities, with a focus on securing applications.
- To learn how to assess risk profiles, utilize threat modeling tools
- To learn to apply security verification standards t.o ensure that security is integrated into the design and development stages of mobile and web applications.
- To become proficient in using security frameworks, performing secure code verification, and utilizing tools.
- To gain hands-on experience in identifying and addressing security flaws.

UNIT I	INTRODUCTION TO SECURE CODING PRACTICES	6

Security fundamentals - Secure development and integration - Principles of security Principles of cryptography - OWASP Top 10 - Full Stack Development using MEAN Stack.

UNIT II	SECURITY REQUIREMENTS AND SECURITY DESIGN	6

Risk profile – Open CRE – Security RAT - Application Security Verification Standard - Mobile Application Security - Security Knowledge Framework – Design Threat modeling – pytm, Threat Dragon, Cornucopia - Threat Modeling toolkit Web application checklist - Mobile application checklist.

UNIT III	SECURITY IMPLEMENTATION AND VERIFICATION	6

Top 10 Proactive Controls - Dependencies Check Track - Secure Libraries - Web Security Testing Guide - Application Security Verification Standard – Tools SAST & DAST – Frameworks secure

Code Box - Vulnerability management Defect Dojo.		
UNIT IV	**VULNERABLE APPLICATIONS AND SOFTWARE ASSURANCE MATURITY MODEL**	**6**
Juice Shop - WebGoat - PyGoat - Security Shepherd - Secure Coding Dojo - Security Knowledge Framework - SamuraiWTF - OWASP Top 10 project - Mobile Top 10 - API Top 10 – SAMM.		
UNIT V	**SECURITY OPERATIONS AND METRICS**	**6**
DevSecOps Guideline - Coraza and ModSecurity Web Application Firewall - Security gap analysis - Bug Logging Tool - Implementation Do's and Don'ts in Container security, Secure coding, Cryptographic practices, Application spoofing, Exception and error handling, File management & Memory management.		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES: - LIST OF EXPERIMENTS

1. Identify and mitigate OWASP Top 10 vulnerabilities in a sample web application.
2. Use Threat Dragon to model threats and identify potential security risks in a web application.
3. Perform dependency tracking and identify insecure libraries in a web application using tools like npm audit and Snyk.
4. Perform static application security testing (SAST) and dynamic application security testing (DAST) on a web application.
5. Identify and exploit vulnerabilities in the deliberately insecure Juice Shop application and apply remediation techniques.
6. Perform a security gap analysis of a web application using the Security Knowledge Framework.
7. Integrate security into a CI/CD pipeline and implement secure containerization practices using tools like Jenkins, Docker, and ModSecurity.

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Develop Secure Application Coding.
CO2:	Identify vulnerability in source code using static and dynamic testing.
CO3:	Make use of popular threat modeling tools such as PyTM, Threat Dragon.
CO4:	Examine Software Security Maturity.
CO5:	Analyze secure coding techniques and best practices across various stages of the software development lifecycle.
CO6:	Apply security vulnerability using MEAN Stack in Full Stack Development.
TEXT BOOKS:	
1	"OWASP Developer Guide - A Guide to Building Secure Web Applications and Web Services." Release version 4.1.5.
2	Howard, Michael, and David LeBlanc. "Writing Secure Code", 2nd ed., Microsoft Press, 2004.
REFERENCES:	
1	Graff, Mark G., and Kenneth R. van Wyk. "Secure Coding: Principles and Practices", O'Reilly Media, Inc., 2003.
2	Thompson, H., and Scott G. Chase. "The Software Vulnerability Guide", Programming Series, 2005.
3	Secure Coding Practices Quick Reference Guide. Open Web Application Security Project (OWASP), 2022.

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	2	1	3	-	1
2	3	2	1	1	-	-	-	-	-	2	2	-	3	-	1
3	3	2	1	1	2	-	-	-	1	-	1	2	3	2	1
4	3	3	2	2	2	-	-	-	-	2	2	1	3	2	1
5	3	3	2	2	2	-	-	-	2	2	2	1	3	2	1
6	3	2	1	1	3	-	-	-	2	-	2	2	3	3	1
Overall Correlation	3	3	2	2	2	-	-	-	1	2	2	2	3	2	1

23CB056	DEVSECOPS: INTEGRATING SECURITY INTO DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the principles and practices of DevSecOps
- To explore how to secure CI/CD pipelines by identifying potential threats, implementing secure configurations, and automating security tasks.
- To gain hands-on experience in applying secure coding practices following OWASP guidelines.
- To learn to monitor applications in real time, detect security threats using tools like ELK Stack and SIEM systems.

UNIT I	INTRODUCTION TO DEVSECOPS AND SECURE SOFTWARE DEVELOPMENT LIFECYCLE	6

Overview of DevSecOps: Introduction, importance, and evolution from DevOps to DevSecOps. Secure Software Development Lifecycle (SDLC): Key phases, including planning, development, testing, deployment, and monitoring with security focus. DevSecOps Principles: Automation, collaboration, shift-left security, and CI/CD integration. Cultural and Organizational Aspects: Building a security-focused culture, roles, and responsibilities.

UNIT II	SECURITY INTEGRATION INTO CI/CD PIPELINE	6

CI/CD Basics: Continuous Integration and Continuous Deployment in DevSecOps. Securing CI/CD Pipelines: Threats in CI/CD, secure configurations, and environment isolation. Automation for Security: Automating security tasks such as code review, scanning, and vulnerability assessments. Security Tools for CI/CD: Introduction to tools like Jenkins, GitLab CI, Azure DevOps with security plugins and features.

