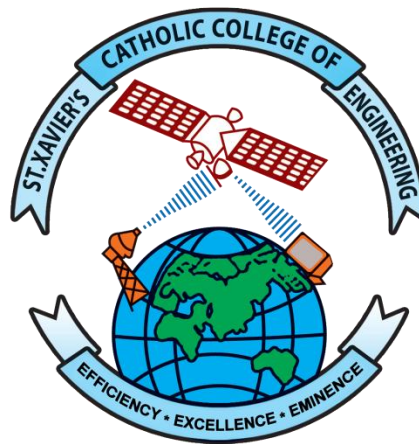# B.E. Degree

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

Inconsonance 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 graduates will have the ability and attitude to acquire new skills and adapt recent technological changes.
II.	To prepare the graduates to serve in the industries related to Computer Science and Engineering, or as entrepreneurs or to do higher education and research.
III.	To ensure that the graduates will work with professionalism and ethics by contributing to the advancement of the society.

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 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	-
		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	-
		GE3152	-	-	-	-	-	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
		GE3252	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
		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

Year	Sem	Course														
		AC22301	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-
		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	1	1	1	1	2	2	3	3	2	2	1	2	-	3	-
		CS22601	3	2	1	-	-	-	-	-	-	-	-	-	-	-	3
		IT22601	3	2	2	-	2	-	-	-	-	1	-	-	-	-	2
		SD22601	2	2	2	-	1	1	1	-	1	-	1	2	2	2	2
IV	VII	MS22701	-	1	1	1	1	1	1	1	2	1	1	2	-	2	-
		CS22701	3	2	1	1	2	-	-	-	-	-	-	-	-	-	2
		CS22702	3	2	3	3	3	-	-	-	-	-	-	1	3	-	-
		CS22703	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3
		SD22701	2	2	2	-	1	1	1	-	1	-	1	2	2	2	2
IV	VIII	CS22801	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
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
THEORY COURSES WITH PRACTICAL COMPONENT								
6.	EN22101	Communicative English	HSMC	2	0	2	4	3
PRACTICAL COURSES								
7.	BS22101	Physics & Chemistry Laboratory	BSC	0	0	4	4	2
8.	CS22102	Python Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
9.	IP22101	Induction Programme	-	-	-	-	-	0
10.	HS22101	Higher Order Thinking	MC	1	0	0	1	1
TOTAL				**17**	**1**	**10**	**28**	**23**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	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.	GE3152	தமிழர் மரபு /Heritage of Tamils	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	CATE GORY	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
6.	GE3252	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	1	1
PRACTICAL COURSES								
7.	CS22305	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
8.	CS22306	Data Structures Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
9.	SD22301	Coding Skills and Soft Skills Training – Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
10.	AC22301	Constitution of India	MC	2	0	0	2	0
11.	HS22301	Value Education I	MC	1	0	0	1	0
TOTAL				**19**	**1**	**12**	**32**	**23**

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 COURSES								
8.	SD22401	Coding Skills and Soft Skills Training – Phase II	EEC	0	0	4	4	2
MANDATORY COURSES								
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	CATE GORY	L	T	P	TOTAL CONTACT PERIODS	CREDITS
				PERIODS PER WEEK				
THEORY COURSES								
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 4th 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	CATE GORY	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 COURSES								
7.	SD22601	Coding Skills, Logical Reasoning and Quantitative Aptitude Training – 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	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MS22701	Principles of Management	HSM C	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	Product development Lab/ Mini project work	EEC	0	0	6	6	3
9.	SD22701	Coding Skills, Logical Reasoning and Quantitative Aptitude Training – Phase II	EEC	0	0	4	4	2
		TOTAL		**16**	**0**	**18**	**34**	**25**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSE								
1.	CS22801	Project Work/Internship	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**	5	4	1			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		23	27	23	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

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 Analysis	PEC-6	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

SI. 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

Sl. No.	Course code	Course Title	Category	L	T	P	Total contact periods	Credits
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

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	Software Defined Networks	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

MA22101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications
- To familiarize the students with differential calculus
- To familiarize the student with functions of several variables. This is needed in many branches of engineering
- To 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} sinbx, e^{ax} cosbx – 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., Chennai, Reprint 2017.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

1.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
3.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4.	Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 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:

- 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

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", McGraw Hill Education (India Pvt. Ltd.) 2nd edition 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:

- 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 familiarise 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 (Fe^{2+} x $Cr_2O_7^{2-}$).

