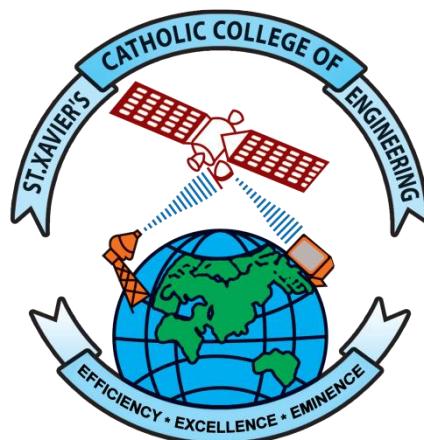


**B.E. Degree
in
COMPUTER SCIENCE AND ENGINEERING**

CURRICULUM & SYLLABUS (CBCS)

(For students admitted from the Academic Year 2022–2023)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

St. Xavier's Catholic College of Engineering

VISION
To be an institution of eminence of optimal human development, excellent engineering education and pioneering research towards developing a technically–empowered humane society
MISSION
To transform the (rural) youth into top class professionals and technocrats willing to serve local and global society with ethical integrity, by providing vibrant academic experience of learning, research and innovation and stimulating opportunities to develop personal maturity and professional skills, with inspiring and high caliber faculty in a quality and serene infrastructural environment

In consonance to the vision of our College,

An engineering graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of Indian Society.

Academically, he/she would be a graduate with a strong engineering foundation with proficient technical knowledge and skills. He would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself and for the benefit of the society.

He would have been well trained in research methodology and would have established himself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He would be a person with a passion for technical innovations committed to lifelong learning and research.

He would be well prepared and confident to develop ingenuous solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

Computer Science and Engineering is a demanding programme due to the fastest growing industries in the world today. This curriculum aims to create accomplished, innovative and

ethical computer professionals who will lead the way in finding problems and solving them when they move into the industry or as entrepreneurs.

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I.	To ensure that the graduate(s) develops his/her ability to adapt new technological changes in the field of Computer Science and Engineering and acquires the ability to give solutions to local problems and the needs of global organizations.
II.	To ensure that the graduate(s) plays a significant role in the development of the organization(s) he/she works for, by applying his/her knowledge and experience in the field of Computer Science and Engineering, with technical creativity, problem-solving abilities and critical thinking.
III.	To ensure that the graduate(s) adheres to ethical practices in all aspects of his/her career, including higher education, research and entrepreneurship.

II. PROGRAMME OUTCOMES (POs)

PO#	Graduate Attribute
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	The engineer and society: Apply reasoning informed by the contextual knowledge to

PO#	Graduate Attribute
	assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III. PROGRAMME SPECIFIC OUTCOMES (PSOs)

I.	Develop and automate business solutions using cutting-edge technology by exhibiting design and programming expertise.
II.	Ability to design, implement, and develop applications and appraise environmental and social issues with ethics to manage different projects in inter-disciplinary fields.
III.	Strong theoretical foundation leading to innovative research, to provide elegant solutions to complex real-world problems.

PEOs – POs & PSOs MAPPING

PEO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I.	3	3	3	2	2	3	1	1	2	1	1	3	3	3	3
II.	3	2	–	1	1	2	1	1	2	1	2	1	2	2	2
III.	3	2	–	–	1	2	1	3	3	3	1	3	2	2	2

PROGRAMME ARTICULATION MATRIX

Year	Semester	Course name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	MA22101	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
		PH22101	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-
		CH22101	3	2	2	1	-	-	2	-	-	-	-	-	-	-	-
		CS22101	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
		HS22102	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
		GE3152	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
		EN22101	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-
		BS22101	3	1	-	-	-	2	2	-	2	1	-	1	-	-	-
		CS22102	3	3	3	3	2	-	-	-	-	-	-	1	3	-	-
		HS22101	3	2	2	1	-	-	1	-	1	-	1	1	-	-	2
I	II	MA22201	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
		ES22202	2	2	-	-	-	1	-	-	-	-	-	1	2	2	-
		CS22201	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
		ME22201	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
		GE3252	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
		EN22201	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
		PH22203	2	1	-	-	-	-	-	-	2	1	-	1	-	-	-
		CH22201	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
		CS22202	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
		ES22203	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
II	III	MA22302	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
		CS22301	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
		CS22302	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
		CS22303	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
		CS22304	2	2	2	2	-	-	-	-	-	-	-	-	-	-	3
		CS22305	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
		CS22306	2	2	2	1	2	-	-	-	-	-	-	-	2	3	-
		SD22301	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2
		AC22301	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-

Year	Semester	Course name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
		HS22301	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
II	IV	MA22401	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
		CS22401	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
		CS22402	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
		CS22403	3	1	1	2	-	-	-	-	-	-	-	1	2	-	-
		CS22404	1	2	2	2	-	-	-	-	-	-	-	-	-	-	2
		CS22405	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
		CS22406	3	1	1	2	-	-	-	-	-	-	-	1	2	-	-
		SD22401	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2
		AC22401	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
III	V	CS22501	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2
		CS22502	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
		SD22501	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2
		AC22501	1	1	1	1	1	2	1	2	1	1	1	1	-	2	-
		HS22501	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
III	VI	HS22601	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-
		CS22601	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
		IT22601	3	2	2	-	2	-	-	-	-	1	-	-	-	-	2
		SD22601	2	2	2	-	2	-	-	-	1	-	-	2	2	-	-
IV	VII	MS22701	2	1	1	2	2	1	1	1	2	3	1	1	2	1	1
		CS22701	3	2	2	1	2	-	-	-	-	-	-	-	-	-	2
		CS22702	3	2	2	-	2	-	-	-	-	-	-	-	-	3	-
		CS22703	3	3	3	3	3	2	2	1	2	3	2	1	3	3	3
		SD22701	2	2	2	-	2	-	-	-	1	-	-	2	2	-	-
IV	VIII	CS22801	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22101	Matrices and Calculus	BSC	3	1	0	4	4
2.	PH22101	Engineering Physics	BSC	3	0	0	3	3
3.	CH22101	Engineering Chemistry	BSC	3	0	0	3	3
4.	CS22101	Problem Solving and Python Programming	ESC	3	0	0	3	3
5.	HS22102	Universal Human Values : Understanding Harmony and Ethical Human Conduct	HSMC	2	0	0	2	2
6.	GE3152	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
7.	EN22101	Communicative English	HSMC	2	0	2	4	3
PRACTICAL COURSES								
8.	BS22101	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
9.	CS22102	Python Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
10.	IP22101	Induction Programme	—	—	—	—	—	0
11.	HS22101	Higher Order Thinking	MC	1	0	0	1	1
TOTAL				18	1	10	29	24

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22201	Statistics and Numerical Methods	BSC	3	1	0	4	4
2.	ES22202	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
3.	CS22201	Programming in C	ESC	3	0	0	3	3
4.	ME22201	Engineering Graphics	ESC	2	0	2	4	3
5.	GE3252	தமிழரும் தொழில்நுட்பமும் Tamil and Technology	HSMC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
6.	EN22201	Technical English	HSMC	2	0	2	4	3
7.	PH22203	Physics for Information Science	BSC	2	0	2	4	3
8.	CH22201	Environment and Sustainability	BSC	2	0	2	4	3
PRACTICAL COURSES								
9.	CS22202	C Programming Laboratory	ESC	0	0	4	4	2
10.	ES22203	Engineering Practices Laboratory	ESC	0	0	4	4	2
TOTAL				18	1	16	35	27

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22302	Discrete Mathematics	BSC	3	1	0	4	4
2.	CS22301	Object Oriented Programming	PCC	3	0	0	3	3
3.	CS22302	Data Structures	PCC	3	0	0	3	3
4.	CS22303	Digital Principles and System Design	PCC	3	0	0	3	3
5.	CS22304	Computer Organization and Architecture	PCC	3	0	0	3	3
PRACTICAL COURSES								
6.	CS22305	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
7.	CS22306	Data Structures Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSE								
8.	SD22301	Coding Skills and Soft Skills Training – Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
9.	AC22301	Constitution of India	MC	2	0	0	2	0
10.	HS22301	Value Education I	MC	1	0	0	1	0
TOTAL				18	1	12	31	22

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22401	Probability and Statistical Techniques	BSC	3	1	0	4	4
2.	CS22401	Design and Analysis of Algorithms	PCC	3	0	0	3	3
3.	CS22402	Database Management Systems	PCC	3	0	0	3	3
4.	CS22403	Operating Systems	PCC	3	0	0	3	3
5.	CS22404	Computer Networks	PCC	3	0	0	3	3
PRACTICAL COURSES								
6.	CS22405	Database Management Systems Laboratory	PCC	0	0	4	4	2
7.	CS22406	Operating Systems and Networks Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSE								
8.	SD22401	Coding Skills and Soft Skills Training – Phase II	EEC	0	0	4	4	2
MANDATORY COURSE								
9.	AC22401	Industrial Safety Engineering	MC	2	0	0	2	0
TOTAL				17	1	12	30	22

- * On successful completion of the second year, students will obtain proficiency in the core concepts of Computer Science and Engineering.

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSE								
1.	CS22501	Theory of Computation	PCC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
2.	CS22502	Internet Programming	PCC	3	0	2	5	4
3.		Professional Elective I	PEC	2	0	2	4	3
4.		Professional Elective II	PEC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSES								
5.	CS22503	Technical Seminar	EEC	0	0	2	2	1
6.	CS22504	Inplant / Industrial Training (2 weeks – During 4 th semester Summer Vacation)	EEC	–	–	–	–	1
7.	SD22501	Coding Skills and Soft Skills Training – Phase III	EEC	0	0	4	4	2
MANDATORY COURSES								
8.	AC22501	Entrepreneurship Development	MC	2	0	0	2	0
9.	HS22501	Value Education II	MC	1	0	0	1	0
TOTAL				13	0	12	25	17

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	HS22601	Professional Ethics	HSMC	3	0	0	3	3
2.	CS22601	Compiler Design	PCC	3	0	0	3	3
3.		Open Elective – I	OEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4.	IT22601	Data Science	PCC	2	0	2	4	3
5.		Professional Elective III	PEC	2	0	2	4	3
6.		Professional Elective IV	PEC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSE								
7.	SD22601	Coding Skills and Quantitative Aptitude– Phase I	EEC	0	0	4	4	2
TOTAL				15	0	10	25	20

- * On successful completion of the third year, students will acquire skill on emerging technologies.

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MS22701	Principles of Management	HSMC	3	0	0	3	3
2.		Open Elective – II	OEC	3	0	0	3	3
3.		Open Elective – III	OEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4.	CS22701	Artificial Intelligence and Machine Learning	PCC	2	0	2	4	3
5.		Professional Elective V	PEC	2	0	2	4	3
6.		Professional Elective VI	PEC	2	0	2	4	3
PRACTICAL COURSES WITH THEORY COMPONENT								
7.	CS22702	Mobile Application Development Laboratory	PCC	1	0	2	3	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	CS22703	Mini Project	EEC	0	0	6	6	3
9.	SD22701	Coding Skills and Quantitative Aptitude– Phase II	EEC	0	0	4	4	2
TOTAL				16	0	18	34	25

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSES								
1.	CS22801	Project Work	EEC	0	0	16	16	8
TOTAL				0	0	16	16	8

TOTAL CREDITS =165

* On successful completion of the final year, students will be able to apply theoretical and practical knowledge which leads to employability.

SUMMARY

B.E. COMPUTER SCIENCE AND ENGINEERING										
S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	6	4				3	3		16
2	BSC	12	10	4	4					30
3	ESC	5	13							18
4	PCC			16	16	7	6	5		50
5	PEC					6	6	6		18
6	OEC						3	6		9
7	EEC			2	2	4	2	5	8	23
8	MC	1		✓		✓				1
9	AC			✓	✓	✓				0
Total		24	27	22	22	17	20	25	8	165

PROFESSIONAL ELECTIVE COURSES

LIST OF VERTICALS	
1.	BIG DATA & DATA ANALYTICS
2.	COMPUTATIONAL INTELLIGENCE
3.	NETWORK AND CYBER SECURITY
4.	WEB TECHNOLOGY
5.	SOFTWARE ENGINEERING & QUALITY MANAGEMENT

VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4	VERTICAL 5
Big Data & Data Analytics	Computational Intelligence	Network and Cyber Security	Web Technology	Software Engineering & Quality Management
Data Mining	Soft Computing	Cryptography and Network Security	Full Stack Web Development	Software Engineering
NoSQL Databases	Artificial Neural Network	Cyber Security	PHP Programming	Software System Design
Big Data Analytics	Computer Vision	Social Network Analysis	UI/UX Design	Software Testing and Automation
Exploratory Data Analysis	Deep Learning	Ethical Hacking	Cloud and DevOps Tools	Engineering Secure Software System
Business Analytics	Genetic Algorithms and Swarm Intelligence	Cyber Forensics	Web Application Security	Software Quality Assurance
Image and Video Analytics	Natural Language Processing	Blockchain Technologies	Rich Internet Applications	Software Project Management
Modern Application Development				Salesforce Administration

VERTICAL 1: BIG DATA & DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22511	Data Mining	PEC-1	2	0	2	4	3
2.	CS22512	NoSQL Databases	PEC-2	2	0	2	4	3
3.	CS22611	Big Data Analytics	PEC-3	2	0	2	4	3
4.	CS22612	Exploratory Data Analysis	PEC-4	2	0	2	4	3
5.	CS22711	Business Analytics	PEC-5	2	0	2	4	3
6.	CS22712	Image and Video Analytics	PEC-6	2	0	2	4	3
7.	CS22713	Modern Application Development	PEC-7	2	0	2	4	3

VERTICAL 2: COMPUTATIONAL INTELLIGENCE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22521	Soft Computing	PEC-1	2	0	2	4	3
2.	CS22522	Artificial Neural Network	PEC-2	2	0	2	4	3
3.	CS22621	Computer Vision	PEC-3	2	0	2	4	3
4.	CS22622	Deep Learning	PEC-4	2	0	2	4	3
5.	CS22721	Genetic Algorithms and Swarm Intelligence	PEC-5	2	0	2	4	3
6.	CS22722	Natural Language Processing	PEC-6	2	0	2	4	3

VERTICAL 3: NETWORK AND CYBER SECURITY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22531	Cryptography and Network Security	PEC–1	2	0	2	4	3
2.	CS22532	Cyber Security	PEC–2	2	0	2	4	3
3.	CS22631	Social Network Analysis	PEC–3	2	0	2	4	3
4.	CS22632	Ethical Hacking	PEC–4	2	0	2	4	3
5.	CS22731	Cyber Forensics	PEC–5	2	0	2	4	3
6.	CS22732	Blockchain Technologies	PEC–6	2	0	2	4	3

VERTICAL 4: WEB TECHNOLOGY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IT22511	Full Stack Web Development	PEC–1	2	0	2	4	3
2.	CS22541	PHP Programming	PEC–2	2	0	2	4	3
3.	CS22641	UI/UX Design	PEC–3	2	0	2	4	3
4.	CS22642	Cloud and DevOps Tools	PEC–4	2	0	2	4	3
5.	CS22741	Web Application Security	PEC–5	2	0	2	4	3
6.	CS22742	Rich Internet Applications	PEC–6	2	0	2	4	3

VERTICAL 5: SOFTWARE ENGINEERING & QUALITY MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22551	Software Engineering	PEC-1	2	0	2	4	3
2.	CS22552	Software System Design	PEC-2	2	0	2	4	3
3.	CS22651	Software Testing and Automation	PEC-3	2	0	2	4	3
4.	CS22652	Engineering Secure Software System	PEC-4	2	0	2	4	3
5.	CS22751	Software Quality Assurance	PEC-5	2	0	2	4	3
6.	CS22752	Software Project Management	PEC-6	2	0	2	4	3
7.	CS22753	Salesforce Administration	PEC-7	2	0	2	4	3

OPEN ELECTIVE TO BE OFFERED TO OTHER DEPARTMENT

OPEN ELECTIVE – I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22681	Data Science for Engineers	OEC	3	0	0	3	3
2.	CS22682	Data Analytics	OEC	3	0	0	3	3

OPEN ELECTIVE – II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22781	IoT Applications	OEC	3	0	0	3	3
2.	CS22782	Cyber Crime and Laws	OEC	3	0	0	3	3

OPEN ELECTIVE – III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS22783	Green Computing	OEC	3	0	0	3	3
2.	CS22784	Web Design and Development	OEC	3	0	0	3	3

SEMESTER I

MA22101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • 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 acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications • To make the students understand various techniques ODE 					
UNIT I	MATRICES				12
Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Problem solving using Cayley – Hamilton method – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature, rank, index.					
UNIT II	DIFFERENTIAL CALCULUS				12
Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules: sum, product, quotient, chain rules – Implicit differentiation – Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable.					
UNIT III	FUNCTIONS OF SEVERAL VARIABLES				12
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.					
UNIT IV	MULTIPLE INTEGRALS				12
Double integrals – Double integrals in Cartesian and polar coordinates – Area enclosed by plane curves – Change of order of integration – Triple integrals – Volume of solids: cube, rectangular parallelopiped.					
UNIT V	ORDINARY DIFFERENTIAL EQUATIONS				12
Linear differential equations of second and higher order with constant coefficients when the R.H.S is e^{ax} , x^n , $\sin ax$, $\cos ax$, $e^{ax}x^n$, $e^{ax}\sin bx$, $e^{ax}\cos bx$ – Linear differential equations of second and third order with variable coefficients: Cauchy's and Legendre's linear equations – Method of variation of parameter.					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Define the basic concepts of matrices, limit and continuity of a function, differentiation, ODE and integration.				
CO2:	Explain the properties of matrices and nature of the quadratic form.				
CO3:	Interpret the techniques of differentiation, partial differentiation, ODE and integration.				

CO4:	Apply diagonalization of matrices in quadratic form and apply Cayley Hamilton theorem to find the inverse of matrices.
CO5:	Solve problems on differentiation, partial differentiation, integration and ODE using different methods.
TEXT BOOKS:	
1.	Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Reprint 2017.
2.	Grewal B.S., "Higher Engineering Mathematics", 43 rd Edition, Khanna Publishers, 2014.
REFERENCES:	
1.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, 2016.
2.	Anton, H, Bivens, I and Davis, S, "Calculus", 10 th Edition, Wiley, 2016.
3.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 3 rd Edition, Narosa Publications, 2007.
4.	Kreyszig. E, "Advanced Engineering Mathematics", 10 th Edition, John Wiley and Sons, 2016.
5.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", 7 th Edition, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 2009.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3
CO2	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3
CO3	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3
CO4	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3
CO5	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3
CO	3	2	—	—	—	—	—	—	—	—	—	1	—	—	3

3-High, 2-Medium, 1-Low

PH22101	ENGINEERING PHYSICS				L	T	P	C				
					3	0	0	3				
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology To help the students to interrelate the topics such as properties of matter, thermal physics, ultrasonics, quantum theory and crystals, learned in the course To motivate students to compare and contrast the available equipment in the respective fields 												

- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course

UNIT I	PROPERTIES OF MATTER	9
Elasticity – Types of Elastic moduli – Factors affecting elasticity – Stress-strain diagram and its uses – beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: determination of young's modulus – I shaped Girders – twisting couple – torsion pendulum: determination of rigidity modulus and moment of inertia – torsion springs – other states of matter.		
UNIT II	THERMAL PHYSICS	9
Modes of Heat transfer – Thermal conductivity – Newton's law of cooling – Linear heat flow – Thermal conductivity in compound media – Lee's Disc method – Radial heat flow – Rubber tube method – Solar water heater – Thermodynamics – Isothermal and adiabatic process – Otto cycle – Diesel cycle.		
UNIT III	ULTRASONICS	9
Sound waves – ultrasonics – properties – production: magnetostriction method – piezoelectric method – cavitation – acoustic grating: wavelength and velocity of ultrasonic waves in liquids – applications: welding, machining, cleaning, soldering and mixing (qualitative) – SONAR – ultrasonic flaw detector – ultrasonography.		
UNIT IV	QUANTUM PHYSICS	9
Black body radiation – Planck's radiation law – Deduction of Wien's displacement law and Rayleigh Jean's law – Compton effect, Photoelectric effect (qualitative) – matter waves – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – scanning tunneling microscope.		
UNIT V	CRYSTAL PHYSICS	9
Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, Crystal planes, directions and Miller indices – Characteristics of crystal structures: SC, BCC, FCC and HCP structures – crystal imperfections: point, line and surface defects – crystal growth: epitaxial and lithography techniques.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recall the basics of properties of matter, thermal physics and ultrasonics, to improve their engineering knowledge.	
CO2:	Define the advanced physics concepts of quantum theory and the characteristics of crystalline materials.	
CO3:	Illustrate Bending of beams, thermal behavior and ultrasonic devices to assess societal and safety issues.	
CO4:	Summarize the dual aspects of matter, crystal structures and imperfections of crystals.	
CO5:	Apply the moduli of elasticity of different materials, thermal energy, ultrasonics, scanning tunneling microscope and crystal growth techniques in engineering fields.	
TEXT BOOKS:		
1.	Gaur, R.K & Gupta.S.L, "Engineering Physics", Dhanpat Rai Publishers, 2016.	

2.	Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson India Pvt Ltd., 2018.
REFERENCES:	
1.	Halliday.D, Resnick, R. & Walker. J, "Principles of Physics", Wiley, 2015.
2.	Bhattacharya, D.K. & Poonam.T., "Engineering Physics", Oxford University Press, 2015.
3.	Pandey.B.K, & Chaturvedi.S, "Engineering Physics", Cengage Learning India, 2012.
4.	Malik H K & Singh A K, "Engineering Physics", 2 nd Edition, McGraw Hill Education (India Pvt. Ltd.), 2018.
5.	Serway.R.A. & Jewett, J.W, "Physics for Scientists and Engineers", Cengage Learning India, 2010.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	—	—	—	—	—	—	—	—	—	1	—	—	—
CO2	2	1	—	—	—	—	—	—	—	—	—	1	—	—	—
CO3	2	1	—	—	—	—	—	—	—	—	—	1	—	—	—
CO4	2	1	—	—	—	—	—	—	—	—	—	1	—	—	—
CO5	3	2	—	—	—	—	—	—	—	—	—	1	—	—	—
CO	2	1	—	—	—	—	—	—	—	—	—	1	—	—	—

3–High, 2– Medium, 1–Low

CH22101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To make the students conversant with water treatment methods and electrochemistry concept To gain basic knowledge of corrosion and protection methods To understand the basic concepts and synthesis of various engineering materials, nano materials and fuels To familiarize the students with the principles, working process and application of energy storage devices 					
UNIT I	WATER TREATMENT	9			
Water: Sources, impurities – Hardness of water: Types – Estimation of hardness (EDTA method) – Disadvantages of hard water in boilers (Scale, Sludge) – Softening methods: Internal treatment (Calgon, Sodium Aluminate) and External treatment (Demineralisation process). Domestic water treatment – Desalination of brackish water: RO and Solar desalination method.					
UNIT II	ELECTROCHEMISTRY AND CORROSION	12			
Electrochemical cell – Free energy and emf – Nernst equation and applications – Oxidation and					

reduction potential – Standard electrodes: Standard Hydrogen electrode, Saturated calomel electrode, Glass electrode – pH measurement – Conductometric titration (acid–base, precipitation) and Potentiometric titrations: Redox titration ($\text{Fe}^{2+} \times \text{Cr}_2\text{O}_7^{2-}$).

Corrosion – Types: Chemical corrosion and Electrochemical corrosion – Corrosion control methods: Sacrificial anodic and Impressed current Cathodic protection method.

UNIT III	FUELS AND COMBUSTION	8
-----------------	-----------------------------	----------

Fuels – classification of fuels – Comparison of solid, liquid and gaseous fuel – Solid fuel – coal – analysis of coal (proximate only) – Liquid fuel – Petroleum – Refining of petroleum – manufacture of synthetic petrol (Bergius process) – Biodiesel – preparation, properties and uses. Gaseous fuel – CNG, LPG.

Combustion – Calorific value – Types (Gross and Net calorific value) – Dulong's formula – GCV and LCV calculation using Dulong's formula. Flue gas – Analysis of flue gas by Orsat method.

UNIT IV	ENERGY STORAGE DEVICES	8
----------------	-------------------------------	----------

Batteries – Types (Primary and Secondary) – Lead acid battery, Lithium ion battery – Super capacitors – Storage principle, types and examples – Electric vehicle – working principle – Fuel cells – microbial fuel cell and polymer membrane fuel cell.

Nanomaterials in energy storage – CNT –Types, properties and applications.

UNIT V	ENGINEERING MATERIALS	8
---------------	------------------------------	----------

Abrasives – Types: Natural and Artificial – SiC – preparation, properties and uses. Refractories – Types Acidic, Basic, Neutral – Refractoriness, RUL. Cement – Manufacture – Special cement – white cement and water proof cement. Glass – Manufacture, properties and uses.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Recall the basic concepts of water softening, nano materials and batteries.
- CO2:** Summarize the types of corrosion, fuels and energy storage devices.
- CO3:** Explain the basic principles of electrochemistry and engineering materials .
- CO4:** Identify suitable methods for water treatment, fuel and corrosion control.
- CO5:** Apply the knowledge of engineering materials, fuels and energy storage devices for material selection and also in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
3. Sivasankar B. "Engineering Chemistry", Tata McGraw Hill Publishing company Ltd, New Delhi, 2008.
4. B.S.Murty, P.Shankar, Baldev Raj, B B Rath and James Murday, "Text book of Nano

	Science and Technology”, Universities press.
5.	O.G. Palanna, “Engineering Chemistry”, 2 nd Edition, McGraw Hill Education (India) Private Limited, 2017.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	—	—	—	—	—	—	—	—	—	—	—
CO2	3	2	2	1	—	—	—	—	—	—	—	—	—	—	—
CO3	3	2	2	1	—	—	1	—	—	—	—	—	—	—	—
CO4	3	2	2	1	—	—	2	—	—	—	—	—	—	—	—
CO5	3	2	2	1	—	—	2	—	—	—	—	—	—	—	—
CO	3	2	2	1	—	—	2	—	—	—	—	—	—	—	—

3–High, 2– Medium, 1–Low

CS22101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L 3	T 0	P 0	C 3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To understand the basics of algorithmic problem solving • To learn to solve problems using Python conditionals and loops • To define Python functions and use function calls to solve problems • To use Python data structures – lists, tuples, and dictionaries to represent complex data 					
UNIT I INTRODUCTION TO COMPUTERS AND PROBLEM SOLVING STRATEGIES 9					
Introduction– Components and functions of a computer system– Hardware and Software. Problem solving strategies– Program design tools: Algorithms, Flow charts, Pseudo code.					
UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS AND CONTROL FLOW 9					
Features of Python –Variables and Identifiers – Data types: Numbers, Strings, Boolean, Tuples, List, Dictionary, Sets – Input operation – Comments, Reserved words, Indentation – Operators and Expressions – Type Conversion – Selection / Conditional Branching Statements – Basic Loop Structures / Iterative Statements – Nested Loops – break statement – continue statement – pass statement.					
UNIT III FUNCTIONS AND STRINGS 9					
Functions: Function Definition, function call– variable scope and lifetime – return statements. Strings: Definition, operations (concatenation, appending, multiply, slicing) – immutability, comparison, iterations, string methods.					
UNIT IV LIST, TUPLES AND DICTIONARIES 9					
Lists: Access, updating values– nested, cloning– list operations– list methods– looping in list.					

Tuples: Tuple operations— nested tuple; Dictionaries— Creating, Accessing, adding, modifying, deleting items.

UNIT V	FILES, EXCEPTIONS AND PACKAGES	9
---------------	---------------------------------------	----------

Files: Types of files, Opening and closing Files, Reading and writing files, File positions, Renaming and deleting files. Exceptions: Errors and exceptions, Handling exceptions, Packages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the basics of computer system and problem solving approaches.
CO2:	Describe the usage of Python selection and looping statements.
CO3:	Solve simple problems using Python functions and strings.
CO4:	Make use of Python data structures - lists, tuples, and dictionaries to represent compound data.
CO5:	Illustrate the basic concepts of files, exceptions and packages.

TEXT BOOKS:

1.	Reema Thareja, "Python Programming Using Problem Solving Approach", 13th Edition, Oxford University Press, 2022.
2.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2 nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", BCS Learning & Development Limited, 2017.
2.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4.	Eric Matthes, "Python Crash Course, A Hands – on Project Based Introduction to Programming", 2 nd Edition, No Starch Press, 2019.
5.	Martin C. Brown, "Python: The Complete Reference", 4 th Edition, Mc–Graw Hill, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	—	—	—	—	—	—	—	—	—	—	3
CO2	3	2	2	2	—	—	—	—	—	—	—	—	—	—	3
CO3	3	3	3	3	—	—	—	—	—	—	—	1	—	—	3
CO4	3	3	3	3	—	—	—	—	—	—	—	1	—	—	3
CO5	3	3	3	3	—	—	—	—	—	—	—	1	—	—	3
CO	3	3	3	3	—	—	—	—	—	—	—	1	—	—	3

3—High, 2— Medium, 1—Low

HS22102	UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	L T P C
		2 0 0 2
COURSE OBJECTIVES:		
<ul style="list-style-type: none"> • To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education • To facilitate the students to understand harmony at all the levels of human living, and live accordingly • To create an awareness on Engineering Ethics and Human Values • To understand social responsibility of an engineer 		
UNIT I	INTRODUCTION TO VALUE EDUCATION	6
Value Education – Definition, Concept and Need for Value Education, Basic Guidelines – The Content and Process of Value Education – Basic Guidelines for Value Education – Self exploration as a means of Value Education – Happiness and Prosperity as parts of Value Education.		
UNIT II	HARMONY IN THE HUMAN BEING	6
Human Being is more than just the Body– Harmony of the Self ('I') with the Body – Understanding Myself as Co-existence of the Self and the Body – Understanding Needs of the Self and the needs of the Body – Understanding the activities in the Self and the activities in the Body.		
UNIT III	HARMONY IN THE FAMILY, SOCIETY AND HARMONY IN THE NATURE	6
Family as a basic unit of Human Interaction and Values in Relationships – The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love – Comprehensive Human Goal: The Five Dimensions of Human Endeavour – Harmony in Nature: The Four Orders in Nature – The Holistic Perception of Harmony in Existence.		
UNIT IV	SOCIAL ETHICS	6
The Basics for Ethical Human Conduct – Defects in Ethical Human Conduct – Holistic Alternative and Universal Order – Universal Human Order and Ethical Conduct – Human Rights violation and Social Disparities.		
UNIT V	PROFESSIONAL ETHICS	6
Universal Human Values – Value based Life and Profession – Professional Ethics and Right Understanding – Competence in Professional Ethics – Issues in Professional Ethics – The Current Scenario – Vision for Holistic Technologies – Production System and Management Models.		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Illustrate the significance of value inputs in a classroom and start applying them in their life and profession.	
CO2:	Explain the role of a human being in ensuring harmony in society and nature.	
CO3:	Demonstrate the value of harmonious relationship based on trust and respect in their life and profession.	
CO4:	Compare values, skills, happiness and accumulation of physical facilities, the Self and	

	the Body, Intention and Competence of an individual, etc.
CO5:	Classify ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.
TEXT BOOKS:	
1.	R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010.
2.	A.N. Tripathy, "Human Values", New Age International Publishers, New Delhi, 2004.
REFERENCES:	
1.	Gaur. R.R., Sangal. R, Bagaria. G.P, "A Foundation Course in Value Education", Excel Books, 2009.
2.	Gaur. R.R., Sangal. R, Bagaria. G.P, "Teachers Manual", Excel Books, 2009.
3.	Gaur R R, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2009.
4.	William Lilly, "Introduction to Ethic", Allied Publisher.
5.	Nagarajan, R.S., Professional Ethics and Human Values, New Age International Publishers, 2006.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO2	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO3	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO4	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO5	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-

3-High, 2-Medium, 1-Low

GE3152	HERITAGE OF TAMILS	L	T	P	C	
		1	0	0	1	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To help students understand the values of Tamil Language, basic language families in India and types of Tamil literature To facilitate the students to understand Tamil heritage of rock arts, paintings and musical instruments in their economic life To facilitate the students in understanding the harmony existing in Tamils martial arts To create an awareness on concept of Thinai Tamils and its values To understand the contribution and Influence of Tamils in Indian culture 						
UNIT I	LANGUAGE AND LITERATURE				3	
Indian Language Families – Dravidian Languages – Tamil as a Classical Language – Tamil						

Monographs – Secularity of Sangha Literature – Virtue of Sharing in Sangha Literature – Concepts of Management in Thirukkural – Tamil Copies – Influence of Jain Buddhism in Tamil Nadu – Bhakti Literature – Alvars and Nayanmars – Small Literature – Development of Modern Literature in Tamil – Contribution of Bharatiyar and Bharathidasan to the development of Tamil literature.

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 – Leather puppetry – 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:

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

CO1:	Describe the importance of Tamil Language and types of Tamil literature.
CO2:	Illustrate their knowledge in rock art paintings to modern art.
CO3:	Demonstrate a strong foundational knowledge in martial arts.
CO4:	Explain the concept of Thinai Tamils and its values.
CO5:	Describe the contribution of Tamils in Indian culture.

TEXT & REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாட்டால் மற்றும் கல்வியல் பணிகள் கழகம்).
2. Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
3. Dr.S.Singaravelu, “Social Life of the Tamils – The Classical Period”, International Institute of Tamil Studies.
4. Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, “Historical Heritage of the Tamils”, International Institute of Tamil Studies.
5. Dr.M.Valarmathi, “The Contributions of the Tamils to Indian Culture”, International Institute of Tamil Studies.

GE3152	தமிழர் மரபு	L 1	T 0	P 0	C 1
COURSE OBJECTIVES:					
	<ul style="list-style-type: none"> தமிழ் மொழியின் மதிப்புகள், இந்தியாவில் உள்ள அடிப்படை மொழிக்குடும்பங்கள் மற்றும் தமிழ் இலக்கிய வகைகளை மாணவர்கள் புரிந்துகொள்ள உதவுதல் மாணவர்கள் பாறை ஒவியங்கள், சிற்பக்கலைகள் மற்றும் இசைக்கருவிகளின் வழி தமிழ் பாரம்பரியத்தைப் புரிந்துகொள்ள வசதி செய்தல் தமிழர்களின் கலை மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்வதற்கு மாணவர்களுக்கு உதவுதல் தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அவர்களின் வாழ்க்கை நெறிகளைப் பற்றி மாணவர்களுக்கு விழிப்புணர்வை ஏற்படுத்துதல் இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பையும் அதன் தாக்கத்தையும் மாணவர்கள் புரிந்துகொள்ள செய்தல் 				
அலகு I	மொழி மற்றும் இலக்கியம்	3			
	இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பெளத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரததாசன் ஆகியோரின் பங்களிப்பு.				
அலகு II	மரபு – பாறை ஒவியங்கள் முதல் நவீன ஒவியங்கள் வரை – சிற்பக் கலை.	3			
	நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு				
அலகு III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	3			
	தெருக்கூத்து கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுக்கள்.				
அலகு IV	தமிழர்களின் திணைக் கோட்பாடுகள்.	3			
	தமிழகத்தின் தாவரங்களும் விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும், சங்ககால நகரங்களும் துறை முகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.				
அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு	3			
	இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.				

TOTAL: 15 PERIODS

COURSE OUTCOMES:

இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:

- CO1:** தமிழ் மொழியின் முக்கியத்துவம் மற்றும் இலக்கிய வகைகளை விவரிக்க முடியும்.
- CO2:** பாறை ஓவியங்கள் முதல் நவீன கலைகள் வரை அவர்களின் அறிவை விவரிக்க முடியும்.
- CO3:** தற்காப்புக் கலைவின் வலுவான அடித்தள அறிவை விவரிக்க முடியும்.
- CO4:** தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அதன் மதிப்புகளை விளக்க முடியும்.
- CO5:** இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பை விவரிக்க இயலும்.

TEXT & REFERENCE BOOKS:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு): தமிழ்நாடு பாடநால் மற்றும் கல்வியல் பணிகள் கழகம்.
2.	Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
3.	Dr.S.Singaravelu, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies.
4.	Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", International Institute of Tamil Studies.
5.	Dr.M.Valarmathi, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies.
6.	Dr.K.K.Pillay, "Studies in the History of India with Special Reference to Tamil Nadu".