UNIT III	SECURE CODING PRACTICES AND AUTOMATED TESTING FOR SECURITY	6
Secure Coding Standards: OWASP guidelines, avoiding common vulnerabilities (e.g., SQL injection, XSS). Code Review and Analysis: Static Application Security Testing (SAST), Dynamic Application Security Testing (DAST). Automated Security Testing: Integration of security testing in development workflows. Tools for Secure Coding: Familiarity with tools like SonarQube, Veracode, and Checkmarx.		
UNIT IV	**CONTINUOUS SECURITY MONITORING AND INCIDENT RESPONSE**	**6**
Security Monitoring in DevSecOps: Real-time monitoring and logging in DevSecOps. Threat Detection: Utilizing Intrusion Detection Systems (IDS) and Security Information and Event Management (SIEM). Incident Response: Principles of incident response, playbooks, and post-incident reviews. Monitoring Tools: ELK Stack, Splunk, and cloud-native monitoring solutions (AWS CloudWatch, Azure Monitor).		
UNIT V	**VULNERABILITY MANAGEMENT, AUDITING, AND COMPLIANCE IN DEVSECOPS**	**6**
Vulnerability Management: Identification, assessment, and remediation strategies. Security Auditing: Regular audits, security assessments, and risk management in DevSecOps. Compliance and Regulatory Requirements: Overview of standards like ISO 27001, GDPR, and HIPAA in DevSecOps. Policy Implementation: Role-based access control, network segmentation, and container security policies.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Case studies on traditional DevOps vs. DevSecOps.		

2. Role-play exercise to define security responsibilities in a DevSecOps team. 3. Setting up a secure CI/CD pipeline with a basic project. 4. Implementing automated security scans (e.g., static code analysis) in the pipeline. 5. Hands-on secure coding tasks following OWASP guidelines. 6. Configuring SAST/DAST tools for automated testing in a sample project. 7. Setting up a basic monitoring dashboard using ELK Stack. 8. Simulating a security incident and conducting a mock response. 9. Conducting a vulnerability scan on a sample application and generating a report. 10. Applying a security policy (e.g., RBAC) in a containerized environment.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Identify and describe the core principles of DevSecOps and the importance of integrating security within the DevOps lifecycle.
CO2:	Apply security requirements to various phases of the CI/CD pipeline and explain the secure software development lifecycle (SDLC) stages.
CO3:	Make use of automated testing tools to detect and mitigate vulnerabilities in code and demonstrate proficiency in secure coding practices.
CO4:	Identify and respond to potential security threats in real time.
CO5:	Apply vulnerability management techniques and conduct security audits to ensure secure deployment and maintenance within CI/CD workflows.

CO6:	Examine compliance requirements and implement security policies that align with industry standards and regulatory frameworks.
TEXT BOOKS:	
1	Hsu, Tony Hsiang-Chih. "Hands-On Security in DevOps: Ensure Continuous Security, Deployment, and Delivery with DevSecOps." Packt Publishing, 2018.
2	Kim, Gene, Patrick Debois, John Willis, and Jez Humble. "The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations." IT Revolution Press, 2016.
REFERENCES:	
1	Akula, Madhu, and Akash Mahajan. "Security Automation with Ansible 2: Leverage Ansible 2 to Automate Security Tasks." Packt Publishing, 2017.
2	Sullivan, Bryan, and Vincent Liu. "Web Application Security: A Beginner's Guide." McGraw-Hill Education, 2011.
3	Kim, Gene, Kevin Behr, and George Spafford. "The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win." IT Revolution Press, 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	-	2	-	-	-	2	3	-	2
2	3	2	1	1	-	-	-	-	-	-	-	2	3	-	-
3	3	2	1	1	3	-	-	2	3	-	-	-	3	3	2
4	3	2	1	1	3	-	2	-	-	-	-	-	3	3	-
5	3	2	1	1	-	-	-	-	3	-	2	3	3	-	-
6	3	3	2	2	-	3	3	-	-	3	3	3	3	-	-
Overall Correlation	3	3	2	2	1	1	1	1	1	1	1	2	3	1	1

23CB057	CLOUD SECURITY ARCHITECTURE FOR FULL STACK SOLUTIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the foundational concepts of cloud computing and security architecture for cloud-based full-stack solutions.
- Know various security challenges specific to cloud environments, including multi-tenant architecture, data privacy, and compliance.
- Identify key security technologies used to protect cloud resources and applications, including identity and access management, encryption, and secure APIs.
- Design secure cloud architectures and integrate security measures at different layers (network, application, data) for full-stack solutions.
- Implement and evaluate security practices for cloud-based systems using industry-standard tools and techniques to ensure scalability, availability, and confidentiality.

UNIT I	INTRODUCTION TO CLOUD SECURITY	6

Overview of cloud computing models: IaaS, PaaS, SaaS, and deployment models: Public, Private, Hybrid. Cloud service providers and their security features (AWS, Azure, GCP, etc.).Security considerations in cloud computing: Multi-tenancy, virtualization, and shared responsibility models

Introduction to Cloud Security Architecture Frameworks (CSA CCM, NIST, etc.) Basic principles of security: Confidentiality, Integrity, Availability (CIA Triad)

UNIT II	CLOUD SECURITY RISKS AND THREATS	6

Cloud-specific threats and vulnerabilities: Data breaches, denial of service, account hijacking, insecure APIs - Security risks in cloud storage and data management - Cloud network security risks:

Virtual networks, firewall management, and intrusion detection/prevention - Compliance standards in the cloud: GDPR, HIPAA, SOC2, ISO 27001 - Case studies of security breaches in cloud environments.		
UNIT III	**IDENTITY AND ACCESS MANAGEMENT IN THE CLOUD**	**6**
IAM fundamentals: Authentication, authorization, and accounting (AAA)-Identity and access management tools: AWS IAM, Azure Active Directory, Google Identity -Single sign-on (SSO), Multi-factor authentication (MFA) -Role-based access control (RBAC) and attribute-based access control (ABAC) - Securing API access and OAuth 2.0 for cloud-based applications Federated identity management and security concerns.		
UNIT IV	**SECURING CLOUD INFRASTRUCTURE AND DATA**	**6**
Data encryption: At rest, in transit, and in use - Virtual machine security and container security in cloud environments - Securing cloud APIs and microservices architecture - Cloud firewalls and security groups: Network security in cloud environments - Cloud-native security tools: AWS Shield, Azure Security Center, Google Security Command Center - Disaster recovery and business continuity in cloud environments.		
UNIT V	**CLOUD SECURITY ARCHITECTURE FOR FULL STACK SOLUTIONS**	**6**
Designing secure full-stack applications: Frontend, Backend, and Database security - Cloud-native application architectures: Containers, microservices, and serverless computing - Best practices for securing cloud-native applications and infrastructure - Integrating security at different layers of the stack (network, application, data) - Monitoring and logging security events: CloudWatch, Azure Monitor, Google Stackdriver - Security as code: Infrastructure as Code (IaC) and automated security testing.		

