S.A ENGINEERING COLLEGE, CHENNAI – 77

(Autonomous- Institute Level Research Centre, Affiliated to Anna University)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REGULATION-2024

CHOICE BASED CREDIT SYSTEM
CURRICULUM & SYLLABUS

+

S.A. ENGINEERING COLLEGE- CHENNAI-77

(Autonomous- Institute Level Research Centre, Affiliated to Anna University)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION OF THE DEPARTMENT

To pioneer in the emerging areas of Computer Science and Engineering education and research, fostering innovation, ethical values, sustainable technologies that advance the digital world and improve societal well-being.

MISSION OF THE DEPARTMENT

1. **Educational Excellence:**

   To provide a transformative learning experience that integrates theory with practical skills, fostering creativity, critical thinking, and lifelong learning in Computer Science and Engineering.

2. **Innovative Research:**

   To promote research and interdisciplinary collaboration, addressing contemporary challenges in technology and society.

3. **Sustainable and Ethical Practices:**

   To facilitate the development of sustainable technological solutions with ethical practices that positively impact the environment and society.

4. **Industry and Society:**

   To build partnerships with industry and stakeholders, enhancing the employability and entrepreneurial spirit of students, while contributing to technological and societal advancement.

S.A. ENGINEERING COLLEGE- CHENNAI-77

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Graduates shall have professional competency in the field of Computer Science and Engineering for pursuing higher education, research or as entrepreneurs.

PEO 2: Graduates shall work in a business environment with ethical standards, leadership qualities and communication necessary for engineering principles.

PEO 3: Graduates shall adapt to emerging technologies and respond to the challenges of the environment and society forever.

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Apply mathematical foundations, management principles and computational concepts to design and develop efficient solutions for complex technical challenges, adhering to ethical standards and sustainable practices.

PSO 2: Analyze and design computer programs in domains such as algorithms, networking, web development, cloud computing, IoT, machine learning etc., for the development of computer- based systems with varying levels of complexity providing practical, industry-relevant solutions to meet societal and organizational needs.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually based mathematics, numerical analysis, data analysis, statistics, and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole- life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

SEMESTER- I

S.NO	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TA3101	Heritage of Tamils	HSMC	1	0	0	1	1
2.	HS3101	Professional English I	HSMC	3	0	0	3	3
3.	MA3101	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3101	Engineering Physics	BSC	3	0	0	3	3
5.	CY3101	Chemistry for Engineers	BSC	3	0	0	3	3
6.	CS3101	Programming for Problem Solving using C	ESC	3	0	0	3	3
PRACTICALS								
7.	BS3101	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
8.	CS3102	Programming for Problem Solving using C Laboratory	ESC	0	0	4	4	2
9.	GE3201	Engineering Practices Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**1**	**12**	**29**	**23**

SEMESTER-II

S.NO	SUBJECT CODE	SUBJECT	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3201	Professional English II	HSMC	3	0	0	3	3
2.	MA3202	Discrete Mathematics	BSC	3	1	0	4	4
3.	PH3201	Physics for Information Science	BSC	3	0	0	3	3
4.	CS3201	Programming in Python	ESC	3	0	0	3	3
5.	CS3202	Essentials and Practices of Software Development (Lab Integrated)	ESC	3	0	2	5	4
6.	TA3201	Tamils and Technology	HSMC	1	0	0	1	1
7.	ME3101	Engineering Graphics	ESC	2	0	2	4	3
PRACTICALS								
8.	CS3203	Programming in Python Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
9.	CY3201	Environmental Sciences and Sustainability	MC	1	0	0	1	1
			TOTAL	**19**	**1**	**8**	**28**	**24**

SEMESTER III

S. NO	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3305	Algebra and Number Theory	BSC	3	1	0	4	4
2.	CS3301	Data Structures	PCC	3	0	0	3	3
3.	CS3302	Digital Principles and Computer Organization	PCC	3	0	0	3	3
4.	CS3303	Design thinking	PCC	2	1	0	3	3
5.	IT3304	Object Oriented Programming	PCC	3	0	0	3	3
PRACTICALS								
6.	CS3304	Data Structures Laboratory	PCC	0	0	3	3	1.5
7.	IT3306	Object Oriented Programming Laboratory	PCC	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
8.	HS3303	English Language Enhancement and Business Communication Laboratory	EEC	0	0	3	3	1.5
9.	CS33PT	Aptitude Skills-I	EEC	0	0	3	3	0
10.	CS33VAC	Value Added Course-I	EEC	0	0	3	3	0
			TOTAL	**14**	**2**	**15**	**31**	**20.5**

SEMESTER IV

S. NO.	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3401	Probability and Statistics	BSC	3	1	0	4	4
2.	CS3401	Computer Networks (Lab Integrated)	PCC	3	0	2	5	4
3.	IT3402	Database Management Systems	PCC	3	0	0	3	3
4.	CS3402	Design and Analysis of Algorithm (Lab Integrated)	PCC	3	0	2	5	4
5.	CS3403	Operating Systems	PCC	3	0	0	3	3
6.	HS3401	Universal Human Values - II: Understanding Harmony and Ethical Human Conduct	HSMC	2	1	0	3	3
PRACTICALS								
7.	IT3403	Database Management Systems Laboratory	PCC	0	0	3	3	1.5
8.	CS3404	Operating Systems Laboratory	PCC	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
9	CS34PT	Aptitude Skills-II	EEC	0	0	3	3	0
10	CS34VAC	Value added Course-II	EEC	0	0	3	3	0
			TOTAL	**17**	**2**	**16**	**35**	**24**

SEMESTER V

S. NO.	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3501	Object Oriented Software Engineering (Lab Integrated)	PCC	3	0	2	5	4
2.	CS3502	Data Science (Lab Integrated)	PCC	3	0	2	5	4
3.	CS3503	Theory of computation	PCC	3	0	0	3	3
4.		Professional Elective I	PEC	3	0	0	3	3
5.		Professional Elective II	PEC	3	0	0	3	3
6.		Open Elective I	OEC	3	0	0	3	3
PRACTICALS								
7	HS3505	Professional and Career Development Laboratory	EEC	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
8.	CS35PT	Advanced Coding Skills-I	EEC	0	0	3	3	0
9.	CS35VAC	Value added Course-III	EEC	0	0	3	3	0
			TOTAL	**18**	**0**	**12**	**30**	**21.5**

SEMESTER VI

S. NO	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3601	Compiler Design (Lab Integrated)	PCC	3	0	2	5	4
2.	CS3602	Web Technologies	PCC	3	0	0	3	3
3.	CS3603	Artificial Intelligence and Machine Learning (Lab Integrated)	PCC	3	0	2	5	4
4		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
6		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
7.	CS3604	Web Technologies Laboratory	PCC	0	0	3	3	1.5
8	CS3605	Mobile Application Development Laboratory	PCC	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
9	CS36PT	Advanced Coding Skills-II	EEC	0	0	3	3	0
10.	CS36VAC	Value added Course-IV	EEC	0	0	3	3	0
11.	CS36SLC	Self Learning Course (MOOC Courses)	EEC					1*
TOTAL				**18**	**0**	**16**	**34**	**23**

SEMESTER VII

S. NO	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3701	Cryptography and Cyber Security (Lab Integrated)	PCC	3	0	2	5	4
2.	CS3702	Ethical Hacking and Penetration Testing	PCC	3	0	0	3	3
3.	CS3703	Cloud Computing (Lab Integrated)	PCC	3	0	2	5	4
4.		Climate Change and Sustainability	MC	2	0	0	2	0
5.		Professional Elective V	PEC	3	0	0	3	3
6.		Professional Elective VI	PEC	3	0	0	3	3
EMPLOYABILITY ENHANCEMENT COURSES								
7.	CS3704	Project work I	EEC	0	0	4	4	2
8.	CS37INT	Summer internship	EEC	0	0	0	0	2
9.	CS37VAC	Value added Course-V	EEC	0	0	3	3	0
10.	CS37PLT	Advanced coding skills-V	EEC	0	0	3	3	0
MANDATORY COURSES								
11.	MC3701	Indian Constitution	MC	2	0	0	2	0
			TOTAL	**19**	**0**	**14**	**33**	**21**

SEMESTER VIII

S. NO	SUBJECT CODE	SUBJECT	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CS3801	Project Work II	EEC	0	0	16	16	8
			TOTAL	**0**	**0**	**16**	**16**	**8**

PROFESSIONAL ELECTIVE I

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3504	Information Security and Management	PE	3	0	0	3	3
2.	CS3505	Business Analytics	PE	3	0	0	3	3
3.	CS3506	Multimedia and animation	PE	3	0	0	3	3
4.	CS3507	3D Printing and Design	PE	3	0	0	3	3
5.	CS3508	UI / UX Design and Human Centered Design	PE	3	0	0	3	3

PROFESSIONAL ELECTIVE II

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3509	Digital and Mobile Forensics	PE	3	0	0	3	3
2.	CS3510	Social Network Analysis	PE	3	0	0	3	3
3.	CS3511	Augmented Reality and Virtual Reality	PE	3	0	0	3	3
4.	CS3512	Robotic Process Automation	PE	3	0	0	3	3
5.	CS3513	Software Testing and Automation	PE	3	0	0	3	3

PROFESSIONAL ELECTIVE III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3606	Recommender System	PE	3	0	0	3	3
2.	CS3607	Video Creation and Editing	PE	3	0	0	3	3
3.	CS3608	Fundamentals of Internet of Things	PE	3	0	0	3	3
4.	CS3609	Web Application Security	PE	3	0	0	3	3
5.	CS3610	Principles of Management	PE	3	0	0	3	3

PROFESSIONAL ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CS3611	Network Firewall	PE	3	0	0	3	3
2.	CS3612	Text and Speech Analytics	PE	3	0	0	3	3
3.	CS3613	Visual Effects	PE	3	0	0	3	3
4.	CS3614	MERN Stack	PE	3	0	0	3	3
5.	CS3615	Digital Marketing	PE	3	0	0	3	3

OPEN ELECTIVE

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	OCS3501	Relational Database Systems	OE	3	0	0	3	3
2.	OCS3502	Creative Web Design	OE	3	0	0	3	3
3.	OCS3601	Principles of Operating Systems	OE	3	0	0	3	3
4.	OCS3602	Software Engineering Methodologies	OE	3	0	0	3	3

TOTAL CREDITS:165

SUMMARY

SL. NO	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL	PERCENTAGE
		I	II	III	IV	V	VI	VII	VIII		
1.	BSC	12	7	4	4					27	16.36
2.	ESC	7	12							19	11.5
3.	PCC			15	17	11	14	11		68	41.21
4.	PEC					6	6	6		18	10.91
5.	OEC					3	3			6	3.64
6.	EEC			1.5		1.5		4	8	15	9.09
7.	MC		1							1	0.00
8.	HSMC	4	4		3					11	7.27
TOTAL		23	24	20.5	24	21.5	23	21	8	165	-

HS3101	PROFESSIONAL ENGLISH - I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To improve the communicative competence of learners.
- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	9

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails and introduction to effective communication. **Listening** - Listening for gist, Innovative Video making; **Writing** - Writing emails, letters in general contexts. **Grammar** - Content vs Function words; Question types: Wh/ Yes or No/ and Tags. **Vocabulary** - Sentence Completion; Abbreviations & Acronyms (as used in technical contexts).

UNIT II	NARRATION AND SUMMATION	9

Reading - Reading biographies, travelogues, Excerpts from literature, **Writing** - Guided writing—Paragraph writing (Analytical, Narrative, Compare & Contrast), Short Report on an event (field trip etc.) **Grammar** –Tenses (All three tenses) Worksheet 2, Prepositions. **Vocabulary** - Word forms (prefixes & suffixes); Phrasal verbs. **Speaking**- Asking &Giving Directions. **Listening**-Listening to INK Talks.

UNIT III	DESCRIPTION OF A PROCESS/PRODUCT	9

Reading – Reading advertisements, gadget reviews and user manuals, reviewing a short story. **Writing** – Writing definitions; Instructions. **Grammar** – Subject-Verb agreement; Adjectives; Degrees of comparison; **Vocabulary** - Compound Nouns, discourse markers (connectives &sequence words).

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	9

Reading – Newspaper articles and Non Verbal Communication (tables, pie charts etc.) **Writing** –Note-making / Note-taking (*Study skills to be taught, not tested) Flash Cards; Writing recommendations; Transferring information from non- verbal (chart , graph etc. to verbal mode) **Grammar** – Articles; Pronouns - Possessive & Relative pronouns. **Vocabulary** – Collocation and Compound Nouns; Fixed/Semi fixed expressions.