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
CO2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
CO3	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
CO4	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
CO5	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
CO	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–

3-High, 2-Medium, 1-Low

EN22101	COMMUNICATIVE ENGLISH				L	T	P	C				
					2	0	2	3				
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> • To guide the learners on the basics of language including vocabulary and grammar • To develop the receptive skills of the learners: Reading and Listening • To develop the productive skills of the learners: Writing and Speaking • To make the learners realize the importance of accuracy and fluency 												

- To help the learners use the language in real situations

UNIT I	VOCABULARY AND LANGUAGE STUDY	6
Vocabulary – Synonyms and Antonyms, Word building – Prefixes and Suffixes – Word formation– Definitions – One word substitutes – Reading for vocabulary and language development – Note making and Summarising – Developing Hints.		
UNIT II	READING AND LANGUAGE DEVELOPMENT	6
Parts of speech, Types of sentences – Statement, Interrogative, Imperative, Exclamatory, Wh-questions, Yes or No questions and tag questions, Formal Letters – Academic, Official, and Business Letters.		
UNIT III	GRAMMAR AND LANGUAGE DEVELOPMENT	6
Tense and Voice, Auxiliary verbs (be, do, have), Modal verbs – <i>Types of Reading</i> : Intensive Reading and Extensive Reading– <i>Strategies</i> : Predicting– Skimming and Scanning –Reading for facts – Understanding the parts of paragraph– Learning the transitional signals used in the passage to classify the text.		
UNIT IV	FUNDAMENTALS OF WRITING	6
Punctuation and Capitalization– Sentence formation : Word order–Completion of sentences– Conjunctions–Transitional signals– sentence and sentence structures– Informal Letters.		
UNIT V	EXTENDED WRITING	6
Degrees of Comparison – Reported speech – Paragraph writing –Topic sentence, supporting sentences and concluding sentence–Informal and Formal expressions.		
TOTAL : 30 PERIODS		
PRACTICAL EXERCISES:		
Listening (Receptive skill) <i>Intensive Listening: Effective and Attentive Listening</i>		
Exercises		
1) Listening for gist from recorded speeches		
2) Listening for specific information from recorded conversations		
3) Listening for strengthening vocabulary skills		
4) Listening to variety of situations and voices– Listening for language development		
5) Listening for pronunciation: syllables, stress and intonation		
Speaking (Productive Skill)		
Exercises		
1) Introducing oneself and others		
2) Asking for / giving personal information		
3) Practicing dialogues in pairs		
4) Giving directions–Informal and formal dialogues		
5) Speaking in connected speech		
6) Responding to questions		
7) Short presentations		
8) Speaking in small and big groups		
9) Learning and practicing the essential qualities of a good speaker		
TOTAL: 30 PERIODS		
TOTAL(T+P): 60 PERIODS		

COURSE OUTCOMES:

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

- CO1:** Apply and practice the correct usages of language.
- CO2:** Receive the language effectively and meaningfully through receptive skills.
- CO3:** Produce the language appropriate to the needs and situations exercising productive skills.
- CO4:** Transfer or interpret any piece of information with accuracy and fluency.
- CO5:** Apply the language intellectually and confidently.

TEXT BOOKS:

1. Shobha. K.N, Rayen, Joavani, Lourdes, "Communicative English", Cambridge University Press, 2018.
2. Sudharshana.N.P and Saveetha. C, "English for Technical Communication", Cambridge University Press: New Delhi, 2016.

REFERENCES:

1. Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015.
2. Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA: 2007.
3. Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education, 2010.
4. Wood F.T, "Remedial English Grammar", Macmillan, 2007.
5. Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	1	1	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	1	1	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-

3-High, 2-Medium, 1-Low

BS22101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C	
		0	0	4	2	
PHYSICS LABORATORY						
OBJECTIVES:						
<ul style="list-style-type: none"> • To learn the proper use of various kinds of physics laboratory equipment. • To learn how data can be collected, presented and interpreted in a clear and concise 						

manner	
<ul style="list-style-type: none"> • To learn problem solving skills related to physics principles and interpretation of experimental data • To determine error in experimental measurements and techniques used to minimize such error • To make the student an active participant in each part of all lab exercises 	
LIST OF EXPERIMENTS:	
1.	Non-uniform bending – Determination of Young's modulus
2.	SHM of Cantilever – Determination of Young's modulus
3.	Poiseuille's flow – Coefficient of viscosity of liquid
4.	Torsional pendulum – Determination of Rigidity modulus
5.	Newton's ring – Radius of curvature of convex lens
6.	Lee's Disc – Determination of coefficient of thermal conductivity of bad conductor
TOTAL: 30 PERIODS	
CHEMISTRY LABORATORY	
OBJECTIVES:	
<ul style="list-style-type: none"> • To inculcate experimental skills to test basic understanding of water quality parameters such as, acidity, alkalinity and hardness. • To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions. 	
LIST OF EXPERIMENTS:	
1.	Determination of total hardness of water by EDTA method
2.	Conductometric titration of strong acid and strong base
3.	Determination of strength of given hydrochloric acid using pH meter
4.	Conductometric precipitation titration using BaCl_2 and Na_2SO_4
5.	Determination of alkalinity in water sample
6.	Estimation of iron content of the given solution using potentiometer
TOTAL: 30 PERIODS	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Determine different moduli of elasticity used in day to day engineering applications.
CO2:	Calculate the viscosity of liquids and radius of curvature of convex lens.
CO3:	Estimate the coefficient of thermal conductivity of bad conductors.
CO4:	Determine the water quality parameters of the given water sample.
CO5:	Analyze quantitatively the metals (Fe, Ni,) in the any sample volumetrically as well as by using spectroanalytical methods.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	—	—	—	—	—	—	2	1	—	1	—	—	—
CO2	3	1	—	—	—	—	—	—	2	1	—	1	—	—	—
CO3	3	1	—	—	—	—	—	—	2	1	—	1	—	—	—
CO4	3	1	—	—	—	2	2	—	1	—	—	—	—	—	—
CO5	3	1	—	—	—	2	2	—	1	—	—	—	—	—	—
CO	3	1	—	—	—	2	2	—	2	1	—	1	—	—	—

3–High, 2– Medium, 1–Low

CS22102	PYTHON PROGRAMMING LABORATORY	L	T	P	C	
		0	0	4	2	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the problem solving approaches • To learn the basic programming constructs in Python • To practice various computing strategies for Python-based solutions to real world problems • To use Python data structures – lists, tuples, dictionaries • To do input/output with files in Python 						
LIST OF EXPERIMENTS:						
1. Identification and solving of simple real life or scientific or technical problems, and developing algorithms and flow charts for the same						
2. Python programming using simple statements and expressions						
3. Scientific problems using Conditionals and Iterative loops						
4. Implementing real-time/technical applications using Lists, Tuples						
5. Implementing real-time/technical applications using Sets, Dictionaries						
6. Implementing programs using Functions						
7. Implementing programs using Strings						
8. Implementing real-time/technical applications using File handling						
9. Implementing real-time/technical applications using Exception handling						
10. Exploring Pygame tool						
11. Developing a game activity using Pygame like bouncing ball						
TOTAL: 60 PERIODS						
COURSE OUTCOMES:						
At the end of the course, the students will be able to:						
CO1:	Develop algorithmic solutions to simple computational problems.					
CO2:	Develop and execute simple Python programs.					

CO3:	Implement programs in Python using conditionals, loops and functions for solving problems.											
CO4:	Process compound data using Python data structures.											
CO5:	Utilize Python packages in developing software applications.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	—	—	—	—	—	—	—	—	3	—	—
CO2	3	2	2	2	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	3	—	—	—	—	—	—	—	1	3	—	—
CO5	3	3	3	3	2	—	—	—	—	—	—	1	3	—	—
CO	3	3	3	3	2	—	—	—	—	—	—	1	3	—	—

3–High, 2– Medium, 1–Low

HS22101	HIGHER ORDER THINKING					
		L	T	P	C	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> Teaching the students the sources and dynamics of thinking Teaching the students the basics of systematic and scientific thinking Initiating the students into critical thinking and to use critical thinking in practical life Initiating students into creative thinking 						
UNIT I	INTRODUCTION TO COGNITION, KNOWLEDGE AND THINKING	3				
Cognition – Different Cognitive functions – Cognition and intelligence – Cognitive development: till adolescence and post adolescence – possibility of true knowledge – The sources of Knowledge. Sensation, perception. Reality of perception – Concept formation, abstraction. Memory and retrieving – Introduction to thinking and types of thinking. Systematic thinking.						
UNIT II	LOGIC AND REASONING	3				
Commonsense and scientific knowledge. Pursuit of truth .– Syllogistic Logic. Greek and Indian. – Exercises.						
UNIT III	CRITICAL THINKING SKILLS AND DISPOSITIONS	3				
Critical Thinking Skills & Dispositions. Critical Thinking Exercises.						
UNIT IV	ANALYSIS OF ARGUMENTS	3				
Propositions and fallacies. – Analyzing arguments. – Exercises.						
UNIT V	CREATIVE THINKING AND INNOVATIVE THINKING	3				
Evolution of Scientific Thinking and Paradigm Shift. – Dynamics of Thoughts: Hegel. – Convergent thinking and divergent thinking (out of the box thinking). – Problem solving and Planning.						

TOTAL: 15 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:
--

CO1: Demonstrate the sources of knowledge and the process of thinking.

CO2: Demonstrate critical thinking skills and dispositions of critical thinking.

CO3: Confidently engage in creative thinking and problem solving.
--

REFERENCES:

1	Introduction to Logic, Irving M. Copi, Carl Cohen and Kenneth McMahon, Fourteenth Edition, Pearson Education Limited, 2014.
2	Teaching Thinking Skills: Theory and Practice, Joan Boykoff Baron and Robert J. Sternberg, W.H. freeman and Company, New York.
3	Cognitive Psychology, Robert J. Sternberg, Third Edition, Thomson Wadsworth, UK, 2002.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	—	—	—	—	—	—	—	1	—	—	2
CO2	3	2	2	1	—	—	—	—	—	—	—	1	—	—	2
CO3	3	2	2	1	—	—	1	—	1	—	1	1	—	—	2
CO	3	2	2	1	—	—	1	—	1	—	1	1	—	—	2

3–High, 2– Medium, 1–Low

SEMESTER II

MA22201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To provide the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology • To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems • To introduce the basic concepts of solving algebraic and transcendental equations • To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines • To acquaint the knowledge of various numerical methods of solving ordinary differential equations 					
UNIT I	TESTING OF HYPOTHESIS	12			
Statistical hypothesis –Type I and Type II errors – Large sample tests based on Normal distribution for single mean and difference of means –Tests based on t distribution for single mean and equality of means – Test based on F distribution for equality of variances – Chi square test for single variance and goodness of fit – Independence of attributes – Contingency table: Analysis of r \times c tables.					
UNIT II	DESIGN OF EXPERIMENTS	12			
General principles – Analysis of variance (ANOVA) – One way classification – Completely randomized design (CRD) – Two way classification – Randomized block design (RBD) – Three way classification –Latin square design(LSD) – Two factor experiments: 2^2 factorial design					
UNIT III	NUMERICAL SOLUTION OF EQUATIONS	12			
Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel .					
UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION	12			
Newton's forward and backward interpolation – Interpolation with unequal intervals – Lagrange's interpolation– Divided differences – Newton's divided difference – Approximation of derivates using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3, 3/8 rules– Numerical double integration: Trapezoidal and Simpson's rules.					
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	12			
Single step methods : Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge–Kutta method for solving first order equations – Multi step methods : Milne's and Adams – Bash forth predictor corrector methods for solving first order equations.					

TOTAL: 60 PERIODS											
COURSE OUTCOMES:											
At the end of the course, the students will be able to:											
CO1:	Define the basic concepts of statistical tests, ANOVA, iterative methods, interpolations and ODE.										
CO2:	Discuss the techniques of statistical tests and design of experiments.										
CO3:	Explain the solution of equations, ODE, single and multistep methods, interpolations, differentiation and integration.										
CO4:	Apply the concept of testing of hypothesis and design of experiment in real life.										
CO5:	Apply numerical techniques in system of equations, differential equations, interpolation, differentiation and integration.										
TEXT BOOKS:											
1.	Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10 th Edition, Khanna Publishers, New Delhi, 2015.										
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9 th Edition, Pearson Education, Asia, 2016.										
REFERENCES:											
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9 th Edition, Cengage Learning, 2016.										
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", 8 th Edition, Cengage Learning, New Delhi, 2014.										
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.										
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics, 4 th Edition, Tata McGraw Hill Edition, 2012.										
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9 th Edition, Pearson Education, Asia, 2012.										

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—
CO2	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—
CO3	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—
CO4	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—
CO5	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—
CO	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—

3-High, 2-Medium, 1-Low

ES22202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C				
		3	0	0	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To introduce the basic circuit components • To educate on the working principles and applications of electrical machine • To explain the construction and working of semiconductor devices • To educate on logic gates, flip flops and registers • To introduce the functional elements and working of measuring instruments 									
UNIT I	INTRODUCTION TO ELECTRICAL ENGINEERNG								
Introduction–Conductors, semiconductors and Insulators–Electrostatics – Electric Current–Electromotive Force–Electric Power– Ohm’s Law–Basic circuit components–Electromagnetism related laws–Kirchhoff’s Laws.									
UNIT II	ELECTRICAL MACHINES								
Construction, working principle and types of DC Generator – Motor– single phase Transformer – single phase and three phase Induction motor –Applications									
UNIT III	ANALOG ELECTRONICS								
Classification of Semiconductors– Construction, Characteristics and working –PN Junction Diode– Zener Diode – Bipolar Junction Transistor–IGBT– SCR– MOSFET.									
UNIT IV	DIGITAL ELECTRONICS								
Review of number systems, binary codes– Boolean Algebra–Logic gates–Implementation of Boolean expression using K-map –Types of flip flops, Registers.									
UNIT V	MEASUREMENTS AND INSTRUMENTATION								
Functional elements of an instrument –Static and dynamic characteristics of instruments, Errors, Principles of electrical indicating instruments– Types of indicating instruments –Moving Coil and Moving Iron instruments– DSO –Transducers–Resistive Transducers									
TOTAL: 45 PERIODS									
COURSE OUTCOMES:									
At the end of the course, the students will be able to:									
CO1:	Apply the basic laws to determine circuit parameters.								
CO2:	Explain the construction, working and application of electrical machines.								
CO3:	Explain the construction and working of semiconductor devices.								
CO4:	Interpret the function of combinational and sequential circuits.								
CO5:	Interpret the operating principles of measuring instruments.								
TEXT BOOKS:									
1.	M .S.Sukhja, T.K.Nagsarkar, “Basic Electrical and Electronics Engineering”, Oxford Higher Education, 2018.								
2.	S. Salivahanan, R.Rengaraj, “Basic Electrical and Instrumentation Engineering”, McGraw Hill Education, 2019.								
REFERENCES:									
1.	Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Fourth Edition,								

	McGraw Hill Education, 2019.
2.	H.S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2010.
3.	V. K. Mehta, Rohit Mehta, "Basic Electrical Engineering", S.Chand & Company Pvt. Ltd, New Delhi, 2012.
4.	S.K.Sahdev, "Basic of Electrical Engineering", Pearson, 2015.
5.	B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", Chand & Co, 2008.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	—	—	—	1	—	—	—	—	—	1	2	2	—
CO2	2	—	—	—	—	1	—	—	—	—	—	1	2	—	—
CO3	2	—	—	—	—	1	—	—	—	—	—	1	2	—	—
CO4	2	—	—	—	—	1	—	—	—	—	—	1	2	—	—
CO5	2	—	—	—	—	1	—	—	—	—	—	1	2	—	—
CO	2	2	—	—	—	1	—	—	—	—	—	1	2	2	—

3–High, 2– Medium, 1–Low

CS22201	PROGRAMMING IN C	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To develop C Programs using basic programming constructs • To develop C programs using arrays and strings • To develop applications in C using functions, pointers and structures • To do input/output and file handling in C 						
UNIT I	BASICS OF C PROGRAMMING				9	
Introduction to C programming – Applications of C Language – Structure of C program – C programming: Tokens – Character Set – Keywords – Identifiers – Data Types – Variables – Constants – Storage Classes – Operators and Expressions – Precedence and Associativity – Input / Output statements – Assignment statements – Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statements– goto Statement						
UNIT II	ARRAYS AND POINTERS				9	
Introduction to Arrays: One Dimensional Arrays – Declaration of Arrays – Storing Values in Arrays – Accessing the Elements of an Array – Searching Algorithms (Linear Search, Binary Search) – Two Dimensional Arrays – Pointers – Pointer Arithmetic – Array of Pointers – Pointer to Array – Void and Null Pointers.						

UNIT III	STRINGS AND FUNCTIONS	9
Functions – Classification of Functions – Strings – String Library Functions – User Defined Functions: Function Declaration/Function Prototype – Function Definition – Function Call – Return Statement – Passing Parameters to Functions (Pass by value, Pass by reference) – Recursion – Sorting Algorithms (Selection Sort, Insertion Sort).		
UNIT IV	STRUCTURES AND UNION	9
Structure – Nested Structures – Array of Structures – Structures and Functions – Pointer to Structure – typedef – Dynamic Memory Allocation – Self-referential structures: Singly Linked List – Union.		
UNIT V	FILE PROCESSING	9
Files – Types of Files – File Handling Functions – Sequential Access File Processing – Random Access File Processing – Command Line Arguments – Preprocessor Directives.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will be able to		
CO1:	Explore simple applications in C using basic programming constructs.	
CO2:	Develop C programs using arrays and strings.	
CO3:	Develop modular programs in C using functions and pointers.	
CO4:	Build applications in C using structures.	
CO5:	Demonstrate applications using sequential and random-access file processing.	
TEXT BOOKS:		
1.	Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.	
2.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Pearson Education, 2013.	
REFERENCES:		
1.	Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth Edition, Pearson Education, 2018.	
2.	Yashwant Kanetkar, “Let us C”, 17 th Edition, BPB Publications, 2020.	
3.	Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.	
4.	Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.	
5.	E. Balagurusamy, “Programming in ANSI C”, Eighth Edition, McGraw Hill Education, 2019.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO2	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—
CO	3	3	3	3	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

ME22201	ENGINEERING GRAPHICS				L	T	P	C				
	2	0	2	3								
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> • To draw the engineering curves • To draw orthographic projection of points and lines • To draw orthographic projection of solids and section of solids • To draw the development of surfaces • To draw the isometric projections of simple solids and freehand sketch of simple objects 												
CONCEPTS AND CONVENTIONS												
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.												
UNIT I	PLANE CURVES							12				
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.												
UNIT II	PROJECTION OF POINTS, LINES AND PLANES							12				
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 and traces Projection of planes (polygonal and circular surfaces) inclined to any one principal plane.												
UNIT III	PROJECTION OF SOLIDS							12				

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

UNIT IV	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	12
----------------	--	-----------

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

UNIT V	ISOMETRIC PROJECTIONS AND FREEHAND SKETCHING	12
---------------	---	-----------

Principles of isometric projection — isometric scale – isometric projections of simple solids and truncated solids – Prisms, pyramids & cylinders, in simple vertical positions.

Representation of Three Dimensional objects — Layout of views— Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of projection of simple objects by CAD Software (Demonstration purpose only).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1:	Recall the existing national standards and interpret a given three dimensional drawing.
CO2:	Interpret graphics as the basic communication and methodology of the design process.
CO3:	Acquire visualization skills through the concept of projection.
CO4:	Develop the sectioned solids and discover its true shape.
CO5:	Develop imagination of physical objects to be represented on paper for engineering communication.

TEXT BOOKS:

1.	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
2.	Jeyapoovan T., “Engineering Graphics using AutoCAD”, 7 th Edition, Vikas Publishing House, 2015.

REFERENCES:

1.	Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
2.	Julyes Jai Singh S., “Engineering Graphics”, 7 th Edition, SRM tri sea publishers, Nagercoil, 2015.
3.	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, 53 rd Edition, Charotar Publishing House, 2019.

4.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), 27 th Edition, Subhas Publications, Bangalore, 2017.
5.	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.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	—	—	—	—	—	—	—	2	—	—	—	2	—
CO2	3	1	—	—	—	—	—	—	—	2	—	—	—	2	—
CO3	3	1	—	—	—	—	—	—	—	—	—	—	—	2	—
CO4	3	1	—	—	—	—	—	—	—	2	—	—	—	2	—
CO5	3	1	—	—	—	—	—	—	—	2	—	—	—	2	—
CO	3	1	—	—	—	—	—	—	—	2	—	—	—	2	—

3–High, 2– Medium, 1–Low

GE3252	TAMILS AND TECHNOLOGY	L	T	P	C	
		1	0	0	1	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To facilitate the students to understand weaving and ceramic technology of sangam age • To create an awareness on structural design of Tamils during sangam age • To help students to distinguish between all the levels of manufacturing technology in ancient period • To understand the ancient Knowledge of agriculture and irrigation technology • To enable the students to understand the digitalization of Tamil language 						
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:

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

CO1:	Describe the importance of weaving and ceramic technology of sangam age.
CO2:	Illustrate the knowledge on structural design of Tamils during sangam age.
CO3:	Demonstrate a strong foundational knowledge in manufacturing technology of ancient Tamils.
CO4:	Describe the importance of ancient agriculture and irrigation technology of Tamils.
CO5:	Explain the concept of digitalization of Tamil language.

TEXT & REFERENCE BOOKS:

1.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசரம்)
2.	கீழடி – வைகை நதிக்கரயில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு) / Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
3.	பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு) / “Porunai Civilization”, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
4.	Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
5.	Dr.S.Singaravelu, “Social Life of the Tamils – The Classical Period”, International Institute of Tamil Studies.
6.	R.Balakrishnan, “Journey of Civilization Indus to Vaigai”, RMRL.

GE3252	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில்நுட்பத்தை மாணவர்கள் புரிந்துகொள்ள வசதி செய்தல்
- சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய விழிப்புணர்வை ஏற்படுத்துதல்

<ul style="list-style-type: none"> பண்டைய கால உற்பத்தி தொழில்நுட்பத்தின் அனைத்து நிலைகளையும் வேறுபடுத்தி அறிய மாணவர்களுக்கு உதவுதல் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவைப் புரிந்துக் கொள்ள செய்தல் தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிப் புரிந்துக் கொள்ள செய்தல் 	
அலகு I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்
3	
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கிறல் குறியீடுகள்.	
அலகு II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்
3	
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோவில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ்; காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.	
அலகு III	உற்பத்தித் தொழில் நுட்பம்
3	
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
அலகு IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்
3	
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழுமித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்கான வடிவமைக்கபட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.	
அலகு V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்
3	
அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
TOTAL: 15 PERIODS	
COURSE OUTCOMES:	
இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:	
CO1:	சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தின் முக்கியத்துவத்தை விவரிக்க முடியும்.
CO2:	சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய அறிவை விளக்க முடியும்.
CO3:	பண்டைய தமிழர்களின் உற்பத்தி தொழில்நுட்பம் பற்றிய வலுவான அடித்தள அறிவை வெளிப்படுத்த முடியும்.
CO4:	தமிழர்களின் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவை விவரிக்க முடியும்.
CO5:	தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிய கருத்தை விளக்க முடியும்.
TEXT & REFERENCE BOOKS:	
1.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசரம்).

2.	கீலடி – வைகை நதிக்கரயில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு) / Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
3.	பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு) / “Porunai Civilization”, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
4.	Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
5.	Dr.S.Singaravelu, “Social Life of the Tamils – The Classical Period”, International Institute of Tamil Studies.
6.	R.Balakrishnan, “Journey of Civilization Indus to Vaigai”, RMRL.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
CO2	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
CO3	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
CO4	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
CO5	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
CO	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–

3-High, 2-Medium, 1-Low

EN22201	TECHNICAL ENGLISH	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To widen strategies and skills to augment ability to read and comprehend engineering and technology texts To develop writing skill to make technical presentations To draft convincing job applications and effective reports To strengthen listening skills to comprehend technical lectures and talks in their areas of specialization To cultivate speaking skills both technical and general 						
UNIT I LANGUAGE STUDY						
Technical Vocabulary– synonyms, antonyms, prefix and suffix, word formation, Homonyms and Homophones – puzzles – Reading: skimming a reading passage – scanning for specific information– Instruction– Interpreting – Writing: Recommendation– Checklist.						
UNIT II READING AND STUDY SKILLS						

Active and Passive voice– Extended Definitions– Imperatives– Numerical Adjectives– Purpose Statement – Reading: Critical reading– Newspaper articles– journal reports– editorials and opinion blogs – Report Writing: Fire Accident, Industrial visit, Project report, feasibility report, survey report, business report.

UNIT III	WRITING SKILLS– INTRODUCTION TO PROFESSIONAL WRITING	6
-----------------	---	----------

Error Spotting/Common Errors– Concord–Compound words– Abbreviations and Acronyms– Discourse Markers – Finding key information – shifting facts from opinion– interpreting visual material– making inference from the reading passage – Interpretation of charts– – Minutes of the meeting– Paraphrasing– Proposal writing

UNIT IV	TECHNICAL WRITING AND GRAMMAR	6
----------------	--------------------------------------	----------

If Conditional Clauses– Prepositional Phrases– Fixed and semi fixed expressions– –e-mail communication– reading the attachment files having a poem /joke / proverb/sending their responses through e-mail.– Job application letter and Resume/CV/ Bio–data.

UNIT V	EXTENDED WRITING AND LANGUAGE STUDY	6
---------------	--	----------

Articles– Cause and Effect expressions– Collocations– Sequencing words– Reading longer technical texts and taking down notes– Structure of Essay– Types of Essay: Narrative essay– Descriptive Essay– Analytical Essay– Cause and Effect Essay – Compare and contrast essays.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

Listening Skills – Listening for professional Development

Listening to UPSC Toppers Mock Interviews– Listening to debates/discussions/different viewpoints /scientific lectures/event narrations/documentaries/telephonic conversations

Speaking Skills –emphasizing communicative establishment

Seeking Information –asking and giving directions– narrating personal experiences/ events– answering interview questions– picture description– presenting a product and giving instruction to use a product – mini presentations–role plays– speaking in formal and informal situations–speaking about one’s locations – speaking about great personalities –describing a simple process– telephone skills and etiquette

TOTAL: 30 PERIODS

TOTAL (T+P) = 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Infer advanced technical texts from varied technical genres to expand engineering knowledge and explore more ideas.
CO2:	Analyze technical contents written on par with international standards and rewrite contents using the right vocabulary without grammatical errors to make their articles published in reputed journals.
CO3:	Present reports and job letters utilizing the required format prescribed on par with international standards using the exact vocabulary to make their works worthy to be read.
CO4:	Employ the language tones and styles appropriately in interviews and Group Discussions

	effortlessly following the strategies expected by the corporate world.
CO5:	Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness.
TEXT BOOKS:	
1.	Mike Markrl, "Technical Communication", Palgrave Macmillan, London, 2012.
2.	Sumant, S and Joyce Pereira, "Technical English II", Chennai: Vijay Nicole Imprints Private Limited, 2014.
REFERENCES:	
1.	Raman, Meenakshi & Sangeetha Sharma, "Communication Skills", New Delhi: OUP, 2018.
2.	Rizvi M, Ashraf, "Effective Technical Communication", New Delhi: Tata McGraw-Hill Publishing Company Limited, 2007.
3.	Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.
4.	Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA, 2007.
5.	Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

3–High, 2– Medium, 1–Low

PH22203	PHYSICS FOR INFORMATION SCIENCE (Common to CSE, IT, AI&DS)					
		L	T	P	C	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the concepts of light, electron transport properties and the essential principles of semiconductors • To become proficient in magnetic properties of materials and the functioning of optical devices • To know the basics of quantum structures and Single electron transistor 						

- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course

UNIT I	PHOTONICS	6
Interference – Air wedge – LASER – population inversion – Einstein coefficient's –NdYAG Laser – CO2 laser – semiconductor laser – Optical fibre – Total internal reflection – propagation of light – Numerical Aperture and Acceptance angle – Fiber optic communication system – Endoscopy.		
UNIT II	ELECTRICAL PROPERTIES OF MATERIALS	6
Classical free electron theory – Expression for electrical conductivity and Thermal conductivity, Wiedemann–Franz law – Success and failures – Fermi– Dirac statistics – Density of energy states – Electron in periodic potential – Band theory of solids – Electron effective mass – concept of hole.		
UNIT III	SEMICONDUCTING MATERIALS	6
Semiconductors –direct and indirect band gap semiconductors – Intrinsic semiconductors Carrier concentration, band gap in intrinsic semiconductors – extrinsic semiconductors – N-type & P-type semiconductors – Variation of carrier concentration and Fermi level with temperature – Hall effect – measurement of Hall coefficient – applications.		
UNIT IV	MAGNETIC PROPERTIES OF MATERIALS	6
Magnetic dipole moment – atomic magnetic moment, permeability, susceptibility– Magnetic material classification: diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism – Domain Theory– B–H curve – Hard and soft magnetic materials – Magnetic storage devices: Magnetic hard disc with GMR sensor.		
UNIT V	OPTOELECTRONIC AND NANODEVICES	6
Carrier generation and recombination processes – Photo diode – solar cell – Organic LED – Optical data storage – Quantum confinement – Quantum structures – single electron phenomena and single electron transistor – Quantum dot laser.		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Relate the concepts of light, electron transport properties of conductors and basic principles of semiconductors.	
CO2:	Define the magnetic properties of materials and the principles of optoelectronic and nano devices.	
CO3:	Illustrate laser and fiber optics, classical and quantum concepts of conducting materials, physics of semiconducting materials.	
CO4:	Summarize the functioning of various magnetic, optoelectronic and nano devices.	
CO5:	Demonstrate the concepts of optics, fibre optics, moduli of elasticity and thermal energy, behavior of conductors, semiconductors and functioning of magnetic, optical and nano devices in various engineering applications.	
TEXT BOOKS:		
1.	Gaur, R.K & Gupta.S.L, "Engineering Physics", Dhanpat Rai Publishers, 2016.	
2.	Kasap,S.O. "Principles of Electronic Materials and Devices", McGraw–Hill	

	Education, 2017.
REFERENCES:	
1.	Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.
2.	Kittel, C. "Introduction to Solid State Physics", Wiley, 2017.
3.	Garcia, N. & Damask, "A. Physics for Computer Science Students", Springer–Verlag, 2012.
4.	Hanson, G.W. "Fundamentals of Nanoelectronics", Pearson Education, 2009.
5.	Rogers, B., Adams, J. & Pennathur, S, "Nanotechnology: Understanding Small Systems", CRC Press, 2014.
LIST OF EXPERIMENTS:	
1.	Uniform bending – Determination of Young's modulus
2.	Air-wedge – Thickness of thin wire
3.	Spectrometer – Grating
4.	LASER – Wavelength and particle size determination
5.	Optical fibre – Acceptance angle and Numerical aperture
6.	Band gap determination
	TOTAL: 30 PERIODS
	TOTAL (T+P) = 60 PERIODS

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	–	–	–	–	–	–	–	–	–	1	–	–	–
CO2	2	1	–	–	–	–	–	–	–	–	–	1	–	–	–
CO3	2	1	–	–	–	–	–	–	–	–	–	1	–	–	–
CO4	2	1	–	–	–	–	–	–	–	–	–	1	–	–	–
CO5	3	3	–	–	–	–	–	–	2	1	–	1	–	–	–
CO	2	1	–	–	–	–	–	–	2	1	–	1	–	–	–

3-High, 2-Medium, 1-Low

CH22201	ENVIRONMENT AND SUSTAINABILITY	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To understand the concept of ecosystem and biodiversity To conversant with various types of pollution and its effects To obtain knowledge on natural resources and its exploitation To understand the social issues related to environment and methods to protect To gain knowledge on sustainability and environment 						
UNIT I	ECOSYSTEM AND BIODIVERSITY				6	

Environment – Ecosystem – Structure and function of an ecosystem – Energy flow in an ecosystem – Food chain and food web – Biodiversity – Types – Values, threats and conservation of biodiversity – Endangered and endemic species – Hot spot of biodiversity – Biodiversity at state level, national level and global level.

UNIT II	NATURAL RESOURCES	6
----------------	--------------------------	----------

Introduction – Forest resources – Uses and Overexploitation – Deforestation – causes and consequences – Water resources – effect of over utilisation of water – Food resources – Impacts of modern agriculture (pesticides, fertilizers, water logging, salinity) – Sustainable Energy resources – Wind, Solar, hydroelectric power, geothermal – Land resources – Desertification, soil erosion – Role of an individual in the conservation of natural resources.

Case study – Deforestation, water conflicts, fertilizer and pesticide problem.

UNIT III	ENVIRONMENTAL POLLUTION AND MANAGEMENT	7
-----------------	---	----------

Definition, causes, effects and control measures of air pollution, water pollution, noise pollution, thermal pollution and marine pollution – Waste water treatment – Waste management – solid waste, bio waste, e-waste – Disaster management – Flood, cyclone, earthquake.

UNIT IV	SOCIAL ISSUES AND HUMAN HEALTH	6
----------------	---------------------------------------	----------

Population explosion and its effects on environment — variation of population among nations – Environmental issues and Human health – Food adulteration – Risk of food adulteration – Detection and prevention of food adulteration – COVID-19 – Human rights – Value Education.

UNIT V	SUSTAINABLE DEVELOPMENT AND ENVIRONMENT	5
---------------	--	----------

Sustainable development – needs and challenges — Goals – Aspects of sustainable development – Assessment of sustainability – Environmental ethics – Green chemistry – Eco mark, Eco products – EIA – Regional and local environmental issues and possible solutions – Role of engineering in environment and human health.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|--|
| CO1: | Recall the basic concepts of environment and sustainable development. |
| CO2: | Summarize the types of pollution, various natural resources and food adulterants. |
| CO3: | Explain the methods for waste management and detection of adulterants. |
| CO4: | Apply the gained knowledge to overcome various issues related to health and environment. |
| CO5: | Identify suitable methods for local environmental issues and sustainability. |

TEXT BOOKS:

- | | |
|----|--|
| 1. | Benny Joseph, “Environmental Science and Engineering”, Tata McGraw Hill, New Delhi, 2017. |
| 2. | Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, 2 nd Edition, Pearson Education, 2015. |

REFERENCES:

- | | |
|----|--|
| 1. | Erach Bharucha, “Text book of Environmental studies”, Universities Press (I) PVT LTD, Hyderabad, 2015. |
| 2. | Rajagopalan. R, “Environmental Studies – From Crisis to Cure”, Oxford University Press, 2015. |

3.	Tyler Miller G and Scott E. Spoolman,"Environmental Science", Cengage Learning India PVT LTD, 2014.
4.	Ruth F. Weiner and Robin A. Matthews. Butterworth, "Environmental Engineering", 4 th Edition, Heineman Publications.
5.	Dash M.C, "Concepts of Environmental Management for Sustainable Development", Wiley Publications, 2019.