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Set up a basic cloud infrastructure (AWS/GCP/Azure) with a focus on IAM configuration and securing the cloud environment.
2. Implement multi-factor authentication (MFA) and role-based access control (RBAC) on cloud resources.
3. Explore and configure cloud storage security options: data encryption, access controls, and permissions in AWS S3 or Azure Blob Storage.
4. Secure API endpoints using OAuth 2.0 and OpenID Connect for authentication and authorization in a cloud-based application.
5. Implement a cloud-based firewall and security groups to restrict traffic between virtual machines and services.
6. Deploy a secure containerized application (e.g., Docker) on a cloud platform and analyze container security features.
7. Set up cloud monitoring and logging with AWS CloudWatch, Azure Monitor, or GCP Stackdriver to detect security events.
8. Configure a cloud-based intrusion detection/prevention system (IDS/IPS) for detecting network anomalies in a cloud environment.
9. Implement a disaster recovery plan in a cloud environment, including data backup and failover mechanisms.
10. Perform a vulnerability assessment and penetration testing (pen testing) on a cloud application and recommend mitigation strategies.

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the key concepts of cloud computing, including service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid).
CO2:	Identify and analyze security threats, vulnerabilities, and risks in cloud environments and design secure cloud architectures for full-stack applications.
CO3:	Experiment with security controls, including encryption, authentication, authorization, and access management, in cloud systems.
CO4:	Apply network security practices to secure cloud infrastructures, including secure APIs, firewalls, and security groups.
CO5:	Develop and implement disaster recovery, incident response, and compliance measures in cloud systems to ensure business continuity.
CO6:	Evaluate and mitigate security threats in cloud-native applications, including containers and microservices.
TEXT BOOKS:	
1	Mather, Tim, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 1st ed. O'Reilly Media, 2009.
2	Krutz, Ronald L., and Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley, 2010.
3	Buyya, Rajkumar, and R. Thamarai Selvi," Cloud Computing Security Issues and Challenges: A Surve", Springer, 2013.
4	Fowler, David P, "Cloud-Native Security: A Comprehensive Guide to Securing Modern Applications and Data in the Cloud",Apress, 2020.

REFERENCES:	
1	Erl, Thomas, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013.
2	Kavis, Michael J, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Wiley, 2014.
3	Scott, Stuart,"AWS Certified Security – Specialty Exam Guide: The Complete Reference for the AWS Certified Security Specialty Exam", Packt Publishing, 2020.
4	Demopoulos, Ted, "Cloud Security For Dummies", Wiley, 2015.
5	K., Manish S, "Cybersecurity for the Cloud: Protecting Cloud Computing", CRC Press, 2020.

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

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 5: EMERGING TECHNOLOGIES

23CS040	AR / VR TECHNOLOGY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To learn about the VR modeling techniques in detail.
- To gain knowledge about various applications of AR/VR.
- To know the basics of AR.
- To learn about the game engines involved in the development of AR/VR based applications.

UNIT I	INTRODUCTION	7

Introduction to virtual reality and augmented reality – Definition – Introduction to trajectories and hybrid space – Three I's of VR – VR Vs 3D computer graphics – Benefits of VR – Components of VR system – Introduction to AR – AR technologies – Input devices – 3D position trackers – Types of trackers – Navigation and manipulation interfaces – Gesture interfaces – Types of gesture input devices – Output devices – Graphics display – Human visual system – Personal graphics displays – Large volume displays – Sound displays – Human auditory system.

UNIT II	VR MODELING	6

Modeling – Geometric modeling – Virtual object shape – Object visual appearance – Kinematics modeling – Transformation matrices – Object position – Transformation invariants – Object hierarchies – Viewing the 3D world – Physical modeling – Collision detection – Surface deformation – Force computation – Force smoothing and mapping – Behavior modeling – Model management.

UNIT III	APPLICATIONS	6

Human factors in VR – VR health and safety issues – VR and society – Medical applications of VR – VR in education, arts, and

entertainment – Military VR applications – Emerging applications of VR – VR applications in manufacturing – Applications of VR in robotics – Information visualization – VR in business.		
UNIT IV	**AUGMENTED REALITY**	**6**
Introduction to augmented reality – Computer vision for AR – Interaction – Modeling and annotation – Navigation – Wearable devices.		
UNIT V	**AR/VR SOFTWARE TOOLS AND GAME ENGINE**	**5**
Joint Fundamentals of Unity – Introduction to Vuforia – Basics of Unreal – Overview of Blender – Basics of Pygame.		
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Study of tools like Unity, Maya, 3DS Max, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model 3D objects using various modeling techniques and apply textures over them.
5. Create 3D realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop AR enabled applications with interactivity like E-learning environment, virtual walkthroughs, and visualization of historic places.
8. Develop AR enabled simple applications like DNA structure visualization and human anatomy visualization.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the basic concepts of AR and VR.

CO2:	Identify different gesture interfaces used in AR/VR.
CO3:	Apply the concepts of VR modeling.
CO4:	Identify VR applications in different domains.
CO5:	Develop AR applications in different domains.
CO6:	Analyze the different types of game engines.

TEXT BOOKS:

1	John Vince, "Introduction to Virtual Reality", Springer London, 1st Edition, India, 2011. (Units 1, 2 & 3)
2	Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 1st Edition, India, 2016. (Unit 1, 3 & 4)

REFERENCES:

1	Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publishing, 1st Edition, India, 2018.
2	William R. Sherman, Alan B. Craig, "Understanding Virtual Reality – Interface, Application, and Design", Morgan Kaufmann Publishers, 2nd Edition, New Delhi, 2018.
3	Justin Plowman, "3D Game Design with Unreal Engine 4 and Blender", Packt Publishing, 1st Edition, New Delhi, 2016.
4	Jonathan Linowes, Krystian Babilinski, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia", Packt Publishing, 1st Edition, New Delhi, 2017.