UNIT V	EXPRESSION	9

Reading – Reading Sports Articles; and Opinion Blogs; **Writing** – Essay Writing (Descriptive or narrative). **Grammar** –Punctuation; and Simple, Compound & Complex Sentences. **Vocabulary** - Cause & Effect Expressions; **Speaking** - PPT preparation and poster presentation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- To use appropriate words in a professional and general context and read and infer the denotative and connotative meanings of technical contexts.
- To gain understanding of basic grammatical structures and use them in paragraph writing.
- To write definitions, descriptions and narrations.
- To interpret the information in any form and give probable suggestions
- To write essays on various topics and mind-map the ideas and post reviews in blogs, sites

TEXTBOOKS

1. English for Engineers & Technologists, Department of English, Anna University, Orient Blackswan Private Ltd. (2020 edition)
2. English for Science & Technology, Authored by Dr. VeenaSelvam, Dr. SujathaPriyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University, Cambridge University Press, 2021

REFERENCES

1.Technical Communication – Principles And Practices By Meenakshi Raman &Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2.A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt.Ltd.
3.English For Technical Communication (With CD) By AyshaViswamohan, Mcgraw Hill Education, ISBN: 0070264244.
4.Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5.Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.
6.English Grammar in Use – Raymond Murphy- Cambridge, Fifth edition

COs POs PSOs MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	1	2	2	2	3	1	2	-	-
CO2	-	-	-	-	1	1	2	1	3	-	1	-	-
CO3	-	-	-	-	1	1	-	-	3	1	1	-	-
CO4	-	-	-	-	2	1	1	2	3	1	2	-	-
CO5	-	-	-	-	2	1	2	1	3	-	2	-	-

1 - Low, 2 - medium, 3 - high, '-' – no correlation

MA3101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To introduce the concepts of Matrices which are needed for practical applications.
- To familiarize the students with differential calculus.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations of higher order that model in various engineering problems.
- To familiarize the student with functions of several variables that is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I	MATRICES	12

Eigen values and Eigen vectors of a real matrix – Properties of Eigen values - Cayley-Hamilton theorem (excluding proof) – Diagonalization of matrices - Reduction of Quadratic form to canonical form by using orthogonal transformation - Nature of a Quadratic form.

UNIT II	DIFFERENTIAL CALCULUS	12

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules Maxima and Minima of functions of one variable.

UNIT III	DIFFERENTIAL EQUATIONS	12

Higher order linear differential equations with constant coefficients- Method of undetermined coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT IV	MULTIVARIABLE CALCULUS	12

Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables– Lagrange's method of undetermined multipliers.

UNIT V	MULTIPLE INTEGRALS	12

Double integrals – Change of order of integration – Double integrals in polar co-ordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Use the matrix algebra methods to diagonalize the matrix.
- Apply differential calculus tools in solving various engineering problems
- Use both the limit definition and rules of differentiation to differentiate functions. apply differentiation to solve maxima and minima problems.
- The subject helps the students to develop the fundamentals and basic concepts in ODE
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.

TEXTBOOKS

1.M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson Education, 2017.
2.Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2016.

3.James Stewart, " Calculus : Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015.

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1.Bali,N.P., Goyal,M.,Watkins,C.,Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2.Boyce,W.E.,andDiPrima,R.C., Elementary Differential Equations and Boundary Value Problems,Wiley India, 2012.
3.Dennis G,Zill, Michael R.Cullen., "Differential Equations with boundary value problems", Cengage Learning, 7th Edition, New Delhi, 2009.
4.GeorgeB.ThomasJr.,MauriceD.Weir,JoelR.Hass,Thomas'Calculus:Early Transcendental, 13th Edition, Pearson Education, 2013.
5.O'Neil. P. V., "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
6.T.Veerarajan, Engineering Mathematics, Mc Grawhill Publications, New Delhi 2017.

CO's-PO's and PSO's MAPPING

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

1 - Low, 2 - medium, 3 - High, – no correlation

PH3101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand and identify different crystal structures and their imperfections
- To Explain the elastic and thermal properties of materials and understand their significance
- To Provide an overview of the production, detection and applications of ultrasound
- To Explain the origin of laser action, production of laser, fiber optics and their applications
- To Develop an understanding of quantum mechanical phenomena and their applications

UNIT I	CRYSTAL PHYSICS	9

Crystalline and Amorphous solids – single crystalline and Polycrystalline solids - Lattice – Unit cell– Bravais lattice – Lattice planes – Miller indices – interplanar spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Packing factor for SC, BCC, FCC and HCP structures – Crystal Defects – Point, line and Volume defects.

UNIT II	PROPERTIES OF MATTER AND THERMAL PHYSICS	9

Elasticity- Hooke's law - stress -strain diagram– Poisson's ratio –Factors affecting elasticity– Torsional stress & deformations – Twisting couple – Torsion pendulum - theory and experiment - Uniform & Non uniform bending: theory and experiment - I-shaped girders. Modes of heat transfer – conduction, convection and radiation - thermal conductivity-– Lee's disc method – Heat transfer application in Engineering.

UNIT III	ULTRASONICS AND NDT	9

Introduction – production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezo electric generator –properties –detection – cavitation –acoustic grating – velocity measurement – applications –Sonar –velocity of blood flow – NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X- ray radiography and fluoroscopy – Thermography- Strategies for minimizing transmission loss using coupling agents

UNIT IV	LASER AND FIBER OPTICS	9

Characteristics of Laser - spontaneous emission - stimulated emission- population inversion – pumping methods - conditions for Laser action - Types of lasers – Nd: YAG, He – Ne, Semiconductor Lasers – Homojunction diode Laser – Heterojunction diode Laser - Industrial and Medical Applications. Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle - Fibre Optical Communication system (Block diagram) – Mechanisms of Attenuation, Types of losses in fiber optic communication systems, , Applications of fiber optic communication system.

UNIT V	BASIC QUANTUM PHYSICS	9

Inadequacy of classical physics- Photons and light waves- Electrons and matter waves- G.P.Thomson Experiment- wave function and physical significance- Schrodinger wave equation (Time dependent and independent forms) – Application of one dimensional of box- Barrier penetration and quantum tunneling(qualitative)- Scanning tunneling microscope.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Analyze the crystal structures and their defects.
- Demonstrate and explain the general concepts of elastic and thermal properties of materials
- Analyze the applications of ultrasonic in engineering and medical disciplines
- Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication
- Understand the importance of quantum physics and apply quantum mechanical principles towards material diagnostics

TEXTBOOKS

1. Gaur R.K and Gupta, S.L, Engineering Physics, Dhanpat Rai Publishers, 2012.
2. Serway R.A and Jewett J.W, Physics for Scientists and Engineers, Cengage Learning, 2010.

REFERENCES

1. Halliday D, Resnick R and Walker J, Principles of Physics, Wiley, 2015.
2. Tipler P.A and Mosca G, Physics for Scientists and Engineers with Modern Physics, WH Freeman, 2007.
3. Avadhanulu M. N and Kshirsagar P. G, A Text Book of Engineering Physics, S. Chand & Co. Ltd., Ninth Revised Edition, 2012.
4. You tube link : https://www.youtube.com/watch?v=XEzJCuWfVuo
5. You tube link : https://www.youtube.com/watch?v=kIVfjRW-INM
6. You tube link : https://www.youtube.com/watch?v=nMfOo7HhybY

CO's-PO's and PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-

1- Low, 2 - Medium, 3 - High, – no correlation

CY3101	CHEMISTRY FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with hardness, boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of different advanced polymeric materials.
- To impart knowledge about the nanomaterial synthesis, properties and applications..
- It enables the students to gain information about Electrochemical reaction, corrosion and its prevention
- To make the students familiar with the different types of Engineering materials

UNIT I	WATER TREATMENT AND TECHNOLOGY	9

Introduction – Water quality parameters - Hardness of water – types – expression of hardness – units – Determination of Hardness by EDTA method. Boiler troubles (scale & sludge - Caustic Embrittlement) - Softening of hard water – external treatment process: Demineralization, internal treatment process: boiler compounds (phosphate, calgon and colloidal conditioning) – Application of Artificial intelligence in water treatment process - Desalination of brackish water by Reverse Osmosis.

UNIT II	ADVANCED POLYMERIC MATERIALS	9

Basics of Polymers -Definition, Classification, Properties. Advanced polymer introduction, preparation, properties and applications of:(1) Conducting Polymer-Nafion; (2) Polymer optical fiber - PMMA; (3) Piezoelectric polymer-PVDE: (4) Intelligent polymers- (a)Shape memory polymer (SMP) –Polyurethane (b) Self-Healing Polymers-Hydrogel (c) Electro active polymer-PANI.

UNIT III	NANOCHEMISTRY	9

Introduction to Nanoscience; Scope and General properties of bulk-materials and nanomaterials - Chemical methods of synthesis of Nanomaterials & its advantages - Chemical vapor deposition method, Precipitation method. Properties and applications of Nanowires, Nano rods, Nanotubes and Nano clusters.; CNTs-Single walled & Multi walled.CNTs. Nanomaterials for Green systems - Green materials including bio-materials,bio-polymers, Bioplastics and composites. Nanotech Materials for Truly Sustainable.
Construction: Windows, Skylights, and Lighting. Application of Nanomaterials (Medicine,Electronics, Catalyst and Agriculture).

UNIT IV	ELECTROCHEMISTRY AND CORROSION	9

Introduction – Cell terminology –Electrodes–origin of electrode potential–single electrode potential, standard electrode. Electrochemical cells- Electrochemical series and its applications. Electrochemical techniques for corrosion measurement.
Corrosion: Dry & wet corrosion – mechanism, Corrosion Control- Material selection and design aspects – corrosion prevention – corrosion inhibitors.

UNIT V	ENGINEERING MATERIALS	9

Alloys-Properties of alloys- Significance of alloying- ferrous alloys (stainless steel and carbon steels) - non-ferrous alloys (brass and bronze) - Special alloys (shape memory alloys). Lubricants - Characteristics of lubricants - viscosity, viscosity index, oiliness, flash point and fire point, cloud point and pour point - solid lubricant (graphite). Role of Machine learning in Materials selection.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Classify the hardness of water, identify related problems, implement appropriate treatment methods, and examine the role of AI in water treatment.
- Recognize the characteristics and applications of various polymeric materials.
- Classify the synthesis methods, properties, and applications of nanomaterials.
- Demonstrate electrochemical cells, classify types of corrosion, and utilize appropriate methods for corrosion control.
- Select the appropriate materials for Engineering applications.

TEXTBOOKS

1.Jain P.C. and Monica Jain, "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd., New Delhi, 2010

REFERENCES

1.Shashi Chawla, "Test book of engineering chemistry" Gagan Kapur,publishers, 2020.
2.K. Shree Meenakshi, "Engineering Chemistry", Bharathi Publishers,Chennai, 2021.
3. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1											
CO3	2	1											
CO4	2	2											
CO5	2	1											

1 - Low, 2 - medium, 3 - high, '-' – no correlation

CS3101	PROGRAMMING FOR PROBLEM SOLVING USING C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To develop C Programs with

- Basic programming constructs.
- Arrays and strings.
- Functions and pointers.
- Applications in C using structures.
- Input/output and file handling in C.

UNIT I	INTRODUCTION TO PROGRAMMING AND BASICS OF C PROGRAMMING	9

Introduction to programming paradigms. Introduction to components of a computer system, Idea and Representation of Algorithm, From algorithms to programs. Introduction to C,C Programming: Tokens, Identifiers, Keywords, Data Types, Variables, Constants, Input/ Output statements, C Operators, Expressions, Type conversion. Control structures: Decision-making statements, Looping statements, Switch case, Break, Continue, goto statements.

UNIT II	ARRAYS AND STRINGS	9

Introduction to Arrays. One dimensional array: Declaration, Initialization, Accessing the elements, Bubble sort, Selection sort, Linear search, Binary search. Two-dimensional arrays: Declaration, Initialization, Accessing the elements, Matrix Operations (Addition, Scaling, Multiplication, Transpose). Strings: Reading, Writing, String handling functions, String Arrays.

UNIT III	FUNCTIONS AND POINTERS	9

Introduction to functions: Function prototype, function definition, function call, Built- in functions (string functions, math functions), User defined functions. Recursion, Types of Recursion, Computation of Sine series, Scientific calculator, Scope of variables, Storage Classes. Introduction to Pointers, Declaration, Null Pointers, Arrays of pointers, Parameter passing: Pass by value, Pass by reference.

UNIT IV	STRUCTURES	9

Introduction to Structures, Declaration, Initialization, Accessing members. Nested Structures. Arrays of structures. Structures and functions. Pointers to structures. Unions. Programs using structures and Unions, Enumerated data type. Dynamic Memory Allocation.

UNIT V	FILE PROCESSING AND GRAPHICS PROGRAMMING	9

Introduction to Files, Types of files: text file, binary file. File operations: open, close, read, write, append. Sequential access file, Random access file, Introduction to Graphics Programming in C basic concepts in graphics programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Demonstrate simple applications in C using basic constructs
- Design and implement applications using arrays and strings
- Design and implement applications in C using functions and pointers.
- Develop applications in C using structures.
- Create applications using sequential and random-access file Processing.

TEXTBOOKS

1. Reema Thareja,"Programming in C", Oxford University Press, Second Edition, 2016.
2. Reema Thareja," Computer fundamentals and programming in C "Second Edition New 2016
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education,2006

REFERENCES

1. Paul Deitel and Harvey Deitel,"C How to Program", Seventh editin, Pearson Publication
2. Juneja,B.L and Anita Seth ,"Programming in C",CENGAGE Learning India pvt.Ltd., 2011
3. Pradip Dey ,Manas Ghosh, "Fundamentals of Computing and Programming in C" ,First Edition,OxfordUniversityPress,2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley(India)Pvt.Ltd.,PearsonEducationinSouthAsia,2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996. C", ,McGraw-HillEducation,1996.