EXPERIMENTS:

1.	Determination of DO content of waste water sample (Winkler's method)
2.	Determination of chloride content of water sample by Argentometric method
3.	Estimation of copper content in water by Iodometry
4.	Determination of Ca / Mg in waste water sample
5.	Detection of adulterant in ghee/edible oil/coconut oil
6.	Detection of adulterant in sugar/honey/chilli powder

TOTAL:30 PERIODS

TOTAL (T+P) = 60 PERIODS

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO2	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO3	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO4	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO5	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-

3—High, 2— Medium, 1—Low

CS22202	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

LIST OF EXPERIMENTS:

- | | |
|----|------------------------------|
| 1. | I/O Statements and Operators |
|----|------------------------------|

2.	Decision Making Statements
3.	Looping Statements
4.	Arrays: 1-Dimensional and 2 –Dimensional Arrays
5.	Strings and its Operations
6.	User Defined Functions
7.	Recursive Functions
8.	Pointers
9.	Structures and Union
10.	File Handling and Pre–Processor Directives
11.	Command Line Arguments
TOTAL: 60 PERIODS	

COURSE OUTCOMES:

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

CO1:	Demonstrate the knowledge on writing, compiling and debugging the C program.
CO2:	Develop programs in C using basic constructs.
CO3:	Develop programs in C using arrays.
CO4:	Develop applications in C using strings, pointers, functions.
CO5:	Develop applications in C using structures and file processing.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–
CO2	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–
CO3	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–
CO4	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–
CO5	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–
CO	3	3	3	3	–	–	–	–	–	–	–	–	3	–	–

3–High, 2– Medium, 1–Low

ES22203	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work • Wiring various electrical joints in common household electrical wire work • 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		
<ul style="list-style-type: none"> Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB 		
GROUP – A (CIVIL & MECHANICAL)		
PART I	CIVIL ENGINEERING PRACTICES	15
PLUMBING WORK	<ul style="list-style-type: none"> Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household Preparing plumbing line sketches Laying pipe connection to the suction side of a pump Laying pipe connection to the delivery side of a pump Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances 	
WOOD WORK	<ul style="list-style-type: none"> Sawing, Planning and Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint 	
PART II	MECHANICAL ENGINEERING PRACTICES	15
WELDING WORK	<ul style="list-style-type: none"> Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding Practicing gas welding 	
BASIC MACHINING WORK	<ul style="list-style-type: none"> Perform turning operation in the given work piece Perform drilling operation in the given work piece Performing tapping operation in the given work piece 	
ASSEMBLY WORK	<ul style="list-style-type: none"> Assembling a centrifugal pump Assembling a household mixer 	
SHEET METAL WORK	<ul style="list-style-type: none"> Making of a square tray 	
GROUP – B (ELECTRICAL AND ELECTRONICS)		
PART-I	ELECTRICAL ENGINEERING PRACTICES	15
<ul style="list-style-type: none"> One lamp controlled by one switch Series and parallel wiring Staircase wiring. Fluorescent Lamp wiring Residential wiring Iron Box wiring and assembly 		
PART-II	ELECTRONIC ENGINEERING PRACTICES	15
<ul style="list-style-type: none"> Introduction to electronic components and equipment's Calculation of resistance using colour coding Verify the logic gates AND, OR, EX-OR and NOT Measurement of AC signal parameters using CRO Soldering simple electronic circuits on a small PCB and checking continuity 		

TOTAL: 60 PERIODS												
COURSE OUTCOMES:												
At the end of the course, the students will be able to:												
CO1:	Prepare various pipe and furniture fittings used in common household.											
CO2:	Perform the given metal joining and metal removal operation in the given work piece as per the dimensions.											
CO3:	Apply the fundamental concepts involved in Electrical Engineering.											
CO4:	Explain the basic electrical wiring procedures.											
CO5:	Assemble basic electronic components.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	—	—	—	—	—	—	—	3	1	—	1	—	1	—
CO2	3	—	—	—	—	—	—	—	3	1	—	1	—	1	—
CO3	3	—	—	—	—	—	—	—	3	1	—	1	—	1	—
CO4	2	—	—	—	—	—	—	—	3	1	—	1	—	1	—
CO5	3	—	—	—	—	—	—	—	3	1	—	1	—	1	—
CO	3	—	—	—	—	—	—	—	3	1	—	1	—	1	—

3–High, 2– Medium, 1–Low

SEMESTER III

MA22302	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES:					
	<ul style="list-style-type: none"> • To introduce Propositional Logic and their rules for validity of statements • To introduce Predicates Calculus for validating arguments and programs • To give the counting principles for solving combinatorial problems • To introduce abstract notion of Algebraic structures for studying cryptography and its related areas • To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems 				
UNIT I PROPOSITIONAL CALCULUS					
	Propositions and notations – Propositional logic – Propositions and truth tables – Propositional equivalences – Conditional propositions – Converse, Contrapositive and Inverse–Tautologies and Contradictions –Normal Forms – Theory of Inference for the statement calculus (Validity using Truth Tables).				12
UNIT II PREDICATE CALCULUS					
	Predicates –Statement function – Variables and Quantifiers – Nested quantifiers – Predicate formulae –Valid formulas and equivalences –Theory of Inference for the Predicate Calculus – Introduction to proofs – Proof methods and strategy.				12
UNIT III COMBINATORICS					
	Mathematical induction – The pigeonhole principle – Permutations and Combinations – Recurrence relations – Solving linear recurrence relations – Inclusion and exclusion principle (without proof) and its applications.				12
UNIT IV ALGEBRAIC STRUCTURES					
	Algebraic systems – Semi groups and Monoids – Groups – Subgroups – Cosets – Lagrange's theorem – Definition: Rings and Fields – Problems on integer modulo n .				12
UNIT V LATTICES AND BOOLEAN ALGEBRA					
	Relations – Equivalence Relation and Partition – Partial order Relations – Partially Ordered Sets – Representation for Partially Ordered Sets – Hasse diagram – Lattices as Partially Ordered Sets (Definition and Examples)– Boolean algebra (Definition and Examples).				12
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Construct truth tables and their rules for validity of statements.				
CO2:	Apply the rules for validating arguments and programs.				
CO3:	Establish the counting principles and recurrence relations.				
CO4:	Apply the concepts and properties of groups and rings in the area of coding theory.				
CO5:	Develop the significance of relations and boolean algebra.				
TEXT BOOKS:					
1.	Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to				

	Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30 th Reprint, 2011.
2.	Kenneth H.Rosen, "Discrete Mathematics and its Applications", Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2018.
REFERENCES:	
1.	Swapan Kumar Sarkar, "Discrete Mathematics", S.Chand & Company Ltd., New Delhi, 2008.
2.	David Makinson, "Sets, Logics and Maths for Computing", Springer Indian Reprint, 2011.
3.	Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, 2007.
4.	Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Third Edition, 2010.
5.	Sengadir.T. "Discrete Mathematics and Combinatorics", Pearson Education, New Delhi, 2009.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3
CO2	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3
CO3	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3
CO4	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3
CO5	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3
CO	3	2	—	—	—	—	—	—	—	—	—	—	—	—	3

3–High, 2– Medium, 1–Low

CS22301	OBJECT ORIENTED PROGRAMMING	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand Object Oriented Programming concepts and basic characteristics of Java • To know the principles of packages, inheritance and interfaces • To define exceptions and use I/O streams • To develop a java application with threads • To design and build simple Graphical User Interfaces 						
UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS					9
Object Oriented Programming concepts – Characteristics of Java –Java Source File – Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – Access specifiers – Comments, Data Types, Variables, Operators, Control Flow, Methods, Static members – Arrays–Strings– JavaDoc comments.						
UNIT II	INHERITANCE AND INTERFACES					9
Constructors in java – Packages – Inheritance – Super classes– Sub classes –Protected members						

– Constructors in sub classes – the Object class – Abstract classes and methods – Final methods and classes – Interfaces – Defining an interface, Implementing interface, Differences between classes and interfaces and extending interfaces.

UNIT III	EXCEPTION HANDLING AND I/O	9
-----------------	-----------------------------------	----------

Exceptions – Exception hierarchy – Throwing and catching exceptions – Built-in exceptions, Creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT IV	COLLECTIONS, MULTITHREADING AND GENERICS	9
----------------	---	----------

The Collections Framework: Collections Overview – The Collection Interface: The List Interface – The Set Interface – The Collection Classes: The ArrayList Class – The LinkedList Class – Accessing a Collection via an Iterator – The For-Each Alternative to Iterators. Multithreading: Differences between multi-threading and multitasking, Thread life cycle, Creating threads, Synchronizing threads, Inter-thread communication, Daemon threads, Thread groups. Generic Programming: Generic classes – Generic Methods.

UNIT V	JAVAFX EVENT HANDLING, CONTROLS AND 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:

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

CO1:	Describe the basic concepts of OOP and fundamentals in Java.
CO2:	Implement the principles of packages, inheritance and interfaces.
CO3:	Develop Java applications using exception handling techniques and I/O operations.
CO4:	Write Java applications using multithreading, collections and generics concepts.
CO5:	Design interactive GUI based applications using the concepts of event handling and JAVAFX components.

TEXT BOOKS:

1.	Herbert Schildt, “Java The Complete Reference”, Tenth Edition, McGraw Hill Education, 2019.
2.	Herbert Schildt, “Introducing JavaFX 8 Programming”, McGraw Hill Education, New Delhi, 2015

REFERENCES:

1.	Cay S. Horstmann, Gary Cornell, “Core Java Volume –I Fundamentals”, Ninth Edition, Prentice Hall, 2013.
2.	Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, Third Edition, Pearson, 2015.
3.	Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
4.	Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.
5.	E Balagurusamy, “Programming with Java”, McGraw Hill Education, 2019.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

CS22302	DATA STRUCTURES				L	T	P	C				
	3	0	0	3								
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> • 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 – Radix Sort – Multi lists.												
UNIT II	STACKS AND QUEUES							9				
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions – Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.												
UNIT III	TREES							9				
Tree ADT – Tree Traversals – Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Threaded Trees – Priority Queue (Heaps) – Binary Heap – B-Tree.												
UNIT IV	GRAPHS							9				
Graph Definition – Representation of Graphs – Types of Graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Shortest path algorithms – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm.												
UNIT V	SEARCHING, SORTING AND HASHING							9				
Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –												

Rehashing – Extendible Hashing.											
											TOTAL: 45 PERIODS
COURSE OUTCOMES:											
At the end of the course, the students will be able to:											
CO1:	Explain the linear data structure List.										
CO2:	Implement stack and queue data structures.										
CO3:	Use appropriate non-linear data structure operations for solving a given problem.										
CO4:	Apply appropriate graph algorithms for graph applications.										
CO5:	Apply different searching, sorting and hashing techniques.										
TEXT BOOKS:											
1.	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2005.										
2.	Kamthane, Introduction to Data Structures in C, Pearson Education, 2007.										
REFERENCES:											
1.	Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, Second 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, Pearson, 2002.										
4.	Kruse, Data Structures and Program Design in C, Second Edition, Pearson Education, 2006.										
5.	Ellis Horowitz, Sratraj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2008.										

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	–	–	–	–	–	–	–	–	–	1	3	–
CO2	3	3	3	–	–	–	–	–	–	–	–	–	2	3	–
CO3	3	3	3	–	–	–	–	–	–	–	–	–	2	3	–
CO4	3	3	3	–	–	–	–	–	–	–	–	–	2	3	–
CO5	3	3	3	–	–	–	–	–	–	–	–	–	2	3	–
CO	3	3	3	–	–	–	–	–	–	–	–	–	2	3	–

3–High, 2– Medium, 1–Low

CS22303	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To design and implement digital circuits using simplified Boolean functions • To analyze, design and implement combinational circuits • To analyze, design and implement synchronous and asynchronous sequential circuits 						

- To understand and implement Programmable Logic Devices
- To develop HDL code for combinational and sequential circuits

UNIT I	DIGITAL SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES	9
---------------	---	----------

Digital Systems–Binary Numbers–Number–Base Conversions– Complements– Boolean Algebra– Basic Definitions– Axiomatic Definitions – Basic Theorems and Properties – Boolean Functions– Canonical and Standard Forms – Digital Logic Gates – Gate–Level Minimization– The Map Method –Four–Variable Map –Five Variable Map– Product–of–Sums Simplification – Don't–Care Conditions.

UNIT II	COMBINATIONAL CIRCUITS	9
----------------	-------------------------------	----------

Combinational Circuits – Analysis Procedure– Design Procedure– Code Converters – Adder–Subtractor– Decimal Adder– Magnitude Comparator – Decoders – Encoders – Multiplexers– Demultiplexers– Introduction to HDL – HDL Models of Combinational circuits.

UNIT III	SEQUENTIAL CIRCUITS	9
-----------------	----------------------------	----------

Sequential Circuits – Storage Elements–Latches–Flip–Flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers and Counters– Shift Registers– Ripple Counters–Synchronous Counters– HDL Models of Sequential circuits.

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	9
----------------	---	----------

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

UNIT V	MEMORY AND PROGRAMMABLE LOGIC	9
---------------	--------------------------------------	----------

Introduction– RAM – Memory Decoding – Error Detection and Correction – ROM – Programmable Logic Array – Programmable Array Logic.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basic concepts of digital systems and simplify the Boolean expressions using K–Map.
CO2:	Design and implement digital circuits using combinational circuits and develop HDL code for combinational circuits.
CO3:	Design and implement digital circuits using synchronous sequential circuits and develop HDL code for sequential circuits.
CO4:	Design and implement digital circuits using asynchronous sequential circuits.
CO5:	Design memory arrays using 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. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, Cengage Learning, 2013.

REFERENCES:

1. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education,

	2017.
2.	G. K. Kharate, Digital Electronics, Oxford University Press, 2010.
3.	Donald D. Givone, Digital Principles and Design, Tata Mc Graw Hill, 2003.
4.	S.Salivahanan and S.Arivazhagan, Digital Circuits and Design, Fifth Edition, Oxford University Press, 2018.
5.	John Patrick Hayes, Introduction to Digital Logic Design, Addison–Wesley, 1993.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-
CO	3	3	3	-	-	-	-	-	-	-	-	1	-	3	-

3-High, 2-Medium, 1-Low

CS22304	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To learn the basic structure and operations of a computer • To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit • To learn the basics of pipelined execution • To understand parallelism and multi-core processors • To understand the memory hierarchies, cache memories and virtual memories • To learn the different ways of communication with I/O devices 					
UNIT I	BASIC STRUCTURE OF A COMPUTER SYSTEM				9
Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.					
UNIT II	ARITHMETIC FOR COMPUTERS				9
Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.					
UNIT III	PROCESSOR AND CONTROL UNIT				9
A Basic MIPS implementation – Pipelining – Data Hazards – Instruction Hazards – Data path and Control considerations — Influence on Instruction Sets – Superscalar Operation.					

UNIT IV	PARALLELISM	9
Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.		
UNIT V	MEMORY & I/O SYSTEMS	9
Memory Hierarchy – Memory technologies – Cache memory –Virtual memory, TLB’s – Accessing I/O Devices — Direct Memory Access –Buses –Universal Serial Bus (USB).		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Describe the basic structure and operations of a computer.	
CO2:	Describe the organization of different memory systems, parallel processing architectures, I/O Processors and its communication.	
CO3:	Summarize the working of processor and control units with and without pipeline.	
CO4:	Demonstrate the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.	
CO5:	Apply the memory hierarchies, cache memories and virtual memories and to learn the different ways of communication with I/O devices.	
TEXT BOOKS:		
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.	
2.	David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.	
REFERENCES:		
1.	William Stallings, Computer Organization and Architecture “Designing for Performance”, Eighth Edition, Pearson Education, 2010.	
2.	John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 2012.	
3.	John L. Hennesssey and David A. Patterson, “Computer Architecture – A Quantitative Approachl, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.	
4.	Mostafa Abd-El-Barr and Hesham El-Rewini, “Fundamentals of Computer Organization and Architecture”, Wiley Series on Parallel and Distributed Computing, First Edition, 2005.	
5.	Douglas Comer, “Essentials of Computer Architecture”, Second Edition, 2017.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	–	–	–	–	–	–	–	–	–	–	–	3
CO2	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO3	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO4	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO5	1	2	2	1	-	-	-	-	-	-	-	-	-	-	3
CO	2	2	2	2	-	-	-	-	-	-	-	-	-	-	3

3-High, 2-Medium, 1-Low

CS22305	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, arraylist, exception handling and file processing
- To develop applications using event handling

LIST OF EXPERIMENTS

1. Write simple java applications using if-else, switch –case, loops, array.
2. Develop a java application to implement packages.
3. Develop a java application to implement inheritance.
4. Develop a java application to implement an interface.
5. Develop a java application to implement abstract classes.
6. Write a Java program to implement user defined exception handling.
7. Write a Java program that performs file operations.
8. Write a java program that implements a multi-threaded application.
9. Design a simple calculator using event-driven programming paradigm of Java.
10. Develop a mini project for any application using Java concepts.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Develop Java programs for simple applications that make use of classes, packages and interfaces.
CO2:	Develop Java programs to implement inheritance, exception handling and multithreading concepts.
CO3:	Design applications using file operations.
CO4:	Design applications using JAVAFX and event handling.
CO5:	Develop a mini project for any application.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO4	3	2	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	2	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	2	3	—	—	—	—	—	—	—	—	—	3	—	—

3-High, 2-Medium, 1-Low

CS22306	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To implement linear and non-linear data structures
- To apply the different operations of search trees
- To implement graph traversal algorithms
- To apply sorting and searching algorithms

LIST OF EXPERIMENTS

1.	Linked list implementation of List ADT, Stack ADT and Queue ADT
2.	Implementation of Doubly Linked List and Circularly Linked List
3.	Polynomial Addition, Subtraction and Multiplication using Linked List
4.	Balancing Symbols, Evaluation of Postfix Expression and Infix to Postfix conversion
5.	Implementation of Double Ended Queue
6.	Implementation of binary tree and its operations with relevant traversals
7.	Implementation of binary search tree
8.	Graph representations, Implementation of BFS & DFS
9.	Shortest path using Dijkstra's algorithm
10.	Minimum spanning tree using Prim's algorithm
11.	Implementation of Sorting Algorithms and Searching Algorithms
12.	Hashing using separate chaining & open addressing

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Write functions to implement linked list.
CO2:	Use appropriate linear / non-linear data structure operations for solving a given problem.
CO3:	Use graph traversal algorithms.
CO4:	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.
CO5:	Write functions to implement searching and sorting algorithms.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	2	1	2	—	—	—	—	—	—	2	3	—	—

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO2	3	3	1	1	2	–	–	–	–	–	–	3	3	–	–
CO3	2	1	3	2	2	–	–	–	–	–	–	3	3	–	–
CO4	3	2	1	2	2	–	–	–	–	–	–	1	3	–	–
CO5	2	2	2	1	2	–	–	–	–	–	–	2	3	–	–
CO	2	2	2	1	2	–	–	–	–	–	–	2	3	–	–

3—High, 2— Medium, 1—Low

SD22301	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE I	L	T	P	C
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To make the students to solve basic programming logics • To help the students develop logics using decision control statements • To make them develop logics using looping statements and arrays • To train the students for effective communication and identify the common errors in formal writings • To guide and motivate the students for setting their goals with positive thinking 					
UNIT I	FUNDAMENTALS IN PROGRAMMING				8
Output of Programs: I/O Functions, Data types, Constants, Operators – Mathematical Problems – Debugging – Puzzles – Company Specific Programming Examples.					
UNIT II	DECISION CONTROL STATEMENTS				8
Logic Building Using Conditional Control Statements – Output of Programs – Mathematical Problems – Puzzles – Company Specific Programming Examples.					
UNIT III	LOOPING STATEMENTS AND ARRAYS				14
Logic Building Using Looping Statements – Number Programs – Programs on Patterns – Array Programs – Programs on Sorting and Searching – Matrix Programs – Puzzles – Output of Programs – Company Specific Programming Examples.					
UNIT IV	COMMUNICATION IN GENERAL				15
Introduction to communication–Types of communication – Effective Communication–Barriers to communication. Language Study: Vocabulary–Formation of sentences–Sentence and sentence structures–Common errors – Writing paragraphs & essays. Professional writing: Job application & Resume writing.					
UNIT V	PERSONALITY DEVELOPMENT				15
Study of personality & ways to improve. Soft Skills: Self–evaluation / self–awareness – Goal setting and positive thinking – Self–esteem and confidence – Public speaking – Extempore – Body language and Observation skills.					
TOTAL: 45 PERIODS					

Suggestive Assessment Methods:

- 1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
- 2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.
- 3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.
- 4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20.
- 5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40.
- 6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- 7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:**At the end of the course, the students will be able to:**

CO1:	Solve problems on basic I/O constructs.
CO2:	Develop problem solving skills using decision control statements.
CO3:	Develop logics using looping statements and arrays
CO4:	Avoid / fix the common errors they commit in academic and professional writings and prepare standard resumes and update the same for future career.
CO5:	Recognize the value of self-evaluation and grow with self confidence.

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. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Pearson Education, 2013.
2. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
3. E Balagurusamy, "Programming in ANSI C", Eighth edition, Mc GrawHill Publications, 2019.
4. S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills" VK Publications', 2016
5. Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO2	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO3	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO4	–	–	–	–	–	–	–	1	2	3	–	2	–	1	1
CO5	–	–	–	–	–	–	–	1	2	3	–	2	–	1	1
CO	3	2	2	–	1	1	1	1	2	3	1	2	2	2	2

3–High, 2– Medium, 1–Low

AC22301	CONSTITUTION OF INDIA				L	T	P	C										
	2	0	0	0														
COURSE OBJECTIVES:																		
<ul style="list-style-type: none"> • Teach history and philosophy of Indian Constitution • Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective • Summarize powers and functions of Indian government • Explain emergency rule • Explain structure and functions of local administration 																		
UNIT I	INTRODUCTION							6										
History of Making of the Indian Constitution – Drafting Committee – Philosophy of the Indian Constitution – Preamble – Salient Features.																		
UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES							6										
Fundamental Rights – Right to Equality – Right to Freedom – Right against Exploitation – Right to Freedom of Religion – Cultural and Educational Rights – Fundamental Duties.																		
UNIT III	ORGANISATIONS OF GOVERNANCE							7										
Parliament – Composition – Qualifications and Disqualifications – Powers and Functions – Executive President – Governor – Council of Ministers – Judiciary, Appointment and Transfer of Judges – Qualifications, Powers and Functions.																		
UNIT IV	EMERGENCY PROVISIONS							4										
Emergency Provisions – National Emergency, President Rule, Financial Emergency.																		
UNIT V	LOCAL ADMINISTRATION							7										
District's Administration head – Role and Importance –Municipalities – Introduction– Mayor and role of Elected Representative – CEO of Municipal Corporation –Pachayati raj – Introduction – PRI– Zila Pachayat–Elected officials and their roles.																		
TOTAL: 30 PERIODS																		
COURSE OUTCOMES:																		

At the end of the course, the students will be able to:												
CO1:	Understand history and philosophy of Indian Constitution.											
CO2:	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.											
CO3:	Understand powers and functions of Indian government.											
CO4:	Understand emergency rule.											
CO5:	Understand structure and functions of local administration.											
TEXT BOOKS:												
1.	Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.											
2.	Busi S N, Ambedkar B R framing of Indian Constitution, Ava Publications, 2015.											
REFERENCES:												
1.	Jain M P, Indian Constitution Law, 7 th Edition, Lexis Nexis, 2014.											
2.	The Constitution of India (Bare Act), Government Publication, 1950.											
3.	M.V.Pylee, "Introduction to the Constitution of India", 4 th Edition, Vikas publication, 2005.											
4.	Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19 th Edition, Prentice-Hall EEE, 2008.											
5.	Merunandan, "Multiple Choice Questions on Constitution of India", 2 nd Edition, Meraga publication, 2007.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	-	-	1	1	-	1	-	-	-	1	-	-	-
CO2	-	1	1	-	-	1	-	1	-	1	-	-	-	-	-
CO3	-	1	1	-	-	1	-	1	-	1	-	-	-	-	-
CO4	-	-	-	1	-	-	1	-	1	1	1	1	-	-	-
CO5	-	-	1	-	-	-	1	-	-	1	-	1	-	-	-
CO	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-

3—High, 2—Medium, 1—Low

HS22301	VALUE EDUCATION I	L	T	P	C	
		1	0	0	0	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To give the students a deeper understanding about the purpose of life • To animate the students to have a noble vision and a right value system for their life • To help the students to set short term and long-term goals in their life 						
UNIT I	MY LIFE AND MY PLACE IN THE UNIVERSE				4	
Value of my life – My Uniqueness, strengths and weakness – My self-esteem and confidence – My identity in the universe.						
UNIT II	MY LIFE AND THE OTHER				4	

Realising the need to relate with other persons and nature – My refined manners and conduct in relationships – Basic communication and relationship skills – Mature relationship attitudes.	
UNIT III	MY LIFE IS MY RESPONSIBILITY
	3
Personal autonomy – developing a value system and moral reasoning skills – setting goals for life.	
UNIT IV	UNDERSTANDING MY EDUCATION AND DEVELOPING MATURITY
	4
Importance of my Engineering education – Managing emotions – personal problem solving skills.	
TOTAL: 15 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain the importance of value based living.
CO2:	Set realistic goals and start working towards them.
CO3:	Apply the interpersonal skills in their personal and professional life.
CO4:	Emerge as responsible citizens with a clear conviction to be a role model in the society.
REFERENCES:	
1.	David Brooks. The Social Animal: The Hidden Sources of Love, Character, and Achievement. Random House, 2011.
2.	Mani Jacob. Resource Book for Value Education. Institute of Value Education, 2002.
3.	Eddie de Jong. Goal Setting for Success. CreateSpace Independent Publishing, 2014.
4.	Dr.Abdul kalam. My Journey–Transforming Dreams into Actions. Rupa Publications, 2013.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–
CO2	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–
CO3	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–
CO4	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–
CO	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–

3–High, 2– Medium, 1–Low

SEMESTER IV

MA22401	PROBABILITY AND STATISTICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables and correlation.
- To acquaint the knowledge of non-parametric tests which plays an important role in real life problems.
- To introduce the concept of control charts for statistical quality control.

UNIT I	PROBABILITY AND RANDOM VARIABLES	12
---------------	---	-----------

Probability - Axioms of probability – Discrete random variable– Probability mass function– Continuous random variable – Probability density function – Probability distribution – Cumulative distribution function – Mean, Variance- Special distributions: Binomial and Poisson distributions (Derivations not included).

UNIT II	NORMAL DISTRIBUTION AND COVARIANCE	12
----------------	---	-----------

Normal distribution: Definition and problems, Central limit theorem (excluding proof) - Two-dimensional discrete distribution – Joint probability mass function - Discrete marginal distribution – Discrete conditional distribution - Covariance.

UNIT III	CORRELATION, REGRESSION AND ESTIMATION THEORY	12
-----------------	--	-----------

Correlation (discrete case) – Karl Pearson's coefficient of correlation and Spearman's rank correlation – Linear regression - Regression coefficients – Definitions: Unbiased estimators, Efficiency, Consistency, Sufficiency - Curve fitting by the method of least squares (linear and quadratic forms).

UNIT IV	NON- PARAMETRIC TESTS	12
----------------	------------------------------	-----------

Introduction - Rank sum tests: Mann – Whitney U test- Wilcoxon two sample test - Kruskal - Wallis H test - Tests based on Runs: One sample run test - Test of randomness - The Kolmogorov -Smirnov test for goodness of fit

UNIT V	STATISTICAL QUALITY CONTROL	12
---------------	------------------------------------	-----------

The Control Chart – Nature of the Control limits - Control charts for variables or measurements - \bar{X} and R charts for variables – Control charts for attributes - The p -chart for Fraction Defective – Control Charts for Number of Defectives - (c and np charts) – Tolerance limits

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply probability and discrete distributions in engineering field.
CO2:	Find the probability using central limit theorem, covariance for discrete random variable.

CO3:	Compute correlation, regression and fitting of curve for discrete data.
CO4:	Apply non-parametric tests in real life problems.
CO5:	Apply control charts in data analysis.

TEXT BOOKS:

1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", 12 th Edition, Sultan Chand & Sons, 2020.
2.	Johnson. R.A., Miller. I.R and Freund. J.E, "Miller and Freund's Probability and Statistics for Engineers", 9 th Edition, Pearson Education, Asia, 2016.

REFERENCES:

1.	John E. Freund, "Mathematical Statistics", 8 th Edition, Prentice Hall, 2013.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", 9 th Edition, Cengage Learning, 2017.
3.	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5 th Edition, Elsevier, 2014.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", 4 th Edition, Tata McGraw Hill, 2012.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9 th Edition, Pearson Education, Asia, 2010.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—
CO2	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—
CO3	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—
CO4	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—
CO5	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—
CO	3	2	—	—	—	—	—	—	—	—	—	1	—	1	—

3-High, 2-Medium, 1-Low

CS22401	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To make the students understand algorithm analysis techniques • To apply Brute Force and Divide and Conquer algorithm design techniques • To use dynamic programming and greedy algorithm design techniques for solving problems • To make the students understand and use backtracking and branch and bound algorithm • To critically analyze the efficiency of alternative algorithmic solutions for the same problem 					

UNIT I	INTRODUCTION	9
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency – Analysis Framework – Asymptotic Notations and their properties. Mathematical analysis for Recursive and Non-recursive algorithms.		
UNIT II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9
Brute Force –String Matching – Closest-Pair and Convex-Hull Problems – Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology –Merge sort – Quick sort – Binary Search –Heap Sort.		
UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9
Dynamic programming –Coin changing problem, Computing a Binomial Coefficient –Optimal Binary Search Trees – Floyd’s algorithm. Greedy Technique – Container loading problem – Prim’s algorithm and Kruskal’s Algorithm – Huffman Trees.		
UNIT IV	BACKTRACKING AND BRANCH-AND-BOUND	9
Backtracking – n–Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – Assignment problem – Knapsack Problem – Travelling Salesman Problem.		
UNIT V	ITERATIVE IMPROVEMENT AND NP-COMPLETENESS	9
The Simplex Method – The Maximum–Flow Problem – Bipartite Graphs – Stable marriage Problem. Lower – Bound Arguments – P, NP NP– Complete and NP Hard Problems. Approximation Algorithms for NP–Hard Problems – Travelling Salesman problem – Knapsack problem.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Describe the algorithm analysis techniques to assess the complexity of an algorithm.	
CO2:	Apply the algorithm design techniques brute–force and divide and conquer to solve the problems.	
CO3:	Apply dynamic programming and greedy techniques to solve problems.	
CO4:	Solve problems using backtracking and branch and bound algorithm design techniques.	
CO5:	Examine the approximation algorithms and iterative improvement technique to assess the complexity of an algorithm.	
TEXT BOOKS:		
1.	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2021.	
2.	Sandeep Sen and Amit Kumar, “Design and Analysis of Algorithms: A Contemporary Perspective”, Department of Computer Science and Engineering, IIT Delhi, New Delhi, 2018.	
REFERENCES:		
1.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.	

2.	Narasimha Karumanchi, "Data Structures And Algorithms Made Easy: Data Structures And Algorithmic Puzzles", 2023.
3.	Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.
4.	S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.
5.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms/ C++", Second Edition, Universities Press, 2008.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

CS22402	DATABASE MANAGEMENT SYSTEMS	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn the fundamental concepts of database, data models, relational algebra and SQL • To represent a database system using ER diagrams and to learn normalization techniques • To understand the fundamental concepts of transaction, concurrency and recovery processing 						
<ul style="list-style-type: none"> • To understand the internal storage structures using different file and indexing techniques which will help in physical DB design • To have an introductory knowledge about the Distributed databases, NOSQL and database security 						
UNIT I	RELATIONAL DATABASES				10	
Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL – Dynamic SQL.						
UNIT II	DATABASE DESIGN				8	
Entity–Relationship model – E–R Diagrams – Enhanced–ER Model – ER–to–Relational Mapping – Functional Dependencies – Non–loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi–valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.						
UNIT III	TRANSACTIONS				9	

Transaction Concepts – ACID Properties – Schedules – Serializability – Need for Concurrency – Concurrency control – Two Phase Locking – Deadlock Handling – Timestamp based Protocols – Recovery Concepts – Recovery based on deferred and immediate update – ARIES Algorithm.

UNIT IV	IMPLEMENTATION TECHNIQUES	9
----------------	----------------------------------	---

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

UNIT V	ADVANCED TOPICS	9
---------------	------------------------	---

NoSQL Databases – Evolution of NoSQL databases. Different types of NoSQL databases. CAP Theorem, Consistency levels. Advantages of NoSQL databases, Scalability and performance. Introducing MongoDB: History, MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Outline the basic concepts of Relational databases.
CO2:	Illustrate database using ER model and normalize the database.
CO3:	Summarize transaction concepts and locking mechanisms.
CO4:	Identify the various indexing and hashing strategies to tune the performance of the database.
CO5:	Examine how does advanced databases differ from relational databases and find a suitable database for the given requirement.

TEXT BOOKS:

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

REFERENCES:

1.	C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2.	Anirudha Kolpyakwar , Pallavi Chaudhari, “Database Management System with NoSQL” Lampert Academic Publishing, 2018.
3.	Saeed K. Rahimi, Frank S. Haug, “Distributed Database Management System. A Practical approach” John Wiley & Sons, 2010.
4.	B.Prabhakaran,“Multimedia Database Management Systems”, The Springer International Series, 2012.
5.	Akmal Chaudhri, Awais Rashid , Roberto Zicari, “XML Data Management: Native XML and XML-Enabled Database Systems”, Addison-Wesley Professional, 2003.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

CS22403	OPERATING SYSTEMS	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> ● To understand the basic concepts and functions of operating systems ● To understand Processes and Threads ● To understand the concept of Deadlocks ● To analyze various memory management schemes ● To understand I/O management and File systems ● To be familiar with the basics of Linux system and Mobile OS like iOS and Android ● To analyze Scheduling algorithms 						
UNIT I	OPERATING SYSTEM OVERVIEW				7	
Computer System Overview–Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview– Objectives and functions, Evolution of Operating System.– Computer System Organization Operating System Structure and Operations– System Calls, System Programs, OS Generation and System Boot.						
UNIT II	PROCESS MANAGEMENT				10	
Processes – Process Concept, Process Scheduling, Operations on Processes, Inter–process Communication; Threads– Overview, Multithreading models, Threading issues; Process Synchronization – The critical–section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors.						
UNIT III	PROCESS SYNCHRONISATION				10	
CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple–processor scheduling, Real time scheduling; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.						
UNIT IV	STORAGE MANAGEMENT				9	

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, Disk structure– Disk scheduling– swap space management– Directory and disk structure, Directory implementation, Allocation Methods.

UNIT V	VIRTUAL MACHINES	9
---------------	-------------------------	----------

Virtual machines – Distributed systems – Types of network based operating system – Linux System – Design Principles, Kernel Modules – Mobile OS – iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the basic concepts, services and structure of operating systems.
CO2:	Interpret process management, process synchronization and multithreading concepts.
CO3:	Apply CPU scheduling algorithms and deadlock detection and avoidance algorithms.
CO4:	Apply various storage management schemes.
CO5:	Compare different types of operating systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, Tenth Edition, John Wiley and Sons Inc., 2018.
2. Andrew. Tanenbaum, “Modern Operating Systems”, Adison Wesley, Fourth Edition, 2014.

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. D M Dhamdhere, “Operating Systems: A Concept-Based Approach, Third Edition, Tata McGraw Hill 2017.
4. William Stallings, “Operating Systems: Internals and Design Principles”, Seventh Edition, Prentice-Hall, 2013.
5. Charles Crowley, “Operating Systems: A Design–Oriented Approach”, Tata McGraw Hill, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	1	1	–	–	–	–	–	–	–	–	1	2	–	–
CO3	3	1	–	–	–	–	–	–	–	–	–	1	2	–	–
CO4	3	1	2	2	–	–	–	–	–	–	–	1	2	–	–
CO5	3	3	1	2	–	–	–	–	–	–	–	1	3	–	–

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	3	1	1	2	-	-	-	-	-	-	-	1	2	-	-

3-High, 2-Medium, 1-Low

CS22404	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of layering in networks, TCP/IP protocol suite and application layer protocols
- To learn the functions and the various routing protocols of network layer
- To learn the functions and the various protocols of Transport layer
- To learn the various routing algorithms
- To familiarize the functions and protocols of the Application layer

UNIT I	INTRODUCTION AND APPLICATION LAYER	10
Data Communication – Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets –Socket Interface programming– Application Layer protocols: HTTP – FTP – Email protocols (SMTP – POP3 – IMAP – MIME) – DNS – SNMP.		

UNIT II	TRANSPORT LAYER	9
Introduction – Transport–Layer Protocols: UDP – TCP: Connection Management – Congestion Control – Congestion avoidance (DECbit, RED) – SCTP – Quality of Service.		

UNIT III	NETWORK LAYER AND SECURITY	8
Switching : Packet Switching – Internet protocol – IPV4 – IP Addressing – Subnetting – IPV6, ARP, RARP, ICMP, DHCP–Network Security: Security Goals–Attacks–Services and Techniques–IP Security–SLS–PGP–Firewall.		

UNIT IV	ROUTING	8
Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing – OSPF – Path–vector routing – BGP – Multicast Routing: DVMRP – PIM.		

UNIT V	DATA-LINK AND PHYSICAL LAYERS	10
Data Link Layer – Framing – Flow control – Error control –DLC Protocols: HDLC – PPP – Ethernet Basics – CSMA/CD – Wireless LAN (802.11) – Physical Layer: Data and Signals – Performance – Transmission media.		