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

23AD043	INTELLIGENT ROBOTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and components of intelligent robotic systems
- To explore various algorithms for perception, planning, and control in robots
- To understand the integration of AI techniques in robotics for developing intelligent behaviors
- To analyze the design and development of autonomous robots for real-world applications
- To evaluate the ethical and societal implications of intelligent robots

UNIT I	INTRODUCTION TO INTELLIGENT ROBOTS	9

Overview of Robotics and Intelligent Robots- History and Evolution of Robotics - Components of Robotic Systems: Sensors, Actuators, and Controllers - Kinematics and Dynamics of Robots - Introduction to Robotic Operating Systems (ROS).

UNIT II	PERCEPTION IN ROBOTICS	9

Sensing and Perception: Camera, Lidar, and Sonar Sensors - Computer Vision for Robotics: Object Detection, Recognition, and Tracking - SLAM (Simultaneous Localization and Mapping) - Sensor Fusion Techniques - Machine Learning for Perception in Robots.

UNIT III	PLANNING AND NAVIGATION	9

Motion Planning: Kinematic and Dynamic Constraints - Navigation in Unstructured Environments - Obstacle Avoidance and Reactive Planning - Multi-Robot Coordination and Swarm Robotics.

UNIT IV	CONTROL AND LEARNING IN ROBOTS	9
Classical Control: PID Controllers, State-Space Models - Reinforcement Learning for Robotics Adaptive Control and .om Demonstration - Human-Robot Interaction and Shared Control.		
UNIT V	**APPLICATIONS AND ETHICAL CONSIDERATIONS**	**9**
Case Studies of Intelligent Robots: Industrial, Healthcare, and Service Robots - Ethical and Societal Implications of Intelligent Robots - Safety and Reliability in Autonomous Robots - Standards and Regulations for Intelligent Robots - Future Trends in Robotics: AI-driven Robotics, Human-Robot Collaboration.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Demonstrate the architecture, components, and basic functioning of Intelligent robotic systems.
CO2:	Utilize perception algorithms sensor technologies for object detection and environmental mapping in robots.
CO3:	Apply path planning and navigation algorithms for autonomous robot movement in various environments.
CO4:	Develop control strategies and integrate advanced techniques such as reinforcement learning for robotic behavior and decision-making.
CO5:	Analyze case studies and understand the applications of intelligent robots across different domains, including industrial, healthcare, and service sectors.
CO6:	Outline the ethical, societal, and safety considerations related to the deployment and operation of intelligent robots.

TEXT BOOKS:	
1	John J. Craig, "Introduction to Robotics: Mechanics and Control",Pearson 4th Edition (2017) (Units I, III, and IV).
2	Sebastian Thrun, Wolfram Burgard, and Dieter Fox , "Probabilistic Robotics" The MIT Press, 1st Edition (2005) (Unit II)
3	Patrick Lin, Ryan Jenkins, and Keith Abney, "Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence" Oxford University Press 2nd Edition (2017) (Unit V)
REFERENCES:	
1	Aaron Martinez and Enrique Fernández, "Learning ROS for Robotics Programming", 2nd Edition, Packt Publishing, 2015.
2	Roland Siegwart, Illah Reza Nourbakhsh, and Davide Scaramuzza, "Introduction to Autonomous Mobile Robots", 2nd Edition, MIT Press, 2011.
3	B. K. Ghosh, "Robotics: Fundamental Concepts and Analysis", Oxford University Press, 2006.

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	3	2	1	1	1	2	-	3	-	1	-	-	3	1	3
4	3	2	1	1	1	2	-	3	-	1	-	-	3	1	3
5	3	3	2	2	-	3	3	3	3	3	3	-	3	-	3
6	2	1	-	-	-	3	3	3	3	2	3	-	2	-	3
Overall Correlation	**3**	**3**	**2**	**2**	**1**	**3**	**1**	**3**	**1**	**2**	**1**	**1**	**3**	**1**	**3**

23CS041	GAME DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Unity

UNIT I	3D GRAPHICS FOR GAME DESIGN	6

Introduction Genres of games, Basics of 2D and 3D graphics for game avatar, Game components – 2D and 3D Transformations – Projections – Color models – Illumination and Shader models – Animation – Controller based animation.

UNIT II	GAME DESIGN PRINCIPLES	6

Character development, Storyboard development for gaming – Script design – Script narration, Game balancing, Core mechanics, Principles of level design – Proposals – Writing for preproduction, Production and Post-production.

UNIT III	GAME ENGINE DESIGN	6

Rendering concept – Software rendering – Hardware rendering – Spatial sorting algorithms – Algorithms for game engine – Collision detection – Game logic – Game AI – Pathfinding

UNIT IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS	6

Pygame game development – Unity – Unity scripts – Mobile gaming, Game studio, Unity single player and multi-player games

UNIT V	GAME DEVELOPMENT USING UNITY ENGINE	6

Exporting assets from 3D software – Different types of camera in

Unity – Character navigation – Third person camera movement – Creating enemy characters runtime – Animation control in Unity – Graphic user interface in Unity – Assigning properties and methods for player

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Installation of a game engine, e.g., Unity, Unreal Engine.
2. Character design, sprites, movement, and character control.
3. Level design: design of the world in the form of tiles along with interactive and collectible objects.
4. Design of interaction between the player and the world, optionally using the physics engine.
5. Developing a 2D interactive using Unity.
6. Design of menus and user interaction in mobile platforms.
7. Developing a 3D game using Unreal.
8. Developing a multiplayer game using Unity.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply the basic concepts of 2D graphics.
CO2:	Apply the fundamentals of 3D graphics.
CO3:	Design games based on the principles.
CO4:	Make use game engines effectively.
CO5:	Analyse gaming environments and frameworks.
CO6:	Develop a simple game in Unity.