CO's-PO's and PSO's MAPPING

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	2	-	2	-	-	-	-	-	-	1	-
CO2	3	1	1	1	1	2	-	-	-	-	-	2	3
CO3	3	2	2	2	1	3	-	-	-	-	-	1	2
CO4	3	2	2	2	1	3	-	-	-	-	-	2	2
CO5	2	1	1	1	1	2	-	-	-	-	-	2	3

1- Low, 2 - Medium, 3 - High, – no correlation

TA3101	தமிழர் மரபு (Heritage of Tamils)	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To enable the students to gain information about Tamil and Literature.
- To develop an understanding of Heritage-Rock Art Paintings, Modern Art and Sculpture.
- To impart knowledge about Folk and Martial Arts.
- To familiarize the student with Thinai Concept of Tamils.
- To understand about the Contribution of Tamils to Indian National Movement and Indian Culture.

அலகு - 1 மொழி மற்றும் இலக்கியம். இந்திய மொழிக் குடும்பங்கள்- திராவிட மொழிகள்- தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள், சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை- சங்க இலக்கியத்தில் அறம். திருக்குறளில் மேலாண்மை கருத்துக்கள்- தமிழ் காப்பியங்கள், தமிழகத்தில், சமண பௌத்த சமயங்களில் தாக்கம்-பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்.சிற்றிலக்கியங்கள்- தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி- தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	**3**
அலகு-2 மரபு-பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை- சிற்பக் கலை. நடுகல் முதல் நவீன சிற்பங்கள் வரை- ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள். பொம்மைகள்- தேர் செய்யும் கலை- சுடுமண் சிற்பங்கள்-நாட்டுப்புற தெய்வங்கள், குமரிமுனையில் திருவள்ளுவர் சிலை.இசை கருவிகள்- மிருதங்கம்,பறை, வீணை, யாழ், நாதஸ்வரம்- தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	**3**
அலகு – 3 நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள். தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு.கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவை கூத்து, சிலம்பாட்டம்.வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	**3**
அலகு – 4 தமிழர்களின் திணை கோட்பாடுகள். தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள்.தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும். சங்க கால நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.	**3**

அலகு - 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு. இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின பிற்பகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம்.சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு.கல்வெட்டுக்கள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	**3**
	TOTAL: 15 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Explain the development of Tamil as a classical language and Literature
- Explore about Tamil Heritage and Sculptures,Role of temples
- Appreciate Sports and games of Tamils
- Perceive Thinai concept of Tamils and literacy during Sangam Age
- Describe the Contribution of Tamils to National Movement and Indian Culture

TEXT – CUM – REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித்தமிழ்- முனைவர். இலசுந்தரம் (விகடன்பிரசுரம்).

3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு).

4. பொருநை - ஆற்றங்கரை நாகரிகம்.(தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilizationon the banks of river Vaigai'(Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

TA3101	தமிழர் மரபு (Heritage of Tamils)	L	T	P	C
		1	0	0	1

UNIT–I	LANGUAGE AND LITERATURE	3

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

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

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple carmaking - 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,Tigerdance-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

TEXT - CUM - REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ்- முனைவர். இலசுந்தரம் (விகடன்பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு).
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10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
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CO/PO /PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO.1	-	-	-	-	-	1	1	2	1	1	-	-	-
CO.2	-	-	-	-	-	2	2	1	1	1	-	-	-
CO.3	-	-	-	-	-	1	2	2	2	1	-	-	-
CO.4	-	-	-	-	-	1	2	2	1	1	-	-	-
CO.5	-	-	-	-	-	1	0	2	2	2	-	-	-

1 - Low, 2 - medium, 3 - high, '-' – no correlation

BS3101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics, and properties of matter for developing basic experimental skills.
- To impart the knowledge in the quantitative chemical analysis of water.
- To learn about the basics of instrumental analysis-conductivity meter, and potentiometer.
- Examine the chloride content in water sample.

LIST OF EXPERIMENTS(PHYSICS)(A minimum of 5 experiments to be performed from the given list)

1. Determination of Young's modulus of the material of the given beam by uniform bending method.
2. Determination of rigidity modulus of the material of the given wire using torsion pendulum.
3. Determination of velocity of sound in the given liquid and compressibility of the liquid using Ultrasonic interferometer.
4. Determination of wavelength of laser, Numerical aperture, and acceptance angle of an optical fiber
5. Determination of energy band gap of the semiconductor.
6. Determination of coefficient of thermal conductivity of the given bad conductor using Lee's disc.
7. Determination of Solar cell characteristics

LIST OF EXPERIMENTS(CHEMISTRY)(A minimum of 5 experiments to be performed from the given list)

1. Determination of total, temporary & permanent hardness of water by
2. EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Estimation of sulphate ion in drinking water by Conductivity method
5. Estimation of iron content of the given solution using potentiometer.
6. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
7. Conductometric titration of strong acid vs strong base.
8. Determination of chloride content of water sample by Argentometric method.

TOTAL: 20 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Understand the functioning of various Physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Solve problems individually and collaboratively.
- Apply hands-on knowledge in the quantitative chemical analysis of water. Carry out the basics of instrumental analysis-conductivity meter, and potentiometer.

TEXTBOOKS

1. J.D. Wilson& C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.
2. M.N. Srinivasan, S. Balasubramanian &R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

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1. https://www.vlab.co.in/broad-area-physical-sciences
2. https://vlab.amrita.edu/?sub=1

CO's PO's and PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-

CO4	2	1	1	1	-	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, – no correlation

CS3102	**PROGRAMMING FOR PROBLEM SOLVING USING C LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop programs in C using control statements.
- To develop applications in C using arrays, strings, pointers.
- To develop applications in C using functions, structures.
- To develop applications in C using file processing

LIST OF EXPERIMENTS

1. Input and Output statements.

2. Control statements – Branching & Looping.

- Write a C program to generate Pascal's triangle.
- Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*,/,% and use Switch Statement)
- Write a C program to find the sum of individual digits of a positive integer.
- A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
- Write a C program to generate the first n terms of the sequence.
- Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
- Write a C program to swap Numbers Using Temporary Variables.

3.Arrays

- Write a C program to search an array element using linear search.
- Write a C program to find both the largest and smallest number in a list of integers.
- Write a C program that uses functions to perform the following:
- Addition of Two Matrices
- Multiplication of Two Matrices
- Write a C program to implement Bubble Sort.

4.Strings

- Write a C program that uses functions to perform following operations

(i)To insert a sub-string in to given main string from a given position.

(ii)To delete n Characters from a given position in a given string.

- Write a C program to determine if the given string is a palindrome or not

5.Functions &Pointers:

Write C programs that use recursive functions

(i) To find factorial of given number

(ii)To solve Towers of Hanoi Problem.

(iii)To swap the variables using call by value and call by reference.

6. Generate mark sheet of students using structures.

7. Compute Salary Slip for five employees using structures and functions Insert, Update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
HARDWARE: 30 terminals
SOFTWARE:C compiler

TOTAL: 60

COURSE OUTCOMES:
At the end of the course, the student will be able

- Simple applications making use of basic constructs
- Control statements.
- Involving Arrays, strings and pointers.
- Involving functions, and structures.
- Sequential and random access file processing.

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	2	-	-	-	-	-	-	1	-
CO2	3	1	1	1	1	2	-	-	-	-	-	2	3
CO3	3	2	2	2	1	3	-	-	-	-	-	1	2
CO4	3	2	2	2	1	3	-	-	-	-	-	2	2
CO5	2	1	1	1	1	2	-	-	-	-	-	2	3

1 - Low, 2 - medium, 3 - high, '-' – no correlation

GE3201	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES: The purpose of learning this course is to:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common Household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding Tee joint, Butt joint and lap job by using arc welding, Machining various process like drilling, Turning, tapping by using Lathe.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB

LIST OF EXPERIMENTS

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES **15**

PLUMBING WORK:

1. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2. Preparing plumbing line sketches.
3. Laying pipe connection to the suction side of a pump.
4. Laying pipe connection to the delivery side of a pump.
5. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

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

Wood Work Study:

1. Studying joints in door panels and wooden furniture
2. Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

1. Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin sockets.
2. Staircase wiring.
3. Fluorescent Lamp wiring with introduction to CFL and LED types.
4. Energy meter wiring and related calculations/ calibration.
5. Study of Iron Box wiring and assembly.
6. Study of Fan Regulator (Resistor type and electronic type using Diac/Triac/quadrac)
7. Study of emergency lamp wiring/Water heater.

GROUP – B (MECHANICAL & ELECTRONIC)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

1. Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
2. Demonstration of gas welding.

BASIC MACHINING WORK:

1. (simple)Turning.
2. (simple)Drilling.
3. (simple)Tapping.

SPECIAL MACHINES:

1. Demonstration on VMC Machine.
2. Demonstration on CNC Machine.

SHEET METAL WORK:

1. Making of a square tray.

FOUNDRY WORK:

1. Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

1. Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

1. Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

1. Study an element of smart phone.
2. Assembly and dismantle of LED TV.
3. Assembly and dismantle of computer/ laptop

Total Hours: 60 periods

COURSE OUTCOMES:

At the end of the course, the student will be able

- Draw pipe line plan; lay and connect various pipe fittings used in common Household plumbing work; Saw; plan; make joints in wood materials used in Common household wood work.
- Wire various electrical joints in common household electrical wire work.
- Ability to weld Tee joint, Butt joint and lap job by using arc welding, Machine various process like drilling, Turning, tapping by using Lathe and perform sheet metal works.
- Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB

CO's PO's and PSO's MAPPING

CO - PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2	-	3	-	-	2	-	-	-	3	2
CO2	3	-	2	-	3	2	-	2	2	-	-	3	2
CO3	3	2	-	-	3	2	-	-	2	-	-	2	2
CO4	3	-	-	2	3	-	-	-	2	-	2	2	-//

1 - Low, 2 - Medium, 3 - High, – no correlation

HS3201	PROFESSIONAL ENGLISH – II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their LSRW skills
- To engage learners in meaningful language activities to improve their LSRW skills
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I	MAKING PROFESSIONAL CORRESPONDENCE	9

Listening – Evaluative Listening: Advertisements, Product Descriptions,-Audio/video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison) **Speaking** – Marketing a product, Persuasive Speech Techniques **Reading** - Reading advertisements, user manuals, brochure **Vocabulary** – Contextual meaning of words **Writing** – Professional Responses for business communication letters- Open ended Essay **Grammar** – Numerical adjectives, Mixed Tenses, Prepositional phrases.

UNIT II	USING APPROPRIATE FORMS OF WORDS & VOICES	9

Listening - Listening to longer technical talks and completing– gap filling exercises; Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects **Speaking** – Describing and discussing the reasons of accidents or disasters based on news reports **Reading** - Reading longer technical texts–Extracts from Literature – Essays, Short stories, Biography **Writing**-Minutes of Meeting **Grammar** - Active Passive Voice transformations, Infinitive and Gerunds **Vocabulary** – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

UNIT III	PROBLEM SOLVING	9

Listening – Listening to / Watching movie scenes / documentaries depicting a technical problem and suggesting solutions **Speaking** – Group Discussion (based on case studies) – Techniques and Strategies **Reading** - Technical case studies in General News reports news reports etc. **Writing** – Checklists, Conversations about problems and solutions **Grammar** – Error correction, conditional sentences **Vocabulary** – Compound Words, Sentence Completion.

UNIT IV	REPORTING OF EVENTS AND RESEACH	9

Listening – Listening Comprehension based on news report and documentaries – Precise writing, Summarising **Speaking** – Interviewing, Presenting an oral report, Mini presentations on select topics **Reading** – Research Articles **Writing** – Transcoding, Accident Report, Survey Report **Grammar** – Reported Speech, Modals **Vocabulary** – Conjunctions - use of prepositions.

UNIT V	THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	9

Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance); **Speaking** – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; **Reading** – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; **Writing** – Job/Internship application – Cover letter & Resume; **Grammar** – Relative Clauses **Vocabulary** – Idioms.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Compare and contrast products and ideas in technical texts.
- Identify cause and effect in events, industrial processes through technical texts
- Analyze problems in order to arrive at feasible solutions and communicate them.
- Prepare a report of events and the processes of technical and industrial nature.
- Express their opinions in a planned and logical manner and draft effective job application letters and resumes in context of job search.

TEXTBOOKS

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. K. N. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

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1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V. N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr.V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji – Macmillan India Ltd. 1990, Delhi.