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" McGraw Hill Education (India) Private Limited, 2nd 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	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	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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 algorithmic solutions to simple and complex computational problems
CO2:	Apply functions, modules and packages in Python program and use conditionals and loops for solving problems
CO3:	Analyze conditional branching statements
CO4:	Evaluate python programs

CO5:	Develop programs using compound data types and files

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", 2nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
2.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 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", 2nd Edition, No Starch Press, 2019.
5.	Martin C. Brown, "Python: The Complete Reference", 4th 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:

- 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", 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

EN22101	COMMUNICATIVE ENGLISH	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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 - *Types of Reading* : Intensive Reading and Extensive Reading- *Strategies*: 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) *Intensive Listening: Effective and Attentive Listening*		
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.
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:

- 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.

- 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

- 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:

- 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
		1	0	0	1

COURSE OBJECTIVES:

- 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

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

MA22201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:
- 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 × 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 ", 10th Edition, Khanna Publishers, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.

REFERENCES:

1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 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, 4th 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", 9th 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	-	-	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

ES22202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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	9

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	9

Construction, working principle and types of DC Generator – Motor- single phase Transformer - single phase and three phase Induction motor -Applications

UNIT III	ANALOG ELECTRONICS	9

Classification of Semiconductors– Construction , Characteristics and working -PN Junction Diode- Zener Diode - Bipolar Junction Transistor-IGBT- SCR- MOSFET.

UNIT IV	DIGITAL ELECTRONICS	9

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	9

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 First Edition, 2018.
2.	S. Salivahanan, R.Rengaraj "Basic Electrical and Instrumentation Engineering" McGraw Hill Education, First Edition, 2019.

REFERENCES:

1.	Kothari DP and I.J Nagrath, "Basic Electrical and Elecronics 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

- 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", Oxford University Press, Second Edition, 2016.
2.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

REFERENCES

1.	Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2.	Yashwant Kanetkar, "Let us C", 17th 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", McGraw Hill Education; Eighth Edition:2019, ISBN: 978-9351343202

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

- 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", Vikas Publishing House, 7th Edition, 2015.

REFERENCES

1.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited 2008.
2.	Julyes Jai Singh S., "Engineering Graphics", SRM tri sea publishers, Nagercoil, 7th Edition, 2015.
3.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
4.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 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

GE3152	HERITAGE OF TAMIL	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- 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
Environment – Ecosytem – 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	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 பாடநூல் 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".

GE3152		தமிழர் மரபு	L	T	P	C
			1	**0**	**0**	**1**

COURSE OBJECTIVES:

- தமிழ் மொழியின் மதிப்புகள், இந்தியாவில் உள்ள அடிப்படை மொழிக்குடும்பங்கள் மற்றும் தமிழ் இலக்கிய வகைகளை மாணவர்கள் புரிந்துகொள்ள உதவுதல்.
- மாணவர்கள் பாறை ஓவியங்கள், சிற்பக்கலைகள் மற்றும் இசைக்கருவிகளின் வழி தமிழ் பாரம்பரியத்தைப் புரிந்துகொள்ள வசதி செய்தல்
- தமிழர்களின் கலை மற்றும் வீர விளையாட்டுகளை 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 காப்பியங்கள்இ தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம்இ ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு	II	மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் 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 – கல்வெட்டுகள்இ கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு 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 கலைின் 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 பாடநூல் 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

EN22201	TECHNICAL ENGLISH	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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	12

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	6

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
		2	0	2	3

COURSE OBJECTIVES:

- 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 - CO_2 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:

- 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 – Ecosytem – 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", 2nd 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",