TEXT BOOKS:

1	Patrick Felicia, "Unity from Zero to Proficiency (Proficient): A step-by-step guide to creating your first 3D Role-Playing Game", LPF Publishing, 1st Edition, New Delhi, 2019.
2	Ernest Adams, "Fundamentals of Game Design", Pearson Education India, 3rd Edition, India, 2015.

REFERENCES:	
1	Franz Lanzinger, "3D Game Development with Unity", CRC Press, 1st edition, New Delhi, 2022.
2	Franz Lanzinger, "2D Game Development with Unity", CRC Press, 1st Edition, New Delhi, 2020.
3	Adam Kramarzewski, Ennio De Nucci, "Practical Game Design: A modern and comprehensive guide to video game design", Packt Publishing Limited, 2nd Edition, New Delhi, 2023.
4	Rachel Cordone, "Unreal Engine 4 Game Development Quick Start Guide", Packt Publishing Limited, 1st Edition, New Delhi, 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	3	1	2	3	3	2	1
2	3	2	1	1	2	-	-	1	3	1	2	3	3	2	1
3	3	2	1	1	2	-	-	1	2	2	3	2	3	2	1
4	3	2	1	1	1	-	-	1	1	1	1	1	3	1	1
5	3	2	1	1	1	-	-	1	2	2	1	1	3	1	1
6	3	2	1	1	1	-	-	1	1	3	2	1	3	1	1
Overall Correlation	3	2	1	1	2	-	-	1	2	2	2	2	3	2	1

23CS042	IoT BASED SMART SYSTEMS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To get familiar with IoT fundamentals.
- To know about essential wireless technologies for IoT.
- To understand about cloud infrastructure for IoT.
- To understand IoT Design Methodologies.
- To gain experience about Smart Systems for IoT

UNIT I	INTRODUCTION TO THE INTERNET OF THINGS	6

Introduction to IoT- Elements of an IoT- Technology drivers- Business drivers- Typical IoT applications- Trends and implications.

UNIT II	WIRELESS TECHNOLOGIES FOR THE IoT	6

Sensors and sensor nodes - Sensing devices- Sensor modules, nodes and systems- Network connectivity and protocols- Wireless sensor networks -Protocols - RFID , NFC, Zigbee, GSM, GPRS.

UNIT III	THE CLOUD FOR IOT	6

The Topology of the Cloud - Cloud-to-Device Connectivity - Device Ingress/Egress - Data Normalization and Protocol Translation- Infrastructure – APIs.

UNIT IV	IoT DESIGN METHODOLOGY	6

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development, Arduino IDE – Programming – APIs.

UNIT V	IoT SMART SYSTEMS	6

Smart Home Automation -Smart Lighting -Smart Appliances - Intrusion Detection - Smoke/Gas Detectors - Smart cities – Smart waste management – Smart Agriculture – Future Trends: AI-enabled IoT.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:	
LIST OF EXPERIMENTS	
1. Introduction to Arduino platform and programming 2. Interfacing Arduino with LED Blinking 3. Interfacing Arduino with LED Blinking with Push Button. 4. Build a simple smart home system 5. Interfacing Arduino with sound sensor. 6. Implement basic security using encryption in MQTT 7. Interfacing Arduino with Soil Moisture Sensor. 8. Build up automated irrigation monitoring	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Apply various concepts of the IoT and their technologies.
CO2:	Develop the IoT application using wireless technologies .
CO3:	Apply cloud integration for IoT.
CO4:	Develop applications using Arduino IDE.
CO5:	Develop Smart systems and IoT for Intrusion Detection.
CO6:	Develop Smart systems and AI-enabled IoT.
TEXT BOOKS:	
1	Misra, Sudip, Anandarup Mukherjee, and Arijit Roy,"Introduction to IoT", Cambridge University Press, 2021.
2	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
REFERENCES:	
1	Milan Milenkovic,"Internet of Things: Concepts and System Design" Springer 2020.
2	J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
3	Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

4	Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", Apress, 2013

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	1	-
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	1	-	-	-	-	-	-	-	3	1	-
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**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**3**	**1**	**1**

23CB058	CRYPTO CURRENCY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamental concepts of cryptocurrency, blockchain, and decentralized finance.
- To explore the technologies behind cryptocurrencies, including cryptography, consensus algorithms, and blockchain architectures.
- To analyze the risks and challenges associated with cryptocurrencies and blockchain technologies.
- To investigate the economic and legal implications of cryptocurrencies, including their impact on global financial systems.
- To develop practical skills in implementing and using cryptocurrency technologies, including wallets, exchanges, and smart contracts.

UNIT I	INTRODUCTION	6

Overview of Cryptocurrency - Blockchain Technology: Concept, Structure, and Functionality - Evolution of Cryptocurrencies - Types of Cryptocurrencies: Bitcoin, Ethereum, Litecoin, and Altcoins - Advantages and Challenges of Cryptocurrencies

UNIT II	CRYPTOGRAPHIC FOUNDATIONS OF CRYPTOCURRENCY	6

Basics of Cryptography: Symmetric and Asymmetric Encryption - Hash Functions and Public Key Infrastructure (PKI) - Digital Signatures and Certificates - Elliptic Curve Cryptography (ECC) - Security in Cryptocurrencies

UNIT III	CONSENSUS ALGORITHMS AND BLOCKCHAIN PROTOCOLS	6

Proof of Work (PoW) vs Proof of Stake (PoS) - Delegated Proof of Stake (DPoS) - Practical Byzantine Fault Tolerance (PBFT) - Consensus in Ethereum and Smart Contracts - Blockchain Protocols and Governance.