CO's PO's and PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
CO 1	-	-	-	-	2	1	1	2	3	1	3	-	-
CO 2	-	-	-	-	2	1	1	1	3	1	3	-	-
CO 3	-	-	-	-	2	1	1	2	3	2	3	-	-
CO 4	-	-	-	-	2	1	1	2	3	1	3	-	-
CO 5	-	-	-	-	3	1	1	2	3	1	3	-	-

1 - Low, 2 - Medium, 3 - High, – no correlation

MA3202	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To extend student ‘s logical and mathematical maturity and ability to deal with abstraction.
- To establish a solid foundation in set theory, lattices, and Boolean algebra
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.

UNIT I	LOGIC AND PROOFS	12

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

UNIT II	SET THEORY	12

Basic concepts – Algebra of sets – Types of relations and their properties – Relational matrix and the graph of a relation – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sub lattices – Boolean algebra – Homomorphism.

UNIT III	COMBINATORICS	12

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT IV	GRAPHS	12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths – Dijkstra's shortest path algorithm – Trees and their Properties.

UNIT V	ALGEBRAIC STRUCTURES	12

Algebraic systems – Definitions-Examples-Properties-Semi groups and monoids – Homomorphism’s- Groups – Subgroups – Normal subgroup and cosets – Lagrange‘s theorem – Codes and group codes – Basic notions of error correction-Error recovery in group codes.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able

- Construct mathematical arguments using logical connectives and quantifiers.
- Employ the concept of lattice to solve the problems in data mining.
- Apply properties of combinatorial structures and properties – know the basic techniques in combinatorics and counting.
- Identify the graphs and apply appropriate graph algorithms for solving computing problems.
- Implement the concepts of group structures in coding theory.

TEXTBOOKS

1. 1Rosen, K.H., "Discrete Mathematics and its Applications", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 7th Edition, Special Indian Edition, 2011.

2.Tremblay, J.P., and Manohar, R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 30th Reprint, 2nd Edition, 2011.

REFERENCES

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T., "Discrete Mathematics with Applications", Elsevier Publications, 1st Edition, 2006.

CO's PO's and PSO's MAPPING

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-

1- Low, 2 - medium, 3 - high, '-' – no correlation

PH 3201	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the transport properties of conducting materials and their modelling using classical and quantum theories.
- Acquire knowledge on basics of semiconductor physics and its application in various devices.
- Understand the origin of magnetism and data storage principles.
- Study the fundamentals of optical materials and their applications to display devices.
- Understand the basics of basics of quantum structures and their applications and basics of quantum computing.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory – Expression for electrical conductivity – Thermal conductivity – deduction of Wiedemann - Franz law – Success and drawbacks of classical free electron theory – Electrons in metals – Particle in a three dimensional box – degenerate states – Fermi - Dirac statistics – Density of energy states and carrier concentration in metals.

UNIT II	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors – Energy band diagram (qualitative) – Direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – Variation of carrier concentration with temperature - extrinsic semiconductors - N type and P type semiconductors (qualitative) – Hall Effect and Hall devices.

UNIT III	MAGNETIC MATERIALS AND DATA STORAGE PRINCIPLES	9

Magnetism- Magnetic dipole moment – magnetic permeability and susceptibility – Magnetic material classification: dia, para and ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory - M versus H behaviour – Hard and soft magnetic materials – Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor)- CD-ROM-WORM- -Holographic optical data storage.

UNIT IV	OPTICAL MATERIALS AND DISPLAY DEVICES	9

Classification of optical materials – carrier generation and recombination processes – Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) – LED – OLED - Photo detectors– Photo diodes and Photo conductors (concepts only) –Solar cell – Liquid crystal display - Charged Coupled Devices.

UNIT V	NANODEVICES AND QUANTUM COMPUTING	9

Introduction – quantum confinement – quantum structures: quantum wells, wires and dots – band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade – tunneling diode – single electron transistor (SET) – quantum system for information processing – quantum states – classical bits– quantum bits or qubits –multiple qubits –quantum gates – advantage of quantum computing over classical computing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Understand the transport properties of conducting materials through classical and quantum theories, including the Wiedemann-Franz law and Fermi-Dirac statistics.
- Recall and explain the fundamental concepts of intrinsic and extrinsic semiconductors, energy band diagrams, and the Hall effect.
- Understand the principles of magnetism, the classification of magnetic materials, and their role in data storage technologies.
- Comprehend the behavior of optical materials and their applications in display devices such as LEDs, OLEDs, and liquid crystal displays.
- Recognize the basics of quantum structures, tunneling phenomena, and the foundational concepts of quantum computing, including qubits and quantum gates.

TEXTBOOKS:

1. Adaptation by Balasubramanian, R, Callister's Material Science and Engineering, Wiley India Pvt .Ltd., 2ndEdition, 2014.
2. Kasap,S.O., Principles of Electronic Materials and Devices, (Special Indian Edition) McGrawHill Education, 3rd Edition, 2017.
3. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.
4. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007.

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1. Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Pearson, 2ndEdition, 2017.
2. Umesh K Mishra & Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2008.
3. Wahab,M.A.,Solid State Physics: Structure & Properties of Materials, Narosa Publishing House, 2009.
4. Gaur, R.K. & Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
5. Salivahanan,S.,Rajalakshmi,A.,Karthie,S.,Rajesh,N.P., Physics for Electronics Engineering &Information Science, McGraw Hill (India) Private Limited, 2018.

CO's PO's and PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - medium, 3 - high, '-' – no correlation

CS3201	PROGRAMMING IN PYTHON	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the basics of python Programming
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To use Object Oriented Programming concepts in Python.

UNIT I	INTRODUCTION TO PYTHON PROGRAMMING	9

Introduction to Python, Program Verses Script, Compiler Verses Interpreter, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions. String: Formatting, Comparison, Slicing, Splitting. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points, exponentiation.

UNIT II	CONTROL STRUCTURES AND FUNCTIONS	9

Selective statements – Iterative statements - Function: definition, call, return statement, parameters and arguments types (required, keyword, default, variable length), local and global scope, function composition, recursion, lambda functions.
Illustrative programs: square root, gcd, sum an array of numbers, linear search, binary search.

UNIT III	LISTS, TUPLES, DICTIONARIES AND SET	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; advanced list processing - list comprehension ;Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; Set operations. Illustrative programs: Students marks statement, Retail bill preparation, Intersection, Union, Symmetric Difference between sets.

UNIT IV	FILES AND EXCEPTION	9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions,
handling exceptions, multiple except block, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation

UNIT V	INTRODUCTION TO OBJECT ORIENTED PROGRAMMING USING PYTHON	9

Introduction, Features of Object Oriented Programming, Merits and Demerits of Object Oriented Programming Language. Class and Objects: Defining classes, object creation, variables, public and private data members, class methods, static methods; Illustrative programs: Display student information using class and object, Deposit or Withdraw money in a bank account.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

At the end of the course, the student will be able

- Understand the basics of Python Programming.
- Be familiar with data expressions and statements.
- Recognize control flow and function problems.
- Comprehend lists, tuples and dictionaries.
- Read and write data from/to files and exceptions in Python Programs.

TEXTBOOKS

1. Reema Thareja, "Problem Solving and Programming with python", 2ndedition, Oxford University press, 2019.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python Shr off/ O'Reilly Publishers,2016 (http://greenteapress.com/wp/thinkpython/)
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2",
Network Theory Ltd., 2011.

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1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter- disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

CO's PO's and PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	1	1	1
CO2	3	3	2	2	2	-	-	-	-	-	2	1	1
CO3	3	3	2	2	2	-	-	-	-	-	2	1	1
CO4	3	3	2	2	2	-	-	-	-	-	2	-	-
CO5	3	3	2	2	2	-	-	-	-	-	2	-	-

1 - Low, 2 - medium, 3 - high, '-' – no correlation

CS3202	ESSENTIALS AND PRACTICES OF SOFTWARE DEVELOPMENT (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I	AGILE SOFTWARE DEVELOPMENT AND CLOUD REPOSITORY	9

The Software Process, Software Engineering Practice – A Generic Process Model Prescriptive Process Models - Agility –Agile Process – Extreme Programming – Other Agile Process Models – Tool set forAgile Process. Introduction to Git –Git Basics - Git Branching - Introduction to GitHub – Git Tools.

UNIT II	HYPERTEXT MARKUP LANGUAGE	9

Introduction – Web Basics – HTML Tags – Organizing a page with paragraphs and line breaks – Organizing content with Headings – Semantic Elements – HTML for responsive web design – HTML5.

UNIT III	CASCADING STYLE SHEETS	9

Introduction –Basic Style Sheet – CSS Style Primer – Internal Style Sheets and Inline Styles – Use CSS to style Hyperlinks – Use CSS to set Background, Text and Border Colors – CSS Box Model andPositioning – Lists, Text,and Navigation – Creating Layouts using CSS Techniques – CSS Outlines – CSS Transformations and Transitions.

UNIT IV	JAVASCRIPT BASICS	9

Basic Concepts – Syntax Rules — JavaScript Variables, Strings and Arrays – Controlling flow with conditions and loops

UNIT V	JAVASCRIPT OBJECTS	9

Understanding JSON – Working with the Document Object Model – DOM Structure – DOM Nodes – Responding to Events and using Windows.

LIST OF EXPERIMENTS

1. Form a Team, Decide on a project:
2. Create a repository in GitHub for the team.
3. Choose and follow a Git workflow
    - Each team member can create a Student Name text file with contents about them selvesand the team project
    - Each team member can create a branch, commit the file with a proper commit messageand push the branch to remote GitHub repository.
    - Team members can now create a Pull request to merge the branch to master branch or main development branch.
    - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.

- Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

4. Create a web page with at least three links to different web pages. Each of the web pages is tobe designed by a team member. Follow Git workflow, pull request and peer reviews.
5. Create web pages using the following:
    - Tables and Lists
    - Image map
    - Forms and Form elements
    - Frames
6. Apply Cascading style sheets for the web pages created.
7. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.
8. Implement Event Handling in the web pages.
9. Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.

Online assessment system
Ticket reservation system
Online shopping
Student management system
Library management Hospital management

THEORY:45 PERIODS
PRACTICALS :30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Apply agile development methods in software development practices.
- Set up and create a GitHub repository.
- Develop static and dynamic webpages using HTML.
- Design interactive personal or professional webpages using CSS.
- Develop web pages using Java script with event-handling mechanism.

TEXTBOOKS

1. Roger S. Pressman, “Software Engineering: A Practitioner„s Approach”, McGraw Hill International Edition, Nineth Edition, 2020.
2. Scott Chacon, Ben Straub, “Pro GIT”, Apress Publisher, 3rd Edition, 2014.
3. Jennifer Kyrnin, Julie C. Meloni, “Sams Teach Yourself HTML, CSS, and JavaScript All inOne”, Pearson, Third Edition, 2019.

REFERENCES

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5thEdition, 2018.
2. Roman Pichler, "Agile Product Management with Scrum Creating Products that CustomersLove", Pearson Education, 1 st Edition, 2010.
3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education,2011.
4. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
5. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
6. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India,2014.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735 _shared/overview
8. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0 13094421427470336209 9_shared/overview

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE:

Systems with either Netbeans or Eclipse Java/JSP/ISP Webserver/Apache Tomcat / MySQL / Dreamweaver or Equivalent/ Eclipse, WAMP/XAMP.

CO's-PO's and PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	-	2	-	-	2	-	-	-	2	3
CO 2	2	2	-	-	3	-	-	2	-	-	-	2	2
CO 3	3	1	2	-	2	-	-	-	-	-	-	3	2
CO 4	3	1	2	-	2	-	-	-	-	-	-	3	2
CO 5	3	1	2	-	2	-	-	-	-	-	-	3	2

1 - Low, 2 - medium, 3 - high, '-' – no correlation

TA3201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
	TAMILS AND TECHNOLOGY	**1**	**0**	**0**	**1**

COURSE OBJECTIVES:

- To introduce students to weaving and pottery technology of Sangam period.
- To Explore Tamil architectural construction techniques and their evolution.
- To Study the skills of ancient Tamils manufacturing technology.
- To know about traditional agriculture and irrigation technology.
- To describe the Scientific Tamil and Kanini Tamil, to know Role of Computer in Tamil Development.

அலகு 1 நெசவு மற்றும் பானைத் தொழில்நுட்பம் சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்புப் சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்	**3**
அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் சங்க காலத்தில் கட்டுமான பொருட்களும் நடு கல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள், மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - சோழர் காலத்துப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் கால கோவில்கள், மீனாட்சியம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.	**3**
அலகு 3 உற்பத்தி தொழில்நுட்பம் கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பு உருக்குதல், எஃகு - செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கம் தொழிற்சாலைகள் - கல் மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்பு துண்டுகள்- தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	**3**
அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் அணை - ஏரி, குளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவு சார் சமூகம்.	**3**
அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள்	**3**

உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	

TOTAL: 15 PERIODS

TEXT – CUM – REFERENCE BOOKS

1. *தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2. *கணினித்தமிழ்- முனைவர். இலசுந்தரம் (விகடன்பிரசுரம்).*
3. *கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு).*
4. *பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)*
5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilizationon the banks of river Vaigai'(Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

TA3201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
	TAMILS AND TECHNOLOGY	1	0	0	1

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

UNIT- III	MANUFACTURING TECHNOLOGY	3

Artof Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source ofhistory - Minting of Coins – Beadsmaking-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 student will be able

- Recognize the Weaving and pottery Technology during Sangam Age
- Explain the evolution of Tamil architectural and structural designs.
- Summarize the traditional Manufacturing process of the Tamils including metallurgy, shipbuilding, coin minting and bead making.
- Discuss the Agricultural practices and irrigation methods developed by the ancient Tamil society.
- Classify the developments in scientific Tamil and digital tools such as Tamil computing software and digital libraries.