	Heineman Publications, 4th Edition.
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:

- 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 commonhousehold 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.	
	• 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:	❖ 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 inhousehold appliances.	
WOOD WORK:	❖ Sawing, ❖ Planning and ❖ Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.	
PART II	**MECHANICAL ENGINEERING PRACTICES**	**15**
WELDING WORK:	❖ Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. ❖ Practicing gas welding.	
BASIC MACHINING WORK:	❖ 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	❖ Assembling a centrifugal pump. ❖ Assembling a household mixer.	
SHEET METAL WORK:	❖ Making of a square tray	
GROUP – B (ELECTRICAL AND ELECTRONICS)		
PART-I	**ELECTRICAL ENGINEERING PRACTICES**	**15**
	❖ One lamp controlled by one switch. ❖ Series and parallel wiring. ❖ Staircase wiring. ❖ Fluorescent Lamp wiring.	

PART-II	ELECTRONIC ENGINEERING PRACTICES	15
	❖ 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.	

- ❖ Residential wiring.
- ❖ Iron Box wiring and assembly.

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:

- 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	12

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).

UNIT II	PREDICATE CALCULUS	12

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.

UNIT III	COMBINATORICS	12

Mathematical induction – The pigeonhole principle - Permutations and Combinations – Recurrence relations – Solving linear recurrence relations - Inclusion and exclusion principle(without proof) and its applications.

UNIT IV	ALGEBRAIC STRUCTURES	12

Algebraic systems – Semi groups and Monoids – Groups – Subgroups – Cosets – Lagrange's theorem – Definition: Rings and Fields – Problems on integer modulo n.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	12

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).

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, 30th 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:

- 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", First Edition, 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:

- 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, First Edition, 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, First Edition, Pearson, 2002.
4.	Kruse, Data Structures and Program Design in C, Second Edition, Pearson Education, 2006.
5.	Ellis Horowitz, Satraj 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:
- 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:

- 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	PARALLELISIM	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. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach‖, 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
CO5	1	2	2	1	-	-	-	-	-	-	-	-	-	-	3
CO	2	2	2	2	-	-	-	-	-	-	-	-	-	-	3

3-High, 2- Medium, 1-Low

GE3252	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- 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 பிரசுரம்)
2.	கீழடி – வைகை நதிக்கரையில் 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 தொழில் நுட்பமும்	L	T	P	C
			1	0	0	1

COURSE OBJECTIVES:
- சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தை மாணவர்கள் புரிந்துகொள்ள வசதி செய்தல்.
- சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய விழிப்புணர்வை ஏற்படுத்துதல்.
- 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 கீறல் 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 கற்றி 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

அணைஇ ஏரி குளங்களஇ மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்கான வடிவமைக்கப்பட்ட 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 பிரசுரம்)
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.

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

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	-	-
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	-	-
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**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:
- 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", First Edition, 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:

* 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, 1st Edition, 2015.

REFERENCES:

1.	Jain M P, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.
2.	The Constitution of India (Bare Act), Government Publication, 1950.
3.	M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication, 2005.
4.	Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19th Edition, Prentice-Hall EEE, 2008.
5.	Merunandan, "Multiple Choice Questions on Constitution of India", 2nd 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:

- 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

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", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2.	Johnson. R.A., Miller. I.R and Freund . J.E, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.

REFERENCES:

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

- 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

COURSEOBJECTIVES:
- 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.
- 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, First Edition, 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

COURSEOBJECTIVES:
- 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	-	-
CO	3	1	1	2	-	-	-	-	-	-	-	1	2	-	-

3-High, 2- Medium, 1-Low

CS22404	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:
- 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:
- 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

Receptive Skills and productive skills - Skills together - Integration of skills - Input and output **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

UNIT V	**SOFT SKILLS: SEARCH AND FIND FOR CAREER DEVELOPMENTS**	15

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

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.

	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.
CO5:	

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", First Edition, 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
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**
		2	**0**	**0**	**0**

COURSE OBJECTIVES:

- 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

CS22501	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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", Thomson Brokecole, Second Edition, 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", First Edition, 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

COURSEOBJECTIVES:

- 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

 1. Create a web page with the following using HTML.

- 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.