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basic layers in computer networks and application layer protocols.
CO2:	Describe the various functions and protocols in the transport layer.
CO3:	Describe the protocols and security in the network.
CO4:	Illustrate the various functions and protocols in data link and physical layer.
CO5:	Apply the various routing algorithms.

TEXT BOOKS:	
1.	Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
2.	Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Sixth Edition, Morgan Kaufmann Publishers Inc., 2021.
REFERENCES:	
1.	James F. Kurose, Keith W. Ross, Computer Networking, A Top–Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2.	William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2017.
3.	Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4.	Ying–Dar Lin, Ren–Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2012.
5.	Andrew S. Tanenbaum, Computer Networks, PHI, Fourth Edition, 2011.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	—	—	—	—	—	—	—	—	—	—	—	—	2
CO2	1	1	—	2	—	—	—	—	—	—	—	—	—	—	2
CO3	1	2	—	2	—	—	—	—	—	—	—	—	—	—	2
CO4	1	2	—	2	—	—	—	—	—	—	—	—	—	—	2
CO5	1	3	2	2	—	—	—	—	—	—	—	—	—	—	2
CO	1	2	2	2	—	—	—	—	—	—	—	—	—	—	2

3–High, 2– Medium, 1–Low

CS22405	DATABASE MANAGEMENT SYSTEMS LABORATORY	L		T		P		C	
		0	0	4	2				
COURSE OBJECTIVES:									
• To learn and implement important commands in SQL									
• To learn the usage of nested and joint queries									
• To understand functions, procedures and procedural extensions of databases									
• To understand design and implementation of typical database applications									
• To be familiar with the use of a front–end tool for GUI based application development									
LIST OF EXPERIMENTS									
1.	Create a database table, add constraints (primary key, unique, check, not null), insert rows, update and delete rows using SQL DDL and DML commands.								
2.	Create a set of tables, add foreign key constraints and incorporate referential integrity.								

3.	Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4.	Query the database tables and explore sub queries and simple join operations.
5.	Query the database tables and explore natural, equi and outer joins.
6.	Write user defined functions and stored procedures in SQL.
7.	Execute complex transactions and realize DCL and TCL commands.
8.	Write SQL Triggers for insert, delete, and update operations in a database table.
9.	Create View and index for database tables with a large number of records.
10.	Create an XML database and validate it using XML schema.
11.	Create Document, column and graph based data using NOSQL database tools.
12.	Data manipulation using MongoDB.

TOTAL: 60 PERIODS

List of Equipment: (30 Students per Batch)

MYSQL / SQL: 30 Users

COURSE OUTCOMES:

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

CO1:	Construct databases with different types of key constraints.
CO2:	Develop simple and complex SQL queries using DML and DCL commands.
CO3:	Experiment with advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO4:	Build an XML database and validate with meta-data (XML schema).
CO5:	Model and manipulate data using NOSQL database.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–
CO2	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–
CO3	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–
CO4	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–
CO5	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–
CO	3	3	3	–	–	–	–	–	–	–	–	–	3	–	–

3—High, 2— Medium, 1—Low

CS22406	OPERATING SYSTEMS AND NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the basic system calls and shell programming
- To implement various CPU scheduling algorithms
- To implement various memory allocation methods
- To learn and use network commands
- To learn socket programming

LIST OF EXPERIMENTS

1.	Write programs using the following system calls of UNIX Operating system fork, exec, getpid, exit, wait, close.
2.	Write C programs to simulate UNIX commands like cp, ls, grep, etc.
3.	Shell Programming – Implement simple programs.
4.	Write C programs to implement any CPU Scheduling Algorithm.
5.	Implementation of the following Memory Allocation Methods for fixed partition. a) First Fit b) Worst Fit c) Best Fit
6.	Study of network commands.
7.	Write a HTTP web client program to download a web page using TCP sockets.
8.	Chat applications using TCP sockets.
9.	Simulation of DNS using UDP sockets.
10.	Write a code simulating ARP /RARP protocols.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Define and implement UNIX Commands.
CO2:	Describe the working of network commands.
CO3:	Implement various applications using TCP and UDP.
CO4:	Implement various CPU Scheduling Algorithms and Memory Allocation Methods.
CO5:	Simulate different network protocols.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	–	–	–	–	–	–	–	–	1	2	–	–
CO2	3	1	1	–	–	–	–	–	–	–	–	1	2	–	–
CO3	3	1	1	–	–	–	–	–	–	–	–	1	2	–	–
CO4	3	1	1	2	–	–	–	–	–	–	–	1	2	–	–
CO5	3	1	1	2	–	–	–	–	–	–	–	1	2	–	–
CO	3	1	1	2	–	–	–	–	–	–	–	1	2	–	–

3-High, 2-Medium, 1-Low

SD22401	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE II	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To help students on developing modular applications using functions • To train them on building logics using strings and pointers • To make them develop applications using user defined data types • To train the students on speaking skills for group discussions • To set them correctly on the track of presentation skills and management skills 					
UNIT I	FUNCTIONS				12
Logic Building Using Functions – Programs on Recursion – Puzzles – Output of Programs – Company Specific Programming Examples.					
UNIT II	STRINGS AND POINTERS				12
Logic Building Using Strings – Programs on Strings – Logic Building Using Pointers – Puzzles – Output of Programs – Company Specific Examples.					
UNIT III	USER DEFINED DATATYPES				6
Working with User Defined Datatypes – Puzzles – Output of Programs – Company Specific Examples.					
UNIT IV	COMMUNICATION SKILLS / LANGUAGE SKILLS				15
<p>Receptive Skills and productive skills – Skills together – Integration of skills – Input and output</p> <p>Receptive Skills: Listening and Reading – Lead-in – Pre-existent knowledge – General understanding of the audio or the written text – Discussion in pairs or small groups – feedback – Text-related task in detail – Focus on aspects of language in the text. Productive Skills: Speaking and Writing – lead-in – engaging students with the topic – setting the task – role-play – Monitoring the task – Giving the feedback–positive– task-related follow up – repetition / re-setting of task. Activities: Pronunciation: syllable, stress, intonation – Writing memos, e-mails and formal letters – Oral presentations / seminars – Written and Oral Descriptions Group discussions.</p>					
UNIT V	SOFT SKILLS: SEARCH AND FIND FOR CAREER DEVELOPMENTS				15
<p>Self-motivation: Interpersonal relationship – Attitudes and interpersonal integrity – Time management – prioritizing – Leadership quality – In the team: Team building and Team work – Memory technique Problem solving: – emotional intelligence – positive attitude towards life – taking up initiatives – developing mind set –openness to feed back – adaptability – active listening – work ethics. Presentation of skills: creative thinking – critical thinking – logical thinking – decision making. Management ability: empathy – selflessness – humility – cultural respectfulness – versatility – generosity – trustworthiness – planning and executing – target achievement – listening to others' views – friendliness – active participation – empowering healthy atmosphere – exchange of ideas – mediation – negotiation – qualities – updating the knowledge – pre-work for performance – respect for rules and regulations.</p>					
TOTAL: 60 PERIODS					
Suggestive Assessment Methods:					

- 1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
- 2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.
- 3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.
- 4) Model Exam for coding skills will be conducted for 100 marks which are then reduced to 20.
- 5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40.
- 6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- 7) The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Develop and implement modular applications using functions.
CO2:	Develop logics using strings and pointers.
CO3:	Develop applications in C using user defined datatypes.
CO4:	Practice both receptive skills (listening and reading) and productive skills (writing and speaking) and speak English with standard pronunciation using correct stress and intonation.
CO5:	Practice team building and team work procedures and develop memory techniques and manage abilities like empathy, selflessness, cultural respectfulness and trustworthiness preparing themselves for target achievement.

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. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Pearson Education, 2013.
2. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth Edition, Pearson Education, 2018.
3. E Balagurusamy, "Programming in ANSI C", Eighth edition, Mc Graw Hill Publications, 2019.
4. S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills" VK Publications', 2016.
5. Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO2	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO3	3	2	2	–	1	1	1	–	–	–	1	2	2	2	2
CO4	–	–	–	–	–	–	–	1	2	3	–	2	–	1	1
CO5	–	–	–	–	–	–	–	1	2	3	–	2	–	1	1
CO	3	2	2	–	1	1	1	1	2	3	1	2	2	2	2

3—High, 2— Medium, 1—Low

AC22401	INDUSTRIAL SAFETY ENGINEERING												L	T	P	C											
COURSE OBJECTIVES:																											
<ul style="list-style-type: none"> • Explaining the fundamental concept and principles of industrial safety • Applying the principles of maintenance engineering • Analyzing the wear and its reduction • Evaluating faults in various tools, equipment and machines • Applying periodic maintenance procedures in preventive maintenance 																											
UNIT I INDUSTRIAL SAFETY 6																											
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.																											
UNIT II MAINTENANCE ENGINEERING 6																											
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.																											
UNIT III WEAR AND CORROSION AND THEIR PREVENTION 6																											
Wear— types, causes, effects, wear reduction methods, lubricants—types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.																											
UNIT IV FAULT TRACING 6																											
Fault tracing—concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors,																											

Types of faults in machine tools and their general causes.

UNIT V	PERIODIC AND PREVENTIVE MAINTENANCE	6
---------------	--	----------

Periodic inspection—concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the fundamental concept and principles of industrial safety.
CO2:	Apply the principles of maintenance engineering.
CO3:	Apply periodic maintenance procedures in preventive maintenance.
CO4:	Analyze the wear and its reduction.
CO5:	Evaluate faults in various tools, equipment and machines.

TEXT BOOKS:

1. L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.
2. Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003.

REFERENCES:

1. Edward Ghali, V. S. Sastri, M. Elboujdaini, Corrosion Prevention and Protection: Practical Solutions, John Wiley & Sons, 2007.
2. Garg, HP, Maintenance Engineering, S. Chand Publishing.
3. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.
4. R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011.
5. W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub, 2014

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—
CO2	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—
CO3	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—
CO4	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—
CO5	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—
CO	2	1	2	—	—	2	1	—	—	—	—	1	—	2	—

3—High, 2— Medium, 1—Low

SEMESTER V

CS22501	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To understand the language hierarchy • To construct automata for any given pattern and find its equivalent regular expressions • To design a context free grammar for any given language • To understand Turing machines and their capabilities • To understand undecidable problems and NP class problems 					
UNIT I	AUTOMATA FUNDAMENTALS				9
Need for automata theory—Introduction to formal proof — Inductive Proofs – Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Equivalence and Minimization of Automata.					
UNIT II	REGULAR EXPRESSIONS AND LANGUAGES				9
Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Regular Expressions and Finite Automata with Epsilon Transitions.					
UNIT III	CONTEXT FREE GRAMMAR AND LANGUAGES				9
Types of Grammar – Chomsky's hierarchy of languages– CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.					
UNIT IV	PROPERTIES OF CONTEXT FREE LANGUAGES				9
Normal Forms for CFG –Simplification of CFG– Chomsky Normal form – Greibach Normal Form – Turing Machine: Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).					
UNIT V	UNDECIDABILITY				9
Non Recursive Enumerable (RE) Language –Undecidable Problems about TM – Posts Correspondence Problem, Recursive and recursively enumerable languages – Properties – Universal Turing machine–The Class P and NP.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Describe automata theory using Finite Automata.				
CO2:	Describe finite automata with epsilon transition and write regular expressions for any pattern.				
CO3:	Summarize decidable and undecidable problems.				
CO4:	Design context free grammar and Pushdown Automata.				
CO5:	Design Turing machine for computational functions.				
TEXT BOOKS:					
1.	J.E.Hopcroft, R.Motwani and J.D Ullman, “Introduction to Automata Theory, Languages and Computations”, Third Edition, Pearson Education, 2015.				
2.	J.Martin, “Introduction to Languages and the Theory of Computation”, Fourth Edition,				

	TMH, 2011.
REFERENCES:	
1.	H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", Second Edition, PHI, 2015.
2.	Micheal Sipser, "Introduction of the Theory and Computation", Second Edition, Cengage Learning, 2014.
3.	Gosh D, "Introduction to Theory of Automata, Formal Languages and Computation", Prentice Hall of India, 2013.
4.	Peter Linz, "An Introduction to Formal Language and Automata", Sixth Edition, Jones & Bartlett, 2016.
5.	Vivek Kulkarni, "Theory of Computation", Oxford University Press, 2013.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	2	–	–	–	–	–	–	–	–	–	–	–	2
CO2	2	2	2	–	–	–	–	–	–	–	–	–	–	–	2
CO3	2	2	2	–	–	–	–	–	–	–	–	–	–	–	2
CO4	2	2	2	–	–	–	–	–	–	–	–	–	–	–	2
CO5	2	2	2	–	–	–	–	–	–	–	–	–	–	–	2
CO	2	2	2	–	–	–	–	–	–	–	–	–	–	–	2

3-High, 2-Medium, 1-Low

CS22502	INTERNET PROGRAMMING	L	T	P	C	
		3	0	2	4	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn webpage design using HTML and CSS • To learn to create dynamic web pages with client side scripting • To learn to create dynamic web pages with server side scripting • To learn to develop simple web pages in PHP and to represent data in XML format • To learn to develop simple web applications with AngularJS and Node.js 						
UNIT I	WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0					9
Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Borders – Images – Colors – Text – Transformations – Transitions – Animations						
UNIT II	CLIENT SIDE PROGRAMMING					9
Java Script: An introduction to JavaScript – Control Statements – Functions – Arrays – Built-in objects – JavaScript DOM Model – Event Handling – DHTML with JavaScript – Exception Handling – Validation – JSON introduction – Syntax – Function Files.						

UNIT III	SERVER SIDE PROGRAMMING	9
Servlets: Java Servlet Architecture– Servlet Life Cycle– Form GET and POST actions– Session Handling– Understanding Cookies– JSP: Understanding Java Server Pages–JSP Standard Tag Library (JSTL) – DATABASE CONNECTIVITY: JDBC.		
UNIT IV	PHP and XML	9
An introduction to PHP: Basics of PHP– Using PHP Variables– Program control– Built-in functions– Regular Expressions– Form Validation – Connecting to Database. XML: Basic XML– Document Type Definition– XML Schema, XML Parsers and Validation, XSL and XSLT Transformation.		
UNIT V	INTRODUCTION TO ANGULAR AND NODE.JS	9
Introduction to AngularJS , MVC Architecture, Understanding ng attributes, Expressions and data binding, Directives, Controllers, Filters, Forms, Modules, Services; Node.js : Basics of Node JS – Installation – Working with Node packages – Using Node package manager –Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks.		
45 PERIODS		
PRACTICAL EXERCISES:		
<p>1. Create a web page with the following using HTML.</p> <ul style="list-style-type: none"> • To embed an image map in a web page. • To fix the hot spots. • Show all the related information when the hot spots are clicked. <p>2. Create a web page with the following.</p> <p>a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets.</p> <p>Use our college information for the web pages.</p> <p>3. Client Side Scripts for Validating Web Form Controls using DHTML.</p> <p>4. Write programs in Java using Servlets:</p> <ul style="list-style-type: none"> • To invoke servlets from HTML forms. • Session Tracking. <p>5. Write programs in Java to create three-tier applications using JSP/Servlets and Databases</p> <ul style="list-style-type: none"> • For conducting on-line examination. • For displaying student mark list. Assume that student information is available in a database which has been stored in a database server. <p>6. Programs using XML – Schema – XSLT/XSL.</p> <p>7. Create a website with Node.js/AngularJS Frameworks.</p>		
30 PERIODS		
TOTAL: 75 PERIODS		
COURSE OUTCOMES:		
At the end 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 interactive web applications with Angular and Node.js frameworks.	
TEXT BOOKS:		
1.	David Flanagan, “JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language”, Seventh Edition, O'Reilly, 2020.	

2.	Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Second Edition, Addison-Wesley, 2018.
REFERENCES:	
1.	Robin Nixon, "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5", Fifth Edition, O'Reilly, 2018.
2.	Paul J. Deitel, Abbey Deitel and Harvey M. Deitel, "Internet and World Wide Web – How to Program", Fifth Edition, Pearson Education, 2018.
3.	Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4.	Jon Duckett, " HTML and CSS: Design and Build Websites", Wiley Publications, 2011.
5.	Shyam Seshadri, "Angular: Up and Running: Learning Angular, Step by Step", O'Reilly, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–
CO2	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–
CO3	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–
CO4	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–
CO5	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–
CO	3	2	1	–	–	–	–	–	–	–	–	–	3	–	–

3-High, 2-Medium, 1-Low

CS22503	TECHNICAL SEMINAR	L	T	P	C	
		0	0	2	1	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To encourage the students to study advanced engineering developments To prepare and present technical reports To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models 						
METHOD OF EVALUATION:						
<p>During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation will be based on the technical presentation and the report</p>						

and also on the interaction during the seminar.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Adapt to review, prepare and present technological developments.

CO2: Defend to face the placement interviews.

CS22504	INPLANT / INDUSTRIAL TRAINING	L	T	P	C
		0	0	0	1

COURSE OBJECTIVES:

- To Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required
- To apply the Technical knowledge in real industrial situations
- To gain experience in writing Technical reports/projects
- To expose the students to experience the engineer's responsibilities and ethics
- To promote academic, professional and/or personal development

Implant/Industrial Training Duration

The students may undergo Industrial training for a period as specified in the Curriculum during the summer / winter vacation. In this case, the training has to be undergone continuously for a period of at least two weeks in an organization.

METHOD OF EVALUATION

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills. .

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

CO1:	Interpret how the theoretical aspects learned in classes are integrated into the practical world	L	T	P	C
CO2:	Make use of the opportunity to learn new skills and supplement knowledge				
CO3:	Develop communication and teamwork skills				
CO4:	Motive the student for higher education				
CO5:	Formulate to learn strategies like time management, multi-tasking etc in an industrial setup				

SD22501	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE III	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To make the students develop logics using basic Programming Logics, Decisional Statements, Arrays and Strings
- To help the students know how to use classes and objects

- To enable the students to implement programs using OOPs Concepts
- To train the students on interview skills with mock interviews and updated / enhanced resumes
- To prepare students for taking initiatives and decision making with critical thinking

UNIT I	BASIC PROGRAMMING CONSTRUCTS & SOFT SKILLS: TIME MANAGEMENT	12
---------------	--	-----------

Structured vs Object oriented programming language – Output of programs on basic I/O functions
– Logic building using Decisional Statements – Programs on Patterns and Numbers – Debugging
– Puzzles – Company specific programming examples.

Soft Skills: Time management: Prioritizing – Delegation – Decision-making – Goal setting – Multitasking – Problem solving – Strategic thinking – Scheduling – Planning – to-do lists and checklists – Evaluating urgent tasks – Auditing and improving workflows – Filtering notifications – Setting thoughtful deadlines – Evaluating the work done schedules – Grouping similar tasks – Learn to say ‘no’.

UNIT II	PROGRAMMING USING FUNCTIONS AND ARRAYS & SOFT SKILLS: STRESS MANAGEMENT AND EMOTIONAL QUOTIENT	12
----------------	---	-----------

Logic building using modular approach – Programming using Friend Function – Programs on Matrices and strings – Puzzles – Output of programs – Company specific programming examples.

Soft Skills: Stress management: Using guided meditation – Maintain physical exercise and good nutrition – Manage social media time – Connect with others – read and relax. **Emotional Quotient:** Overcoming challenges – defusing conflict – Self-awareness – Self-regulation – Professional etiquette – Avoiding doubt – Introducing others – Courteousness – Non-interruption – Avoiding gossip.

UNIT III	IMPLEMENTING OOPS CONCEPTS & SOFT SKILLS: VALUES OF LIFE AND BEHAVIOURAL ATTITUDES	12
-----------------	---	-----------

Discussion on basics of OOPs Concepts – Solving problems based on Data Members and Member Functions – Programs based on Construction and Destruction of Objects – Puzzles – Output of Programs – Understanding Access Specifiers – Company specific programming examples.

Soft Skills: Values of life: Loyalty to others and responsibilities – Living with Spirituality – Maintaining humility – Possessing compassion – Proving being honest – developing kindness – Learning to have integrity – Embracing responsibility. **Behavioural attitudes:** Behaving with sportive attitude – Respecting the freedom of the others – Being bold – Enhancing fun and joy.

UNIT IV	LOGIC BUILDING USING INHERITANCE AND ABSTRACTION & SOFT SKILLS: EMPLOYERS EXPECTATIONS AND RESUME ENHANCEMENT	12
----------------	--	-----------

Understanding Super class and Derived Class – Logic building based on inheritance – Programming using Pure Virtual Function and Abstract Classes – The Final Keyword – Puzzles – Output of Programs – Company specific programming examples.

Soft Skills: Employers expectations: Contributing to the team – Being with stability – Developing the ability to grow – Improving the productivity. **Resume enhancement:** Select the best template for your skills, experience, and goals Adding skills to be an expert – Robusting and compelling objective – Displaying online presence – Quantifying accomplishments various roles.

UNIT V	PROGRAMMING USING ENCAPSULATION AND POLYMORPHISM & SOFT SKILLS: INTERVIEW SKILLS	12
---------------	---	-----------

Understanding how Encapsulation works – Understanding the term Polymorphism –

Programming using Function Overloading and Overriding – Puzzles – Output of programs – Company specific programming examples.

Soft Skills: Interview Skills: Clarifying interview questions – Communicate nonverbally – Knowing the resume thoroughly – Leveraging knowledge of the company and interviewer – Mock interviews – Getting rehearsed before moving for interviews.

TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS:

- 1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
- 2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.
- 3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.
- 4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20.
- 5) A test for Soft Skills will be conducted for 100 marks which will be then calculated to 40.
- 6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- 7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Develop programs using Functions, Strings and Arrays.
CO2:	Write programs using Classes and Objects.
CO3:	Develop applications using OOPs Concepts.
CO4:	Apply all the interview skills learned with updated resumes and language skills balancing technical skills and interpersonal skills
CO5:	Attend different job interviews with emotional balance and achieve the target with right planning and unique solutions.

TEXT BOOKS:

1. Balagurusamy E, “Object Oriented Programming with C++”, Eighth Edition, Tata McGraw Hill Education, 2020.
2. Anthony Williams, “C++ Concurrency in Action”, Second Edition, Manning Publications, 2019.

REFERENCES:

1. Bjarne Stroustrup, “A Tour of C++”, Second Edition, Pearson Education, 2018.
2. Scott Meyers, “Effective Modern C++”, O'Reilly Publication, December 2014.
3. Stanley Lippman, Josee Lajoie, Barbara Moo, “C++ Primer”, Fifth Edition, Pearson Education, 2012.
4. Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education, 2013.
5. S.Sobana, R.Manivannan, G.Immanuel, “Communication and Soft Skills”, VK Publications, 2016.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	—	1	1	1	—	—	—	1	2	2	2	2
CO2	3	2	2	—	1	1	1	—	—	—	1	2	2	2	2
CO3	3	2	2	—	1	1	1	—	—	—	1	2	2	2	2
CO4	—	—	—	—	—	—	—	1	2	3	—	2	—	—	—
CO5	—	—	—	—	—	—	—	1	2	3	—	2	—	—	—
CO6	3	2	2	—	1	1	1	1	2	3	1	2	2	2	2
CO	3	2	2	—	1	1	1	1	2	3	1	2	2	2	2

3–High, 2– Medium, 1–Low

AC22501	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C	
		2	0	0	0	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> To explain the types, characteristics of entrepreneurship and its role in economic development To apply the theories of achievement motivation and the principles of entrepreneurship development program to enterprise To select the appropriate form of business ownership in setting up an enterprise To apply the fundamental concepts of finance and accounting to enterprise To identify sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise 						
UNIT I	ENTREPRENEURSHIP				6	
Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Entrepreneurial Competencies – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth.						
UNIT II	BUSINESS PLAN				6	
Sources of business ideas and tests of feasibility: Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation; Project Appraisal, preparation of project report.						
UNIT III	SMALL SCALE INDUSTRIES				6	
Legal formalities in setting up of SSIs, Business Laws, Governmental Setup in promoting small industries, Status of Small Scale Industrial Undertakings, Steps in starting a small industry, Ownership Structures.						
UNIT IV	FINANCING AND ACCOUNTING				6	
Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management.						
UNIT V	SUPPORT TO ENTREPRENEURS				6	
Government Policy for Small Scale Enterprises – Institutional Support to Entrepreneurs: Need						

and Support – Taxation Benefits to Small Scale Industry, Social Responsibility of Business.												
												TOTAL: 30 PERIODS
COURSE OUTCOMES:												
At the end of the course, the students will be able to:												
CO1:	Explain the types, characteristics of entrepreneurship and its role in economic development.											
CO2:	Apply the theories of achievement motivation and the principles of entrepreneurship development program.											
CO3:	Select the appropriate form of business ownership in setting up an enterprise.											
CO4:	Apply the fundamental concepts of finance and accounting to enterprise.											
CO5:	Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.											
TEXT BOOKS:												
1.	S.S.Khanka, “Entrepreneurial Development”, S.Chand & Co. Ltd. Ram Nagar NewDelhi, 2007.											
2.	Kurahko & Hodgetts, “Entrepreneurship – Theory, process and practices”, Sixth Edition, Thomson Learning, 2010.											
REFERENCES:												
1.	Charantimath, P. M., “Entrepreneurship Development and Small Business Enterprises”, Pearson, 2006.											
2.	Hisrich R D and Peters M P, “Entrepreneurship”, Fifth Edition, Tata McGraw-Hill, 2002.											
3.	Mathew J Manimala, “Entrepreneurship theory at cross roads: paradigms and praxis”, Second Edition, Dreamtech, 2006.											
4.	Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.											
5.	Singh, A. K., “Entrepreneurship Development and Management”, University Science Press, 2009.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	1	–	–	1	–	1	2	1	2	–	1	–	–	–
CO2	–	–	1	–	1	1	1	2	2	2	–	1	–	2	–
CO3	–	–	1	–	–	2	1	1	1	1	–	1	–	2	–
CO4	1	–	1	–	–	2	1	–	1	1	1	–	–	–	–
CO5	–	1	–	1	–	1	1	–	1	1	–	1	–	2	–
CO	1	1	1	1	1	2	1	2	1	1	1	1	–	2	–

3–High, 2– Medium, 1–Low

HS22501	VALUE EDUCATION II	L	T	P	C				
		1	0	0	0				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To impart knowledge on essential qualities to become a good leader • To prepare them to have the ability to relate with others and contribute to industrial and human development • To teach the significance of being responsible citizens of the society 									
UNIT I	UNDERSTANDING THE SOCIETY AND BECOMING A LEADER	3							
Problems of our society and their causes – styles of leadership – qualities and skills of leadership.									
UNIT II	PRACTICING LEADERSHIP FOR SOCIAL CHANGE	4							
Possible areas of changes in the society with education – Utilising Engineering education to create social changes – strategies and people movement for the change.									
UNIT III	BALANCING PROFESSIONAL, PERSONAL, FAMILY FOR FULLNESS OF LIFE	4							
Healthy adult as an individual and family – stages of life – strategies to balance life.									
UNIT IV	INNOVATIVE SOCIAL COMMITMENT, SPIRITUALITY AND SOCIAL NETWORKING	4							
Social commitment as a healthy spirituality – systematic contribution to society and industry – Networking professionals for growth and change.									
TOTAL: 15 PERIODS									
COURSE OUTCOMES:									
At the end of the course, the students will be able to:									
CO1:	Demonstrate the essential steps to become good leaders.								
CO2:	Identify the various societal problems and also the solution.								
CO3:	Realise their role and contribution to nation building.								
CO4:	Apply the essential steps to become value based professionals.								
TEXT BOOKS:									
1.	Warren G.Bennis, “On Becoming a Leader”, Basic Books, 2009.								
2.	Suresh Agarwal, “Social Problems in India”, Rajat Publications, 2015.								
REFERENCES:									
1.	Biswaranjan Mohanty, “Constitution, Government and Politics in India”, New Century Publication, 2009.								
2.	Myles Munroe, “Releasing Your Potential”, Destiny Image, 2007.								
3.	Kelsang Gyatso, “How to Solve Our Human Problems: The Four Noble Truths”, Tharpa Publications, 2005.								
4.	Ifeanyi Enoch Onuoha, “Overcoming the challenges of life”, Authorhouse, 2011.								
5.	John c Maxwell, “Five Levels of Leadership, the Proven Steps to Maximize Your Potential”, Center Street, 2011.								

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	–	–	–	–	2	–	1	1	2	–	2	–	–	–
CO2	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–
CO3	–	–	–	–	–	2	–	1	1	2	–	2	–	–	–
CO4	–	–	–	–	–	2	–	1	1	2	–	2	–	–	–
CO	–	–	–	–	–	2	–	1	1	2	–	2	–	1	–

3–High, 2– Medium, 1–Low

SEMESTER VI

HS22601	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
	<ul style="list-style-type: none"> • To identify and analyze ethical issues in engineering • To recognize the code of ethics with appropriate perspective as per industrial standards • To understand the ethical situations in risky situation • To provide services in their areas of expertise • To be aware of the role of engineers in solving global issues 				
UNIT I	ENGINEERING ETHICS, MORAL REASONING AND ETHICAL THEORIES	10			
Senses of ‘Engineering Ethics’ – Variety of Moral Issues – Types of Inquiry – Social Ethics vs Scientific Ethics vs Experiential Ethics – Moral Dilemmas – Moral Autonomy – Kohlberg’s Theory – Gilligan’s Theory – Professions and Professionalism – Professional Ideals and Virtues – Theories about Right Action – Uses of Ethical Theories.					
UNIT II	ENGINEERING AS SOCIAL EXPERIMENTATION	8			
Role of Professional Ethics in Engineering Based Product Development – Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – Case Study.					
UNIT III	ENGINEERS’ RESPONSIBILITY FOR SAFETY AND RISK	8			
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analyses and Reducing Risk – Case Studies.					
UNIT IV	RESPONSIBILITIES AND RIGHTS	9			
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Whistle Blowing – Employee Rights – Discrimination – Intellectual Property Rights (IPR).					
UNIT V	GLOBAL ISSUES AND ROLE OF ENGINEERS	10			
Multinational Corporations – Environmental Ethics – Computer Ethics – Ethics of AI – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Corporate Social Responsibility – Ethics in Engineering Practice and Research – Ethical Audit.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Visualize the scope of engineering ethics and ethical decision making.				
CO2:	Develop a perspective on engineering as an experiment.				
CO3:	Detail the importance of assessing safety and risk and reducing the risk.				
CO4:	Realize the responsibilities and rights of engineers, employees, employers and public.				
CO5:	Recognize the role of ethics related to MNC, Environment, Computer, AI, and while acting as manager, consultant, and experts.				
TEXT BOOKS:					
1.	Mike W. Martin and Roland Schinzingher, “Ethics in Engineering”, McGraw Hill Education, 2017.				
2.	Govindarajan M, Natarajan S and Senthil Kumar V.S, “Engineering Ethics”, Prentice Hall of India Pvt. Ltd., 2015.				
REFERENCES:					
1.	Robert McGinn R., “The Ethical Engineer: Contemporary Concepts & Cases”, Princeton University Press, February 2018.				

2.	Mark Coeckelbergh, "AI Ethics", The MIT Press, April 2020.
3.	Qin Zhu, Mike Martin and Roland Schinzinger, "Ethics in Engineering", Fifth Edition, McGraw Hill, 2022.
4.	Deborah C. Poff and Alex C. Michalos, "Encyclopedia of Business and Professional Ethics", Springer Nature, Switzerland AG, May 2023.
5.	Frederic G. Reamer, "Social Work Values and Ethics", Sixth Edition, Columbia University Press, New York, May 2024.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-
CO	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-

3-High, 2-Medium, 1-Low

CS22601	COMPILER DESIGN	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn the various phases of compiler • To learn the various parsing techniques • To understand intermediate code generation and run-time environment • To learn to implement front-end of the compiler • To learn to implement code generator 						
UNIT I	INTRODUCTION TO COMPILERS AND LEXICAL ANALYSIS				9	
Introduction – Language Processors– The Structure of a Compiler– Compiler–Construction Tools– Lexical Analysis– The Role of the Lexical Analyzer– Tokens, Patterns, and Lexemes– Specification of Tokens – The Lexical–Analyzer Generator Lex – Finite Automata – Construction of an NFA from a Regular Expression – Conversion of an NFA to a DFA – Minimizing the Number of States of a DFA.						
UNIT II	SYNTAX ANALYSIS				9	
Syntax Analysis – The Role of the Parser– Syntax Error Handling– Error–Recovery Strategies– Context–Free Grammars – Derivations – Parse Trees – Ambiguity – Top–down parsing – Recursive descent parser – Predictive parser – bottom–up parsing – shift reduce parser – LR parsers – Construction of SLR parsing table –YACC.						
UNIT III	SYNTAX–DIRECTED TRANSLATION AND INTERMEDIATE–CODE GENERATION				9	
Syntax–Directed Definitions – Evaluation Orders for SDD's – Construction of Syntax tree –						

Directed Acyclic Graphs for Expressions – Three–Address Code – Types and Declarations – Translation of Expressions – Type Checking.																										
UNIT IV	RUN–TIME ENVIRONMENTS AND CODE GENERATION													9												
Storage Organization – Static Versus Dynamic Storage Allocation – Stack Allocation of Space – Heap Management – Issues in the Design of a Code Generator – A simple code Generator–Optimal Code Generation for Expressions.																										
UNIT V	CODE OPTIMIZATION													9												
Basic Blocks and Flow Graphs– DAG –The Principal Sources of Optimization –Optimization of Basic Blocks – Peep-hole optimization– Data–Flow Analysis – Reaching Definitions– Live–Variable Analysis – Available Expressions.																										
TOTAL: 45 PERIODS																										
COURSE OUTCOMES:																										
At the end of the course, the students will be able to:																										
CO1:	Describe different phases of the compiler and design a lexical analyzer for a sample language.																									
CO2:	Explain semantics rules (SDT) and intermediate code generation.																									
CO3:	Summarize various storage allocation strategies and machine code generation for simple language constructs.																									
CO4:	Develop parsers using different parsing algorithms for a given grammar.																									
CO5:	Implement various optimization techniques to improve the performance of the compiler.																									
TEXT BOOKS:																										
1.	Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Updated Second Edition, Pearson Education, 2023.																									
2.	Douglas Thain, “Introduction to Compilers and Language Design”, Second Edition, 2020.																									
REFERENCES:																										
1.	K. Muneeswaran, “Compiler Design”, Oxford University Press, 2013.																									
2.	Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Third Edition, Morgan Kaufmann Publishers Elsevier Science, 2022.																									
3.	Santanu Chattopadhyay, “Compiler Design”, PHI Learning Pvt. Ltd., 2015.																									
4.	John I Moore, “Introduction to Compiler Design – An Object–Oriented Approach Using Java”, Third Edition, Softmoore Consulting, 2019.																									
5.	V. Raghavan, “Principles of Compiler Design”, Tata McGraw Hill Education Publishers, 2017.																									

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2	3	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	3

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO4	3	2	1	—	—	—	—	—	—	—	—	—	—	—	3
CO5	3	2	1	—	—	—	—	—	—	—	—	—	—	—	3
CO	3	2	1	—	—	—	—	—	—	—	—	—	—	—	3

3-High, 2-Medium, 1-Low

IT22601	DATA SCIENCE	L	T	P	C					
		2	0	2	3					
COURSE OBJECTIVES:										
<ul style="list-style-type: none"> • To understand the data science fundamentals and process • To learn to describe the data for the data science process • To learn to describe the relationship between data • To utilize the Python libraries for Data Wrangling • To present and interpret data using visualization libraries in Python 										
UNIT I	INTRODUCTION					6				
Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications.										
UNIT II	DESCRIBING DATA					6				
Types of Data – Types of Variables – Describing Data with Tables and Graphs – Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores.										
UNIT III	DESCRIBING RELATIONSHIPS					6				
Correlation – Scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – Regression – regression line – least squares regression line – Standard error of estimate.										
UNIT IV	PYTHON LIBRARIES FOR DATA WRANGLING					6				
Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – operating on data – missing data – aggregation and grouping.										
UNIT V	DATA VISUALIZATION					6				
Importing Matplotlib – Line plots – Scatter plots – density and contour plots – Histograms – legends – colors – subplots – text and annotation – three-dimensional plotting.										
30 PERIODS										
PRACTICAL EXERCISES:										
<ol style="list-style-type: none"> 1. Working with Numpy arrays 2. Working with Pandas data frames 3. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set 4. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the 										

- following:
- Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis
 - Bivariate analysis: Linear and logistic regression modeling
- Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
 - Multiple Regression analysis
 - Also compare the results of the above analysis for the two data sets
 - Apply and explore the below plotting functions on UCI data sets
 - Normal curves
 - Density and contour plots
 - Correlation and scatter plots
 - Three-dimensional plotting Visualizing Geographic Data with Base map
 - Mini Project— Use machine learning models to predict the likelihood of diseases such as diabetes, cancer or heart disease based on patient data.