TEXT – CUM – REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ்- முனைவர். இலசுந்தரம் (விகடன்பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilizationon the banks of river Vaigai'(Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

CO's PO's and PSO's MAPPING													
CO/ PO/ PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO2**
CO1	-	-	-	-	-	1	2	2	2	2	2	-	-
CO2	-	-	-	-	-	2	2	2	2	2	1	-	-
CO3	-	-	-	-	-	2	2	2	2	2	1	-	-
CO4	-	-	-	-	-	2	2	2	2	2	2	-	-
CO5	-	-	-	-	-	2	2	2	2	2	1	-	-

Low, 2 - Medium, 3 - High, – no correlation

ME3101	**ENGINEERING GRAPHICS**	**L – T - P**	**C**
		2 – 0 - 2	**3**
Course Objectives	• To develop in students, graphic skills for communication of concepts, ideas and design of engineering products. • To expose them to existing national standards related to technical drawings.		

Course Outcomes:

At the end of the course, the student will be able

- *Construct* plane curves and orthographic views using visualization principles and geometric constructions.
- *Apply* orthographic projection techniques to represent points, lines, and plane surfaces inclined to principal planes.
- *Construct* the projections of simple solids with their axes inclined to any one principal planes using the rotating object method.
- *Apply* sectioning and development techniques to determine the true shape of sectioned solids and their lateral surfaces.
- *Draw* isometric and perspective projections of simple and truncated solids to visualize three-dimensional objects.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications –Use of drafting instruments – BIS conventions and specifications – Size and layout of drawing sheets – Lettering and dimensioning.

UNIT 1 PLANE CURVES AND FREE HAND SKETCHING	**12**
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method– construction of cycloid– Drawing of tangents and normal to the above curves. Visualization principles – Layout of views- Orthographic projection of multiple views from pictorial views of objects-Principal planes.	
UNIT 2 PROJECTION OF POINTS STRAIGHT LINES AND PLANE SURFACES	**12**
Orthographic projections-principles-Principal planes-First angle projection-Projection of points-Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to one of the principal planes.	
UNIT 3 PROJECTION OF SOLIDS	**12**

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

UNIT 4 PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	**12**

Sectioning of Prisms, pyramids, cylinders and cones in simple vertical position - the cutting plane is inclined to 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 5 ISOMETRIC AND PERSPECTIVE PROJECTIONS	**12**

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

Total Periods	**60**

Text Books

1. NatrajanK.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai,2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

References

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition,2010.
2. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore,2007.
4. 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.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition,2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

CO's PO's and PSO's MAPPING													
CO/PO /PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1	-	1	-	-	-	1	2	-	3	2
CO2	3	3	2	1	1	-	-	-	1	2	-	3	2
CO3	3	3	2	1	1	-	-	1	1	2	-	3	3
CO4	3	3	2	1	2	-	-	-	1	2	-	3	3
CO5	2	3	3	-	1	1	-	2	2	2	1	3	3

Low, 2 - Medium, 3 - High, – no correlation

CS3203	PROGRAMMING IN PYTHON LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To study python programs with conditionals and loops.
- To use functions for python structured programs.
- Use strings for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- To read and write data from and to files in python.

LIST OF EXPERIMENTS:

1. Write a program to display the largest number among three numbers.
2. Write a program to display the Fibonacci series by using looping constructs.
3. Write a function to compute the GCD of two numbers.
4. Explore String Functions
5. With the help of strings, array or list, display a simple calendar in python program without using the calendar module.
6. With the help of list perform linear search and Binary search.
7. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters.
8. Programs that take command line arguments (word count)
9. Find the most frequent words in a text read from a file.
10. Write a program using Dictionaries to compute the following.
    i)Students marks statement,
    ii)Retail bill preparation,
11. Write a program using sets to compute
    the following. i)Intersection,
    ii)Union,
    iii)Symmetric Difference between sets.
12. Write a program using exceptions to calculate the following.
    i) Voter's age validation,
    ii) Marks range validation (0-100).
13. Write a program to Display student information using class and object.

14. Write a program to Deposit or Withdraw money in a bank account using class and objects

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
HARDWARE: 30 terminals
SOFTWARE: Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Design simple programs using conditionals and loops.
- Write functions to solve mathematical problems
- Use strings for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Identify to read and write data from and to files in python.

CO's PO's and PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	1	2	-	3	2
CO2	3	3	2	1	1	-	-	-	1	2	-	3	2
CO3	3	3	2	1	1	-	-	1	1	2	-	3	3
CO4	3	3	2	1	2	-	-	-	1	2	-	3	3
CO5	2	3	3	-	1	1	-	2	2	2	1	3	3

1 - Low, 2 - Medium, 3 - High, – no correlation

CY3201	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyse climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT- I	ENVIRONMENT AND BIODIVERSITY	6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, Human-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In- situ and ex-situ.

UNIT- II	**ENVIRONMENTAL POLLUTION**	**6**

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Artificial intelligence in pollution monitoring and management. Solid and E-Waste management. Disaster management –Flood, Land slide and Earth quake. Case studies .

UNIT -III	**RENEWABLE SOURCES OF ENERGY**	**6**

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy, Solar and wind energy.

UNIT -IV	**SUSTAINABILITY AND MANAGEMENT**	**6**

Sustainability- concept, needs and challenges-Economic and Social aspects of sustainability-from unsustainability to sustainability-millennium development goals, Sustainable Development Goals,Climate change-Green house effect,Global warming and Acid rain. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT- V	**SUSTAINABILITY PRACTICES**	**6**

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, reen materials, Sustainable development index, Sustainable transports. Sustainable energy: Green Engineering: Sustainable urbanization- Socio- economical and technological change.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able

- Recognize and infer the functions of environment, ecosystems and biodiversity and their conservation.
- Identify and explain the causes and effects of environmental pollution, natural disasters and demonstrate knowledge by proposing effective control or prevention measures.
- Identify renewable and non-renewable resources and explain sustainable measures to preserve them for future generations.
- Summarize the different goals of sustainable development and interpret sustainable measures to facilitate suitable technological advancements and societal development.
- Appreciate sustainability practices, identify green materials and the role of sustainable urbanization.

TEXTBOOKS

1.Anubha Kaushik and C. P. Kaushik‘s Perspectives in Environmental Studies‖, 7th Edition, New Age International Publishers ,2021

2..Benny Joseph, _Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2016.

3..Gilbert M.Masters, _Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education, 2004

4.Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case

Studies, Prentice Hall. 1st Edition 2011
5.Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, engage learning.

REFERENCES

1.Anubha Kaushik and C. P. Kaushik's Perspectives in Environmental Studies‖, 7th Edition, New Age International Publishers ,2021.
2. Benny Joseph, _Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 2016.
3..Gilbert M.Masters, _Introduction to Environmental Engineering and Science, 2nd edition, Pearson Education, 2004.
4.Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall. 1st Edition 2011.
5.Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, engage learning

CO's PO's and PSO's MAPPING

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO 1	1	1	-	-	-	1	-	-	-	-	-	-	-
CO 2	2	2	1	-	-	2	-	-	-	-	-	-	-
CO 3	2	1	1	-	-	1	-	-	-	-	-	-	-
CO 4	2	2	1	-	-	2	-	-	-	-	-	-	-
CO 5	2	1	1	-	-	1	-	-	-	-	-	-	-

1 - Low, 2 - medium, 3 - high, '-' – no correlation

MA3305	ALGEBRA AND NUMBER THEORY	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic notions of rings, fields which will then be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- To understand the basic concepts in number theory.
- To examine the key questions in the theory of numbers.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I	RINGS AND MODULAR ARITHMATIC	12

Rings: Definition – Properties-Simple problems -Sub rings – Integral domain – Field – Integer modulo n – Ring homomorphism.

UNIT II	FINITE FIELDS AND POLYNOMIALS	12

Rings – Polynomial rings – Irreducible polynomials over finite fields – Factorization of polynomials over inite fields.

UNIT III	DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS	12

Division algorithm – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT IV	DIOPHANTINE EQUATIONS AND CONGRUENCES	12

Linear Diophantine equations -Congruence‘s – Linear Congruence‘s – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems

UNIT V	CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS	12

Wilson‘s theorem – Fermat‘s little theorem – Euler‘s theorem -Euler‘s Phi functions – Tau and Sigma functions – The order of a positive Integer – Primality test – Primitive roots for Primes – Composite with Primitive roots – Quadratic residues

TOTAL PERIODS	60

COURSE OUTCOMES:

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

- Apply the basic notions rings, fields which will then be used to solve related problems.
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non – trivial problems related to the concepts, and by proving simple theorems about the statements proven by the text.
- Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

TEXTBOOKS:

1. 1.Grimaldi, R.P and Ramana, B.V., “Discrete and Combinatorial Mathematics”, Pearson Education, 5th Edition, New Delhi, 2007.
2. Koshy, T.,Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.

REFERENCES:

1. Lidl, R. and Pitz, G, “Applied Abstract Algebra”, Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Niven, I., Zuckerman.H.S., and Montgomery, H.L., ―An Introduction to Theory of
3. Numbers, John Wiley and Sons , Singapore, 2004.
4. San Ling and Chaoping Xing, ―Coding Theory – A first Course‖, Cambridge Publications,
5. Cambridge, 2004.

CS3301	DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To comprehend the foundational concepts of Abstract Data Types (ADTs).
- To acquire knowledge and apply linear data structures, including lists, stacks, and queues.
- To analyze and explain non-linear data structures such as trees and graphs.
- To examine and interpret sorting, searching, and hashing algorithms.
- To utilize and implement tree and graph structures in relevant applications and scenarios.

UNIT I	LINEAR DATA STRUCTURES – LIST	9

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

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9

Stack ADT –Array based Stacks, Linked Stacks– Applications- Balancing Symbols-Infix to postfix expression- Postfix Expression Evaluation– Queue ADT – Array based Queue, Linked Queue – Circular Queue –Double Ended Queues – Applications of queues.

UNIT III	NON LINEAR DATA STRUCTURES – TREES	9

Introduction to Tree ADT – Implementations of trees- Binary Tree ADT -Tree traversals -Expression Trees- Binary Search Tree ADT –Threaded Binary Trees- AVL Trees – Priority Queue – Heaps-Binary Heaps.

UNIT IV	MULTI WAY SEARCH TREE AND GRAPHS	9

Multi-way Search Trees- B-Tree- B+Tree- Graphs-Representations-Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS)-Topological Sort- Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	9

Searching- Linear Search – Binary Search. Sorting – Bubble Sort – Selection Sort – Insertion Sort – Quick Sort-Merge Sort-Shell Sort – Radix Sort-Heap Sort- Hashing- Hash Functions – Separate Chaining – Open Addressing- Rehashing – Extendible Hashing-Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Apply the concepts and operations associated with the List Abstract Data Type (ADT) in various scenarios.
- Understand and implement the concepts and operations of Stack and Queue ADTs.
- Analyze and demonstrate the knowledge of Tree ADTs and their applications in different contexts.
- Utilize graph data structures to address real-world problems and scenarios.
- Apply graph-based solutions to practical challenges.

TEXT BOOKS:-

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition, Oxford University Press, 2011

REFERENCES:-

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008.

CO's-PO's and PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	0	0	0	0	0	2	2	0
CO2	3	2	2	2	1	0	0	0	0	0	2	2	0
CO3	3	2	2	2	1	0	0	0	0	0	2	2	0
CO4	3	2	2	2	1	0	0	0	0	0	2	2	0
CO5	3	2	2	2	1	0	0	0	0	0	2	2	0

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CS3302	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To design and analyze clocked sequential circuits using both Moore and Mealy models.
- To understand the encoding of machine instructions and their role in computer operation.
- To gain knowledge of pipelined architecture in improving the efficiency and performance of digital systems.
- To understand the concept of various memories and I/O interfacing.

UNIT I	COMBINATIONAL CIRCUITS	9

Number Systems – representation – conversions – Arithmetic operations – Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers – Demultiplexers.

UNIT II	SYNCHRONOUS SEQUENTIAL LOGIC	9

Introduction to Sequential Circuits – Flip-Flops – Operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, State minimization, State assignment, Circuit implementation - Registers – Counters.

UNIT III	FUNDAMENTALS OF COMPUTER	9

Functional Units - Basic Operational Concepts - Eight great Ideas in Computer architecture - Performance - Instructions – Operations and Operands – Instruction representation – Arithmetic & Logical operations – control operations - Needs and types of various addressing modes- Flynn's Taxonomy– SIMD and MIMD systems.