2. Create a web page with the following.
a. Cascading style sheets.   b. Embedded style sheets.   c. Inline style sheets.
Use our college information for the web pages.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Write programs in Java using Servlets:

- To invoke servlets from HTML forms.
- Session Tracking.

5. Write programs in Java to create three-tier applications using JSP/Servlets and Databases

- 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.

6. Programs using XML – Schema – XSLT/XSL.

7. Create a website with Node.js/AngularJS Frameworks

	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", Addison-Wesley, Second Edition, 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", Pearson Education, Fifth Edition, 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", First Edition, 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
		2	0	2	3

COURSEOBJECTIVES:

- 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:

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 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.

Inplant/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.
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

COURSEOBJECTIVES:

- 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 Programing with C++", Tata McGraw Hill Education Pvt.Ltd, Eighth Edition, 2020.

2.	Anthony Williams, "C++ Concurrency in Action", Manning Publications, Second Edition 2019.

REFERENCES:	
1.	Bjarne Stroustrup, "A Tour of C++", Pearson Education, Second Edition, 2018.
2.	Scott Meyers, "Effective Modern C++", O'Reilly Publication, December 2014.
3.	Stanely Lippman, Josee Lajoie, Barbara Moo, "C++ Primer", Pearson Education, Fifth Edition, 2012.
4.	Bjarne Stroustrup, The C++ Programming Language, Pearson Education, Fourth Edition 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	2	2	2

3-High, 2- Medium, 1-Low

AC22501	**ENTREPRENEURSHIP DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSEOBJECTIVES:

- Explaining the types, characteristics of entrepreneurship and its role in economic development.
- Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
- Selecting the appropriate form of business ownership in setting up an enterprise.
- Applying the fundamental concepts of finance and accounting to enterprise.
- Identifying 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", Thomson learning, Sixth edition, 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" Dream tech, Second Edition, 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

COURSEOBJECTIVES:
- 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

PROFESSIONAL ELECTIVES

VERTICAL 1: BIG DATA & DATA ANALYTICS

CS22511	DATA MINING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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

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", Elsevier, Fourth Edition, 2016.

REFERENCES:

1.	K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2021.
2.	G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy 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 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	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**

COURSEOBJECTIVES:

- 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", Kindle Edition, Apress, 2018.
2.	Kristina Chodorow, "MongoDB: The Definitive Guide-Powerful and Scalable Data Storage", Second Edition, 2020.

REFERENCES:

1.	Eelco Plugge, Peter Membrey, "The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing", Kindle Edition, 2013.
2.	Sadalage, P. & Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Wiley Publications, First Edition, 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 Harizopoulas, "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, 2019.
2.	V K Jain, " Big Data and Hadoop", Khanna Publisers, 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.	Sadalage, Pramod J. "NoSQL distilled", 2013
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**

COURSEOBJECTIVES:

- 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

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.

2 Visualize each variable in diabetes or any other dataset using Line Plot, Scatter Plot, Bar Plot, Pair Plot, Correlation Matrix and Heatmap

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.

4. Perform Time Series Analysis and apply the various visualization techniques.

5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse, Rollover effect, user interaction, etc.

6.Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.

7. Perform EDA on Wine Quality Data Set.

8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

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", First Edition, 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, First Edition, 2023 (Practical exercises)
.5	Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 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	-	-		-	-	-	-				-	-	-	-
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

COURSEOBJECTIVES:

- 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.

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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

COURSEOBJECTIVES:

- 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-speralct 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, First Edition, 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", Pearson Education, Second Edition, 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

VERTICAL 2: COMPUTATIONAL INTELLIGENCE

CS22521	SOFT COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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.

PRACTICAL EXERCISES	30 PERIODS

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

TOTAL: 30 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", First Edition, McGraw Hill, 2018.
2.	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2011.
3.	Samir Roy, Udit Chakraborthy, "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:

- 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

PRACTICAL EXERCISES	30 PERIODS

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.