UNIT IV	CRYPTOCURRENCY ECONOMICS AND MARKETS	6
The Role of Cryptocurrencies in Modern Financial Systems - Cryptocurrency Markets: Exchanges, Trading, and Volatility - Cryptocurrency Mining and Proof of Work - Initial Coin Offerings (ICO) and Tokenomics - Economic Impacts and Challenges of Cryptocurrencies		
UNIT V	**LEGAL, REGULATORY, AND SECURITY ISSUES**	**6**
Legal Frameworks for Cryptocurrencies Globally - Anti-Money Laundering (AML) and Know Your Customer (KYC) - Security Issues in Cryptocurrency Transactions and Wallets - Regulatory Challenges: Taxation and Compliance - The Future of Cryptocurrencies in Legal and Economic Systems		
		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Setting up a Cryptocurrency Wallet (Bitcoin, Ethereum)
2. Sending and Receiving Cryptocurrencies
3. Understanding and Using Blockchain Explorers
4. Cryptocurrency Mining: Setting Up a Mining Rig (Bitcoin, Ethereum)
5. Exploring Cryptocurrency Exchanges (Buying, Selling, and Trading)
6. Using and Interacting with Ethereum Smart Contracts
7. Analyzing the Bitcoin Blockchain Using Tools (e.g., Blockchair, Blockchain.info)
8. Setting up a Private Blockchain using Ethereum or Hyperledger
9. Simulating an ICO: Token Creation and Launch

10. Security Testing of Cryptocurrency Transactions and Smart Contracts	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the core concepts of cryptocurrency, blockchain, and decentralized networks.
CO2:	Analyze the underlying technologies and protocols that enable cryptocurrencies, including cryptographic algorithms and consensus mechanisms
CO3:	Examine the risks, vulnerabilities, and challenges of using cryptocurrencies in real-world scenarios.
CO4:	Apply the economic, legal, and regulatory implications of cryptocurrencies and blockchain technologies.
CO5:	Make use of cryptocurrency tools such as wallets, exchanges, and smart contracts.
CO6:	Analyze the future of cryptocurrency and blockchain in emerging markets, financial systems, and industries.
TEXT BOOKS:	
1	Nakamoto, Satoshi. Bitcoin: A Peer-to-Peer Electronic Cash System. Bitcoin.org, 2008.
2	Mougayar, William. The Business Blockchain: Promise, Practice, and the 4th Industrial Revolution. Wiley, 2016.
REFERENCES:	
1	Buterin, Vitalik. Ethereum," A Next-Generation Smart Contract and Decentralized Application Platform" Ethereum Foundation, 2013.
2	Crosby, Michael, et al.," Blockchain Technology: Beyond Bitcoin" Applied Innovation Review, 2016.
3	Narayanan, Arvind, et al." Bitcoin and Cryptocurrency Technologies"Princeton University Press, 2016.
4	Zohar, Aviv," Bitcoin and Cryptocurrencies" MIT Press, 2018.

5	Gans, Joshua S.," The Blockchain and the New Architecture of Trust."MIT Press, 2019.
6	Tapscott, Don, and Alex Tapscott. Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World. Penguin, 2016.
7	Antonopoulos, Andreas M. Mastering Bitcoin: Unlocking Digital Cryptocurrencies. O'Reilly Media, 2017.

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

23CB059	QUANTUM CRYPTOGRAPHY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamental principles of quantum mechanics and their application to cryptography, including quantum states, superposition, and entanglement.
- To explore quantum key distribution (QKD) protocols, such as BB84 and E91, and understand how these protocols ensure secure communication.
- To enable the students to analyze the impact of quantum algorithms (e.g., Shor's and Grover's) on the security of classical cryptosystems.
- To enable the students to evaluate the potential applications of quantum cryptography in real-world cybersecurity systems and secure communication channels.
- To understand the challenges and opportunities posed by quantum computing to current encryption methods and the development of quantum-resistant cryptographic techniques.

UNIT I	INTRODUCTION TO QUANTUM CRYPTOGRAPHY	6

Introduction to Quantum Mechanics: Qubits, Superposition, Entanglement - Classical Cryptography vs. Quantum Cryptography - Overview of Quantum Computing and its impact on cybersecurity - Basics of Quantum Information Theory and Quantum States

UNIT II	QUANTUM KEY DISTRIBUTION (QKD)	6

Principles of Quantum Key Distribution (QKD) - BB84 Protocol: Mechanism, Security, and Use Cases - E91 Protocol: Quantum Entanglement and its Role in Security - Security Analysis of QKD Protocols and Practical Considerations

UNIT III	**QUANTUM ALGORITHMS AND CRYPTOGRAPHY**	**6**
Shor's Algorithm: Factoring and its Implications for RSA - Grover's Algorithm: Quantum Search and its Impact on Symmetric Key Cryptography - Quantum Digital Signatures - Introduction to Post-Quantum Cryptography		
UNIT IV	**QUANTUM COMMUNICATION AND SECURITY**	**6**
Quantum Communication Channels: How they differ from classical channels - Quantum Teleportation and Quantum Secure Direct Communication (QSDC) - Quantum Networks and their Role in Secure Communication - Practical Implementations and Challenges of Quantum Cryptography		
UNIT V	**REAL-WORLD APPLICATIONS AND FUTURE CHALLENGES**	**6**
Practical applications of Quantum Cryptography in cybersecurity (e.g., Quantum Key Distribution in the cloud, secure government communications) - Quantum-resistant algorithms and emerging cryptographic protocols -The future of quantum-safe encryption and cybersecurity -Ethical and legal challenges		
TOTAL: 30 PERIODS		

PRACTICAL EXERCISES:

LIST OF EXPERIMENTS

1. Simulating Quantum Key Distribution (BB84 Protocol) using a quantum programming framework like Qiskit.
2. Implementing Quantum Entanglement and QKD protocols (BB84/E91) on a quantum simulator.
3. Using Qiskit to implement and test basic quantum algorithms (Grover's and Shor's)
4. Exploring Quantum Digital Signatures and their cryptographic applications.
5. Practical demonstration of Quantum Communication Channels.