UNIT IV	PROCESSOR AND CONTROL UNIT	9

Introduction- Building a data path for MIPS implementation –Control Implementation scheme – An Pipelining – Pipelined data path and control – Handling Data hazards &Control Hazards-Exceptions.

UNIT V	MEMORY & INPUT/ OUTPUT ORGANIZATION	9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Bus Arbitration-Buses-synchronous Bus-Asynchronous Bus- Standard I/O Interfaces-Universal serial Bus (USB).

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Design various combinational digital circuits using logic gates.
- Design sequential circuits and analyze the design procedures.
- Articulate the necessity of different addressing modes and apply them to various scenarios in execution instruction
- Analyze different types of control design using pipelining and identify hazards.
- Identify the characteristics of various memory systems and I/O communication.

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The

Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

CO's-PO's and PSO's MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	3	2	0	0	0	0	3	3		3	1
CO2	3	3	3	2	0	0	0	0	2	1		3	1
CO3	3	2	2	0	0	0	0	0	0	1		2	1
CO4	3	2	2	0	0	0	0	0	0	1		2	1
CO5	2	2	2	0	0	0	0	0	0	1		2	1

CS3303	DESIGN THINKING	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES:

- To learn design thinking concepts and principles
- To use design thinking methods in every stage of the problem
- To learn the different phases of design thinking
- To apply various methods in design thinking to different problems
- To understand DevOPs the advanced process of software engineering for faster problem resolution & team collaboration.

UNIT I	INTRODUCTION	9

The need for design - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.

UNIT II	UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM	9

Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

UNIT III	IDEATION AND PROTOTYPING	9

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

UNIT IV	TESTING AND IMPLEMENTATION	9

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.

UNIT V	SOFTWARE DESIGN USING DEVOPS	9

Applying Design Thinking in the DevOps Lifecycle-Empathy in DevOps-Problem Definition in a DevOps Environment-Ideation and Innovation in Continuous Integration-Prototyping and Continuous Deployment-Testing and Continuous Feedback-Collaborative Tools and Techniques.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Demonstrate an understanding of the fundamental concepts and principles of design thinking, including its significance in problem solving and innovation.
- Apply design thinking processes such as empathizing, defining, ideating, prototyping, and testing to address real-world challenges.
- Utilize various creativity techniques and tools to generate innovative ideas and develop effective prototypes in a structured design thinking environment.
- Conduct thorough problem analysis, empathetic observations, and customer needs assessments to accurately define and reformulate design problems.
- Integrate DevOps principles and tools into the design thinking process to enhance collaboration, automation, and efficiency in software development and delivery.

TEXT BOOKS:

1. Christian Mueller Roterberg, Handbook of Design Thinking: Tips & Tools for How to Apply Design Thinking, 1st Edition, 2018.
2. Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A Design Thinking Toolkit for Managers, 1st Edition, 2011.

REFERENCES:

1. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011
4. KalloriVikram, ―Introduction to DevOps, 1 st Edition, KalloriVikram Publication, 2016.
5. Joakim Verona, ―Practical DevOps, 2 nd Edition, Packt. Publication, 2018.
6. Stephen Fleming, Pravin, ―DevOps Handbook: Introduction of DevOps Resource Management―,1st Edition, Createspace Independent Pub. , 2010.
7. Len Bass, Ingo Weber, Liming Zhu, G., ―DevOps: A Software Architect‘s Perspective, 1st Edition, AddisonWesley Professional, 2015.
   http://ajjuliani.com/designthinkingactivities/
8. https://venturewell.org/classexercises.

CO’s PO’s and PSO’s MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	0	1	2	1	0	0	0	0	3	1
CO2	3	3	3	2	2	2	2	1	0	0	2	3	2
CO3	2	3	3	2	3	2	2	0	1	2	2	3	3
CO4	2	3	3	2	2	3	2	0	2	2	2	3	2
CO5	2	2	2	2	3	3	3	0	1	2	2	2	3

IT3304	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 inheritance and interfaces and I/O Streams
- To define exception handling and multithreading
- To develop a java application with generics and collection frameworks
- To design and build simple GUI applications using JavaFX and JDBC.

UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9

Object Oriented Programming - Java Buzzwords – Characteristics of Java – Fundamental Programming Structures in Java - Defining classes in Java – Constructors - Methods - Access specifiers - Static members – Over Loading - Packages: Packages – Member Access –Importing Packages - Strings – JavaDoc comments

UNIT II	INHERITANCE, INTERFACES AND I/O	9

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 - inner classes– Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT III	EXCEPTION HANDLING MULTITHREADING	9

Exceptions - exception hierarchy – Exception handling Mechanisms– built-in exceptions, User Defined exceptions, Stack Trace Elements–Understanding Threads - Thread life cycle - Multi threading in java - Thread Priorities, Limitation of multithreading , Thread Synchronization, Inter-thread communication.

UNIT IV	GENERICS AND COLLECTION FRAMEWORK	9

Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations Collections Interfaces – Collection, Set, List, Queue, Collections Classes – Array List, Hash Set, Tree Set. Accessing a Collection via Iterators. Map Interfaces. Map Classes – Abstract Map, Hash Map, Tree Map.

UNIT V	JAVAFX EVENT HANDLING AND JDBC	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. Introduction to JDBC, JDBC Drivers and Architecture, Accessing Databse with JDBC

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Develop Java programs using OOP principles
- Develop Java programs with the concepts of inheritance and interfaces
- Build Java applications using exceptions handling and multithreading
- Design problems solutions using Generics and Collections frameworks
- Design and develop solutions using JavaFX and JDBC

TEXT BOOKS:

1. Herbert Schildt, ―Java The complete reference, 13th Edition, McGraw Hill Education, 2024.
2. Cay S. Horstmann ―Core Java Volume –I Fundamentals, 11th Edition, Pearson, 2020.

REFERENCES:

1. Allen B.Downey & Chris Mayfield Think Java, 2nd Edition, Oreilly, 2023.
2. MarcLoy,Patrick Niemeyer & Daniel LeuckLearning Java: An Introduction To Realworld Programming With Java, Sixth Edition Grayscale Indian Edition, 6th edition , Oreilly.
3. Kathy sierra, Bert Bates & Trisha Gee, Head First Java: A Brain Friendly Guide Third edition , Shroff Publishers ,June 2022.

CO's PO's and PSO's MAPPING

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	3	2	2	0	1	2	1	0	0	0	0	3	1
CO2	3	3	3	2	2	2	2	1	0	0	2	3	2
CO3	2	3	3	2	3	2	2	0	1	2	2	3	3
CO4	2	3	3	2	2	3	2	0	2	2	2	3	2
CO5	2	2	2	2	3	3	3	0	1	2	2	2	3

CS3304	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To develop and apply linear and nonlinear data structures.
- To analyze and demonstrate the various operations associated with trees.
- To execute and apply graph algorithms to solve specific problems.
- To explore and gain proficiency in sorting, searching, and hashing algorithms.

LIST OF EXPERIMENTS

1. Array Implementation of List ADT.
2. Implementation of Singly Linked list and its application.
3. Stack Data Structure: Implementation and Applications.
4. Queue Data Structure: Implementation and Applications.
5. Circular Queue Implementation.
6. Implementation of Binary Search Tree.
7. Implementation of Dictionary ADT using AVL Trees.
8. Implementation of Priority Queues using Heaps.
9. Multiway search tree: Implementation B Tree.
10. Graph Traversal: Implementing Depth First Search and Breadth First Search.
11. Implementation of graph representation using Array and Linked List.
12. Implementation of Topological Sorting.
13. Hashing Implementation: Separate Chaining and Open Addressing Techniques.
14. Implementation of Searching algorithms.
15. Implementation of Sorting algorithms.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 Terminals

SOFTWARE:C Compiler

COURSE OUTCOMES:

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

- Implement and apply operations for managing lists.
- Develop and demonstrate operations for Stack and Queue Abstract Data Types (ADTs). Utilize these operations to address real world problems.
- Analyze and perform various operations on trees to solve specific problems.
- Execute graph traversal algorithms and techniques.
- Examine various sorting, and searching techniques and assess the performance of various algorithms in different scenarios.

CO's PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	1	0	0	2	1	0	2	2	0
CO2	3	3	2	1	1	0	0	2	1	0	2	2	0
CO3	3	3	2	1	1	0	0	2	1	0	2	2	0
CO4	3	3	2	1	1	0	0	2	1	0	2	2	0
CO5	3	3	2	1	1	0	0	2	1	0	2	2	0

IT3306	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

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 generic programming and event handling.

LIST OF EXPERIMENTS

1. Develop Simple java applications using classes & objects .
2. Develop a java application using packages.
3. Develop a java application using Inheritance.
4. Write a Java Program to create an abstract class and demnonstrate polymorphism.
5. Design a java program to demonstarte multiple inheritance using interface.
6. Write a program to perform string operations using String and StringBuffer classs.
7. Implement exception handling and creation of user defined exception.
8. Write a Java program to perform file operations.
9. Write a java program that implements multi-threading.
10. Develop a java applications to demonstrate the features of collection frameworks.
11. Develop applications using JavaFX controls, layouts and menus.
12. Develop a simple student database management system using event-driven and concurrent programming paradigms of Java. Use JDBC to connect a back-end database

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE:JAVA, JDK & NETBEANS

COURSE OUTCOMES:

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

- Develop and implement Java programs for simple applications that make use of classes, packages, inheritance and interfaces.
- Develop and implement Java programs with array list and exception handling.
- Develop and implement Java programs using the concept of Multithreading.
- Design and develop the applications using file processing, generic programming.
- Design and develop the applications using event handling mechanism.

CO's PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	1	0	0	2	1	0	2	2	0
CO2	3	3	2	1	1	0	0	2	1	0	2	2	0
CO3	3	3	2	1	1	0	0	2	1	0	2	2	0
CO4	3	3	2	1	1	0	0	2	1	0	2	2	0
CO5	3	3	2	1	1	0	0	2	1	0	2	2	0

HS3303	ENGLISH LANGUAGE ENHANCEMENT AND BUSINESS COMMUNICATION LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To enhance the ability of the students to converse in simple and short sentences.
- To improve the fluency in spoken English by refining language skills.
- To expose students to address various scenarios in the domain of LSRW skills.
- To help the students to learn, practice and apply English language at different pace.

UNIT I **9**

Listening – Listen to business terminologies and use them
Speaking – People, Relationships and interpersonal skills
Reading – Word Search
Writing – Stream of Consciousness

UNIT II **9**

Listening – Listen and narrate a story
Speaking – Imitation, SWOT analysis, Engineering ethics, rights and responsibilities
Reading – Echo reading, professionalism in workplace
Writing – Free style writing, Construction of Paragraphs & essays

UNIT III **9**

Listening – Listen and act
Speaking – Speaking skills, methods of speech, Role Play, Team and group, conflict management
Reading – Inference, cultural and global diversities
Writing – Report writing, using social media

UNIT IV **9**

Listening – Listen, respond and motivate
Speaking – Picture yourself to different scenarios
Reading – Read and comprehend
Writing – Clubbing Keywords, Letter & mail correspondence, Job Application and Resume

UNIT V **9**

Listening – Listen and perform, traits of a leader, winning formula
Speaking – Variation, Varieties in speeches, women empowerment, Human values, corporate culture& etiquette
Reading – Visual reading
Writing – E-Writing and email-communication

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Receive sound, understand the message, evaluate it, and respond promptly.
- Demonstrate professional responsibilities and coherent expression of ideas using SWOT analysis.
- Communicates excellent speaking and writing skills expressing team spirit drawing inferences from cultural and global diversities using social media.
- Identifies pictorial information and inscribe one's candidature through mail and letter communication.
- Showcase leadership traits fitting the corporate culture keeping in mind the gender equality.

REFERENCES

1. English and Soft Skills. SP Dhanavel. Orient Blackswan 1, 124, 2011. 20, 2011. English Language Teaching in India: The Shifting Paradigms.
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011.
3. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
4. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
5. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004

MA3401	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- Introduce the fundamental concepts of probability theory and random variables with their properties and applications.
- Develop an understanding of joint distributions, correlation, regression, and the central limit theorem.
- Familiarize students with various standard probability distributions and their real-world applications.
- Provide knowledge of statistical inference techniques, including estimation and hypothesis testing, for decision-making.
- Impart skills in the design of experiments and statistical quality control tools for practical applications in engineering, science, and industry.

UNIT I	PROBABILITY AND ONE-DIMENSIONAL RANDOM VARIABLE	9+3

Probability – The axioms of probability – Conditional probability – Baye 's theorem – Discrete and continuous random variables– Properties – Mathematical Expectations – Moments – Moment generating functions –Chebyshev's inequality.

UNIT II	TWO – DIMENSIONAL RANDOM VARIABLES	9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III	STANDARD DISTRIBUTION	9+3

Discrete distributions: Bernoulli' trial – Binomial distribution – Poisson distribution – Geometric distribution – Continuous distributions: Uniform distribution – Exponential distribution – Gamma distribution– Normal distribution.

UNIT IV	TESTING OF HYPOTHESIS	9+3

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests basedon Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion – Contingency table (test for independent) – Goodness of fit.