TOTAL: 30 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", 2022. |

REFERENCES:

1.	Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", 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, 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:

- 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

1. OpenCV Installation and working with Python
2. Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb 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

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", Springer- Texts in Computer Science, Second Edition, 2022.
2.	D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, Second Edition, 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

COURSEOBJECTIVES:

- 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	6

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	6

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	6

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	6

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

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, December 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

COURSEOBJECTIVES:
- 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", First Edition, Chapman and Hall/CRC, 2018.
2.	David Goldberg, "Genetic Algorithms in search, optimization machine leaning", 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

- 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	6

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).

PRACTICAL EXERCISES

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 Indurkhya 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 ANDCYBER SECURITY

CS22531	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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

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, 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, New Delhi, 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
COURSEOBJECTIVES:					

- 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

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 Maltego
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 Fail2banto 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 pocket 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:

- 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	6

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	6

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

1.Working of semantic web and how it is useful for developers. Show with an example or case study.

2. Representation of OWL Ontology.

3.Provide the Ontological Representation of Social individuals

4.Provide the Ontological Representation of Social relationships

5.Use Gephi, for quick analysis of relatively small network data .

6.Use NetworkX, an extensive Python package for network analysis that can handle larger network datasets and computations.

7.Perform Knowledge representation of Semantic Web.

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.	Franziska Keller, Lu Zheng, and Song Yang, "Social Network Analysis: Methods and Examples", 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", First Edition, Springer, 2011.
4.	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2010.
5.	Borko Furht, "Handbook of Social Network Technologies and Applications", First Edition, 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

COURSEOBJECTIVES:

- 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 – Honeypots.

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, Kent Backman, and James E. Corley, "Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning", Third Edition, 2016.
2.	Hein smith & Hillary Morrison, "Ethical Hacking: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking", 2018.

REFERENCES:	
1.	Roger Grimes, Wiley, "Hacking the Hacker: Learn From the Experts Who Take Down Hackers", 2017.
2.	Matthew Hickey, Jennifer Arcuri, "Hands on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming", First Edition, Wiley, 2020.
3.	Kimberly Graves, "CEH official Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 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", 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:					
• 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

1. Study and Explore the following forensic tools:
(a) FTK Imager
(b) Autopsy
(c)EnCase Forensic Imager
(d) LastActivityView
(e) USBDeview
2. Recover deleted files using FTKImager
3. Acquire forensic image of hard disk using EnCase Forensics Imager and also perform integrity
checking/validation
4. Restore the Evidence Image using EnCase Forensics Imager.
5. Study the following:
(a) Collect Email Evidence in Victim PC.
(b) Extract Browser Artifacts (ChromeHistory view for Google Chrome)
6. Use USBDeview to find the last connected USB to the system
7. Perform Live Forensics Case Investigation using Autopsy
8. Study Email Tracking and EmailTracing and write a report on them.

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", Cengage Learning, India Sixth Edition, 2019.
2.	Kimberly Graves, "CEH official Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 2021.

REFERENCES:

1.	Dejey, S. Murugan , "Cyber Forensics", Oxford University Press, India, 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.Brancik "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**

COURSEOBJECTIVES:

- 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:	Understand 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, First Edition, 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; Illustrated Edition, 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 DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSEOBJECTIVES:

- 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

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", Addison-Wesley, Second Edition, 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; First Edition, 2018.
3.	Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, Second Edition, 2018.
4.	Jon Duckett, "HTML and CSS-Design and Build Websites", John Wiley Sons, 2011.
5.	Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, "MongoDB in Action", Manning Publication, Second Edition, 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

COURSEOBJECTIVES:

- 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	
	• 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	6

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	6

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	6

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	6

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	6

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

1. Create a website with HTML and CSS
2. Construct simple web pages in PHP
3. Form Handling in PHP
4. Form Validation in PHP
5. Implement OOP features in PHP
6. Use cookies and sessions to store some data in the browser and pass it to the next request
7. Create an application in PHP with CRUD operations on database
8. 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.	Joel Murach, Mike Murach, "PHP and MySQL", Incorporated, 2014.
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:
- 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