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the data science process.
CO2:	Explore different types of data description for data science process.
CO3:	Build knowledge on relationships between data.
CO4:	Use the Python Libraries for Data Wrangling.
CO5:	Apply visualization Libraries in Python to interpret and explore data.
CO6:	Infer different visualization tools and techniques to leverage the visualization of data set.

TEXT BOOKS:

- Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
- Jake VanderPlas, “Python Data Science Handbook”, O’Reilly Media Inc., 2022.

REFERENCES:

- David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
- Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
- Peter Bruce and Andrew Bruce, “Practical Statistics for Data Scientists”, O’Reilly Media Inc., 2020.
- Wes McKinney, “Python for Data Analytics”, Third Edition, O’Reilly Media Inc, 2022.
- Roger D. Peng and Elizabeth Matsui, “The Art of Data Science — A Guide for Anyone Who Works With Data”, Lulu.com, 2016.

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	2	-	-	-	-	1	-	-	-	-	2

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO2	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2
CO3	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2
CO4	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2
CO5	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2
CO6	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2
CO	3	2	2	—	2	—	—	—	—	1	—	—	—	—	2

3–High, 2– Medium, 1–Low

SD22601	CODING SKILLS AND QUANTITATIVE APTITUDE – PHASE I	L	T	P	C				
		0	0	4	2				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To create a simple, React Application using React Components • To implement Routing and API Integration in React Applications • To gain hands-on experience with real-world React Applications • To improve aptitude, problem solving skills and reasoning ability of the students • To demonstrate the use of mathematical reasoning by justifying through numerical skills 									
UNIT I	Front End Engineering with React & QA & LR	12							
Basic HTML and JavaScript – JSX– Introduction to React– Setting up the environment – Creating first React Component.									
Quants: Numbers – Number Systems, Types of Numbers, Series (Arithmetic Progression, Geometric Progression), HCF & LCM, Decimal Fractions, Simplification (Including Expression & Evaluation).									
Logical Reasoning – Analogy – Blood Relations/Family Tree.									
UNIT II	Working with React Components & QA & LR	12							
React Components: Component properties – Component State – Handling Events– Life Cycle Methods and Hooks– Conditional Rendering– List and Keys – Forms and User Input.									
Quants: Average –Problem on Ages.									
Logical Reasoning: Coding–Decoding.									
UNIT III	Styling in React & Routing & QA & LR	12							
Styling React Components – Routing: Introduction to React Router– Nested Routes – Redirects and Navigation.									
Quants: Ratio & Proportions – Partnership–Mixtures and Alligations.									
Logical Reasoning: Cryptarithmetic Problems, Syllogisms.									
UNIT IV	State Management & QA & LR	12							
Context API Basics – Context Provider and Consumer – useContext hook									
Quants: Time & Work–Chain Rule–Pipes and Cisterns									
Logical Reasoning – Calendar – Clocks – Images (Mirror & Water).									
UNIT V	Working With APIs & QA & LR	12							

Fetching Data – Displaying Fetched Data – Updating Data – Project Work.

Quants: Time, Speed & Distance – Problems on Trains, Boats & Streams.

Logical Reasoning: Cubes and Dices – Data Sufficiency.

TOTAL: 60 PERIODS

Suggestive Assessment Methods:

- 1) Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning.
- 2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
- 3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
- 4) For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all assignments will be reduced to 40 marks.

Thus 60 marks from internal and 40 marks from assignments will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Construct a basic React application.
CO2:	Apply Routing and API Integration in web applications.
CO3:	Construct a real-world React application.
CO4:	Apply quantitative techniques to solve a variety of problems and can enhance their employability quotient and to establish a stronger connection with the technical environment in which they operate.
CO5:	Interpret solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.

TEXT BOOKS:

1.	Robin Wieruch,” The Road to React: with React18 and React Hooks”, CreateSpace Independent Publishing Platform, 2024.
2.	Stoyan Stefanov, “React: Up & Running: Building Web Applications”, Second Edition, O’ Reilly Publications, 2021.

REFERENCES:

1.	Zac Gordan, Mikall Angela Hill, RobbieAddair, “React Explained: Your Step-By-Step Guide to React”, OS Training Publishers, 2020.
2.	Alex Banks, Eve Porcello, “Learning React: Functional Web Development with React and Redux”, O’ Reilly Publications, January 2017.
3.	Anand P A, “Quantitative Aptitude,” Wiley India Pvt. Ltd., New Delhi, 2016.
4.	Arun Sharma, “How to Prepare for Logical Reasoning,” Tata-McGraw Hill Education Series. New Delhi, 2016.
5.	Sharon Weiner Green, Ira K Wolf, “Barron’s GRE,” Barron Publishers, 2016.

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	–	2	–	–	–	–	–	–	2	2	–	–
CO2	2	2	2	–	2	–	–	–	–	–	–	2	2	–	–
CO3	2	2	2	–	2	–	–	–	–	–	–	2	2	–	–
CO4	1	1	1	–	–	–	–	–	1	–	–	1	1	–	–
CO5	1	1	1	–	–	–	–	–	1	–	–	1	1	–	–
CO	2	2	2	–	2	–	–	–	1	–	–	2	2	–	–

3–High, 2– Medium, 1–Low

SEMESTER VII

MS22701	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To explain the evolution of Management and its principles. • To discuss the functions of management and their importance in business. • Learn the application of the principles in an organization like planning, organizing, directing and controlling. • Analyze the position of self and company goals towards business. 					
UNIT I	INTRODUCTION TO MANAGEMENT AND BASICS OF MANAGING IN TODAY'S WORKPLACE				9
Definition of Management – Role of Managers in the Workplace – Management Functions, Levels, Roles and Skills – Evolution of Management – Influence of the External Environment and the Organization's Culture – Diversity, Equity, and Inclusion – Types of Business organizations – Managing in a Global Environment – Managing Corporate Social Responsibility and Ethics – Current trends and issues.					
UNIT II	PLANNING				9
Foundations of planning – Planning process – Types of planning – Objectives – Setting objectives – MBO – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making process – Entrepreneurial Ventures – Business Plan Development in Entrepreneurship – Contemporary issues in planning.					
UNIT III	ORGANIZING AND STAFFING				9
Nature and purpose – Organization structure design – Departmentalization – Delegation of authority – Centralization and decentralization – Managing Human Resources – HR Planning – Recruitment and Decruitment – Selection, Orientation, Training and Development, Performance Management – Career planning, development and management – Managing change and innovation – Recent issues in HRM.					
UNIT IV	DIRECTING AND LEADING				9
Understanding and managing individual behavior – Perception, Personality, Attitude, and Learning – Motivating Employees – Motivation theories – Managing Groups and Teams – Team Dynamics – Effective Leadership – quality, styles, skills and theories of leadership – Communication management – Process and Forms of communication – Barrier in communication – Effective communication styles and Negotiation skills.					
UNIT V	MANAGEMENT CONTROL				9
Management control – Use of computers and IT in Management control – System and process of controlling – Planning and Control Techniques- CPM-PERT-Productivity problems and management – Control and performance – Direct and preventive control – Levers of control framework – Reporting – Managing Operations – Modern issues in control.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					

CO1:	Understand the fundamentals of Managerial functions and Business Environment.
CO2:	Explain the various planning processes and become competent when involved in team to achieve success.
CO3:	Demonstrate the concept of organizing for the effective functioning of a management.
CO4:	Practice and develop style to anticipate the consequences of each leadership style.
CO5:	Apply the controlling techniques to the practical situations concerning the management of people and organizations in real business life.

TEXT BOOKS:

- Stephen P. Robbins, Mary A. Coulter and Lori Long, "Management", 16th Edition Pearson Education, 2024.
- P C Tripathi, P N Reddy, Ashish Bajpai, "Principles of Management", Tata McGraw Hill, 2021.

REFERENCES:

- Almas Sabir, "Principles of Management", Partridge Publishing Singapore, 2019.
- Harold Koontz, Heinz Weihrich and Mark V. Cannice, "Essentials of Management", Tata McGraw Hill, 2020.
- Chandran J S, " Principles of Management- Text & Cases", Third Edition, Sultan & Chand publications, 2024.
- Oliver Laasch, "Principles of Management: Practicing Ethics, Responsibility, Sustainability", Second Edition, SAGE Publications Ltd; 2021.
- David Bright, "Principles of Management", 2023.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	1	-	-	2	-	-	1	-	2	-	1	1	-	-	2
CO4	-	1	1	1	2	-	-	1	2	-	-	-	1	1	1
CO5	1	-	-	-	1	1	-	-	3	-	1	1	-	-	1
CO	2	1	1	2	2	1	1	1	2	3	1	1	2	1	1

3-High, 2-Medium, 1-Low

CS22701	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To describe uninformed and heuristic search techniques.
- To identify techniques for reasoning under uncertainty
- To summarize machine learning and supervised learning algorithms
- To use ensembling and unsupervised learning algorithms
- To build neural networks using deep learning

UNIT I PROBLEM SOLVING

6

Introduction to AI - AI Applications - Problem solving agents – Search algorithms – Uninformed

search strategies – Heuristic search strategies – Constraint Satisfaction Problems (CSP).	
UNIT II	PROBABILISTIC REASONING 6
Acting under uncertainty – Bayesian inference – Naïve bayes models. Probabilistic reasoning – Bayesian networks – Exact inference in BN – Approximate inference in BN – Causal networks.	
UNIT III	SUPERVISED LEARNING 6
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model –Maximum margin classifier – Decision Tree.	
UNIT IV	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 6
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - Bagging, Boosting, Stacking, Unsupervised learning: K-means, Instance Based Learning: KNN.	
UNIT V	NEURAL NETWORKS 6
Perceptron - Multilayer perceptron, Activation functions, Network training – Gradient descent optimization, Error backpropagation from shallow networks to deep networks.	
30 PERIODS	
PRACTICAL EXERCISES:	
<ol style="list-style-type: none"> 1. Implementation of Uninformed search algorithms (BFS, DFS) 2. Implement naïve Bayes models 3. Build Regression models 4. Build decision trees 5. Implement K-means Clustering 6. Build simple NN models 7. Build deep learning NN models 	
30 PERIODS	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Illustrate the algorithms for problem solving.
CO2:	Infer reasoning under uncertainty.
CO3:	Illustrate supervised learning models.
CO4:	Implement ensembling and unsupervised models.
CO5:	Demonstrate deep learning neural network models.
TEXT BOOKS:	
1.	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2.	Ethem Alpaydin, “Introduction to Machine Learning”, Fourth Edition, MIT Press, 2020.
REFERENCES:	
1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2.	Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press, 2014.
3.	Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
4.	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2017.
5.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	2	2	-	-	-	-	-	-	-	-	-	2
CO3	3	3	2	1	2	-	-	-	-	-	-	-	-	-	2
CO4	3	2	2	1	2	-	-	-	-	-	-	-	-	-	1
CO5	2	1	1	1	1	-	-	-	-	-	-	-	-	-	1
CO	3	2	2	1	2	-	-	-	-	-	-	-	-	-	2

3–High, 2– Medium, 1–Low

CS22702	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C				
		1	0	2	2				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> To use the components and structure of mobile application development frameworks for Android and windows OS based mobiles. To work with various mobile application development frameworks. To relate the basic and important design concepts and issues of development of mobile applications. To demonstrate the capabilities and limitations of mobile devices. To design and develop real-time mobile applications. 									
UNIT I	INTRODUCTION				3				
Downloading and Installing the Android SDK, Creating Your First Android Application, Types of Android Applications, Android Development Tools.									
UNIT II	UI DESIGN				3				
Android User Interface Fundamentals, Using Layouts to Create Device Independent User Interfaces, Customizing the To-Do List Array Adapter.									
UNIT III	ANDROID DATABASES				3				
Working with SQLite Databases- Querying a Database, Extracting Values from a Cursor, Adding, Updating, and Removing Rows,Creating and Implementing Content Provider's Database- Content Provider Transactions - Storing Files in a Content Provider.									
UNIT IV	EXPANDING THE USER EXPERIENCE				3				
Introducing the Notification Manager, Creating Notifications - Configuring the Status Bar Display, Using the Default Notification Sounds, Lights, and Vibrations. Using Alarms to schedule application events - Creating, Setting, and Canceling Alarms.									
UNIT V	LOCATION-BASED SERVICES				3				
Using Location-Based Services, Using the Emulator with Location-Based Services, Selecting a Location Provider, Finding Your Current Location.									
15 PERIODS									

PRACTICAL EXERCISES:	
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. Create a To-Do List Database and Content Provider	
5. Develop an application that makes use of Notification Manager	
6. Implement an application that creates an alert upon receiving a message	
7. Develop an application that Creating, Setting, and Canceling Alarms	
8. Develop a native application that uses GPS location information	
30 PERIODS	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Build a native application using GUI components, Event Listener and Mobile application development framework.
CO2:	Develop an application using basic graphical primitives.
CO3:	Develop mobile applications using databases.
CO4:	Create mobile applications that uses notification manager.
CO5:	Make use of location identification using GPS in an application.
REFERENCES:	
1.	Reto Meier, Ian Lake, "Professional Android", Fourth Edition, John Wiley & Sons, Inc, 2018.
2.	Barry Burd, John Paul Mueller, "Android Application Development, All-In-One for Dummies", Third Edition, John Wiley & Sons, Inc. 2021.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-

3-High, 2-Medium, 1-Low

CS22703	MINI PROJECT				L	T	P	C
				0 0 6 3				

COURSE OBJECTIVES:

- To interpret the Product Development Process.
- To plan for various activities of the project and distribute the work amongst team members.
- To develop technical solutions to the problem.
- To prepare a technical report based on the Mini project.

PROCEDURE

1. Identification of Project Domain.
2. Literature Review to isolate problem.
3. Problem Definition.
4. Submission of Abstract.
5. Project Review 1.
6. Development of Design models.
7. Selection of programming frame work & coding.
8. Project Review 2.
9. Testing using various testing techniques & formulating test cases.
10. Generation of Results/output screens.
11. Project Review 3(Final Internal Review).
12. Documentation of Project Report.

TOTAL: 90PERIODS

COURSEOUTCOMES:

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

CO1:	Identify and finalize problem statement by surveying variety of domains.
CO2:	Perform requirement analysis and identify design methodologies.
CO3:	Apply advanced programming techniques to develop solutions to the problem.
CO4:	Test the quality of the proposed method by evaluation metrics.
CO5:	Present technical report by applying different visualization tools.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	2	2	1	2	-	-	1	3	3	3
CO2	-	3	-	-	2	-	-	-	-	-	2	1	3	3	3
CO3	-	-	3	2	3	-	-	-	-	-	-	1	3	3	3
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO	3	3	3	3	3	2	2	1	2	3	2	1	3	3	3

3-High, 2-Medium, 1-Low

SD22701	CODING SKILLS AND QUANTITATIVE APTITUDE – PHASE II	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To help students to work with Database. • To help them create a simple Spring Boot application and gain foundational skills in Spring Boot by exploring Spring Boot Starters, RESTful web services, Dependency Injection, and handling HTTP methods effectively. • To make them to learn to create and use repositories, perform basic CRUD operations with JPA Repository, and apply these skills in a hands-on project • To improve aptitude, problem solving skills and reasoning ability of the students. • Demonstrate the use of mathematical reasoning by justifying through numerical skills. 					
UNIT I	DATABASE BASICS & QUANTS – TIME, SPEED AND DISTANCE	12			
Introduction to Database- Database Design Principles – SQL Basics – Querying a Database Quants: Time, Speed and Distance - Time, Speed & Distance - Problems on Trains-Boats & Stream					
UNIT II	DEVELOPING BACK END USING SPRING BOOT & QUANTS – PERCENTAGE & INTEREST	12			
Introduction to Spring Boot – Creating a simple Spring Boot Application- Bean Scopes and Life Cycle Quants: Percentage & Interest - Percentage-Interest (Simple Interest, Compound Interest)- Profit & Loss					
UNIT III	BUILDING RESTFUL WEB SERVICES & QUANTS – PROBABILITY	12			
Spring Boot Starters – Introduction to REST - Dependency Injection – Handling HTTP Methods Quants: Probability - Probability-Permutations & Combinations					
UNIT IV	DATA PERSISTENCE WITH SPRING DATA JPA & LOGICAL REASONING	12			
Path Variables and Request Parameters – Overview of JPA and Hibernate – Setting up Spring Data JPA in a Spring Boot project. Logical Reasoning: Data Interpretation (Tabulation, Bar Chart, Pie Chart, Line Graphs)- Direction sense test - Linear/Seating Arrangements - Series completion					
UNIT V	CREATING AND USING REPOSITORIES & LOGICAL REASONING	12			
Creating and using Repositories – Basic CRUD operations with JPA Repository – Project Work. Logical Reasoning: Logical Venn Diagram/Syllogisms - Odd man out/Finding missing elements - Crypt arithmetic Questions – Puzzles					
TOTAL: 60 PERIODS					
Suggestive Assessment Methods:					
<ol style="list-style-type: none"> 1) Pre-Assessment Test - To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning. 2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30. 3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30. 4) Post-Assessment - Evaluating students' knowledge gained from the Coding Skill and Quantitative Aptitude – Phase II Skill Development Course. 					

5) For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Design and Query a Database.
CO2:	Utilize Spring Boot Starters, develop RESTful web services, implement Dependency Injection, and effectively handle various HTTP methods.
CO3:	Implement a hands-on project using Spring Boot.
CO4:	Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate.
CO5:	Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.

TEXT BOOKS:

1. Craig Walls, "Spring Boot in Action", Sixth Edition, Manning Publishers, March 2022.
2. Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt. Ltd., New Delhi, 2016.

REFERENCES:

1. Alex Antonov, "Spring Boot 2.0 Cookbook", Second Edition, Packt Publishers, February 2018.
2. Felipe Gutierrez, "Pro Spring Boot 2: An authoritative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices", Second Edition, Apress Publishers, January, 2018.
3. Anand P A, "Quantitative Aptitude," Wiley India Pvt. Ltd., New Delhi, 2016.
4. Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning," S.Chand and Company Pvt. Ltd.,New Delhi, 2016.
5. Arun Sharma, "How to Prepare for Logical Reasoning," Tata-McGraw Hill Education Series.New Delhi, 2016.

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO2	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO3	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO4	1	1	1	-	-	-	-	-	1	-	-	1	1	-	-
CO5	1	1	1	-	-	-	-	-	1	-	-	1	1	-	-
CO	2	2	2	-	2	-	-	-	1	-	-	2	2	-	-

3-High, 2-Medium, 1-Low

SEMESTER VIII

CS22801	PROJECT WORK	L	T	P	C
		0	0	16	8

COURSE OBJECTIVES:

- Prepare students with the necessary domain knowledge and technical expertise to address real-world business or research problems effectively.
- To effectively gather requirements, analyze needs, and design software solutions to meet project goals and ethics.
- Work collaboratively in small teams, gaining experience in industry-standard practices, project management, and team dynamics.
- Enable students to ethically implement software solutions, conduct thorough testing, and deploy solutions across multiple platforms.
- Develop students' ability to prepare comprehensive project reports and deliver professional presentations to effectively communicate findings and solutions.

PROCEDURE

The students shall individually / or as group work on business/research domains and related problems approved by the Department / Organization that offered the internship / project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology.

At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the College and submitted to the Head of the department.

The students will be evaluated based on the project reviews, report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 240 PERIODS

COURSEOUTCOMES:

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

CO1:	Apply domain-specific knowledge and technical skills to effectively solve complex business or research problems through innovative software solutions.
CO2:	Conduct thorough requirements gathering, analyze client needs, and design efficient, scalable software solutions, ensuring ethical practices in privacy and security.
CO3:	Work effectively within multidisciplinary teams, applying industry-standard processes, and collaborative tools to achieve project objectives.
CO4:	Develop, test, and deploy software applications, ensuring functionality, security, and ethical responsibility in the final product.
CO5:	Prepare comprehensive project reports and deliver clear, and professional presentations to communicate the project goals, methodologies, findings, and outcomes.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	-	3
CO2	-	3	2	-	-	2	-	2	-	-	-	-	3	3	-
CO3	-	-	3		3	-	2	-	3	-	-	-	-	3	3
CO4	-	-	-	3	-	2	-	2	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	-	-	3	2	2	1	1	1
CO	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3

3–High, 2– Medium, 1–Low

PROFESSIONAL ELECTIVES
VERTICAL 1: BIG DATA & DATA ANALYTICS

CS22511	DATA MINING	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To understand data pre-processing and data visualization techniques • To understand algorithms for finding hidden and interesting patterns in data • To apply various classification algorithms using tools • To apply clustering techniques for real time applications • To apply appropriate data mining method using WEKA tool for an application 					
UNIT I	DATA MINING – INTRODUCTION				6
Data Mining Functionalities – Kinds of Data Mining – Issues – applications– Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.					
UNIT II	DATA MINING – FREQUENT PATTERN MINING				6
Efficient and Scalable Frequent Item set Mining Methods – Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining.					
UNIT III	CLASSIFICATION				6
Classification by Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners –Other Classification Methods.					
UNIT IV	CLUSTERING				6
Cluster analysis–Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data– Clustering with constraints, Outlier analysis–outlier detection methods.					
UNIT V	WEKA TOOL				6
Ensemble Learning – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.					
30 PERIODS					
PRACTICAL EXERCISES:					
<ol style="list-style-type: none"> 1. Installation of WEKA Tool 2. Creating new Arff File 3. Data Processing Techniques on Data set 4. Implementation of Apriori algorithm 5. Implementation of FP– Growth algorithm 6. Implementation of Decision Tree Induction 7. Classification of data using Bayesian approach 					
30 PERIODS					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Summarize the data pre–processing and visualization techniques for data analysis.				

CO2:	Describe the frequent pattern and association rule mining techniques for data analysis.
CO3:	Apply clustering techniques for real time applications.
CO4:	Apply appropriate techniques to implement pattern mining.
CO5:	Apply appropriate data mining method using WEKA tool for an application.

TEXT BOOKS:

- | | |
|----|--|
| 1. | Jiawei Han, Jian Pei and Hanghang Tong, "Data Mining Concepts and Techniques", Fourth Edition, Elsevier, 2022. |
| 2. | Ian H.Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Fourth Edition, Elsevier, 2016. |

REFERENCES:

- | | |
|----|---|
| 1. | Parteek Bhatia, "Data Mining and Data Warehousing Principles and Practical Techniques", Cambridge University Press, 2019. |
| 2. | G. K. Gupta, "Introduction to Data Mining with Case Studies", Third Edition, Prentice Hall of India, 2014. |
| 3. | Pang–Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2019. |
| 4. | Max Bramer, "Principles of Data Mining", Springer, 2016. |
| 5. | Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill, 2017. |

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	–	–	–	–	–	–	–	–	3	–	3	–	–
CO2	2	1	–	–	–	–	–	–	–	–	3	–	3	–	–
CO3	3	2	3	–	–	–	–	2	–	2	3	–	3	–	–
CO4	3	2	1	–	–	–	–	–	–	–	3	–	3	–	–
CO5	3	2	–	–	–	–	–	–	–	–	3	–	3	–	–
CO	3	2	2	–	–	–	–	2	–	2	3	–	3	–	–

3–High, 2– Medium, 1–Low

CS22512	NoSQL DATABASES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the fundamental of NoSQL databases
- To gain knowledge on clustering techniques in NoSQL databases
- To learn the basic concepts involved in document databases
- To understand the fundamental concepts of MongoDB
- To learn different data models in MongoDB

UNIT I	NoSQL DATABASES	6
---------------	------------------------	----------

NoSQL Databases – Evolution of NoSQL Databases–Different types of NoSQL databases–Advantages of NoSQL databases, Scalability and performance. Document data stores, Key–Value data stores. Case studies of MongoDB, HBase, Neo4J. NoSQL database design for applications.

UNIT II	CLUSTERING IN NoSQL	6
----------------	----------------------------	----------

Clustering in NoSQL databases. Data distribution methods. Configurations for replication and fault-tolerance. NoSQL configurations for disaster tolerance. NoSQL query languages, CQL, Pig Latin.

UNIT III	DOCUMENT DATABASES	6
-----------------	---------------------------	----------

Document Databases: Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Complex Transactions, Queries against Varying Aggregate Structure.

UNIT IV	MongoDB	6
----------------	----------------	----------

Introducing MongoDB: MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features, Running the Database Anywhere, SQL Comparison, The MongoDB Data Model: JSON and BSON.

UNIT V	MongoDB SHELL	6
---------------	----------------------	----------

Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model.

30 PERIODS

PRACTICAL EXERCISES:

1. Create a database and perform the manipulations and querying (Insert, Update, Delete, Projection, Query– Where Clause, AND, OR operations)
2. Execute Aggregation Pipeline and its operations
3. Execute Limit Records and Sort Records operation in MongoDB
4. Implementation of Aggregation and Map Reduce functions in MongoDB
5. Implementations of Indexing, Advanced Indexing using MongoDB
6. Implementations of Hashing using MongoDB
7. Establish a connection with a database or access any tabular data source using Java Driver/Python Driver/PHP Driver to do the following operations
 - a) Send various MongoDB statements.
 - b) Retrieve and process the results received from the database

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Outline the evolution and application of NoSQL databases.
CO2:	Summarize the clustering techniques and different aggregate structures in NoSQL databases.
CO3:	Identify strategies to perform queries in MongoDB.
CO4:	Apply the concepts of Indexing, Advanced Indexing and Hashing techniques using MongoDB.
CO5:	Apply aggregation and Map Reduction in MongoDB.

TEXT BOOKS:

1.	Guy Harrison “Next Generation Databases — NoSQL and Big data”, Apress, 2018.
2.	Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, “MongoDB: The Definitive Guide— Powerful and Scalable Data Storage”, Third Edition, O'Reilly Media, 2019.

REFERENCES:

1.	Eelco Plugge, Peter Membrey, “The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing”, Apress, 2011.
2.	Sadalage, P. & Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Wiley Publications, 2019.
3.	Christopher D.Manning, Prabhakar Raghavan, Hinrich Schutze, “An Introduction to Information Retrieval”, Cambridge University Press, 2017.
4.	Daniel Abadi, Peter Boncz and Stavros Harizopoulos, “The Design and Implementation of Modern Column–Oriented Database Systems”, Now Publishers, 2013.
5.	Francesco Marchioni, “MongoDB for Java Developers”, Packt Publishing, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	—	—	—	—	—	—	—	—	2	3	—	—
CO2	3	2	2	—	—	—	—	—	—	—	—	2	3	—	—
CO3	3	2	3	—	—	—	—	—	—	—	—	2	3	—	—
CO4	3	2	3	—	—	—	—	—	—	—	—	2	3	—	—
CO5	3	2	3	—	—	—	—	—	—	—	—	2	3	—	—
CO	3	2	3	—	—	—	—	—	—	—	—	2	3	—	—

3—High, 2— Medium, 1—Low

CS22611	BIG DATA ANALYTICS				L	T	P	C
					2	0	2	3

COURSE OBJECTIVES:

- To understand big data
- To learn and use NoSQL big data management
- To learn mapreduce analytics using Hadoop and related tools
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I	UNDERSTANDING BIG DATA	6
Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.		

UNIT II	NOSQL DATA MANAGEMENT	6
Introduction to NoSQL – aggregate data models – key–value and document data models –		

relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency – Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III | MAP REDUCE APPLICATIONS

6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV | BASICS OF HADOOP

6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures – Hadoop integration.

UNIT V | HADOOP RELATED TOOLS

6

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

30 PERIODS

PRACTICAL EXERCISES:

1. Install, configure and run python, numPy and Pandas
2. Install, configure and run Hadoop and HDFS
3. Visualize data using basic plotting techniques in Python
4. Implement NoSQL Database Operations
5. Implement word count / frequency programs using MapReduce
6. Implement a MapReduce program that processes a dataset
7. Implement an application that stores big data in Pig using Hadoop / R

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe big data and use cases from selected business domains.
CO2:	Explain NoSQL big data management.
CO3:	Install, configure, and run Hadoop and HDFS.
CO4:	Perform map-reduce analytics using Hadoop.
CO5:	Utilize Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

TEXT BOOKS:

1. Subhashini Chellappan, Seema Acharya, "Big Data and Analytics", Second Edition, Wiley, 2019.
2. V K Jain, " Big Data and Hadoop", Khanna Publishers, 2017.

REFERENCES:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Martin Fowler, Pramod Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World

	of Polyglot Persistence", Addison-Wesley Educational Publishers Inc, 2012.
3.	Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
4.	Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilly, 2010.
5.	Alan Gates, "Programming Pig", O'Reilly, 2011.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	—	—	—	2	2	3	1	—	—	3
CO2	3	3	2	3	2	—	—	—	2	2	3	3	—	—	3
CO3	3	3	3	2	3	—	—	—	2	2	1	2	—	—	3
CO4	2	3	3	3	3	—	—	—	2	2	3	2	—	—	3
CO5	3	3	3	3	3	—	—	—	3	1	3	2	—	—	2
CO	3	3	3	3	3	—	—	—	2	2	3	2	—	—	3

3–High, 2– Medium, 1–Low

CS22612	EXPLORATORY DATA ANALYSIS	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To outline an overview of exploratory data analysis • To implement data cleaning and visualization using python libraries • To perform univariate data exploration and analysis • To apply bivariate data exploration and analysis • To use Data exploration and visualization techniques for multivariate and time series data 					
UNIT I	EXPLORATORY DATA ANALYSIS	6			
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA– Data transformation techniques–merging database, reshaping and pivoting, Transformation techniques.					
UNIT II	EXPLORING DATA USING R/ PYTHON /TABLEAU PUBLIC/ POWER BI	6			
Importing data, Descriptive Statistics, Handling Missing Data, Outlier Detection, Treatment, Line Plots, Scatter Plots and Bar Plots, Numerical Distributions, Categorical Data, Pair Plots and Correlation Matrices, Heatmap Basics.					
UNIT III	UNIVARIATE ANALYSIS	6			
Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread –Scaling and Standardizing – Inequality.					
UNIT IV	BIVARIATE ANALYSIS	6			
Relationships between Two Variables – Percentage Tables – Analysing Contingency Tables – Handling Several Batches – Scatterplots and Resistant Lines					

UNIT V	MULTIVARIATE AND TIME SERIES ANALYSIS	6
Introducing a Third Variable – Causal Explanations – Three–Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.		
		30 PERIODS
PRACTICAL EXERCISES:		
<p>1. Import diabetes dataset and perform measures of Central Tendency, Measures of Dispersion, Measures of Shape, Frequency Distribution, Percentiles and Quartiles and summary statistics on the BMI variable.</p> <p>2 Visualize each variable in diabetes or any other dataset using Line Plot, Scatter Plot, Bar Plot, Pair Plot, Correlation Matrix and Heatmap</p> <p>3. Import diabetes dataset and display the first 10 rows, check for missing values and fill them, check for duplicate and remove them. Explore the data using correlation matrix.</p> <p>4. Perform Time Series Analysis and apply the various visualization techniques.</p> <p>5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse, Rollover effect, user interaction, etc.</p> <p>6. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.</p> <p>7. Perform EDA on Wine Quality Data Set.</p> <p>8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.</p>		
Software requirement : R/ Python /Tableau Public/ Power BI		
		30 PERIODS
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Describe the fundamentals of exploratory data analysis.	
CO2:	Implement the data cleaning and visualization using R/ Python /Tableau Public/ Power BI.	
CO3:	Apply univariate data exploration and analysis.	
CO4:	Apply bivariate data exploration and analysis.	
CO5:	Perform Data exploration and visualization techniques for multivariate and time series data.	
TEXT BOOKS:		
1.	Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O Reilly, 2017.	
2	G. David Garson, "Data Analytics for the Social Sciences", Taylor & Francis, 2021.	
REFERENCES:		
1	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.	
2	Claus O. Wilke, "Fundamentals of Data Visualization", O'Reilly publications, 2019.	
3	Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", Second Edition, CRC press, 2015.	
4	Ayodele Oluleye, "Exploratory Data Analysis with Python Cookbook", Packt Publications, 2023. (Practical exercises)	
5	David S. Brown, "Statistics and Data Visualization Using R The Art and Practice of Data Analysis", SAGE Publications, 2021.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	—	—		—	—	—	—			—	—	—	—	—
CO2	2	1	1	1	3	—	—	—	—		1	1	—	—	1
CO3	2	2	2	1	2	—	—	—	1	—	2	1	—	—	3
CO4	2	2	2	1	2	—	—	—	1	—	2	1	—	—	3
CO5	2	2	2	1	2	—	—	—	1	—	2	1	—	—	3
CO	2	2	2	1	2	—	—	—	1	—	2	1	—	—	3

3–High, 2– Medium, 1–Low

CS22711	BUSINESS ANALYTICS	L	T	P	C				
		2	0	2	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To understand the Analytics Life Cycle • To comprehend the process of acquiring Business Intelligence • To understand various types of analytics for Business Forecasting • To model the supply chain management for Analytics • To apply analytics for different functions of a business 									
UNIT I	INTRODUCTION TO BUSINESS ANALYTICS	6							
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.									
UNIT II	BUSINESS INTELLIGENCE	6							
Data Warehouses and Data Mart – Knowledge Management – Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence – OLAP – Analytic functions.									
UNIT III	BUSINESS FORECASTING	6							
Introduction to Business Forecasting and Predictive analytics – Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling – Machine Learning for Predictive analytics.									
UNIT IV	HR & SUPPLY CHAIN ANALYTICS	6							
Human Resources – Planning and Recruitment – Training and Development – Supply chain network – Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain – Applying HR Analytics to make a prediction of the demand for hourly employees for a year.									
UNIT V	MARKETING & SALES ANALYTICS	6							
Marketing Strategy, Marketing Mix, Customer Behaviour – selling Process – Sales Planning – Analytics applications in Marketing and Sales – predictive analytics for customers' behaviour in marketing and sales.									
30 PERIODS									
PRACTICAL EXERCISES:									

Use MS–Excel and Power–BI to perform the following experiments using a Business data set, and make presentations. Students may be encouraged to bring their own real-time socially relevant data set.

I Cycle – MS Excel

1. Explore the features of Ms–Excel.
2. (i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) ii) Perform data import/export operations for different file formats.
3. Perform statistical operations – Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis.
4. Perform Z–test, T–test & ANOVA.
5. Perform data pre–processing operations i) Handling Missing data ii) Normalization.
6. Perform dimensionality reduction operation using PCA, KPCA & SVD.
7. Perform bivariate and multivariate analysis on the dataset. 120.
8. Apply and explore various plotting functions on the data set.

II Cycle – Power BI Desktop

9. Explore the features of Power BI Desktop
10. Prepare & Load data
11. Develop the data model
12. Perform DAX calculations
13. Design a report
14. Create a dashboard and perform data analysis
15. Presentation of a case study

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the real world business problems and model with analytical solutions.
CO2:	Identify the business processes for extracting Business Intelligence.
CO3:	Apply predictive analytics for business fore–casting.
CO4:	Apply analytics for supply chain and logistics management.
CO5:	Use analytics for marketing and sales.

TEXT BOOKS:

1. James R. Evans, "Business Analytics, Methods models and decisions", Third Edition, Pearson, 2021.
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications: What, Why, and How", Pearson, 2022.