UNITV	DESIGN OF EXPERIMENTS AND STATISTICAL QUALITY CONTROL	9+3

One way and Two way classifications – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design – Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Demonstrate understanding the fundamental concepts of probability and one-dimensional random variables their applications in describing real-life phenomena.
- Understand the basic concepts of two-dimensional random variables and apply in engineering applications.
- Apply standard probability distributions (discrete and continuous) such as Binomial, Poisson, Normal, Exponential, and Gamma in solving real-life problems.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control

TEXTBOOKS

1.Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

3. Kapoor, V.K. and Gupta S.P (1978): Fundamentals of Applied Statistics, Sultan Chand & Sons.

REFERNCES

1.Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.

2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.

3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.

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, 2004.

5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

CS3401	COMPUTER NETWORKS (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To introduce the fundamentals of the physical layer, including network types, topologies, and transmission media.
- To understand the data link layer, focusing on error control, flow control, and protocols such as HDLC and Ethernet.
- To explore network layer concepts, including packet switching, IP protocols, and various routing mechanisms.
- To gain knowledge of transport layer protocols, focusing on flow control, congestion control, and Quality of Service.
- To familiarize with application layer protocols and their role in communication over networks, including HTTP, FTP, and email protocols.

UNIT I	BUILDING NETWORKS AND APPLICATION LAYER	9

Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets - 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 – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service

UNIT III	NETWORK LAYER	9

Switching : Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP.

UNIT IV	ROUTING	9

Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP.

UNIT V	DATA LINK AND PHYSICAL LAYERS	9

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat
4. Simulation of DNS using UDP sockets.
5. Use a tool like Wireshark to capture packets and examine the packets
6. Write a code simulating ARP /RARP protocols.
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
8. Study of TCP/UDP performance using Simulation tool.
9. Simulation of Distance Vector/ Link State Routing algorithm.
10. Simulation of an error correction code (like CRC)

THEORY: 45 PERIODS
PRACTICALS: 30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

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

- Understand and explain the principles of network architecture, including the OSI and TCP/IP models, and the functionality of various network types, protocols, and transmission media.
- Analyze and evaluate the functionality of the transport layer protocols, including TCP, UDP, and SCTP, and understand their role in managing data flow, congestion, and ensuring Quality of Service.
- Demonstrate knowledge of network layer protocols, including IP addressing, subnetting, and packet switching, and apply these concepts to design efficient IP based networks.
- Compare and contrast different routing protocols, including unicast and multicast routing, and assess their effectiveness in different networking scenarios.
- Implement and simulate data link layer protocols and physical layer concepts, such as Ethernet, VLAN, wireless LAN, framing, flow control, and error control, to analyze network performance.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: C / C++ / Java / Python / Equivalent Compiler 30.2. Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalent

TEXT BOOKS:

1. James F. Kurose, Keith W. Ross, Computer Networking, A TopDown Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. YingDar Lin, RenHung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.

CO's PO's and PSO's MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	PSO2
CO1	3	2	1	0	2	0	0	0	1	0	0	3	0
CO2	2	3	2	2	2	0	0	0	0	0	0	3	2
CO3	3	3	2	2	2	0	0	0	0	0	0	3	2
CO4	3	3	2	2	2	0	0	0	1	0	0	3	2
CO5	3	2	2	2	3	0	0	1	1	0	0	3	3

IT3402	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION TO RELATIONAL DATABASES	9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL .

UNIT II	ER MODEL AND RELATIONAL DATABASE DESIGN	9

Entity Relationship model – E-R Diagrams – Enhanced E-R Model – E-R to Relational Mapping – Functional Dependencies – Non loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd's Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III	TRANSACTIONS	9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery -Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV	DATABASE DESIGN	9

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

UNIT V	ADVANCED DATABASE CONCEPTS	9

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model and Formulate solutions to a broad range of query.
- Recognize and identify the use of normalization and functional dependencies to refine the database system.
- Demonstrate various SQL queries for the Transaction Processing & Locking using concept of concurrency control.
- Build the query processing techniques for the optimization of SQL queries.
- Implement the indexing and hashing techniques for the organization of database records

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, Sixth Edition, Tata McGraw Hill, 2014.
2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2017.

REFERENCES:

1. David Loshin,"Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL,and Graph", Morgan Kaufmann/El Sevier Publishers,2013.
2. Vlad Vlasceanu, Wendy A. Neu, Andy Oram, Sam Alapati, An Introduction to Cloud Databases, O'Reilly Media, Inc.,2019.
3. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw Hill College Publications, 2015.
5. G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
6. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation and Management", Ninth Edition, Cengage Learning, 2011.

CO's PO's and PSO's MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	3	0	0	0	0	0	0	2	2	1
CO2	3	3	3	3	0	0	0	0	0	0	2	2	1
CO3	3	3	3	3	0	0	0	0	0	0	2	2	1
CO4	3	3	3	3	0	0	0	0	0	0	2	2	1
CO5	3	3	3	3	0	0	0	0	0	0	2	2	1

CS3402	DESIGN AND ANALYSIS OF ALGORITHMS (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To construct algorithms that is efficient in space and time complexities.
- To understand different design technique like Brute force and Divide and Conquer
- To understand Greedy and Dynamic Programming design techniques
- To understand Backtracking and Branch & Bound design technique
- To understand the Tractability and Scalability problems.
- To know the best algorithm technique to solve problems.

UNIT I	INTRODUCTION	9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical Analysis- Mathematical analysis for Recursive and Non recursive algorithms- Visualization

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	9

Brute Force: Closest Pair – Pattern Search: String Matching – Rabin–Karp algorithm – Selection Sort – Bubble Sort Divide and Conquer Methodology: Binary Search – Merge sort – Quick sort – Randomized version of Quick sort- Analysis of Quick sort–Multiplication of Large Integers

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9

Dynamic programming: Computing a Binomial Coefficient -Floyd‘s and Warshall’s algorithm for All Pairs shortest Path Problem- Single Source Shortest Path Problem-Bellman ford Problem-Multi Stage Graph– -/1 Knapsack Problem and Memory functions. Greedy Technique: Prim‘s algorithm and Kruskal’s Algorithm - Dijkstra’s Algorithm - Fractional Knapsack problem, Network flow: Ford-Fulkerson method- Huffman Trees.

UNIT IV	BACKTRACKING AND BRANCH & BOUND	9

Backtracking: n-Queen’s problem -Hamiltonian Circuit Problem – Subset Sum Problem- Graph Colouring .Branch and Bound: Solving 15-Puzzle problem- Assignment problem – Knapsack Problem – Travelling Sales person Problem .

UNIT V	NP –COMPLETE AND APPROXIMATION ALGORITHM	9

Lower – Bound Arguments – P, NP NP- Complete- Dominating Set Problem - NP Hard Problems – Clique Decision Problem – Node Cover Decision Problem – Bin Packing problem -NP Hard Scheduling Problems:Job Shop Scheduling. Approximation Algorithm for NP Hard Problems – Travelling Salesperson Problem – Knapsack Problem.

LIST OF EXPERIMENTS

1. Implement a linear search algorithm to find the position of a target value in a list.
2. Implement a recursive binary search algorithm to find the position of a target value in a sorted list.
3. Write a function search(pat: str, txt: str) 0> None that prints all starting indices of occurrences of the pattern pat in the text txt, where len(txt) > len(pat).
4. Implement the Quick Sort algorithm to sort an array of integers.
5. Implement the Merge Sort algorithm to sort an array of integers.
6. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
7. Implement 0/1 Knapsack problem using Dynamic Programming.
8. Compute the transitive closure of a given graph using Warshall's algorithm
9. Implement Floyd’s algorithm for the AllPairs Shortest Paths problem.
10. Find the minimum cost spanning tree of a given undirected graph using Prim’s algorithm.

11. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
12. Implement N Queen's problem using Back Tracking.
13. Implement Subset sum problem using Back tracking.
14. Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

COURSE OUTCOMES:

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

- Apply efficient algorithms for both recursive and non-recursive relations to compute space and time complexity
- Critically analyze the different algorithms using design techniques like Brute force and Divide and Conquer.
- Construct algorithms using design paradigms like Greedy and Dynamic Programming for a given problem.
- Implement algorithms using Backtracking and Branch & Bound design technique.
- Illustrate various algorithms and interpret solutions to evaluate NP Hard problems.

THEORY 45 PERIODS
PRACTICALS 30 PERIODS
TOTAL 75 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals
SOFTWARE:C compiler

TEXT BOOKS:

1. AnanyLevitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2019
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Fourth Edition, PHI Learning Private Limited, 2022

REFERENCES:

1. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―The Design and Analysis of Computer Algorithms‖, Pearson Education, Twelth impression, 2013.
3. Harsh Bhasin, ―Algorithms Design and Analysis‖, Oxford university press, 2016.
4. S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, 2014.

CO's PO's and PSO's MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	3	0	0	0	0	0	0	2	2	1
CO2	3	3	3	3	0	0	0	0	0	0	2	2	1
CO3	3	3	3	3	0	0	0	0	0	0	2	2	1
CO4	3	3	3	3	0	0	0	0	0	0	2	2	1
CO5	3	3	3	3	0	0	0	0	0	0	2	2	1

CS3403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	OPERATING SYSTEM OVERVIEW	9

Operating system overview-objectives and functions, Evolution of Operating System - Computer System Organization-Operating System Structure and Operations- System Calls, OS Generations and System Boot, Process Concept, Threads- Overview, Multithreading Models, Threading issues

UNIT II	PROCESS MANAGEMENT	9

Processes-Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - CPU Scheduling Algorithms; Process Synchronization - Critical Section Problem - Mutex Locks – Semaphores - Classic problems of synchronization - Critical regions - Monitors; Deadlock - Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection - Recovery from deadlock.

UNIT III	MEMORY MANAGEMENT	9

Main Memory - Swapping - Contiguous Memory Allocation, Paging – Structure of the Page Table – Segmentation; Virtual Memory - Demand Paging - Page Replacement - Allocation of Frames, Thrashing;

UNIT IV	FILE SYSTEMS AND I/O SYSTEMS	9

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management; File concept, Access methods, Directory Structure - File System Mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory Implementation - Allocation Methods – Free Space Management; I/O Systems - I/O Hardware, Application I/O interface, Kernel I/O subsystem

UNIT V	VIRTUAL MACHINES AND MOBILE OS	9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their implementations, Virtualization; Mobile OS - iOS and Android Architecture and SDK Framework; Role of Operating Systems in Security.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basic concepts, functions, processes and threads of operating systems.
- Analyze various scheduling algorithms, process synchronization and understand the concept of deadlock.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems, I/O systems.
- Explain virtualization and compare iOS and Android Operating Systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018
3. AchyutS.Godbole, AtulKahate, "Operating Systems", McGraw Hill Education, 2016.
4. Gerardus Blokdyk,"Mobile Operating Systems A Complete Guide" 2020 Edition Kindle Edition.

CO's PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	0	0	0	0	0	0	0	0	0	0	1	1
CO2	3	3	2	0	0	0	0	0	0	0	0	1	1
CO3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO4	3	2	0	0	0	0	0	0	0	0	0	2	0
CO5	3	2	0	0	0	0	0	0	0	0	0	2	0

IT3403	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

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.Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application
9. Database Connectivity with Front End Tools.
10. Case Study using real life database applications

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 Terminals.

SOFTWARE:

Front end: VB/VC++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/PostGress / DB2 or Equivalent.

COURSE OUTCOMES:

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

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Critically analyze the use of Tables, Views, Functions and Procedures
- Implement an application that require a Frontend Tool

CO's PO's and PSO's MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	0	0	0	0	0	0	1	2	0	1	0	0
CO2	3	2	1	0	0	0	0	1	2	0	1	2	0
CO3	3	2	1	0	0	0	0	1	2	0	1	2	0

	CO4	3	2	1	0	0	0	0	1	2	0	1	2	0	
	CO5	3	2	1	0	0	0	0	1	2	0	1	2	0	
	CO6	3	2	1	0	0	0	0	1	2	0	1	1	0	

CS3404	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To learn Unix commands and shell programming
- To implement Process Creation, Inter Process Communication and various CPU Scheduling Algorithms
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Allocation Strategies

LIST OF EXPERIMENTS

1. Basics of UNIX and LINUX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition a) First Fit b) Worst Fit c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
14. Implementation of the various file organization techniques and the following File Allocation Strategies a) Sequential b) Indexed c) Linked
15. Install any guest operating system like Linux using VMware.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: C / C++ / Java

COURSE OUTCOMES:

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

- Learn various UNIX commands, shell programming
- Compare the performance of various CPU Scheduling and Page Replacement Algorithms
- Create processes, implement IPC and Semaphores
- Implement Deadlock avoidance and Detection Algorithms
- Implement File Organization and File Allocation Strategies

CO's PO's and PSO's MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	0	0	0	0	0	0	1	2	0	1	0	0
CO2	3	2	1	0	0	0	0	1	2	0	1	2	0
CO3	3	2	1	0	0	0	0	1	2	0	1	2	0
CO4	3	2	1	0	0	0	0	1	2	0	1	2	0
CO5	3	2	1	0	0	0	0	1	2	0	1	2	0

HS3505	PROFESSIONAL AND CAREER DEVELOPMENT LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- Enhance the employability skills of students
- Orient the students towards grooming as a professional
- Enable them to become employable, industry readygraduates
- Build their self-esteem and guide them in achieving success in interviews
- Aid them to fit into any professional working environment

UNIT I		9

Introduction to Employability Skills –Rapport Building - Emotional Awareness - Professional Grooming - Adaptability

UNIT II		9

Presentation Skills -Topic Selection – Organizing the Material –Significance of Presentation - Presentation Techniques – Do's and Don'ts of Presentation - Differences between Reading and Presenting – Formal Phrases for Presentation– Effective PPT Techniques - Mini Presentation.