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 Professional, 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	L	T	P	C
		2	0	2	3

COURSEOBJECTIVES:

- 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 Artificats, 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", 2020.
2.	Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 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", First Edition, 2015.
3.	David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for

	DevOps", Second Edition, 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, Kindle Edition, 2016.
5.	Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 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**

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

UNIT I	**FUNDAMENTALS OF WEB APPLICATION SECURITY**	**6**

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

UNIT II	**SECURE DEVELOPMENT AND DEPLOYMENT**	**6**

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

UNIT III	**SECURE API DEVELOPMENT**	**6**

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

UNIT IV	**VULNERABILITY ASSESSMENT AND PENETRATION TESTING**	**6**

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

UNIT V	HACKING TECHNIQUES AND TOOLS	6

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

30 PERIODS

PRACTICAL EXERCISES

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
    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", First Edition, O'Reilly Media, Inc, 2020.
2.	Neil Madden, "API Security in Action", Manning Publications Co., NY, USA, 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, USA, 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, 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

COURSEOBJECTIVES:
- 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", Pearson Education, Fifth Edition, 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
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

COURSEOBJECTIVES:

- 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, RMMM 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, 2023.
2.	Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education Asia, 2017.

REFERENCES:	
1.	Roger S. Pressman, "Object-Oriented Software Engineering: An Agile Unified Methodology", First Edition, Mc Graw-Hill International Edition, 2014.
2.	Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", Third Edition, 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

COURSEOBJECTIVES:

- 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", 2022
2.	Neal Ford, "Fundamentals of Software Architecture: An Engineering Approach", 2020.

REFERENCES:

1.	Martin Fowler, "UML distilled: A Brief Guide to the Standard Object Modeling Language", Addison Wesley, Third Edition, 2018.
2.	Gandharba Swain, "Object-Oriented Analysis and Design Through Unified Modeling Language", 2010.
3.	Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", Third Edition, 2012.
4.	John Hunt, "The Unified Process for Practitioners Object-Oriented Design, UML and Java", Springer, 2013.
5.	Alex Nordeen, "Learn UML in 24 Hours", 2020.

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CO1	3	2	2	-	1	-	-	-	-	-	-	-	3	-	-

CO2	3	2	2	-	1	-	-	-	-	-	-	-	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

COURSEOBJECTIVES:

- 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, 2021.
2.	Dorothy Graham, Rex Black, Erik van Veenendaal, "Foundations of Software Testing: ISTQB Certification", 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, 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 Incorporated, 2022.

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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	-	-
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:
- 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

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", 2021.
2.	Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First Edition, Syngress Publishing, 2011.

REFERENCES:

1.	Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First Edition, 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", Kindle Edition, McGraw Hill, 2012
5.	Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, 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

COURSEOBJECTIVES:

- 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 COMPONENETS 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 developmenting - 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 st 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:

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 report 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 andPayment 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 thepackage.

 a. The User Selects the Package.

 b. The User calculates the VAT amount applicable with respect to the countryselection.

 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 thesystem.

– List out the enhancement point which can avail user more flexibility about one ofthe 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 sanbox environment access shouldbe available.

– Prepare the Test Plan for the above with all the possible criteria need to beconsidered.

– 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", Wiley. Third Edition, 2018.

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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
		2	0	2	3

COURSEOBJECTIVES:

- 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, New Delhi, 2018.
2.	Moh'd A. Radaideh, "Software Project Management: With PMI, IEEE-CS, and Agile-SCRUM", 2023.
REFERENCES:	
1.	Shailesh Mehta, "Project Management and Tools & Technologies – An overview", First Edition, SPD 2017.
2.	Subramanian Chandramouli, "Software Project Management", Pearson Education, 2015.
3.	Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.
4.	Walker Royce, Barry Boehm, "Software Project Management: A Unified Framework", Pearson 2013.
5.	Robert K. Wysocki, "Effective Software Project Management" Wiley Publication, 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	-	-	-	-	-	-	-	-	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