REFERENCES:

1. U. Dinesh Kumar, "Business Analytics – The Science Of Data Driven Decision Making", Second Edition, Wiley India, 2020.
2. Mahadevan B, "Operations Management –Theory and Practice", Third Edition, Pearson Education, 2018.
3. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", Second Edition, Wiley, 2016.
4. Philip Kotler and Kevin Keller, Marketing Management, Fifteenth Edition, PHI, 2016.
5. VSP RAO, Human Resource Management, Third Edition, Excel Books, 2010.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	1	1	—	—	—	1	2	1	1	—	—	—
CO2	3	3	3	2	3	—	—	—	1	2	2	2	—	—	—
CO3	2	2	3	3	2	—	—	—	3	1	1	3	—	—	—
CO4	2	1	1	2	2	—	—	—	3	3	2	1	—	—	—
CO5	2	3	2	3	2	—	—	—	3	3	1	3	—	—	—
CO	2	2	2	2	2	—	—	—	2	2	1	2	—	—	—

3-High, 2-Medium, 1-Low

CS22712	IMAGE AND VIDEO ANALYTICS	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the basics of image processing techniques for computer vision • To learn the techniques used for image pre-processing • To discuss the various object detection techniques • To understand the various Object recognition mechanisms • To elaborate on the video analytics techniques 						
UNIT I	INTRODUCTION	6				
Computer Vision – Image representation and image analysis tasks – Image representations – digitization – properties – color images – Data structures for Image Analysis – Levels of image data representation – Traditional and Hierarchical image data structures.						
UNIT II	IMAGE PRE-PROCESSING	6				
Local pre-processing – Image smoothing – Edge detectors – Zero-crossings of the second derivative – Scale in image processing – Canny edge detection – Parametric edge models – Edges in multi-spectral images – Local pre-processing in the frequency domain – Line detection by local pre-processing operators – Image restoration.						
UNIT III	OBJECT DETECTION USING MACHINE LEARNING	6				
Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach–Intersection over Union (IoU) –Deep Learning Architectures–R-CNN–Faster R-CNN–You Only Look Once(YOLO)–Salient features–Loss Functions–YOLO architectures.						
UNIT IV	FACE RECOGNITION AND GESTURE RECOGNITION	6				
Face Recognition–Introduction–Applications of Face Recognition–Process of Face Recognition–DeepFace solution by Facebook–FaceNet for Face Recognition– Implementation using FaceNet–Gesture Recognition.						
UNIT V	VIDEO ANALYTICS	6				

Video Processing – use cases of video analytics–Vanishing Gradient and exploding gradient problem–RestNet architecture–RestNet and skip connections–Inception Network–GoogleNet architecture–Improvement in Inception v2–Video analytics–RestNet and Inception v3.

30 PERIODS

PRACTICAL EXERCISES:

1. Write a program that computes the T–pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity.
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition.
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition.
7. Write a program for event detection in video surveillance system.

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Fourth Edition, Thomson Learning, 2013.
2. Vaibhav Verdhan, "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", Apress, 2021.

REFERENCES:

1. Reinhard Klette, Karsten Schluens, Andreas Koschan, "Computer Vision: Principles, Algorithms, Applications, Learning", Wiley, 2014.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Second Edition, Pearson Education, 2015.
4. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012
5. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2	2	2	—	—	—	3	3	2	1	—	—	3
CO2	2	2	3	3	3	—	—	—	3	2	1	1	—	—	1
CO3	1	2	2	2	3	—	—	—	1	2	1	2	—	—	3
CO4	1	2	3	2	3	—	—	—	2	2	2	3	—	—	2
CO5	3	2	1	3	2	—	—	—	2	1	1	3	—	—	1
CO	2	2	2	2	3	—	—	—	2	1	1	2	—	—	2

3–High, 2– Medium, 1–Low

CS22713	MODERN APPLICATION DEVELOPMENT	L	T	P	C				
		2	0	2	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • Create a deep understanding of how Software and Hardware work together • Introduce the students to Flutter • Introduce the students to Firebase • Help the students to solve real life problems with Data Oriented thinking • Motivate the students to follow Clean Coding Principles 									
UNIT I	STORY OF HIDDEN LANGUAGE				6				
Codes and Combinations – Braille and Binary Codes – Anatomy of a Flashlight – Telegraphs and Relays – Bit by bit by bit – Logic and Switches – A binary adding Machines – Bytes and Hex – Assemblage of Memory – From Abaci to Chips – ASCII and a cast of Characters – The Operating System – Languages – High and Low – The Graphical Revolution.									
UNIT II	FLUTTER				6				
Dart: Syntax Basics – Types – Functions – Control Flow – Error Handling – Classes & Objects – Class Modifiers – Concurrency – Null Safety – Core Libraries, Flutter: Widgets – Layout – Assets & Media – Platform Integration.									
UNIT III	FIREBASE				6				
Introduction – Authentication – Firestore Database – Data Modeling – Storage – Hosting – Cloud Messaging – Cloud Functions – In App Messaging – Security Rules – Cost Estimation – Extensions.									
UNIT IV	DATA MANAGEMENT				6				
Understand: Emergence of NoSQL – Data Models – Consistency – Map Reduce, Implement: Key–Value Database – Document Database – Column–Family Database – Graph Database – Schema Migration – Polyglot Persistence – Choosing Database									
UNIT V	THREE LAYER ARCHITECTURE				6				
Introduction – Paradigm Overview – SOLID Principles – Component Principles – Architecture – Boundaries – Policy – Business Rules – Clean Architecture – Details									
30 PERIODS									

PRACTICAL EXERCISES:												
1. Study and Installation of Flutter Multi Platform Environment. 2. Develop a Flutter application using Firebase Authentication. 3. Develop a Flutter application that performs CRUD operations with Firestore Database. 4. Develop a ToDo application with authentication, Firestore, and Image upload. 5. Develop a Flutter application that persists data using Hive. 6. Mini Project.												
30 PERIODS												
TOTAL: 60 PERIODS												
COURSE OUTCOMES:												
At the end of the course, the students will be able to:												
CO1: Create PWA with responsive UI for Mobile view and Desktop view.												
CO2: Create PWA with Firebase Auth and Firestore.												
CO3: Create PWA using Flutter deploy using Firebase.												
CO4: Develop an Architecture for Offline first PWA.												
CO5: Develop an Offline first PWA with Flutter, Firebase, Hive.												
TEXT BOOKS:												
1.	Robert Cecil Martin, "Clean Architecture: A Craftman's Guid to Software Structure and Design", Pearson Publication, 2017.											
2.	Robert Cecil Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", Pearson Publication, 2008.											
REFERENCES:												
1.	Martin Fowler, Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional Publication, 2012.											
2.	Charles Petzold, "Code: The Hidden Language of computer Hardware and Software", Second Edition, Pearson Education, 2022.											
3.	Documentation of Flutter: docs.flutter.dev											
4.	Documentation of Dart: dart.dev/guides											
5.	Documentation of Firebase: firebase.google.com/docs											

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO2	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO3	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO4	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO5	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–

3-High, 2-Medium, 1-Low

VERTICAL 2: COMPUTATIONAL INTELLIGENCE

CS22521	SOFT COMPUTING	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience • To provide the mathematical background for carrying out the optimization associated with neural network learning • To learn various evolutionary Algorithms • To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems • To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing 					
UNIT I	INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC	6			
Introduction – Fuzzy Logic – Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.					
UNIT II	NEURAL NETWORKS	6			
Supervised Learning Neural Networks – Perceptrons – Backpropagation –Multilayer Perceptrons –Unsupervised Learning Neural Networks – Kohonen Self–Organizing Networks.					
UNIT III	GENETIC ALGORITHMS	6			
Chromosome Encoding Schemes –Population initialization and selection methods – Evaluation function – Genetic operators– Cross over – Mutation – Fitness Function – Maximizing function.					
UNIT IV	NEURO FUZZY MODELING	6			
ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum – Analysis of Adaptive Learning Capability.					
UNIT V	APPLICATIONS	6			
Modeling a two input sine function – Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition – Soft Computing for Color Recipe Prediction.					
30 PERIODS					
PRACTICAL EXERCISES:					
<ol style="list-style-type: none"> 1. Implementation of fuzzy control/ inference system 2. Programming exercise on classification with a discrete perceptron 3. Implementation of XOR with backpropagation algorithm 4. Implementation of self organizing maps for a specific application 5. Programming exercises on maximizing a function using Genetic algorithm 6. Implementation of two input sine function 7. Implementation of three input non linear function 					
30 PERIODS					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					

CO1:	Summarize the fundamentals of fuzzy logic operators and inference mechanisms.
CO2:	Describe neural network architecture for AI applications such as classification and Clustering.
CO3:	Interpret the functionality of Genetic Algorithms in Optimization problems.
CO4:	Use hybrid techniques involving Neural networks and Fuzzy logic.
CO5:	Apply soft computing techniques in real world applications.
TEXT BOOKS:	
1.	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro–Fuzzy and Soft Computing", Pearson Education, 2015.
2.	Himanshu Singh, Yunis Ahmad Lone, "Deep Neuro–Fuzzy Systems with Python", Apress, 2020.
REFERENCES:	
1.	Roj Kaushik and Sunita Tiwari, "Soft Computing–Fundamentals Techniques and Applications", McGraw Hill, 2018.
2.	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2011.
3.	Samir Roy, Udit Chakraborty, "Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms", Pearson Education, 2013.
4.	S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Third Edition, Wiley India Pvt Ltd, 2019.
5.	Russell C. Eberhart, Yuhui Shi, "Computational Intelligence Concepts to Implementations", Elsevier, 2011.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	3	3	—	—	—	3	1	3	2	3	1	2
CO2	2	3	3	2	3	—	—	—	3	2	3	2	2	1	3
CO3	1	3	2	2	1	—	—	—	3	1	1	2	1	3	2
CO4	1	2	1	3	2	—	—	—	3	3	1	1	2	1	1
CO5	2	3	1	2	1	—	—	—	3	3	3	2	1	2	3
CO	2	3	2	2	2	—	—	—	3	2	2	2	2	2	2

3–High, 2– Medium, 1–Low

CS22522	ARTIFICIAL NEURAL NETWORK	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To know the fundamental concepts of artificial neural networks (ANNs) • To describe the Multi Layer perceptron and backpropagation algorithm in MLP • To demonstrate the design of Support Vector Machines and SVM separating hyperplane • To illustrate the basic principles of Self–Organizing Maps and SOM algorithm 						

- To explain the mathematical models used in dynamics of neural systems

UNIT I	INTRODUCTION	6
A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Feedback, Network Architectures, Knowledge Representation, Learning Processes, Learning Tasks.		
UNIT II	MULTI LAYER PERCEPTRONS	6
Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Computer Experiment: Pattern Classification–Back Propagation and Differentiation, convolution Networks, Non–Linear Filtering.		
UNIT III	SUPPORT VECTOR MACHINES	6
Introduction–Optimal Hyperplane for Linearly Separable Patterns–Optimal Hyperplane for Nonseparable patterns–The support Vector Machine views as a Kernel machine–Design of support Vector machines–XOR problem–Computer Experiment: Pattern Classification–Regression :Robustness Considerations–Optimal solution of the Linear Regression Problem.		
UNIT IV	SELF-ORGANIZATION MAPS (SOM)	6
Two Basic Feature Mapping Models, Self–Organization Map, SOM Algorithm, Properties of Feature Map, Computer Experiment, Hierarchical Vector Quantization, Kernel self–Organizing map–Computer Experiment.		
UNIT V	NEURO DYNAMICS	6
Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamic Models, Manipulation of Attractors as a Recurrent Network Paradigm –Hopfield Models –Computer Experiment.		
30 PERIODS		
PRACTICAL EXERCISES:		
<ol style="list-style-type: none"> 1. Implement how the weight and bias value effects the output of neurons 2. Program to train a neural network to classify two clusters in a 2–dimensional space. 3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. 4. Implement Perceptron Learning rule works for Linearly Separable Problem. 5. Implement the Perceptron Learning rule works for Non–Linearly Separable Problem. 6. Implement pattern classification using Perceptron Model. 7. Implement two–dimensional lattice driven by two–dimensional stimulus using SOM. 		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recognize the fundamentals of Artificial Neural Networks (ANN).	
CO2:	Describe backpropagation algorithm in MLP.	
CO3:	Design of Support Vector Machine.	
CO4:	Use the basic principles of Self–Organizing Maps and SOM algorithm.	
CO5:	Design the mathematical models used in Neuro Dynamics	
TEXT BOOKS:		
1.	Simon Haykin, “Neural Networks and Learning Machines”, Third Edition, Pearson, 2023	

2.	Sebastian Klaas,, "Neural Network for Beginners", BPB Publications, 2022.
REFERENCES:	
1.	Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer, 2018.
2.	Pat Nakamoto, "Neural Networks & Deep Learning", CreateSpace, 2017.
3.	Robert J. Schalkoff, "Artificial Neural Networks", McGrawHill, 2013.
4.	Daniel Graupe, "Principles of Artificial Neural Networks", Fourth Edition, World Scientific Publishing Company 2019.
5.	Ivan Nunes da Silva, Danilo Hernane Spatti, Rogerio Andrade Flauzino, "Artificial Neural Networks: A Practical Course", Springer, 2016.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–
CO2	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–
CO3	1	2	2	–	–	–	–	–	–	–	–	–	1	–	–
CO4	1	2	1	–	–	–	–	–	–	–	–	–	2	–	–
CO5	2	2	1	–	–	–	–	–	–	–	–	–	1	–	–
CO	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–

3-High, 2-Medium, 1-Low

CS22621	COMPUTER VISION	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the essential ideas driving the creation and processing of images • To learn feature detection, matching and deep learning • To become familiar with alignment and motion estimation • To develop skills in deep estimation and 3D reconstruction • To understand image-based rendering and recognition 						
UNIT I	INTRODUCTION TO COMPUTER VISION, IMAGE FORMATION AND IMAGE PROCESSING					6
Computer Vision – Image Formation: Geometric primitives and transformations – Photometric image formation – The digital camera. Image Processing: Point operators – Linear filtering – More neighbourhood operators.						
UNIT II	FEATURE DETECTION, MATCHING AND DEEP LEARNING					6
Feature Detection and Matching: Points and patches – Edges and contours – Contour tracking – Lines and vanishing points – Segmentation. Deep Learning: Supervised learning – Unsupervised learning.						
UNIT III	IMAGE ALIGNMENT, STITCHING & MOTION ESTIMATION					6
Pairwise alignment – Image stitching – Global Alignment. Motion Estimation: Translational						

alignment – Parametric motion – Layered motion.		
UNIT IV	DEPTH ESTIMATION AND 3D RECONSTRUCTION	6
Depth Estimation: Epipolar geometry – 3D curves and profiles. 3D Reconstruction: Shape from X – 3D Scanning – Surface representations – Point-based representations.		
UNIT V	RECOGNITION AND IMAGE-BASED RENDERING	6
Image Recognition: Instance recognition – Image classification. Image-based Rendering: View interpolation – Layered depth images – Light fields and Lumigraphs.		
30 PERIODS		
PRACTICAL EXERCISES:		
<ol style="list-style-type: none"> 1. OpenCV Installation and working with Python 2. Basic Image Processing – loading images, Cropping, Resizing, Thresholding, Contour analysis, Blob detection 3. Image Annotation – Drawing lines, text circles, rectangles, and ellipses on images 4. Image Enhancement – Understanding Color spaces, color space conversion, 5. Image: Histogram equalization, Convolution, Image smoothing, Gradients, Edge Detection 6. Image features, Feature matching, cloning, Image Alignment 7. 3D Reconstruction – Creating Depth map from stereo images 		
Software Requirement:		
OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or equivalent		
<ol style="list-style-type: none"> 1. docs.opencv.org 2. https://opencv.org/opencv-free-course/ 		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Summarize the fundamentals of computer vision, image formation and image processing theories and techniques.	
CO2:	Implement basic and extensive OpenCV image processing methods.	
CO3:	Apply feature-based image alignment, segmentation and motion estimations.	
CO4:	Apply 3D image reconstruction techniques.	
CO5:	Design and develop innovative image processing and computer vision applications.	
TEXTBOOKS:		
1.	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Second Edition, Springer, 2022.	
2.	D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Second Edition, Pearson Education, , 2015.	
REFERENCES:		
1.	Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Second Edition, Cambridge University Press, 2012.	
2.	Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2016.	
3.	E. R. Davies, “Computer and Machine Vision”, Fourth Edition, Academic Press, 2012.	
4.	D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt	

	Publishing, 2012.
5.	Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	1	—	—	—	2	1	3	2	—	—	1
CO2	3	3	3	2	3	—	1	—	2	1	2	2	—	—	2
CO3	3	3	2	2	3	—	—	—	1	1	2	2	—	—	2
CO4	2	3	3	2	3	—	—	—	2	1	2	3	—	—	3
CO5	2	3	3	2	2	2	—	—	3	1	2	3	—	—	3
CO	3	3	2	2	2	2	1	—	2	1	2	2	—	—	2

3–High, 2– Medium, 1–Low

CS22622	DEEP LEARNING	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn deep neural network foundation • To be familiar with preprocessing the data using Tensorflow/Keras Environment • To understand convolutional networks and its operations • To illustrate the Recurrent Neural Network • To get exposure on variants of autoencoders and Generative Adversarial Networks 						
UNIT I	INTRODUCTION					
Introduction to Neural Network– Perceptron – Multi–layer feed forward Network– Activation Function–Defining Deep Learning– Common Architectural Principles of Deep Networks. Regression MLPs– Implementing MLPs with Keras – Building Image Classifier and Regression MLP using the Sequential API–Fine–tuning Neural Network Hyperparameters.						
UNIT II	LOADING AND PREPROCESSING DATA					
Using TensorFlow like NumPy – The tf.data API: Chaining Transformations – Shuffling the data – Interleaving Lines from Multiple Files – Preprocessing the data. Keras Preprocessing Layers.						
UNIT III	COMPUTER VISION USING CONVOLUTIONAL NEURAL NETWORKS					
Convolutional Layers – Pooling Layers – CNN Architecture: GoogLeNet, ResNet, SENet – Pretrained Models from Keras – Transfer Learning – Classification and Localization – Object Detection – Object Tracking – Semantic Segmentation.						
UNIT IV	RECURRENT NEURAL NETWORKS					
Recurrent Neurons and Layers – Training RNN – Natural Language Processing with RNN: Generating Text using a Character RNN – Sentiment Analysis – An Encoder–Decoder Network for Neural Machine Translation.						

UNIT V	AUTOENCODERS AND GENERATIVE ADVERSARIAL NETWORKS	6
Autoencoders: Stacked Autoencoders – Convolutional Autoencoders – Sparse Autoencoders – Denoising Autoencoders. Generative Adversarial Networks: Deep Convolutional GANs– Progressive Growing of GANs– StyleGANs.		
30 PERIODS		
PRACTICAL EXERCISES:		
<ol style="list-style-type: none"> 1. Implement a perceptron in TensorFlow/Keras Environment 2. Implement a Feed–Forward Network in TensorFlow/Keras 3. Implement a regression model in Keras 4. Implement an Image Classifier using CNN in TensorFlow/Keras 5. Implement a Transfer Learning concept in Image Classification 6. Implement Object Detection using CNN 7. Perform Sentiment Analysis using RNN 8. Image generation using GAN 		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Use Multilayer perceptron for applications with hyper–parameter tuning.	
CO2:	Use Tensorflow/Keras Environment to preprocess the data.	
CO3:	Apply convolutional networks for real world applications in Computer Vision domain.	
CO4:	Design Recurrent Neural Network for Natural Language processing.	
CO5:	Apply the Autoencoders and Generative Adversarial Network based deep learning techniques for recent applications.	
TEXT BOOKS:		
1.	Aurélien Géron, “Hands–On Machine Learning with Scikit–Learn, Keras and TensorFlow”, O’Reilly, 2022.	
2.	Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2021.	
REFERENCES:		
1.	Santanu Pattanayak, “Pro Deep Learning with TensorFlow 2.0”, Apress, 2023.	
2.	Antonio Gulli, Amita Kapoor, Sujit Pal, “Deep Learning with Tensorflow 2 and Keras”, Second Edition, Packt Publishing, 2019.	
3.	Umberto Michelucci, “Advanced Applied Deep Learning: Convolutional Neural Networks and Object Detection”, Apress, 2019.	
4.	Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.	
5.	Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

CS22721	GENETIC ALGORITHMS AND SWARM INTELLIGENCE	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To study the basic mathematical foundations of Genetic Algorithms • To learn and implement genetic algorithm techniques • To advance the state of the art in Swarm Intelligence • To learn Ant Colony Optimization Algorithm • To know various optimization algorithms 						
UNIT I	INTRODUCTION				6	
Overview of Genetic Algorithms–Genetic Optimization –Derivation of Simple Genetic Algorithm –Genetic Algorithms vs. Other Optimization Techniques–Pros and Cons of Genetic Algorithms–Hybrid Genetic Algorithms.						
UNIT II	IMPLEMENTATION OF GENETIC ALGORITHMS				6	
Data structure – Reproduction – Crossover and Mutation – Mapping objective functions to fitness form – Applications of Genetic Algorithms: DeJong and Function optimization– Structural optimization – Medical image registration.						
UNIT III	INTRODUCTION TO SWARM INTELLIGENCE				6	
Introduction to Swarm Intelligence– Biological Foundations of Swarm Intelligence– Metaheuristics– Concept of Swarm– Concept of Self–Organization in Social Insects– Adaptability and Diversity in Swarm Intelligence– Swarm Intelligence in Data Mining.						
UNIT IV	ANT COLONY OPTIMIZATION				6	
Concept of Artificial Ants– ACO Metaheuristics – ACO Applied Toward Travelling Salesperson Problem– The Ant Algorithm– Comparison of Ant Colony Optimization Algorithms– Application of ACO in Different Fields.						
UNIT V	OPTIMIZATION ALGORITHMS				6	
Particle Swarm Optimization–Basic Concepts– PSO Variants– Applications of PSO in Various Engineering Domains– The Artificial Bee Colony Algorithm– The Firefly Algorithm– The Bat Algorithm.						
30 PERIODS						
PRACTICAL EXERCISES:						
1. Study and analysis of Genetic Algorithm Life Cycle						

2. Implementation of Simple Genetic Application
3. Implementation of Data mining using Genetic Algorithm
4. Implement an algorithm to demonstrate the significance of Genetic Algorithm
5. Implementation of Ant colony optimization
6. Implementation of PSO
7. Implementation of Firefly Algorithm

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|--|
| CO1: | Explain the basic mathematical foundations in Genetic Algorithm. |
| CO2: | Describe the state of the art in Swarm Intelligence. |
| CO3: | Apply genetic algorithms in real world problems. |
| CO4: | Use Ant colony optimization algorithm. |
| CO5: | Implement various optimization techniques. |

TEXT BOOKS:

- | | |
|----|--|
| 1. | Anand Nayyar, Dac–Nhuong Le, Nhu Gia Nguyen, “Advances in Swarm Intelligence for Optimizing Problems in Computer Science”, Chapman and Hall/CRC, 2018. |
| 2. | David Goldberg, “Genetic Algorithms in search, optimization machine learning”, Pearson Education, 2013. |

REFERENCES:

- | | |
|----|--|
| 1. | Jun Sun, Choi–Hong Lai and Xiao–Jun Wu, “Particle Swarm Optimization – Classical and Quantum perspectives”, CRC Press 2019. |
| 2. | Eyal Wirsansky, “Hands–On Genetic Algorithms with Python”, Packt, 2020. |
| 3. | Adam Slowik, “Swarm Intelligence Algorithms”, CRC Press, 2022. |
| 4. | Abhishek Kumar, Pramod Singh Rathore, Rashmi Agrawal, Vicente Garcia Diaz, “Swarm Intelligence Optimization Algorithms and Applications”, Wiley, 2020. |
| 5. | Dan Simon. “Evolutionary Optimization Algorithms: Biologically Inspired and Population–based Approaches to Computer Intelligence”, Wiley, 2013. |

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	–	–	–	–	–	–	–	–	–	–	–	2
CO2	3	2	1	–	–	–	–	–	–	–	–	–	–	–	3
CO3	3	2	1	–	–	–	–	–	–	–	–	–	–	–	2
CO4	3	2	1	–	–	–	–	–	–	–	–	–	–	–	1
CO5	3	2	1	–	–	–	–	–	–	–	–	–	–	–	3
CO	3	2	1	–	–	–	–	–	–	–	–	–	–	–	2

3–High, 2– Medium, 1–Low

CS22722	NATURAL LANGUAGE PROCESSING	L	T	P	C				
		2	0	2	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To learn the fundamentals of natural language processing • To implement a rule-based system to tackle morphology/syntax of a Language • To understand the use of CFG and PCFG in NLP • To understand the role of semantics of sentences and pragmatics • To apply the NLP techniques to IR applications 									
UNIT I	INTRODUCTION								
Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.									
UNIT II	MORPHOLOGY AND PART OF SPEECH TAGGING	6							
Regular expressions– Finite State Automata– word recognition–lexicon. Morphology– acquisition models– Finite State Transducer– Tokenization– N–grams–Unsmoothed N–grams, Evaluating N–grams, Smoothing, Interpolation and Backoff – Word Classes, Part–of–Speech Tagging, Rule–based, Stochastic and Transformation–based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.									
UNIT III	SYNTACTIC ANALYSIS	6							
Context–Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.									
UNIT IV	SEMANTICS AND PRAGMATICS	6							
Requirements for representation, First–Order Logic, Description Logics – Syntax–Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.									
UNIT V	DISCOURSE ANALYSIS AND LEXICAL RESOURCES	6							
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).									
30 PERIODS									
PRACTICAL EXERCISES:									
<ol style="list-style-type: none"> 1. Predict similar words from dataset using NLP 2. Implement pre–processing of text such as Tokenization, Filtration, Script validation, stop–word removal, Stemming 3. Perform an experiment to simulate morphological analysis using natural language processing 4. Demonstration of stemming and lemmatization 5. Perform an NLP experiment to demonstrate chunking 6. Conduct an NLP experiment to create n grams from text 7. Using NLP, perform the sentimental analysis on the given statements and classify the given sentiments and generate the evaluation metrics 8. Classification of spam messages using NLP 									

30 PERIODS**TOTAL: 60 PERIODS****COURSE OUTCOMES:****At the end of the course, the students will be able to:**

CO1:	Describe the basic Language features.
CO2:	Implement a rule based system to tackle morphology/syntax of a language.
CO3:	Design a tag set to be used for statistical processing for real-time applications.
CO4:	Design an innovative application using NLP components.
CO5:	Compare and contrast the use of different statistical approaches for different types of NLP applications.

TEXT BOOKS:

1. Ansari Sakil, "Introduction to Natural Language Processing – A Practical Guide for Beginners", White Falcon Publishing, 2023.
2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems", O'Reilly Media, 2020.

REFERENCES:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Nitin Indurkha and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.
3. Richard M Reese, "Natural Language Processing with Java", O'Reilly Media, 2015.
4. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2014.
5. Yue Zhang, Zhiyang Teng, "Natural Language Processing A Machine Learning Perspective", Cambridge University Press, 2021.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–
CO2	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–
CO3	1	2	2	–	–	–	–	–	–	–	–	–	1	–	–
CO4	1	2	1	–	–	–	–	–	–	–	–	–	2	–	–
CO5	2	2	1	–	–	–	–	–	–	–	–	–	1	–	–
CO	2	2	2	–	–	–	–	–	–	–	–	–	2	–	–

3-High, 2-Medium, 1-Low

VERTICAL 3: NETWORK AND CYBER SECURITY

CS22531	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • Learn to analyze the security of in-built cryptosystems • Know the fundamental mathematical concepts related to security • Develop cryptographic algorithms for information security • Realize the various types of data integrity and authentication schemes • Get knowledge on Security Practice and System Security 					
UNIT I	INTRODUCTION				6
Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques– Foundations of modern cryptography: Product Cryptosystem – Cryptanalysis.					
UNIT II	SYMMETRIC CIPHERS				6
Number theory –Symmetric Key Ciphers: DES, Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES.					
UNIT III	ASYMMETRIC CIPHERS				6
Mathematics Of Asymmetric Key Cryptography: Primes – Primality 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.					
UNIT IV	CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST				6
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem –Kerberos –X.509 Certificates.					
UNIT V	SECURITY PRACTICE AND SYSTEM SECURITY				6
Wireless Network Security– Electronic Mail security – PGP— System Security: Intruders – Malicious software – viruses – Firewalls.					
30 PERIODS					
PRACTICAL EXERCISES:					
<ol style="list-style-type: none"> 1. Perform encryption, decryption for any two substitution techniques 2. Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation 3. Apply AES algorithm for practical applications 4. Implement RSA Algorithm using HTML and JavaScript 5. Implement the Diffie–Hellman Key Exchange algorithm for a given problem 6. Calculate the message digest of a text using the SHA–1 algorithm 7. Implement the SIGNATURE SCHEME – Digital Signature Standard 					
30 PERIODS					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Describe the fundamentals of networks security, security architecture.				

CO2:	Realize about the various Security Practices and System Security.
CO3:	Apply the different cryptographic operations of symmetric cryptographic algorithms.
CO4:	Apply the different cryptographic operations of public key cryptography.
CO5:	Apply the various Authentication schemes to simulate different applications.
TEXT BOOKS:	
1.	William Stallings, "Cryptography and Network Security: Principles and Practice", Seventh Edition, Pearson, 2017.
2.	Hans Delfs and Helmut Knebl, "Introduction to Cryptography, Principles and Applications", Third Edition, Springer, 2015.
REFERENCES:	
1.	Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: Private Communication in a Public World", Prentice Hall, 2022.
2.	C K Shyamala, N Harini and Dr. T R Padmanabhan, "Cryptography and Network Security", Wiley India Pvt.Ltd, 2011.
3.	BehrouzA.Foruzan, "Cryptography and Network Security", Third Edition, Tata McGraw Hill 2015.
4.	Jean-Philippe Aumasson, "A Practical Introduction to Modern Encryption", No Starch Press, 2017.
5.	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
CO2	3	2	2	2	—	—	—	—	—	—	—	—	—	—	3
CO3	3	2	2	2	—	—	—	—	—	—	—	—	—	—	3
CO4	3	2	2	2	—	—	—	—	—	—	—	—	—	—	3
CO5	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
CO	3	2	2	2	—	—	—	—	—	—	—	—	—	—	3

3–High, 2– Medium, 1–Low

CS22532	CYBER SECURITY	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn cybercrime and cyberlaw • To understand the cyber attacks and tools for mitigating them • To understand information gathering 						

- To learn how to detect a cyber attack
- To learn how to prevent a cyber attack

UNIT I	INTRODUCTION	6
Cybercrime–Definition and origin of the word–Cybercrime and Information security–Cyber criminals–Classifications of Cybercrimes– Cybercrime: The Legal Perspective– Cybercrime: An Indian Perspective–A Global Perspective on Cybercrimes.		
UNIT II	ATTACKS AND COUNTERMEASURES	6
Threat Classification– Representing and Exchanging Cyberthreat Intelligence–Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.		
UNIT III	RECONNAISSANCE	6
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	6
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	6
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.		
30 PERIODS		
PRACTICAL EXERCISES:		
<ol style="list-style-type: none"> 1. Install Kali Linux on Virtual box, Explore Kali Linux and bash scripting 2. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Metago 3. Understand the nmap command d and scan a target using nmap 4. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities, Use Metasploit to exploit an unpatched vulnerability 5. Install Linux server on the virtual box and install ssh 6. Use Fail2bant scan log files and ban Ips that show the malicious signs 7. Launch brute-force attacks on the Linux server using Hydra 8. Perform real-time network traffic analysis and data packet logging using Snort 		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Understand the basics of cyber security, cyber crime and cyber law.	
CO2:	Classify various types of attacks and learn the tools to launch the attacks.	
CO3:	Use various tools to perform information gathering.	
CO4:	Demonstrate intrusion techniques to detect intrusion.	

CO5:	Apply intrusion prevention techniques to prevent intrusion.
TEXT BOOKS:	
1.	David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2021.
2.	Leslie F. Sikos, Kim-Kwang Raymond Choo, "Data Science in Cybersecurity and Cyberthreat Intelligence", Springer, 2023.
REFERENCES:	
1.	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.
2.	Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2013.
3.	Ahmed Sheikh, " Certified Ethical Hacker (CEH) Preparation Guide ", Apress, 2021.
4.	William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015.
5.	Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab).

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1	—	—	—	—	—	—	—	—	—	—	—	2
CO2	1	3	1	—	—	—	—	—	—	—	—	—	—	—	1
CO3	2	1	1	—	—	—	—	—	—	—	—	—	—	—	2
CO4	3	3	2	—	—	—	—	—	—	—	—	—	—	—	3
CO5	3	2	1	—	—	—	—	—	—	—	—	—	—	—	2
CO	2	2	1	—	—	—	—	—	—	—	—	—	—	—	2

3–High, 2– Medium, 1–Low

CS22631	SOCIAL NETWORK ANALYSIS	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the concept of semantic web and related applications • To learn knowledge representation using ontology • To understand human behavior in social web and related communities • To learn visualization of social networks 						
UNIT I INTRODUCTION						
Introduction–Social network and Semantic Web– Limitations of current Web – The Semantic Web–Development of Semantic Web – Development of Social Network Analysis – Applications of Social Network Analysis.						
UNIT II SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS						

Electronic sources for network analysis – Ontology–based Knowledge Representation –Modelling and aggregating social network –Developing Semantic Web applications with social network features.		
UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	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 –Tools for detecting communities.		
UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	6
Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks.		
UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	6
Graph theory – Centrality – Clustering – Node–Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix–based representations – Matrix and Node–Link Diagrams.		
30 PERIODS		
PRACTICAL EXERCISES:		
<p>1. Working of semantic web and how it is useful for developers. Show with an example or case study</p> <p>2. Representation of OWL Ontology</p> <p>3. Provide the Ontological Representation of Social individuals</p> <p>4. Provide the Ontological Representation of Social relationships</p> <p>5. Use Gephi, for quick analysis of relatively small network data</p> <p>6. Use NetworkX, an extensive Python package for network analysis that can handle larger network datasets and computations</p> <p>7. Perform Knowledge representation of Semantic Web</p>		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Explain the concept of semantic web, extraction and mining communities and related applications.	
CO2:	Represent knowledge using ontology.	
CO3:	Develop semantic web related applications.	
CO4:	Apply human behavior in social web and related communities.	
CO5:	Visualize social networks.	
TEXT BOOKS:		
1.	Mohammad Gouse Galety, Chiai Al Atroshi, Buni Balabantaray, Sachi Nandan Mohanty, “Social Network Analysis: Theory and Applications”, John Wiley & Sons, 2022	
2.	Song Yang, Franziska Keller and Lu Zheng, “Social Network Analysis: Methods and Examples”, SAGE Publications, 2016.	
REFERENCES:		
1.	Peter Brusilovsky, Daqing He, “Social Information Access: Systems and Technologies”, Springer, 2018.	

2.	Tope Omitola, Sebastián A. Ríos, John G. Breslin, "Social Semantic Web Mining", Springer, 2022.
3.	Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 2011.
4.	Peter Mika, "Social Networks and the Semantic Web", Springer 2010.
5.	Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 2010.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	–	–	–	–	3	–	–	–	–	–	2	3	–	1
CO2	3	2	2	2	3	1	–	–	–	–	–	2	2	–	3
CO3	3	2	2	2	3	1	–	–	–	–	–	2	2	–	3
CO4	3	2	2	2	3	2	–	–	–	–	–	2	2	–	3
CO5	3	–	–	–	3	1	–	–	–	–	–	2	3	–	3
CO	3	2	2	2	–	2	–	–	–	–	–	2	2	–	3

3–High, 2– Medium, 1–Low

CS22632	ETHICAL HACKING	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the basics of Ethical hacking and computer-based vulnerabilities • To understand hacking options available in Web and wireless applications • To explore different foot printing, reconnaissance and scanning methods • To expose the enumeration and vulnerability analysis methods • To explore the options for network protection 						
UNIT I	INTRODUCTION	6				
Ethical Hacking Overview – Principles of Ethical Hacking – Phases of Penetration Testing – Types of Hacking – Penetration Testing Methodologies – Laws of the Land – Overview of TCP/IP – 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 – UNIX Enumeration – Vulnerability Assessment Concepts – Desktop and Server OS Vulnerabilities – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities in Windows– Linux OS Vulnerabilities– Vulnerabilities of Embedded Oss.

UNIT IV	SYSTEM HACKING	6
----------------	-----------------------	----------

Hacking Web Servers – Web Application Components – Web Application Vulnerabilities – Tools for Web Attackers and Security Testers Hacking – Wireless Networks – Components of a Wireless Network – Overview of Wireless Technologies – Authentication – Wardriving– Wireless Hacking – Tools of the Trade.

UNIT V	NETWORK PROTECTION SYSTEMS	6
---------------	-----------------------------------	----------

Overview of routing Protocol – Basic Hardware Routers – Access Control Lists – Overview of Firewall – 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 – Honeyhops.