6. Experimenting with Quantum Secure Communication protocols (Quantum Direct Communication) 7. Analysis of the impact of quantum algorithms on RSA and AES encryption. 8. Setting up a Quantum Cryptography experiment on a real quantum computing platform (e.g., IBM Q Experience or similar).	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Demonstrate a deep understanding of quantum mechanics and its relevance to cryptographic systems, including quantum states, superposition, and entanglement.
CO2:	Apply quantum key distribution protocols such as BB84 and E91 and assess their security properties.
CO3:	Apply quantum algorithms (e.g., Shor's and Grover's) and analyze their impact on existing cryptographic methods.
CO4:	Analyze the role of quantum communication technologies in secure communications, focusing on quantum teleportation and quantum direct communication.
CO5:	Identify and analyze the challenges and solutions for quantum-safe encryption, preparing for the quantum computing era.
CO6:	Apply quantum cryptography techniques in practical settings, considering real-world implementation issues and security concerns.
TEXT BOOKS:	
1	Nielsen, Michael A., and Isaac L. Chuang. Quantum Computation and Quantum Information. 10th Anniversary ed. Cambridge: Cambridge University Press, 2011.
2	Bennett, Charles H., and Gilles Brassard. "Quantum Cryptography: Public Key Distribution and Coin Tossing." In Proceedings of IEEE International Conference on Computers, Systems and Signal Processing, 1984.

REFERENCES:	
1	Gisin, Nicolas, and Rob Thew. Quantum Communication, Quantum Cryptography, and Quantum Metrology. Cambridge: Cambridge University Press, 2010.
2	Lo, Hoi-Kwong, Marcos Curty, and Kai Chen. Secure Quantum Communication. Cambridge: Cambridge University Press, 2014.
3	Shor, Peter W. "Algorithms for Quantum Computation: Discrete Logarithms and Factoring." Proceedings of the 35th Annual Symposium on Foundations of Computer Science (1994).
4	Arute, Frank, et al. "Quantum Supremacy Using a Programmable Superconducting Processor." Nature 574 (2019): 505-510.
5	Bennett, Charles H., and Stephen Wiesner. "Communication via One- and Two-Particle Operators on Einstein-Podolsky-Rosen States." Physical Review Letters 69, no. 20 (1992): 2881-2884.
6	Bennett, Charles H., and Stephen Wiesner. "Communication via One- and Two-Particle Operators on Einstein-Podolsky-Rosen States." Physical Review Letters 69, no. 20 (1992): 2881-2884.
7	Mayers, Dominic. Quantum Cryptography and Secret Key Distillation. Cambridge: Cambridge University Press, 2001.

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

23CB060	DEEP LEARNING TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamental concepts of deep learning and neural networks.
- To explore advanced deep learning techniques.
- To develop proficiency in designing, training, and evaluating deep learning models.
- To implement deep learning models using frameworks and understand the computational complexities and optimization methods used in deep learning.
- To learn to apply deep learning to real-world problems, particularly in fields like image recognition, speech recognition, and cybersecurity applications.

UNIT I	INTRODUCTION TO DEEP LEARNING AND NEURAL NETWORKS	6

Introduction to Artificial Neural Networks (ANNs) and their significance in machine learning - Overview of Perceptrons and Multilayer Perceptrons (MLPs) - Activation functions (sigmoid, tanh, ReLU) - Cost functions and Backpropagation Algorithm - Training deep networks and understanding convergence.

UNIT II	CONVOLUTIONAL NEURAL NETWORKS (CNNS)	6

Fundamentals of Convolutional Neural Networks - Convolution layers, pooling layers, and fully connected layers - CNN architectures: LeNet, AlexNet, VGG, and ResNet - Applications of CNNs in image recognition and classification - Transfer learning with pre-trained CNN models.

UNIT III	RECURRENT NEURAL NETWORKS (RNNS) AND LSTM	6

Introduction to RNNs and sequence data - Backpropagation through time (BPTT) and vanishing gradient problem -Long

Short-Term Memory (LSTM) networks and their advantages over traditional RNNs - Applications of RNNs and LSTMs in speech recognition and natural language processing - Introduction to attention mechanisms and transformers.		
UNIT IV	**GENERATIVE MODELS**	**6**
Overview of generative models in deep learning - Generative Adversarial Networks (GANs): Architecture and working principle -Variational Autoencoders (VAEs) -Applications of GANs in image generation, art, and data augmentation - Challenges in training GANs and regularization techniques.		
UNIT V	**DEEP LEARNING IN PRACTICE**	**6**
Best practices in training deep learning models (data preprocessing, overfitting, dropout) - Optimization techniques: Gradient Descent, Adam, and Learning Rate Scheduling - Introduction to deep learning frameworks: TensorFlow and PyTorch - Ethical considerations and the impact of deep learning in cybersecurity (e.g., adversarial attacks) - Real-world applications of deep learning in cybersecurity, autonomous systems, and healthcare.		
		TOTAL: 30 PERIODS
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Implement a simple feedforward neural network using NumPy. 2. Build a multi-layer perceptron (MLP) with backpropagation in TensorFlow or PyTorch. 3. Implement a Convolutional Neural Network (CNN) for image classification on MNIST dataset. 4. Fine-tune a pre-trained CNN model (e.g., ResNet) for a custom image classification task.		

5. Implement a Recurrent Neural Network (RNN) for time-series prediction. 6. Use Long Short-Term Memory (LSTM) for sentiment analysis on text data. 7. Build and train a Generative Adversarial Network (GAN) for image generation. 8. Explore adversarial attacks on deep learning models in cybersecurity.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the fundamental principles of deep learning, including the architecture and training of neural networks.
CO2:	Develop and implement advanced deep learning models such as CNNs and RNNs for real-world applications.
CO3:	Examine deep learning models and apply techniques for improving performance, such as hyperparameter tuning, regularization, and transfer learning.
CO4:	Build deep learning solutions for complex tasks like image recognition, natural language processing, and time-series analysis.
CO5:	Experiment with deep learning frameworks like TensorFlow and PyTorch to implement and optimize neural networks.
CO6:	Identify ethical issues and challenges in deploying deep learning models in real-world systems, particularly in cybersecurity.
TEXT BOOKS:	
1	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep Learning", Cambridge: MIT Press, 2016.
2	Bishop, Christopher M. "Pattern Recognition and Machine Learning", New York: Springer, 2006.