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's Maltego
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

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|---|
| CO1: | Summarize the basics of Ethical Hacking and computer-based vulnerabilities. |
| CO2: | Illustrate hacking options available in Web and wireless applications. |
| CO3: | Identify loopholes in the target system. |
| CO4: | Apply the enumeration and vulnerability analysis methods. |
| CO5: | Design the network protection systems. |

TEXT BOOKS:

- | | |
|----|---|
| 1. | Michael T. Simpson, Rob Wilson, Robert S. Wilson, Nicholas Antill , “Hands-On Ethical Hacking and Network Defense, Cengage Learning”, Fourth Edition, 2022. |
| 2. | Hein Smith & Hillary Morrison, “Ethical Hacking: A Comprehensive Beginner’s Guide to Learn and Master Ethical Hacking”, CreateSpace, 2018. |

REFERENCES:

1.	Roger Grimes, "Hacking the Hacker: Learn From the Experts Who Take Down Hackers", Wiley, 2017.
2.	Matthew Hickey, Jennifer Arcuri, "Hands on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming", Wiley, 2020.
3.	Kimberly Graves, "CEH official Certified Ethical Hacking Review Guide", Wiley, 2021.
4.	Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", Auerbach Publications, 2017.
5.	Peter Kim, "The Hacker Playbook 3: Practical Guide To Penetration Testing", Secure Planet LLC, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	1	—	—	—	1	2	2	1	—	—	3
CO2	2	1	1	2	1	—	—	—	1	3	3	3	—	—	1
CO3	1	2	1	2	1	—	—	—	2	2	1	1	—	—	2
CO4	2	2	3	3	1	—	—	—	1	2	1	2	—	—	1
CO5	2	3	1	1	2	—	—	—	2	1	1	1	—	—	3
CO	2	2	2	2	1	—	—	—	1	2	2	2	—	—	2

3–High, 2– Medium, 1–Low

CS22731	CYBER FORENSICS	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn cyber crime and forensics • To become familiar with forensics tools • To learn to analyze and validate forensics data • To understand cyber laws and the admissibility of evidence with case studies • To learn the vulnerabilities in network infrastructure with ethical hacking 						
UNIT I	INTRODUCTION TO CYBER CRIME AND FORENSICS					6
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime – Classification of Cyber Crime. The Present and future of Cybercrime – Cyber Forensics –Steps in Forensic Investigation – Forensic Examination Process – Types of CF techniques – Forensic duplication and investigation – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.						
UNIT II	EVIDENCE COLLECTION AND FORENSICS TOOLS					6
Processing Crime and Incident Scenes – Digital Evidence – Sources of Evidence –Working with File Systems. – Registry – Artifacts – Current Computer Forensics Tools: Software/ Hardware Tools – Forensic Suite – Acquisition and Seizure of Evidence from Computers and Mobile Devices – Chain of Custody– Forensic Tools.						

UNIT III	ANALYSIS AND VALIDATION	6
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics – Analysis of Digital Evidence – Admissibility of Evidence – Cyber Laws in India – Case Studies.		
UNIT IV	ETHICAL HACKING	6
Introduction to Ethical Hacking – Footprinting and Reconnaissance – Scanning Networks – Enumeration – System Hacking – Malware Threats – Sniffing – Email Tracking.		
UNIT V	ETHICAL HACKING IN WEB	6
Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications – SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.		
30 PERIODS		
PRACTICAL EXERCISES:		
<p>1. Study and Explore the following forensic tools:</p> <ul style="list-style-type: none"> (a) FTK Imager (b) Autopsy (c) EnCase Forensic Imager (d) LastActivityView (e) USBDevview <p>2. Recover deleted files using FTKImager</p> <p>3. Acquire forensic image of hard disk using EnCase Forensics Imager and also perform integrity checking/validation</p> <p>4. Restore the Evidence Image using EnCase Forensics Imager.</p> <p>5. Study the following:</p> <ul style="list-style-type: none"> (a) Collect Email Evidence in Victim PC. (b) Extract Browser Artifacts (ChromeHistory view for Google Chrome) <p>6. Use USBDevview to find the last connected USB to the system</p> <p>7. Perform Live Forensics Case Investigation using Autopsy</p> <p>8. Study Email Tracking and EmailTracing and write a report on them.</p>		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Describe the fundamentals of computer forensics and cybercrime.	
CO2:	Summarize a variety of computer forensic tools to bear on a particular situation.	
CO3:	Identify and confirm the forensic data.	
CO4:	Examine the vulnerabilities in a given network infrastructure.	
CO5:	Apply real-world hacking techniques to assess the security of the system.	
TEXT BOOKS:		
1.	Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Sixth Edition, Cengage Learning, 2019.	
2.	Kimberly Graves, “CEH official Certified Ethical Hacking Review Guide”, Wiley, 2021.	
REFERENCES:		
1.	Dejey, S. Murugan, “Cyber Forensics”, Oxford University Press, 2018.	

2.	John R. Vacca, "Computer and Information Security Handbook", Elsevier Science, 2017.
3.	MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction", Third Edition, Prentice Hall, 2013.
4.	Zaid Sabih, "Learn Ethical Hacking from Scratch", Packt, 2018.
5.	Kenneth C.Branzik "Insider Computer Fraud", Auerbach Publications Taylor & Francis Group, 2019.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	2	2	-	-	-	-	1	1	2	3	-	-
CO2	2	3	2	3	2	-	-	-	2	2	3	2	2	-	-
CO3	2	3	2	1	1	-	-	-	2	2	3	2	3	-	-
CO4	2	3	2	2	3	-	-	-	2	2	3	2	2	-	-
CO5	2	3	1	2	2	-	-	-	-	-	-	1	2	-	-
CO	2	3	2	2	2	-	-	-	2	2	3	2	2	-	-

3-High, 2-Medium, 1-Low

CS22732	BLOCKCHAIN TECHNOLOGIES	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> Get to grips with the underlying technical principles of Blockchain Explore cryptography, mine crypto-currencies, and solve scalability issues with this comprehensive guide Build powerful applications using Ethereum to secure transactions and create smart contracts Investigate Securing, interconnecting public and private Blockchain Understand the decentralized applications (Dapps) 						
UNIT I	INTRODUCTION AND CONSENSUS MECHANISM	6				
Introduction: Overview of Block chain, History of Blockchain, Peer to Peer Network, Smart Contract, Wallet, Digital Currency, Ledgers, Types of Blockchain Platform. Permissioned Blockchain, Permissionless Blockchain, Different Consensus Mechanism– Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance.						
UNIT II	CRYPTO CURRENCY AND WALLET	6				
Types of Wallet, Desktop Wallet, App based Wallet, Browser based wallet, Meta-mask, Creating an account in Meta-mask, Use of faucet to fund wallet, transfer of cryptocurrency in meta-mask.						
UNIT III	SMART CONTRACT AND ETHEREUM	6				

Overview of Ethereum, Writing Smart Contract in Solidity, Remix IDE , Different networks of Ethereum, understanding blocks practically at blockhcain.com, how to compile and deploy smart contract in remix.		
UNIT IV	CRYPTO PRIMITIVES, SECURING AND INTERCONNECTING PUBLIC AND PRIVATE BLOCK CHAINS	7
Hash Function and Merle Tree—Security Properties—Security Considerations for block chain—Digital Signature—Public Key Cryptography—Bitcoin blockchain incentive structures— Nash Equilibriums— evolutionary stable strategies,—and Pareto efficiency (game theory).		
UNIT V	USE CASES—APPLICATIONS IN DIFFERENT AREAS	5
Industry applications of Blockchain—Blockchain in Government—Government use cases—Preventing Cybercrime through block chain—Block Chain in defense, tax payments		
30 PERIODS		
PRACTICAL EXERCISES:		
1: Creating Merkle tree 2: Creation of Block 3: Block chain Implementation Programming code 4: Creating ERC20 token 5: Java code to implement blockchain in Merkle Trees 6: Java Code to implement Mining using block chain 7: Java Code to implement peer-to-peer using block chain 8: Creating a Crypto—currency Wallet		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recognize the block chain technology.	
CO2:	Comprehend the Consensus Mechanism, Crypto—Currency, smart contract, Hyperledger Fabric.	
CO3:	Identify the block—chain based solutions and write smart contract using Ethereum Framework.	
CO4:	Demonstrate how to secure the private and public blockchain.	
CO5:	Apply Blockchain in future use cases for security.	
TEXT BOOKS:		
1.	Imran Bashir, “Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more”, Third Edition, Packt Publishing, 2020.	
2.	Antonopoulos, Andreas M., and Gavin Wood, “Mastering Ethereum: Building smart contracts and DApps”. O'Reilly Media, 2018.	
REFERENCES:		
1.	Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly, 2014.	
2.	Swan, Melanie, “Blockchain: Blueprint for a new economy”, O'Reilly Media, Inc., 2015.	
3.	Badr, Bellaj, Richard Horrocks, and Xun Brian Wu, “Blockchain by Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and	

	Hyperledger”, Packt Publishing Ltd, 2018.
4.	Chittoda, Jitendra. “Mastering Blockchain Programming with Solidity: Write production-ready smart contracts for Ethereum blockchain with Solidity”, Packt Publishing Ltd, 2019.
5.	Antony Lewis, “The Basics of Bitcoins and Blockchains: An Introduction To Cryptocurrencies And The Technology That Powers Them”, Mango Media, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	–	–	–	–	–	–	–	–	–	–	2	–
CO2	2	2	2	2	–	–	–	–	–	–	–	–	–	2	–
CO3	2	2	2	2	–	–	–	–	–	–	–	–	–	2	–
CO4	2	2	2	2	–	–	–	–	–	–	–	–	–	2	–
CO5	–	2	2	2	–	–	–	–	–	–	–	–	–	2	–
CO	2	2	2	2	–	–	–	–	–	–	–	–	–	2	–

3—High, 2— Medium, 1—Low

VERTICAL 4: WEB TECHNOLOGY

IT22511	FULL STACK WEB DEVELOPMENT	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To understand the various components of full stack development • To learn Node.js features and applications • To develop applications with MongoDB • To understand the role of Angular and Express in web applications • To develop simple web applications with React 					
UNIT I	BASICS OF FULL STACK				6
Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express–Angular – Node – Mongo DB – React.					
UNIT II	NODE JS				6
Basics of Node JS – Installation – Working with Node packages – Using Node package manager,Creating a simple Node.js application – Using Events.					
UNIT III	MONGO DB				6
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections.					
UNIT IV	EXPRESS AND ANGULAR				6
Implementing Express in Node.js – Configuring routes – Using Request and Response objects– Angular – Typescript – Angular Components.					
UNIT V	REACT				6
MERN STACK – Basic React applications – React Components – React State – Express REST APIs.					
30 PERIODS					
PRACTICAL EXERCISES:					
<ol style="list-style-type: none"> 1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter. 2. Create a web application to manage the TO–DO list of users, where users can login and manage their to–do items. 3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them. 4. Create a grocery delivery website where users can order from a particular shop listed in the website. 5. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed. 					
30 PERIODS					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Explain the various stacks available for web application development				

CO2:	Use Node.js for application development											
CO3:	Develop applications with MongoDB											
CO4:	Use the features of Angular and Express.											
CO5:	Develop React applications											
TEXT BOOKS:												
1.	Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.JS, MongoDB and Angular Web Development", Second Edition, Addison-Wesley, 2018.											
2.	Vasan Subramanian, "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node", Second Edition, Apress, 2019.											
REFERENCES:												
1.	Jeffrey C. Jackson, "Web Technologies—A Computer Science Perspective", Pearson Education, 2012.											
2.	Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress, 2018.											
3.	Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Second Edition, Addison-Wesley, 2018.											
4.	Jon Duckett, "HTML and CSS—Design and Build Websites", John Wiley Sons, 2011.											
5.	Kyle Bunker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, "MongoDB in Action", Second Edition, Manning Publication, 2016.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2
CO2	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2
CO3	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2
CO4	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2
CO5	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2
CO	2	3	3	—	2	2	—	—	—	—	—	—	—	—	2

3—High, 2— Medium, 1—Low

CS22541	PHP PROGRAMMING	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To learn the functionality of web pages and basics of HTML • To learn the fundamentals of PHP • To learn OOP concepts, file handling and web application techniques, such as form processing, data validation, session tracking and cookies. • To learn how databases work and interact with relational databases like MySQL or 						

NoSQL databases such as MongoDB	
<ul style="list-style-type: none"> To learn to generate images and PDF files dynamically with PHP and protect web applications from the most common and dangerous attacks 	
UNIT I	INTRODUCTION TO HTML
Basic HTML – Lists – Tables – Forms – Audio and Video – CSS – Inline, embedded and external style sheets – HTTP and HTML – The Request/Response Procedure – HTTP Request Message – HTTP Response Message – Setting up a Development Server.	
UNIT II	INTRODUCTION TO PHP
Language Basics – Comments – Literals – Identifiers – Keywords – Data Types – Variables – Expressions and Operators – Control Statements – Embedding PHP in Web Pages – Functions – Strings – Arrays.	
UNIT III	OBJECT ORIENTED PROGRAMMING AND WEB TECHNIQUES
Objects – Classes – Constructors – Destructors – Inheritance – Static Properties and Methods – Final methods – Abstract Classes – Serialization – File Handling – Processing Forms – Setting Response Headers – Cookies – Sessions – Authentication – SSL.	
UNIT IV	DATABASE CONNECTIVITY AND MYSQL
Relational Databases and SQL – Introduction to MySQL – MySQL Basics – Accessing MySQL via the Command Line – Indexes – MySQL Functions – PHP Data Objects – Accessing MySQL Using PHP – MySQLi Object Interface – SQLite – MongoDB.	
UNIT V	GRAPHICS AND SECURITY
Graphics – Embedding an Image in a Page – Basic Graphics Concepts – Creating and Drawing Images – Images with Text – Dynamically Generated Buttons – Scaling Images – Color Handling – PDF: PDF Extensions – Documents and Pages – Text – Security – Filter Input – Cross-Site Scripting – SQL Injection.	
30 PERIODS	
PRACTICAL EXERCISES:	
<ol style="list-style-type: none"> Create a website with HTML and CSS Construct simple web pages in PHP Form Handling in PHP Form Validation in PHP Implement OOP features in PHP Use cookies and sessions to store some data in the browser and pass it to the next request Create an application in PHP with CRUD operations on database Create a dynamic web page with graphics 	
30 PERIODS	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Construct a basic website using HTML and CSS.
CO2:	Describe the basic features of PHP.
CO3:	Implement OOP features, upload files, access form parameters, use cookies and sessions in PHP applications.
CO4:	Design web pages with the ability to access databases from PHP.
CO5:	Generate images and PDF files dynamically with PHP.

TEXT BOOKS:												
1.	Steven Holzner, "PHP: The Complete Reference", McGraw–Hill Education, 2017.											
2.	Aamer Khan, "PHP Programming– The Complete Guide", Code Academy, 2022.											
REFERENCES:												
1.	Alan Forbes, "The Joy of PHP Programming: A Beginner's Guide", Sixth Edition, Create Space Independent Publishing Platform, 2020.											
2.	Kevin Yank, Tom Butler, "PHP & Mysql: Novice to Ninja", SitePoint, 2017.											
3.	Robin Nixon, "Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites", Third Edition, O'Reilly, 2014.											
4.	Jon Duckett, "PHP and MySQL– Server-side Web Development", Wiley, 2022.											
5.	Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", Third Edition, O'Reilly, 2013.											

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	—	—	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	3	3	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	2.	3	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

CS22641	UI/UX DESIGN	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the basics concepts of Design Thinking process • To learn the fundamental concepts of User Interface Design process • To introduce the basic concepts of User Experience Design process • To induce the students to create a wireframe and prototype • To understand the various Research Methods used in Design 						
UNIT I	FUNDAMENTALS OF DESIGN				6	
Introduction to User Interface (UI) and User Experience (UX) – Evolution of Design – Need of Good design – Core Stages of Design Thinking – Divergent and Convergent Thinking – Brainstorming and Game storming – Observational Empathy.						
UNIT II	FUNDAMENTALS OF UI DESIGN				6	
UI Design Principles – UI Elements and Patterns – Responsive Grids and Breakpoints – Typography– Color Schemes – Branding – Style Guides.						
UNIT III	FUNDAMENTALS OF UX DESIGN				6	

UX Design Process and its Methodology – Research in User Experience Design – Tools and Methods used for Research – Usability Testing – Information architecture – Sitemaps.	
UNIT IV	WIREFRAMING AND PROTOTYPING 6
Sketching Principles – Sketching Red Routes – Tools used for UI and UX Design – Wireframing – Creating Wireflows – Building a Prototype – Create interaction – Share Prototypes – Comment on Prototype – Incorporate feedback – Export designs. – Prototype Iteration.	
UNIT V	USER RESEARCH AND IDEATION 6
Identifying and Writing Problem Statements – Identifying Appropriate Research Methods – Creating Personas – Solution Ideation – Creating User Stories – Creating Scenarios – Flow Diagrams – Flow Mapping – Journey Map.	
30 PERIODS	
PRACTICAL EXERCISES:	
<ol style="list-style-type: none"> 1. Use the design thinking process to create the ideal user interface design a societal application. 2. Create an interface design to investigate different UI interaction patterns. 3. Develop an interface for responsive home page of hotel management system using Icons, Primary and Secondary Buttons. 4. Developing an interface for a shopping application with proper UI Style Guides. 5. Make a wireflow diagram for a banking application using open-source software. 6. Develop an interface for a bus ticket booking application by conducting the end-to-end user research. 7. Identify the customer problem that users of an agriculture information system are having, then create an interface design to overcome that issue. 8. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements. 	
30 PERIODS	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain the basic user interface and user experience design concepts.
CO2:	Describe user interface design for real time applications.
CO3:	Summarize user experience design process and its methodology.
CO4:	Sketch Wireframe and Prototype for a new project.
CO5:	Illustrate various User Experience Research methods in Design.
TEXT BOOKS:	
1.	Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O'Reilly, 2021.
2.	Joel Marsh, “UX for Beginners”, O'Reilly, 2022.
REFERENCES:	
1.	David Platt, “The Joy of UX: User Experience and Interactive Design for Developers”, Addison-Wesley, 2016.
2.	Elisa Paduraru, “Fundamentals of Creating a Great UI/UX”, Creative Tim, 2022.
3.	Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interfaces”, Third Edition, O'Reilly Media, 2020.

4.	Garrett JJ, The elements of user experience: user-centered design for the Web, Berkeley: New Riders, 2011.
5.	https://www.interaction-design.org/literature .

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	3	1	—	—	—	3	3	2	1	2	—	—
CO2	2	3	1	3	2	—	—	—	1	2	2	2	1	—	—
CO3	1	3	3	2	2	—	—	—	2	3	1	2	1	—	—
CO4	1	2	3	2	1	—	—	—	2	1	1	1	3	—	—
CO5	1	3	3	2	2	—	—	—	2	3	1	2	3	—	—
CO	2	2	2	2	2	—	—	—	2	2	1	2	2	—	—

3-High, 2-Medium, 1-Low

CS22642	CLOUD AND DEVOPS TOOLS	L	T	P	C
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To introduce DevOps tools terminology, definition and concepts • To understand the different Version control tools like Git and Github • To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment • To understand Configuration management using Ansible • Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real world problems 					
UNIT I	INTRODUCTION TO CLOUD COMPUTING	6			
Cloud Computing: Defining a cloud – Characteristics and Benefits – The cloud reference model– Types of cloud – Virtualization: Introduction – Hypervisor– Types of virtualization: Full Virtualization and Para Virtualization– Levels of Virtualization Implementation – Virtualization of CPU, Memory and I/O devices.					
UNIT II	COMPILE AND BUILD USING MAVEN & GRADLE	6			
Introduction to Git and Github, Create Github Account, Create Repository – Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle.					
UNIT III	CONTINUOUS INTEGRATION USING JENKINS	6			
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters).					

Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV | CONFIGURATION MANAGEMENT USING ANSIBLE

6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V | BUILDING DEVOPS PIPELINES USING AZURE

6

Introduction to cloud platforms (Azure, GCP, AWS) – Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

30 PERIODS

PRACTICAL EXERCISES:

1. Installation of Docker and working with Docker containers
2. Installation of Kubernetes and application deployment
3. Build a simple application using Gradle/Maven
4. Run regression tests using Maven build pipeline in Azure
5. Install Ansible, configure Ansible roles and to write playbook
6. CI/CD pipeline using Jenkins
7. Create dashboards using Prometheus and Grafana

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|---|
| CO1: | Describe the fundamental concepts of cloud computing and DevOps tools. |
| CO2: | Use Maven and Gradle tools for software project management. |
| CO3: | Apply Jenkins and monitoring tools for CI/CD. |
| CO4: | Utilize Ansible for agentless software automation. |
| CO5: | Use containerized software application and DevOps pipeline using GCP/Azure/AWS. |

TEXT BOOKS:

- | | |
|----|--|
| 1. | Mitesh Soni, “Hands-On Azure Devops: CICD Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure”, BPB Publications, 2020. |
| 2. | Mariot Tsitoara, “Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, Apress, 2019. |

REFERENCES:

- | | |
|----|--|
| 1. | Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013. |
| 2. | Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, Midwestern Mac, LLC, 2020. |
| 3. | David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, CreateSpace, 2016. |
| 4. | Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Reiter Consulting, 2016. |
| 5. | Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and |

	Command Line”, Createspace, 2014.
--	-----------------------------------

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	2	–	–	–	–	–	–	1	2	2	2
CO2	3	3	3	2	3	–	–	–	–	–	–	2	3	2	2
CO3	3	3	3	2	3	–	–	–	–	–	–	2	3	2	2
CO4	3	3	3	2	3	–	–	–	–	–	–	2	3	2	2
CO5	3	3	3	2	3	–	–	–	–	–	–	2	3	2	2
CO	3	3	3	2	3	–	–	–	–	–	–	2	3	2	2

3–High, 2– Medium, 1–Low

CS22741	WEB APPLICATION SECURITY	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand the fundamentals of web application security • To focus on wide aspects of secure development and deployment of web applications • To learn how to build secure APIs • To learn the basics of vulnerability assessment and penetration testing • To get an insight about Hacking techniques and Tools 						
UNIT I	FUNDAMENTALS OF WEB APPLICATION SECURITY					
The history of Software Security–Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management–Input Validation.						
UNIT II	SECURE DEVELOPMENT AND DEPLOYMENT					
Web Applications Security – Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM).						
UNIT III	SECURE API DEVELOPMENT					
API Security– Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.						
UNIT IV	VULNERABILITY ASSESSMENT AND PENETRATION TESTING					
Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.						

UNIT V	HACKING TECHNIQUES AND TOOLS	6
Social Engineering, Injection, Cross–Site Scripting(XSS), Broken Authentication and Session Management, Cross–Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nmap, Nikto, Burp Suite,etc.		
30 PERIODS		
PRACTICAL EXERCISES:		
<ol style="list-style-type: none"> 1. Install wireshark and analyze the difference between HTTP vs HTTPS. 2. Analyze the various security mechanisms embedded with different protocols using wireshark. 3. Identify the vulnerabilities using OWASP ZAP tool. 4. Create simple REST API using python for following operation <ol style="list-style-type: none"> 1. GET 2. PUSH 3. POST 4. DELETE 5. Install Burp Suite and explore SQL injection. 6. Explore cross–site scripting (XSS) using Burp site. 7. Attack the website using Social Engineering method. 		
30 PERIODS		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Illustrate the basic concepts of web application security and need for it.	
CO2:	Outline the process for secure development and deployment of web applications.	
CO3:	Develop Secure Web Applications that use Secure APIs.	
CO4:	Apply vulnerability assessment and penetration testing.	
CO5:	Make use of hacker tool set.	
TEXT BOOKS:		
1.	Andrew Hoffman, “Web Application Security: Exploitation and Countermeasures for Modern Web Applications”, O’Reilly Media, Inc, 2020.	
2.	Neil Madden, “API Security in Action”, Manning Publications, 2020.	
REFERENCES:		
1.	Ravi Das and Greg Johnson, “Testing and Securing Web Applications”, Taylor & Francis Group, LLC, 2021.	
2.	Prabath Siriwardena, “Advanced API Security”, Apress Media LLC, 2020.	
3.	Malcom McDonald, “Web Security for Developers”, No Starch Press, Inc, 2020.	
4.	Brij B. Gupta and Pooja Chaudhary, “Cross–Site Scripting Attacks: Classification, Attack, and Countermeasures”, CRC Press, Taylor and Francis Group, 2020.	
5.	Allen Harper, Daniel Regalado, Ryan Linn, Stephen Sims, Branko Spasojevic, Linda Martinez, Michael Baucom, Chris Eagle, Shon Harris, “Gray Hat Hacking: The Ethical Hacker’s Handbook”, Fifth Edition, McGraw Hill, 2020.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	–	–	–	–	–	–	–	1	–	–	–	2	–	2	–
CO2	–	–	–	–	2	1	–	1	–	–	–	2	–	2	–
CO3	1	2	3	1	3	–	–	–	–	–	–	3	–	3	–
CO4	2	1	3	1	2	1	–	–	–	–	–	2	–	3	–
CO5	2	3	2	1	1	2	–	1	–	–	–	2	–	3	–
CO	2	2	3	1	2	1	–	1	–	–	–	2	–	3	–

3–High, 2– Medium, 1–Low

CS22742	RICH INTERNET APPLICATIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the properties of Rich Internet Applications
- Study the development of these applications in various frameworks
- Process client and server technologies
- Understand various web services and how these web services interact

UNIT I	INTRODUCTION TO WEB2.0	6
---------------	-------------------------------	----------

Introduction–What is Web2.0?– Search Content Networks– User–Generated Content – Blogging – Social Networking– Social Media – Tagging – Social Bookmarking Software Development – Rich Internet Applications (RIAs) – Web Services, Mashups, Widgets and Gadgets – Location–Based Services – XML, RSS, Atom, JSON and VoIP – Web2.0 Monetization Models – Web2.0 Business Models Future of the Web.

UNIT II	AJAX–ENABLED RICH INTERNET APPLICATIONS	6
----------------	--	----------

Introduction – Traditional Web Applications vs. Ajax Applications – Rich Internet Applications (RIAs) with Ajax – History of Ajax – Ajax Example Using the XMLHttpRequest Object – Using XML and the DOM – Creating a Full–Scale Ajax–Enabled Application – JSON – Dojo Toolkit.

UNIT III	RICH INTERNET APPLICATION– CLIENT TECHNOLOGIES	6
-----------------	---	----------

Adobe®Flash®CS3: Introduction – Flash Movie Development – Publishing Flash Movie – Creating Special Effects with Flash – Creating a Website Splash Screen; **Adobe®Flex™2 and Rich Internet Applications:** Introduction – Flex Platform Overview – Creating a Simple User Interface – Accessing XML Data from Your Application – Interacting with Server–Side Applications – Customizing Your User Interface – Creating Charts and Graphs – Connection Independent RIAs on the Desktop: Adobe Integrated Runtime(AIR).

UNIT IV	RICH INTERNET APPLICATION– SERVER TECHNOLOGIES	6
----------------	---	----------

Ruby on Rails: Introduction – Ruby – Rails Framework – Action Controller and Action View – A Database–Driven Web Application – Case Study: Message Forum – Ajax–Enabled Rails Applications – Java Server™ Faces Web Applications: Introduction Creating and Running a

Simple Application – JSF Components.													
UNIT V	WEB SERVICES										6		
Introduction – Java Web Services Basics – Creating, Publishing, Testing and Describing a Web Service – Consuming a Web Service – SOAP – Session Tracking in Web Services – Consuming a Database–Driven Web Service from a Web Application.										30 PERIODS			
PRACTICAL EXERCISES:													
1. Creation of a website with HTML, CSS and JavaScript 2. Creation of Ajax–Enabled Web Application 3. Creation of a flash movie 4. Creation of a web application with Ruby 5. Creation of a web application with JSF 6. Creating, publishing, testing and describing a simple web service 7. Creating, publishing, testing and describing a database driven web service													
30 PERIODS													
TOTAL: 60 PERIODS													
COURSE OUTCOMES:													
At the end of the course, the students will be able to:													
CO1:	Describe the Web 2.0 and the features of Rich Internet Applications (RIA).												
CO2:	Develop Ajax–Enabled applications.												
CO3:	Develop application using client technologies.												
CO4:	Develop application using server technologies.												
CO5:	Develop simple and database driven web services.												
TEXT BOOKS:													
1.	Paul J. Deitel, Abbey Deitel and Harvey M. Deitel, “Internet and World Wide Web – How to Program”, Fifth Edition, Pearson Education, 2018.												
2.	Giovanni C.Gentry, “Ajax: The Complete Reference”, CreateSpace, 2017.												
REFERENCES:													
1.	Paul Anderson, “Web 2.0 and Beyond: Principles and Technologies”, CRC Press, 2012.												
2.	Paul J Deitel and Harvey M Deitel, "AJAX, Rich Internet applications and web development", Prentice Hall, 2008.												
3.	Wyke-Smith Charles, “Scriptin' With Javascript And Ajax: A Designer'S Guide”, Pearson, 2010.												
4.	Michael B. White. “Mastering JavaScript A Complete Programming Guide Including JQuery, AJAX, Web Design, Scripting and Mobile Application”, Newstone Publishing, 2019.												
5.	Nicholas C. Zakas, Jeremy McPeak, Joe Fawcett, “Professional AJAX”, Wrox publications, 2011.												

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—
CO2	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—
CO3	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—
CO4	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—
CO5	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—
CO	3	2	1	—	—	—	—	—	—	—	—	—	3	—	—

3–High, 2– Medium, 1–Low

VERTICAL 5: SOFTWARE ENGINEERING & QUALITY MANAGEMENT

CS22551	SOFTWARE ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand Software Engineering Lifecycle Models
- To understand fundamental concepts of requirements engineering and Analysis Modelling
- To gain knowledge of the System Analysis and Design concepts using UML
- To learn different testing strategies
- To learn the software project management principles

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT

6

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

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION

6

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document — Requirement Engineering Process— Petri Nets— Data Dictionary— Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram— CASE TOOLS.

UNIT III SOFTWARE DESIGN

6

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

UNIT IV SOFTWARE TESTING

6

Software testing fundamentals—Internal and external views of Testing—white box testing — basis path testing—control structure testing—black box testing— Regression Testing — Unit Testing — Integration Testing — Validation Testing — System Testing and Debugging.

UNIT V PROJECT MANAGEMENT

6

Software Project Management: Estimation — LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model — Project Scheduling — Scheduling, Earned Value Analysis Planning — Project Plan, Planning Process. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMM plan.

30 PERIODS

PRACTICAL EXERCISES:

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design

8. Test the software system for all the scenarios identified as per the usecase diagram.
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios.

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system
2. Book bank
3. Exam registration
4. Stock maintenance system
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the basic requirements of software process and projects.
CO2:	Demonstrate the software design process and testing techniques of software models.
CO3:	Determine project management techniques, risk management, and methods for estimating costs and schedules.
CO4:	Use UML diagrams for analysis and design.
CO5:	Analyze the design process using architectural styles and test the systems.

TEXT BOOKS:

1. Roger Pressman, Bruce Maxim, "Software Engineering: A Practitioner's Approach", Ninth Edition, McGraw Hill, 2023.
2. Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education Asia, 2017.

REFERENCES:

1. David C. Kung, Kung, "Object-Oriented Software Engineering: An Agile Unified Methodology", McGraw-Hill, 2013.
2. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", Third Edition, PHI Learning Pvt. Ltd., 2012.
3. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", Second Edition, PHI Learning Pvt. Ltd., 2010.
4. Rajib Mall, "Fundamentals of Software Engineering", Fourth Edition, PHI Learning Pvt. Ltd., 2014.
5. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2010.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	—	1	—	—	—	—	—	—	1	3	—	—
CO2	3	2	2	—	1	—	—	—	—	—	—	1	3	—	—
CO3	3	2	2	2	1	—	—	—	—	—	2	1	3	—	—
CO4	3	2	2	—	2	—	—	—	—	—	—	1	3	—	—
CO5	3	2	2	—	2	—	—	—	—	—	—	1	3	—	—
CO	3	2	3	1	2	—	—	—	—	—	1	1	3	—	—

3–High, 2– Medium, 1–Low

CS22552	SOFTWARE SYSTEM DESIGN				L	T	P	C				
	2	0	2	3								
COURSE OBJECTIVES:												
<ul style="list-style-type: none"> • Understand the fundamentals of object modeling • Learn the unified process phases • Prepare the requirements for various case studies • Appreciate the idea behind Design Patterns in handling common problems faced during building an application • To practice object modeling using UML 												
UNIT I	INTRODUCTION							6				
Introduction to OOAD; typical activities / workflows / disciplines in OOAD, Introduction to iterative development and the Unified Process, Introduction to UML; mapping disciplines to UML artifacts, Introduction to Design Patterns – goals of a good design – MVC architecture.												
UNIT II	INCEPTION							6				
Artifacts in inception, Understanding requirements – the FURPS model, Understanding Use case model – introduction, use case types and formats, Writing use cases – goals and scope of a use case, elements / sections of a use case, Use case diagrams, Use cases in the UP context and UP artifacts.												
UNIT III	ELABORATION							6				
System sequence diagrams for use case model, Domain model: identifying concepts, adding associations, adding attributes, Interaction Diagrams, Introduction to GRASP design Patterns, Design Model: Use case realizations with GRASP patterns, Design Class diagrams in each MVC layer, Mapping Design to Code, Design class diagrams for case study and skeleton code.												
UNIT IV	DESIGN PATTERNS							6				
Fabrication, Indirection, Singleton, Factory, Facade, Publish–Subscribe.												
UNIT V	UML DIAGRAMS							6				
State–Chart diagrams, Activity diagrams, Component Diagrams, Deployment diagrams, Object diagrams. Advanced concepts in OOAD: Use case relationships, Generalizations Domain Model refinements, Architecture, Packaging model elements.												

	30 PERIODS
PRACTICAL EXERCISES:	
1. Write a Problem Statement to define a title of the project with bounded scope of project. 2. Select relevant process model to define activities and related task set for assigned project Tentative. 3. Prepare broad SRS (Software Requirement Specification) for the above selected projects. 4. Prepare USE Cases and Draw Use Case Diagram using modelling Tool. 5. Develop the activity diagram to represent flow from one activity to another for software development. 6. Draw class diagram and sequence diagram for the assigned project. 7. Draw Collaboration Diagram and State Transition Diagram for the assigned project.	
	30 PERIODS
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Summarize UML notations for various applications.
CO2:	Determine the requirements through use case driven approach.
CO3:	Design the conceptual model for various scenarios and applications.
CO4:	Use design patterns for better class and object composition.
CO5:	Analyze the concepts of Model refinement and UML diagrams.
TEXT BOOKS:	
1.	Harsh Kumar Ramchandani, "Hands-On System Design: Learn System Design, Scaling Applications, Software Development Design Patterns with Real Use-Cases", BPB Publishers, 2022.
2.	Neal Ford, "Fundamentals of Software Architecture: An Engineering Approach", O'Reilly, 2020.
REFERENCES:	
1.	Martin Fowler, "UML distilled: A Brief Guide to the Standard Object Modeling Language", Third Edition, Addison Wesley, 2018.
2.	Gandharba Swain, "Object-Oriented Analysis and Design Through Unified Modeling Language", Laxmi Publications, 2010.
3.	Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", Third Edition, PHI, 2012.
4.	John Hunt, "The Unified Process for Practitioners Object-Oriented Design, UML and Java", Springer, 2013.
5.	Martina Seidl, Marion Scholz, Christian Huemer, Gerti Kappel, "UML @ Classroom: An Introduction to Object-Oriented Modelin", Springer, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	1	-	-	-	-	-	-	-	3	-	-

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO3	3	2	2	–	2	–	–	–	–	–	–	–	3	–	–
CO4	3	2	2	–	2	–	–	–	–	–	–	–	3	–	–
CO5	3	2	2	–	2	–	–	–	–	–	–	–	3	–	–
CO	3	2	2	–	2	–	–	–	–	–	–	–	3	–	–

3—High, 2— Medium, 1—Low

CS22651	SOFTWARE TESTING AND AUTOMATION	L	T	P	C				
		2	0	2	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • To understand the basics of software testing • To learn how to do the testing and planning effectively • To build test cases and execute them • To focus on wide aspects of testing and understanding multiple facets of testing • To get an insight about test automation and the tools used for test automation 									
UNIT I	FOUNDATIONS OF SOFTWARE TESTING				6				
Why do we test Software?, Black–Box Testing and White–Box Testing, Software Testing Life Cycle, V–model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing.									
UNIT II	TEST PLANNING				6				
The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.									
UNIT III	TEST DESIGN AND EXECUTION				6				
Test Objective Identification, Test Design Factors, Requirement Identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model–Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.									
UNIT IV	ADVANCED TESTING CONCEPTS				6				
Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail–Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security Testing, Testing in the Agile Environment, Testing Web and Mobile Applications.									
UNIT V	TEST AUTOMATION AND TOOLS				6				
Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.									
30 PERIODS									
PRACTICAL EXERCISES:									

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application.
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|---|
| CO1: | Summarize the basic concepts of software testing and the need for software testing. |
| CO2: | Design Test planning and different activities involved in test planning. |
| CO3: | Design effective test cases that can uncover critical defects in the application. |
| CO4: | Carry out advanced types of testing. |
| CO5: | Automate the software testing using Selenium and TestNG. |

TEXT BOOKS:

1. Paul C. Jorgensen, Byron DeVries, "Software Testing: A Craftsman's Approach", Fifth Edition, Auerbach Publications, 2021.
2. Dorothy Graham, Rex Black, Erik van Veenendaal, "Foundations of Software Testing: ISTQB Certification", Cengage Learning, 2020.