REFERENCES:	
1	Raschka, Sebastian. “Python Machine Learning”, 3rd ed. Birmingham: Packt Publishing, 2019.
2	Chollet, François. “Deep Learning with Python”, 2nd ed. Shelter Island: Manning Publications, 2021.
3	1Ng, Andrew. Machine Learning Yearning. Self-published, 2018. [Online] Available at: https://www.mlyearning.org
4	Karpathy, Andrej. "CS231n: Convolutional Neural Networks for Visual Recognition." Stanford University, 2017. [Online] Available at: http://cs231n.stanford.edu/
5	Deng, Li, and Dong Yu. "Deep Learning for Speech Recognition." IEEE Signal Processing Magazine 29, no. 6 (2012): 25–35.
6	Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, 2nd ed. New York: Springer, 2009.
7	Yegnanarayana, B. “Artificial Neural Networks”. 2nd ed. New Delhi: PHI Learning, 2018.

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

23CB061	BIG DATA ANALYTICS AND SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the core concepts of big data including its characteristics, tools, technologies, and challenges associated with processing and storing large datasets.
- To explore and implement distributed computing systems such as Hadoop and Apache Spark to process and analyze big data.
- To develop expertise in data processing and data mining techniques, enabling effective handling of structured, unstructured, and semi-structured data.
- To learn to apply machine learning algorithms and statistical models on large datasets for data analysis and predictive analytics.
- To learn to assess security, privacy, and ethical issues related to big data processing, focusing on its impact on cybersecurity and business decision-making.

UNIT I	INTRODUCTION TO BIG DATA	6

Definition of Big Data and its characteristics (Volume, Variety, Velocity, Veracity, Value) - Introduction to Big Data Technologies - Overview of Big Data Analytics: Applications and Challenges - Hadoop Ecosystem Overview (HDFS, MapReduce) - Tools for Big Data Processing: Hadoop, Spark, and NoSQL Databases

UNIT II	DATA STORAGE AND PROCESSING WITH HADOOP	6

Hadoop Distributed File System (HDFS): Architecture and Functionality - Understanding MapReduce for Large-Scale Data Processing - Introduction to Hive and Pig for data warehousing and querying - Setting up Hadoop Cluster and Running MapReduce Jobs - Integrating Hadoop with other tools (e.g., Sqoop, Flume, Oozie)

UNIT III	BIG DATA PROCESSING WITH APACHE SPARK	6
Introduction to Apache Spark: RDDs, DataFrames, and Datasets - Spark SQL, Spark Streaming, and MLlib for Machine Learning - Comparison of Hadoop MapReduce and Spark - Real-time Data Processing with Spark Streaming - Case Study: Using Spark for Big Data Analytics in Cybersecurity		
UNIT IV	**NOSQL DATABASES AND DATA MINING**	**6**
Overview of NoSQL Databases: Key-Value, Document, Column, and Graph Databases - Working with HBase, Cassandra, and MongoDB - Data Modeling with NoSQL Databases - Data Mining Techniques for Big Data Analytics - Application of Data Mining in Cybersecurity (e.g., anomaly detection)		
UNIT V	**SECURITY, PRIVACY, AND ETHICAL ISSUES IN BIG DATA ANALYTICS**	**6**
Data Privacy Challenges in Big Data Analytics - Security Measures for Big Data Systems: Encryption, Authentication, Access Control - Ethical Implications: Data Bias, Data Ownership, and Accountability - Case Studies on Security Issues in Big Data Systems (e.g., data breaches) - The Role of Big Data in Enhancing Cybersecurity		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES:		
LIST OF EXPERIMENTS 1. Setting up a Hadoop Cluster and Running Simple MapReduce Jobs 2. Using HDFS for Data Storage – Uploading and Retrieving Files from HDFS) 3. Querying with Apache Hive – Writing Queries to Analyze Large Datasets.		

4. Data Processing with Apache Spark – Implementing Spark RDDs and DataFrames. 5. Real-Time Data Processing with Spark Streaming. 6. NoSQL Database Implementation – Hands-on with HBase or MongoDB. 7. Data Mining with Apache Mahout – Implementing Classification Algorithms on Big Data. 8. Implementing Big Data Security – Encryption and Access Control in Hadoop Ecosystem.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	Explain the core concepts of big data, including its characteristics, tools, and technologies used for storage, processing, and analysis.
CO2:	Make use of distributed computing frameworks like Hadoop and Apache Spark to process large-scale data efficiently.
CO3:	Construct and deploy NoSQL databases (e.g., MongoDB, Cassandra) for managing big data and implement efficient data models.
CO4:	Apply data mining and machine learning techniques on large datasets for pattern recognition, anomaly detection, and predictive analytics.
CO5:	Examine the security, privacy, and ethical issues in big data systems, with a focus on data protection mechanisms and regulatory frameworks.
CO6:	Analyze and interpret real-world big data applications, particularly in cybersecurity, business intelligence, and other societal contexts.

TEXT BOOKS:	
1	Zikopoulos, Patrick, and Chris Eaton. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data. 2nd ed. New York: McGraw-Hill, 2011.
2	Raj, P. R. Hadoop 2.x Administration Cookbook. Birmingham: Packt Publishing, 2015.
REFERENCES:	
1	Vassilakis, Christos. Big Data Analytics with Spark: A Hands-On Approach. Birmingham: Packt Publishing, 2017.
2	Mohan, C. S. Big Data Analytics with R and Hadoop. New York: Springer, 2015.
3	White, Tom. Hadoop: The Definitive Guide. 4th ed. Sebastopol: O'Reilly Media, 2015.
4	Sharma, Sandeep. Big Data and Cloud Computing: Architecture, Techniques, and Applications. New York: Springer, 2016.
5	Karmarkar, Uday, and S. M. P. Setia. Big Data Processing with Apache Spark. New York: Wiley, 2017
6	Chakrabarti, Aditya. Big Data: Concepts, Methodologies, Tools, and Applications. Hershey, PA: IGI Global, 2016.
7	Singh, M., and S. Soni. Big Data and Analytics for Cybersecurity. Boca Raton: CRC Press, 2020.

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