REFERENCES:

1. Carl Cocchiaro, "Selenium Framework Design in Data–Driven Testing", Packt Publishing, 2018.
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide", Second Edition, Packt, 2018.
3. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
4. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of Software Testing", Third Edition, John Wiley & Sons, 2012.
5. Neha Kaul, "Implementing Automated Software Testing", Arcler Education, 2022.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	2	—	—	—	—	—	—	—	3	—	—
CO2	2	3	1	1	1	—	—	—	—	—	—	—	1	—	—
CO3	2	2	1	3	1	—	—	—	—	—	—	—	2	—	—
CO4	2	1	3	2	1	—	—	—	—	—	—	—	3	—	—
CO5	2	2	1	3	1	—	—	—	—	—	—	—	2	—	—

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	2	2	2	2	1	-	-	-	-	-	-	-	2	-	-

3-High, 2-Medium, 1-Low

CS22652	ENGINEERING SECURE SOFTWARE SYSTEM	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • Know the importance and need for software security • Know about various attacks • Learn about secure software design • Understand risk management in secure software development • Know the working of tools related to software security 					
UNIT I	NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS	6			
Software Assurance and Software Security – Threats to software security – Sources of software insecurity – Benefits of Detecting Software Security – Properties of Secure Software – MemoryBased Attacks: Low–Level Attacks Against Heap and Stack – Defense Against Memory–Based Attacks.					
UNIT II	SECURE SOFTWARE DESIGN	7			
Requirements Engineering for secure software – SQUARE process Model – Requirements elicitation and prioritization– Isolating The Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection – Session Hijacking. Secure Design – Threat Modeling and Security Design Principles.					
UNIT III	SECURITY RISK MANAGEMENT	5			
Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.					
UNIT IV	SECURITY TESTING	8			
Traditional Software Testing – Comparison – Secure Software Development Life Cycle – Risk Based Security Testing – Prioritizing Security Testing with Threat Modeling – Penetration Testing – Planning and Scoping – Enumeration – Remote Exploitation – Web Application Exploitation – Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection – Tools for Penetration Testing.					
UNIT V	SECURE PROJECT MANAGEMENT	4			
Governance and security – Adopting an Enterprise Software Security Framework – Security and Project Management – Maturity of Practice.					
30 PERIODS					
PRACTICAL EXERCISES:					
<ol style="list-style-type: none"> 1. Implement the SQL injection attack 2. Implement the Buffer Overflow attack 3. Implement Cross Site Scripting and Prevent XSS 4. Perform Penetration testing on a web application to gather information about the system, then 					

initiate XSS and SQL injection attacks using tools like Kali Linux

5. Develop and test the secure test cases

6. Penetration test using kali Linux

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Identify various vulnerabilities related to memory attacks.

CO2: Describe security principles in software development.

CO3: Calculate the extent of risks.

CO4: Involve selection of testing techniques related to software security in the testing phase of software development.

CO5: Use tools for securing software.

TEXT BOOKS:

1. Loren Kohnfelder, "Designing Secure Software: A Guide for Developers", No Starch Press, 2021.
2. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", Syngress Publishing, 2011.

REFERENCES:

1. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", Syngress Publishing, 2012.
2. Harsh Bothra, "Hacking", Khanna Book Publishing, 2018.
3. LakshmiKanth Merkow, Mark S. Raghavan, "Secure and Resilient Software Development", Auerbach Publications, 2010.
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", McGraw Hill, 2012.
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Packt Publishing, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	2	—	—	—	2	1	2	2	2	2	1
CO2	2	2	2	3	3	—	—	—	2	1	2	2	1	2	1
CO3	1	2	2	2	1	—	—	—	1	1	2	1	2	2	1
CO4	2	3	2	2	2	—	—	—	2	1	2	2	2	2	1
CO5	2	1	2	2	3	—	—	—	2	1	1	2	2	1	2
CO	2	2	2	2	2	—	—	—	2	1	2	2	2	2	1

3—High, 2— Medium, 1—Low

CS22751	SOFTWARE QUALITY ASSURANCE	L	T	P	C				
		2	0	2	3				
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> • Understand the basic tenets of software quality and quality factors • Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA Components • Understand of how the SQA components can be integrated into the project life cycle • Be familiar with the software quality infrastructure • Be exposed to the management components of software quality 									
UNIT I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	6							
Need for Software quality – Quality challenges – Software Quality Assurance (SQA) – Definition and objectives – Software quality factors– McCall’s quality model – SQA system and architecture – Software project life cycle components – Pre project quality components.									
UNIT II	SQA COMPONENTS AND PROJECT LIFE CYCLE	6							
Software development methodologies – Quality assurance activities in the development process– Verification & Validation – Reviews – Software testing – Software testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools.									
UNIT III	SOFTWARE QUALITY INFRASTRUCTURE	6							
Procedures and work instructions – Templates – Checklists – 3S development – Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit –Documentation control.									
UNIT IV	SOFTWARE QUALITY MANAGEMENT & METRICS	6							
Project process control – Computerized tools – Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics –Cost of software quality – Classical quality cost model – Extended model – Application of cost model.									
UNIT V	STANDARDS, CERTIFICATION & ASSESSMENTS	6							
Quality management standards – ISO 9001 and ISO 9000–3 – Capability Maturity Models – CMM and CMMI assessment methodologies – Bootstrap methodology – SPICE Project – SQA project process standards – IEEE standard 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.									
30 PERIODS									
PRACTICAL EXERCISES:									
A) Setup: <ol style="list-style-type: none"> 1. Download and install the Java Software Development Kit (JDK) http://www.oracle.com/technetwork/java/javase/downloads/index.html 2. Download "Eclipse IDE for Java Developers" http://www.eclipse.org/downloads/ 3. Download the Selenium Java Client Driver http://seleniumhq.org/download/ 									

4. Configure Eclipse IDE with WebDriver

B) Suggested Applications for QA & QC:

1. Leave Management System with following modules:

- a. Login – Two types of User: Admin and User
 - b. Admin Functionalities:
 - i. Manage Leave Types
 - ii. Manage User Leaves
 - iii. Manage Users
 - iv. Manage Different Shifts
 - v. Manage Reporting Groups and Team Structure
 - c. Time and Attendance
 - i. User can view his/her attendance detail
 - ii. Admin can view user's attendance log
 - iii. Admin can generate various reports like LateIn, EarlyOut, etc.
 - d. Leaves
 - i. User can apply leave and Admin can reject/approve
 - ii. User can view his leave request log, can modify and cancel as well
- ** Many other functionalities can be added to make it more complex

2. Recruitment System

- a. Manage Positions and vacancies within an organization
- b. Manage Advertisement on the positions
- c. Manage vacancy process from application to acceptance or rejection
- d. Manage and Setup Interviews
- e. Maintain Database

3. Consider the below module which is responsible for Package purchase and Payment in different currencies:

- The User can purchase one out of three packages namely, Basic, Moderate & Premium.
 - The User can purchase a particular package in three currencies.
 - The available currencies are Dollar, which is by default, Pound & INR.
 - User can change the currency only on first step of 3 which is while selecting the package.
- a. The User selects the Package.
 - b. The User calculates the VAT amount applicable with respect to the country selection.
 - c. The User pays online through debit/ credit card only.
- List out all the possible Test Cases for above module.
 - List out critical step, which if not properly handled can deviate the user from the system.
 - List out the enhancement point which can avail user more flexibility about one of the above three steps.

4. In Airline reservation system, the following features need to be tested namely,

- a. Login
- b. Search and book flights
- c. Search and book packages
- d. Register

Feature not in scope,

e. Search and book hotels

- Pre-requisites: Database & Payment gateway's sandbox environment access should be available.
- Prepare the Test Plan for the above with all the possible criteria need to be considered.
- Prepare the Test Cases for the features in scope to be tested. (At least one for above mentioned feature)

Prepare the Defect Report.

5. Healthcare Web application with following modules:

- a. Patient Registration
- b. Scheduling
- c. Treatment
- d. Billing

6. Consider a School Management System, which allows Parent to download Children's Progress Report and Results from School's website. So how can we authenticate the User (parent) & it has dual Authentication system integrated on Login page.

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- | | |
|-------------|---|
| CO1: | Utilize the concepts in software development life cycle. |
| CO2: | Demonstrate their capability to adopt quality standards. |
| CO3: | Assess the quality of software product. |
| CO4: | Apply the concepts in preparing the quality plan & documents. |
| CO5: | Develop a comprehensive software quality and test plan. |

TEXT BOOKS:

1. Daniel Galin, "Software Quality: Concepts and Practice", Wiley, 2018.
2. Claude Y.Laporte, Alain, "Software Quality Assurance", Wiley, 2018.

REFERENCES:

1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.
2. Mordechai Ben-Menachem, "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 2014.
3. Kshirsagar Naik and Priyadarshi Tripathy, "Software Testing & Quality Assurance Theory and Practice", Wiley Student Edition, 2010.
4. Dorothy Graham, Rex Black, "Foundations of Software Testing: ISTQB Certification", Cengage Learning, 2020.
5. William E. Perry, "Effective Methods for Software Testing", Third Edition, Wiley, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	2	–	–	–	–	–	–	–	3	–	–

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO2	2	3	1	1	1	—	—	—	—	—	—	—	1	—	—
CO3	2	2	1	3	1	—	—	—	—	—	—	—	2	—	—
CO4	2	1	3	2	1	—	—	—	—	—	—	—	3	—	—
CO5	2	2	1	3	1	—	—	—	—	—	—	—	2	—	—
CO	2	2	2	2	1	—	—	—	—	—	—	—	2	—	—

3–High, 2– Medium, 1–Low

CS22752	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To understand the Software Project Planning and Evaluation techniques • To plan and manage projects at each stage of the software development life cycle (SDLC) • To learn about the activity planning and risk management principles • To develop skills to manage the various phases involved in project management and people management • To deliver successful software projects that support organization's strategic goals 					
UNIT I	INTRODUCTION TO SOFTWARE PROJECT PLANNING AND PROJECT EVALUATION				6
Introduction to Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting Objectives – Management Control– Cost–benefit Evaluation Technology – Overview of Project Planning – Stepwise Project Planning.					
UNIT II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION				6
Software Process and Process Models – Choice of Process Models – Rapid Application Development – Agile Methods – Basics of Software Estimation – Effort and Cost Estimation Techniques – COCOMO: a Parametric Productivity Model.					
UNIT III	ACTIVITY PLANNING AND RISK MANAGEMENT				6
Objectives of Activity Planning – Project Schedules – Sequencing and Scheduling Activities – Network Planning Models – Formulating Network Model – Forward Pass – Backward Pass – Critical Path (CRM) Method – Risk Identification – Assessment – Risk Planning –Risk Management – Evaluating risk to the Schedule – PERT technique.					
UNIT IV	PROJECT MANAGEMENT MONITORING AND CONTROL				6
Creating Framework – Collection of Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis – Managing Contracts – Introduction – Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.					
UNIT V	STAFFING IN SOFTWARE PROJECTS				6
Introduction – Understanding behavior – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and					

Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational and Team Structures – Leadership.

30 PERIODS

PRACTICAL EXERCISES:

1. Create Project Plan
 - Specify project name and start (or finish) date.
 - Identify and define project tasks.
 - Define duration for each project task.
 - Define milestones in the plan
 - Define dependency between tasks
2. Create project plan as a bar chart.
3. Create a MS Project application. Set the file property and set the project Calendar.
4. Using Project Planning Activities describe how to manage Tasks.
5. Using Project Planning Activities draw the PERT for the project.
6. Write a program to implement Basic COCOMO.
7. Write a program to implement Early Design Model and calculate the effort for the development of project.

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basic project management concepts, software project planning, evaluation techniques and staffing in projects.
CO2:	Describe each stage of the software development life cycle, activity planning and risk management principles.
CO3:	Demonstrate the organizational behavior and risk management principles.
CO4:	Apply project management skills and cost estimation techniques in various project activities.
CO5:	Analyse the cost–benefit evaluation technology, risk management technique and project management technique.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall, “Software Project Management”, Sixth Edition, Tata McGraw Hill, 2018.
2. Moh'd A. Radaideh, “Software Project Management: With PMI, IEEE-CS, and Agile–SCRUM”, De Gruyter, 2023.

REFERENCES:

1. Shailesh Mehta, “Project Management and Tools & Technologies – An overview”, SPD 2017.
2. Subramanian Chandramouli, “Software Project Management”, Pearson Education, 2015.
3. Gopalaswamy Ramesh, “Managing Global Software Projects”, McGraw Hill Education, 2013.
4. Walker Royce, Barry Boehm, “Software Project Management: A Unified Framework”, Pearson 2013.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	—	—	—	—	—	—	—	—	3	—	—	—	3
CO2	2	1	—	—	—	—	—	—	—	—	3	—	—	—	3
CO3	3	2	3	—	—	—	—	2	—	2	3	—	—	—	3
CO4	3	2	1	—	—	—	—	—	—	—	3	—	—	—	3
CO5	3	2	—	—	—	—	—	—	—	—	3	—	—	—	3
CO	3	2	2	—	—	—	—	2	—	2	3	—	—	—	3

3–High, 2– Medium, 1–Low

CS22753	SALESFORCE ADMINISTRATION	L	T	P	C	
		2	0	2	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To understand Salesforce architecture and features • To know the customization process in Salesforce • To understand the security model • To understand the business process automation features • To understand the reports and dashboard 						
UNIT I	SALESFORCE FUNDAMENTALS	6				
Introduction to CRM – CRM Use Cases – Why Salesforce? – Overview of Salesforce platform and its Architecture – Advantage of Salesforce, Salesforce editions and licenses – Salesforce user interface and navigation – Salesforce Mobile App and Salesforce Lightning Experience – Signing up Developer Edition – Standard Objects – Creating Custom Objects – Fields and data types – Apps Creation.						
UNIT II	SALESFORCE DATA MANAGEMENT AND CUSTOMIZATION ESSENTIALS	6				
Relationships and junction objects, Roll-up Summary – Creating Formula Fields, Schema Builder. Data Validation – Validation rules. Working with Record Types and Page Layouts – Compact Layout – Lightning Record Pages – Home Page Customization – Path Settings. – List Views – Data import and data management tools.						
UNIT III	SECURITY AND DATA ACCESS	6				
Public groups and Queues – Organization Security Controls – Passwords, IP restrictions, Network Settings. User Setup and Security – User Creation – Security Model: Profiles – Permission Set – Permission Set Group – Salesforce Sharing model – Organization Wide Defaults (OWD) – Role Hierarchy – Sharing Rules – Manual Sharing.						
UNIT IV	BUSINESS PROCESS AUTOMATION	6				
Introduction to Workflow and Process Builder - Work flow rules – Workflow action – Email						

Alerts and Field Updates. Flows: Types of Flow Screen Flow– Record Triggered Flow– Scheduled Trigger Flow– Auto Launched Flow. uses cases of Process Automation. – Approval Processes.

UNIT V	REPORTS, DASHBOARDS, AND ANALYTICS	6
---------------	---	----------

Creating or customizing a Report –Types of Reports – Summary Report– Tabular Report – Matrix Report – Joined Report. Row Level Formula – Summary Level Formula. Various charts in Reports. Creating and modifying Dashboards – Filters – Various Charts – Standard Dashboards & Dynamic Dashboards. Folder Creation and Sharing.

30 PERIODS

PRACTICAL EXERCISES:

1. Create Objects, Fields and App
2. Explore Data Types
3. Create Fields and Relationships
4. Create Record Types (create), Page Layout (adding section, field property settings), Page Layout Assignment (assign page layout based on Record types)
5. Create Lightning Record Page, List View, Path Settings
6. Validation Rule
7. Automation I
 - a. Screen Flow
 - b. Auto Launched Flow
8. Automation II
 - a. Record Trigger Flow
 - b. Scheduled Trigger Flow
 - c. Approval Process
9. Security
 - a. Profiles and Permission Set
 - b. Org Wide Default
 - c. Roles
 - d. Sharing Rules
 - e. Manual Sharing
10. Reports and Dashboards
 - a. Custom Report Types
 - b. Dynamic Dashboards
 - c. Report and Dashboards Sharing

30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply data modelling techniques to design and configure custom objects, fields, and relationships in Salesforce.
CO2:	Apply advanced data management and customization techniques in Salesforce to enhance data organization and user experience.
CO3:	Evaluate and recommend appropriate Salesforce user setup and security settings to control access and permissions.

CO4:	Develop advanced automation solutions using Process Builder and Visual Workflow to meet complex business requirements.
CO5:	Evaluate and recommend appropriate reporting and analytics strategies based on business requirements.
TEXT BOOKS:	
1.	Enrico Murru, "Salesforce Advanced Administrator Certificate", Packt Publishers, 2019.
2.	Rakesh Gupta, "Mastering Salesforce CRM Administration", Packt Publishers, 2017.
REFERENCES:	
1.	Wes Nolte, Jeff Douglas, "Salesforce Handbook", Includes Winter '11 Publishers, 2011.
2.	Tom Wong, Liz Kao, Matt Kauff, "Salesforce.com for Dummies", Fifth Edition, Expert Salesforce.com Consultants, 2015.
3.	Rakesh Gupta, "Learning Salesforce Visual Workflow and Process Builder", Second Edition, Packt Publishers, 2017.
4.	Jonathan Keel, "Salesforce.com Lightning Process Builder and Visual Workflow", Apress, 2016.
5.	Paul Goodey, "Salesforce CRM – The Definitive Admin Handbook: A Deep Dive into the Working of Salesforce CRM", Fourth Edition, Packt Publishers, 2016.

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO2	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO3	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO4	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO5	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–
CO	2	1	1	1	2	–	–	–	–	–	1	1	1	–	–

3–High, 2– Medium, 1–Low

OPEN ELECTIVE TO BE OFFERED TO OTHER DEPARTMENTS

OPEN ELECTIVE – I

CS22681	DATA SCIENCE FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Students will have in depth understanding of the key technologies in data science and business analytics
- Students will Practice problem analysis and decision-making
- Students can apply algorithms to build machine intelligence
- Students will demonstrate proficiency with statistical analysis of data
- Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT I	INTRODUCTION	9
---------------	---------------------	----------

Data science— Benefits and uses of data science and big data— Facets of data— The Data Science Process —The big data ecosystem and data science.

UNIT II	DATA SCIENCE PROCESS	9
----------------	-----------------------------	----------

Overview of the data science process— Defining research goals and creating— Retrieving data— Cleansing, integrating, and transforming data— Exploratory data analysis— Build the models— Presenting findings and building applications on top of them.

UNIT III	LEARNING ALGORITHMS AND MODELS	9
-----------------	---------------------------------------	----------

Need for machine learning in data science—Types of machine learning— Semi-supervised learning— Three Basic Algorithms —Linear Regression —k—Nearest Neighbors (k—NN)—k—means.

UNIT IV	HANDLING LARGE DATA AND TEXT MINING	9
----------------	--	----------

General techniques for handling large volumes of data— General programming tips for dealing with large data sets. Distributing data storage and processing with frameworks. Text mining in the real world, Text mining techniques.

UNIT V	APPLICATIONS AND RECENT TRENDS	9
---------------	---------------------------------------	----------

Social network analysis— Social Network Analysis at Morning Analytics— Terminology from Social Networks— Data Leakage – Avoid Leakage.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Understand the basics about Data Science.
CO2:	Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
CO3:	Write Python code to statistically analyze a dataset.
CO4:	Apply the structured framework to solve data problems.

CO5:	Apply data science concepts and methods to solve problems in real-world contexts.
TEXT BOOKS:	
1.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2022.
2.	Chirag Shah, "A Hands-On Introduction to Data Science", Wiley, 2020.
REFERENCES:	
1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2.	Lillian Pierson, "Data Science— Dummies", Wiley, 2017.
3.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
4.	Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
5.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	—	2	—	—	—	—	—	—	—	—	—	2
CO2	2	1	—	—	1	—	—	—	—	—	—	—	—	—	2
CO3	3	2	1	—	2	—	—	—	—	—	—	—	—	—	2
CO4	3	2	2	—	2	—	—	—	—	—	—	—	—	—	2
CO5	3	2	1	—	2	—	—	—	—	—	—	—	—	—	2
CO	3	2	1	—	2	—	—	—	—	—	—	—	—	—	2

3—High, 2— Medium, 1—Low

CS22682	DATA ANALYTICS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> ● To analyze different types of data using Python ● To learn how to prepare data for analysis ● To perform simple statistical analysis ● To create meaningful data visualizations ● To predict future trends from data. 					
UNIT I	PYTHON FUNDAMENTALS FOR DATA ANALYSIS				9
Python data structures, Control statements, Functions, Object oriented programming concepts using classes, Objects and methods, Exception handling.					
UNIT II	INTRODUCTION TO DATA AND PREPROCESSING				9
Knowledge domains of Data Analysis, Understanding structured and unstructured data, Data					

Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.																					
UNIT III	DATA PROCESSING AND VISUALIZATION										9										
Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using Pandas. Data Visualization: Basic Visualization Tool – Power BI.																					
UNIT IV	PYTHON LIBRARIES FOR DATA WRANGLING										9										
Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing.																					
UNIT V	MODEL DEVELOPMENT AND EVALUATION										9										
Introduction to machine learning– Supervised and Unsupervised Learning, Model development using Linear Regression, Model Visualization, Prediction and Decision Making, Case studies.																					
TOTAL: 45 PERIODS																					
COURSE OUTCOMES:																					
At the end of the course, the students will be able to:																					
CO1:	Explore the basics of python for performing data analysis.																				
CO2:	Interpolate the processing and data visualization to get insights from data.																				
CO3:	Demonstrate the various preprocessing techniques.																				
CO4:	Apply different python packages for data wrangling in data analysis.																				
CO5:	Develop the model for data analysis and evaluate the model performance.																				
TEXT BOOKS:																					
1.	Reema Thareja, “Python Programming using Problem Solving approach”, Second Edition, Oxford University press, 2023.																				
2.	Wes Mckinney “Python for Data Analysis”, O’Reilly Media, 2017.																				
REFERENCES:																					
1.	David Taieb, “Data Analysis with Python: A Modern Approach”, Packt Publishing, 2018.																				
2.	David Ascher and Mark Lutz, “Learning Python”, Third Edition, O’Reilly Media, 2017.																				
3.	Allen Downey, Jeffrey Elkner, Chris Meyers, “Learning with Python”, Dreamtech Press, 2015.																				
4.	Joao Moreira, Andre Carvalho, Tomas Horvath, “A General Introduction to Data Analytics”, Wiley, 2018.																				
5.	Jeff Reed, “Data Analytics– Applicable Data to Advance Any Business”, CreateSpace 2017.																				

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	–	–	–	–	–	–	–	–	–	–	–	3
CO2	3	2	1	–	–	–	–	–	–	–	–	–	–	–	3

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO3	3	3	3	–	3	–	–	–	–	–	–	–	–	–	3
CO4	3	3	3	–	–	–	–	–	–	–	–	–	–	–	3
CO5	3	3	3	–	3	–	–	–	–	–	–	–	–	–	3
CO	3	3	2	–	3	–	–	–	–	–	–	–	–	–	3

3—High, 2— Medium, 1—Low

OPEN ELECTIVE – II

CS22781	IOT APPLICATIONS	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To know about the basics of Internet of Things. • To understand the protocols and security in IoT systems. • To learn about the IOT technologies in manufacturing and oil and gas industry. • To understand smart cities and transportation in the context of IoT. • To learn about the IOT applications in mining and public safety. 						
UNIT I	INTRODUCTION				9	
Introduction to IoT - Definition and Characteristics of IoT, Physical Design of IoT, Logical Design o IoT, IoT Levels and Deployment Templates. Domain Specific IoTs – Home Automation, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.						
UNIT II	APPLICATION PROTOCOLS & SECURING IOT				9	
Application Protocols for IoT- The Transport Layer, IoT Application Transport Methods - SCADA, Tunneling Legacy SCADA over IP Networks- SCADA Protocol Translation- SCADA Transport over LLNs with MAP-T- Generic Web-Based Protocols- IoT Application Layer Protocols- CoAP and MQTT. Securing IoT- Common Challenges in OT Security, Insecure Operational Protocols- Modbus, DNP3 – ICCP – OPC - IEC, Formal Risk Analysis Structures: OCTAVE and FAIR.						
UNIT III	IOT IN MANUFACTURING & OIL AND GAS				9	
Manufacturing- An Introduction to Connected Manufacturing, An Architecture for the Connected Factory, Industrial Automation Control Protocols, Connected Factory Security, Edge Computing in the Connected Factory. Oil and Gas- An Introduction to the Oil and Gas Industry, Industry Key Challenges as Digitization Drivers, Improving Operational Efficiency, IoT Architectures for Oil and Gas.						
UNIT IV	SMART AND CONNECTED CITIES & TRANSPORTATION				9	
Smart and Connected Cities- An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples. Transportation - Transportation and Transports, Transportation Challenges, IoT Use Cases for Transportation,						

An IoT Architecture for Transportation.																							
UNIT V	IOT APPLICATIONS IN MINING & PUBLIC SAFETY											9											
Mining - Mining Today and Its Challenge, Challenges for IoT in Modern Mining, An IoT Strategy for Mining, An Architecture for IoT in Mining, Public Safety - Overview of Public Safety, An IoT Blueprint for Public Safety, Emergency Response IoT Architecture, IoT Public Safety Information Processing, School Bus Safety.																							
TOTAL: 45 PERIODS																							
COURSE OUTCOMES:																							
At the end of the course, the students will be able to:																							
CO1:	Explain the basic concept of IoT.																						
CO2:	Describe the various application protocols and common challenges in IoT.																						
CO3:	Explain the IOT technologies in manufacturing and oil and gas industry.																						
CO4:	Illustrate IoT Strategy in smart cities and transportation.																						
CO5:	Describe the architecture for IoT in Mining and Public Safety.																						
TEXT BOOKS:																							
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2018. (Unit 2-5)																						
2.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015. (Unit 1)																						
REFERENCES:																							
1.	Rajkamal, "Internet of Things: Architecture, Design Principles and Applications", McGraw Hill Education, 2017																						
2.	Samuel Greengard, "The Internet of Things", The MIT Press, 2021.																						
3.	Perry Lea, "Internet of things for architects", Packt Publishing, 2018.																						
4.	Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things - Key applications and Protocols", Wiley, 2012.																						
5.	Dieter Uckelmann, Mark Harrison, Michahelles and Florian, "Architecting the Internet of Things", Springer, 2011.																						

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	1	-	-	2	-	-	-	-	-	-	-	-	3
CO	3	2	1	-	-	2	-	-	-	-	-	-	-	-	3

3-High, 2-Medium, 1-Low

CS22782	CYBER CRIME AND LAWS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To visualize the various crimes in the cyber space • To interpret the different issues in the cyber world • To help the victims through investigation procedures • To summarize the cyber laws • To apply the guidelines for solving the cyber case 					
UNIT I	CYBER CRIMES				9
Introduction – Cyber Stalking – Cyber Terrorism – General remediation strategies, International examples and Protections – Function of Trade Mark – Software Piracy – Networking Crimes – Emerging crimes in Fintech – Cyber Attacks – Emerging Threats.					
UNIT II	CYBER ISSUES				9
Defamation on Internet – Pornography on the Internet – Programming Error and Tampering – Types of Cyber E-commerce – Ransomware Attack – Revenge Porn – Deep Fake Fabrication – Phishing – IoT Attacks – Investment Scams – Metaverse Uncertainty.					
UNIT III	CYBER CRIME INVESTIGATION				9
Investigation of Cyber Crime – Computer Evidence – Creation and Verification of Digital Signature – Offence and Penalty – Criminal Liability – Penalty and Compensation – Punishment – Cyber forensics tools and softwares, Recovering deleted evidences, Password cracking.					
UNIT IV	CYBER LAWS, RULES, REGULATION AND NOTIFICATIONS				9
Information Security and Cyber Laws – Right to Privacy – IT Act – IT Rules – Cyber Regulations – IT Regulations – Digital Signature Rules – National Policy on Software Products – Email Policy – NPE – MIETy Rules – IIIT Rules – eSign rules – Cyber Appellate Tribunal.					
UNIT V	GUIDELINES AND CASE STUDIES				9
Nine IPR acts – The Digital Personal Data Protection (DPDP) Act 2023 – Legal issues – Guidelines for real world investigations – Guidelines by the supreme court – Cyber law cases – Recent cyber crimes – Latest judgments.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
At the end of the course, the students will be able to:					
CO1:	Identify the cyber risk				
CO2:	Understand the cyber issues				
CO3:	Visualize the various legal provisions of cybercrimes				
CO4:	Interpret the cyber laws				
CO5:	Discuss the guidelines for real world cybercrime cases				
TEXT BOOKS:					
1.	Dr. Santosh Kumar and Dr. Gagandeep Kaur, “Cyber Crimes and Laws”, Whitesmann Publishing, 2024.				
2.	Priya Bishnoi, “Cyber Crimes – A Comparative Study with Case”, Book Leaf Publishing, 2023.				
REFERENCES:					

1.	Dr. Pavan Duggal, "Cyber Law", Third Edition, Universal LexisNexis, 2023.
2.	Sushma Arora and Raman Arora, "Cyber Crimes and Laws", Fourth Edition, Taxmann, 2021.
3.	Dr. Chintan Pathak and Associates, "Law & Justice Landmark Judgements on Cyber Crimes & Cyber Laws", Law and Justice Publishing Co, 2023.
4.	Maurice E. Dawson, "Cyber Law, Privacy, and Security: Concepts, Methodologies, Tools, and Applications", Information Resources Management Association, Third Edition, IGI Global, 2019.
5.	Justice Yatindra Singh, "Cyber Laws", Sixth Edition, Universal Law Publishing Co., 2016.
ADDITIONAL RESOURCES:	
1.	Anurag Ulhas Dabholkar, "Cyber Laws In India: A handbook for lawyers: Navigating the Digital Landscape, Understanding Cyber Crimes, Privacy Rights, and Emerging Technologies", 2023.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
CO	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-

3-High, 2- Medium, 1-Low

OPEN ELECTIVE – III

CS22783	GREEN COMPUTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> ● To learn the fundamentals of green computing. ● To analyze the green computing grid framework. ● To understand the issues related with green compliance. ● To study and develop various case studies. 					
UNIT I FUNDAMENTALS					
9					
Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.					
UNIT II GREEN ASSETS AND MODELING					
9					

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT III	GRID FRAMEWORK	9
-----------------	-----------------------	----------

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

UNIT IV	GREEN COMPLIANCE	9
----------------	-------------------------	----------

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

UNIT V	CASE STUDIES	9
---------------	---------------------	----------

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2:	Illustrate green (power efficient) technologies for components of one single computer such as CPU, memory and disk.
CO3:	Extend the skill in energy saving practices in their use of hardware.
CO4:	Analyze the technology tools that can reduce paper waste and carbon footprint by the stakeholders
CO5:	Examine the ways to minimize equipment disposal requirements

TEXT BOOKS:

1. Neha Sharma, Jai Prakash Verma- Green Computing for Sustainable Smart Cities: A Data Analytics Applications Perspective, CRC Press, 2024
2. SeungJin Lee-"Energy-Efficient Computing and Data Center Design", Springer, September 2020

REFERENCES:

1. Amit Prakash Agarwal-“Green Information Technology: A Sustainable Approach”, CRC Press, March 2018
2. RajkumarBuyya-“Green Cloud Computing: Principles and Practices” Wiley, December 2018
3. BhuvanUnhelkar, —Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
4. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey,

	Shroff/IBM rebook, 2011
5.	John R. Vacca- "Green Computing: Tools and Techniques for Saving Energy, Money, and Resources" Syngress, February 2017

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-
CO2	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-
CO3	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-
CO4	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-
CO5	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-
CO	3	2	2	-	-	2	2	-	-	-	-	-	-	2	-

3-High, 2-Medium, 1-Low

CS22784	WEB DESIGN AND DEVELOPMENT	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To introduce the fundamentals of HTML. • To develop a webpage design with HTML and CSS • To understand the basics of JavaScript • To learn the basic concepts of PHP • To acquire knowledge on PHP programming with MySQL 						
UNIT I	Basics of HTML				9	
Introduction-Document background color and image – Text Structuring –Character Formatting – Lists – Ordered – Unordered – Definition Lists – Links to a web page – Tables – Borders and Rules – Rows and Cells – Formatting with Tables –Form handling - HTML5 Features						
UNIT II	Presentation with CSS				9	
CSS Basics- Style Definitions-CSS Values and Units- CSS Inheritance and Rule Cascading- Font Properties - Text Formatting - CSS Layouts - Advanced CSS with CSS3 - Attribute Selectors - CSS3 Backgrounds - CSS3 Borders –Text Effects - Transformations						
UNIT III	JAVASCRIPT				9	
Introduction-Comments-Variables-Operators- Functions - Global Variables- Local Variables- Expressions and Control Flow in JavaScript - Arrays – The Document Object Model- Validating User Input with JavaScript						
UNIT IV	INTRODUCTION TO PHP				9	
PHP Syntax- Variables – Constants - Expressions – Control Flow – Operators - Implicit and						

Explicit Casting – PHP Form Handling																					
UNIT V	MYSQL AND PHP										9										
MySQL Basics- Creating a database - Creating users- Creating a table- Data Types- Adding data to a table - Indexes – Insertion into a MySQL Database - Displaying Data from a MySQL Database - Deletion from a MySQL Database																					
TOTAL: 45 PERIODS																					
COURSE OUTCOMES:																					
At the end of the course, the students will be able to:																					
CO1:	Explain the basics of HTML.																				
CO2:	Design web pages using CSS.																				
CO3:	Design interesting and appealing web pages JavaScript.																				
CO4:	Describe the basic concepts of PHP																				
CO5:	Summarize the database operations with PHP and MySQL.																				
TEXT BOOKS:																					
1.	Lemay Laura, “Mastering HTML, CSS & Javascript Web Publishing”, BPB Publications, 2022.																				
2.	Alan Forbes, “The Joy of PHP Programming: A Beginner’s Guide”, 6 th Edition, Create Space Independent Publishing Platform, 2020.																				
REFERENCES:																					
1.	Jürgen Wolf, “HTML and CSS: The Comprehensive Guide”, Shroff/Rheinwerk Computing, 2023.																				
2.	Philip Ackermann, “JavaScript: The Comprehensive Guide”, Shroff/Rheinwerk, 2022.																				
3.	Nixon Robin “Learning PHP, MySQL, JavaScript, CSS & HTML5 A step- by-step guide to creating Dynamic Websites”, O'Reilly Media, Inc, USA, June 2014.																				
4.	Thomas A. Powell, “Web Design: The Complete Reference”, McGraw Hill, June 2000.																				
5.	Thomas Powell, ”HTML & CSS: The Complete Reference”, McGraw Hill, Fifth Edition, Mar 2010																				

Mapping of Course Outcomes to Program Outcomes

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-

3–High, 2– Medium, 1–Low