UNIT III		9

Group Discussion (GD) Strategies – Prepared GD - Importance of GDs in professional and academic settings- Understanding the topic - Time management and prioritization - Developing persuasive arguments - Active listening and responding - Conflict resolution and negotiation -Understanding Group Dynamics- Brainstorming the Topic – Questioning and Clarifying – Mock GDs.

UNIT IV		9

Job Interview Tips - Etiquette– Self preparation and introduction - One-to-one interview &Panel Interview – Stress Interview management –Mock Interview in Google Meet-

UNIT V		9

Recognizing Differences between Group and Teamwork – Multitasking – Stress Management – Networking professionally- Leadership skills– Respecting Social Protocols- Work Ethics -Developing a Long-term Career plans – Panel Expectations.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Present oneself as an efficient candidate with adequate soft skills

- Make effective presentations
- Perform the role as a team member and individual.
- Demonstrate effective participation and engagement in group discussions. (Unit-III)
- Attend job interviews successfully and demonstrate soft skills suiting any work environment as a complete professional

RECOMMENDED SOFTWARE

Globearena
https://placement.freshersworld.com/
Related Online Repositories for Soft Skill Development
Videos from TED and YouTube

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students. Orient BalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.
6. Singh, Prachi, Professional Communication JBC Press: Daryaganj, 2015.

Eric H. Glendinning, Oxford English for Careers Technology for Engineering and Applied Sciences:Student Book, Oxford University Press, Oxford, 2013.

CS3501	OBJECT ORIENTED SOFTWARE ENGINEERING (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand Software Engineering Lifecycle Models
- To Perform software requirements analysis
- To gain knowledge of the System Analysis and Design concepts using UML.
- To understand software testing and maintenance approaches
- To work on project management scheduling using DevOps

UNIT I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9

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	9

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – 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	9

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 Studies on Scalable Web Applications (Netflix, Facebook)		
UNIT IV	**SOFTWARE TESTING AND MAINTENANCE**	**9**
Introduction to Software Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – System testing Debugging-Case studies in software testing and Maintenance(E-commerce)		
UNIT V	**PROJECT MANAGEMENT**	**9**
Software Project Management- Software Configuration Management - Project Scheduling- DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline:Overall Architecture Building and Testing-Deployment- Tools- Case Study on Microsoft's DevOps Transformation		

LIST OF EXPERIMENTS

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.

THEORY 45 PERIODS
PRACTICAL 30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

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

- Compare various Software Development Lifecycle Models
- Demonstrate project management approaches as well as cost and schedule estimation strategies
- Apply formal analysis on specifications
- Apply UML diagrams for analysis and design
- Design using architectural styles and design patterns, and test the system

TEXTBOOKS:

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.
2. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, McGraw-Hill International Edition, 2014.

REFERENCE:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

3. Len Bass, Ingo Weber, and Liming Zhu, "DevOps: A Software Architect 's Perspective", Pearson Education, 2016
4. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
5. Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 2010.*
6. Ali Bahrami ,Object Oriented Systems Development, MCGRAW HILL EDUCATION (INDIA) PRIVATE LIMITED

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: ArgoUML

CO's PO's and PSO's MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	2	2	0	0	0	1	1	2	2	2
CO2	2	3	2	3	2	0	0	2	2	3	2	3	2
CO3	2	3	2	1	1	0	0	2	2	3	2	2	3
CO4	2	3	2	2	3	0	0	2	2	3	2	2	3
CO5	2	3	1	2	2	0	0	0	0	0	1	3	2

CS3502	DATA SCIENCE (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To provide a strong foundation in data science concepts, processes, and data preparation methods for structured analysis.
- To develop the ability to summarize, describe, and interpret datasets using descriptive statistics and regression techniques.
- To build proficiency in managing, manipulating, and analyzing structured and numerical data using Python libraries such as NumPy and Pandas.
- To enable effective representation and communication of insights through data visualization techniques with Matplotlib and Seaborn.
- To apply the complete data science workflow for real-world problem solving using predictive modeling, evaluation metrics, and case studies.

UNIT I	FUNDAMENTALS OF DATA SCIENCE	9

Introduction to Python libraries – Applications of Data Science – Data Science Process: Overview – Defining Research Goals – Retrieving Data – Data Preparation: Data Wrangling, Handling Missing Data, Data Transformation, Outlier/Noise and Anomalies – Exploratory Data Analysis – Data Mining – Data Warehousing.

UNIT II	DESCRIPTIVE ANALYTICS AND STATISTICS WITH PYTHON	9

Facets of Data – Types of Variables – Statistical Description of Data – Describing Data with Tables and Graphs – Measures of Central Tendency – Measures of Variability – Normal Distributions and Standard (z) Scores – Correlation – Scatter Plots – Correlation Coefficient – Regression – Regression Line – Least Squares Regression Line.

UNIT III	DATA HANDLING WITH NUMPY AND PANDAS	9

NumPy: Creating Arrays – Attributes – NumPy Array Objects – Basic Operations (Join, Split, Search, Sort) – Indexing, Slicing, Iterating – Copying Arrays – Shape Manipulation – Identity Array, eye() Function. Pandas: Exploring Data using Series and DataFrames – Index Objects – Reindex – Dropping and Selecting Entries – Data Alignment – Rank and Sort – Summary Statistics – Index Hierarchy – Handling Missing Data – Importing/Exporting Data (CSV, Excel, JSON).

UNIT IV	DATA VISUALIZATION WITH MATPLOTLIB AND SEABORN	9

Introduction to Matplotlib – Creating Plots and Subplots – Controlling Axes, Ticks, Labels, Legends – Annotations and Drawing on Subplots – Saving Plots – Seaborn Basics – Advanced Visualization and Chart Properties – Scatter Plot – Line Plot – Bar Plot – Histogram – Box Plot – Pair Plot – Heatmaps – Time Series Visualization – Styling Plots – 3D Surface Plots.

UNIT V	APPLIED DATA SCIENCE WITH PYTHON	9

End-to-End Data Science Workflow: Problem Definition and Dataset Selection – Data Preprocessing with Pandas and NumPy – Exploratory Data Analysis with Visualization – Feature Engineering Basics – Predictive Modeling with Scikit-learn – Linear Regression – Train-Test Split – Evaluation Metrics (MAE, MSE, R^2). Case Studies: Predicting Student Performance / Sales Data (Regression) – Iris Dataset Classification – Presenting Findings through Visualization and Reports.

LIST OF EXPERIMENTS

NumPy Array Operations in Python

1. Write Python programs to create 1D, 2D, and 3D NumPy arrays.
2. Perform array operations: indexing, slicing, reshaping, joining, splitting, sorting, and searching.

Statistical Analysis using Python

3. Implement Python code to calculate mean, median, mode, variance, standard deviation, and correlation.
4. Plot regression lines using Python libraries (NumPy/Matplotlib).

Data Wrangling with Pandas in Python

5. Write Python programs using Pandas to import datasets (CSV/Excel/JSON).
6. Perform data cleaning: handling missing values, renaming columns, filtering rows, replacing values, and data transformation.

Exploring Data using Pandas

7. Implement Python programs to create and manipulate Series and DataFrames. Perform indexing, reindexing, dropping entries, rank & sort, summary statistics, and groupby operations in Pandas.

Data Visualization using Matplotlib

8. Write Python code to generate line plots, bar plots, histograms, scatter plots, and box plots using Matplotlib. Add labels, titles, legends, annotations, and subplots in the visualization.

Advanced Data Visualization using Seaborn

9. Write Python programs to create pair plots, heatmaps, distribution plots, and regression plots using Seaborn.

THEORY 45 PERIODS
PRACTICAL 30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

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

- Explain data science concepts, processes, and data preparation techniques.
- Summarize datasets using descriptive statistics, correlation, and regression.
- Handle and analyze structured data using NumPy and Pandas.
- Create visualizations with Matplotlib and Seaborn.
- Apply a complete data science workflow for real-world problem solving.

TEXT BOOKS :

1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython,3rd Edition, O'Reilly Media, 2022.
2. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data,O'Reilly Media, 2016.

REFERENCES:

1. Joel Grus, Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media, 2019.
2. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, 2nd Edition, O'Reilly Media, 2014.
3. Yuli Vasiliev, Python for Data Science: A Hands-On Introduction, No Starch Press, 2022.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: Windows 10/11 Python 3.9+ with Anaconda/Jupyter Notebook, and essential libraries (NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn)

CO's-PO's and PSO's MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	-	2	2	-	-	-	-	2	-	2	1
CO2	3	3	-	2	2	-	-	-	-	2	-	2	1
CO3	3	3	2	2	3	-	-	-	-	2	-	2	1
CO4	2	2	2	2	3	-	-	-	-	3	2	2	1
CO5	3	3	3	3	3	2	-	2	2	3	2	2	1

CS3503	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 identify the real time applications on automata theory.
• To design a context free grammar for any given language.
• To understand Turing Machine undecidable problems and NP class problems and their capability.

UNIT I	AUTOMATA FUNDAMENTALS	9

Proof Techniques in Mathematics- Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Equivalence of NFA and DFA – Finite Automata with Epsilon Transitions – Equivalence of NFA with epsilon transitions and NFA without Epsilon Transitions.

UNIT II	REGULAR EXPRESSION AND REGULAR GRAMMAR	9

Regular Languages – Regular Expressions – FA and Regular Expressions – Pattern matching and regular expressions-Arden's Theorem –Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata

UNIT III	CONTEXT FREE GRAMMAR AND CONTEXT FREE LANGUAGE	9

CFG – Parse Trees – Ambiguity in Grammars and Languages-Cocke–Younger–Kasami (CYK Algorithm)– Normal Forms for CFG- Chomsky Normal Form – Griebach Normal Forms-Pumping Lemma for CFL – Closure Properties of CFL – Conversion of normal forms to Regular Expression.

UNIT IV	PUSH DOWN AUTOMATA AND TURING MACHINE	9

Definition of the Pushdown Automata – Instantaneous Descriptions – Context Free languages – Equivalence of Pushdown Automata and CFG – Turing Machines – Programming Techniques for TM.

UNIT V	UNDECIDABILITY	9

Language not recursively enumerable – Undecidable Problem with RE – RICE Theorem – Undecidable Problems about TM – Recursive and recursively enumerable languages- Post's Correspondence Problem – The Class P and NP.

	TOTAL	45 Periods

Course Outcomes:

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

- Apply automata for any pattern
- Analyse regular expression for any pattern
- Demonstrate context free grammar for any grammar.
- Solve computation solution to build Turing machine
- Interpret whether a problem is decidable or not

TEXTBOOKS

1. J.E. Hopcroft, R. Motwani, and J.D. Ullman, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2003.

REFERENCE BOOKS

1. H.R. Lewis and C.H. Papadimitriou, Elements of the Theory of Computation, Second Edition, PHI, 2003.
2. J. Martin, Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003.
3. Micheal Sipser, Introduction of the Theory and Computation, Thomson Brokecole, 1997.
4. Laurel Brodkorb, The Entscheidungs and Alan Turing, 2019.

5. Deepak 'D'Souza—Modern Applications of Automata Theory, 2021.

CO's PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	0	0	0	0	0	1	0	2	2	2
CO2	2	3	3	0	1	0	0	0	1	2	2	2	2
CO3	2	3	3	0	2	0	0	0	2	2	2	2	1
CO4	2	2	2	0	2	0	0	0	1	2	2	2	2
CO5	2	2	2	0	2	0	0	0	1	2	2	2	2

CS3601	**COMPILER DESIGN(Lab Integrated)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

COURSE OBJECTIVES:

- To recall key concepts of compilers and lexical analysis.
- To explain parsers and grammar-based parsing methods.
- To construct syntax trees and intermediate code.
- To analyze runtime environments and design code generators.
- To apply code optimization techniques.

UNIT I	**INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS**	**8**

Introduction- Translators- Compilation and Interpretation- Language processors -The Phases of Compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA - Language for Specifying Lexical Analyzers – Lex tool.

UNIT II	**SYNTAX ANALYSIS**	**10**

Role of Parser – Grammars – Context-free grammars – Writing a grammar Top Down Parsing - General Strategies - Recursive Descent Parser Predictive Parser-LL(1) - Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC tool - Design of a syntax Analyzer for a Sample Language.

UNIT III	**SYNTAX DIRECTED TRANSLATION & INTERMEDIATE CODE GENERATION**	**9**

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions-Design of predictive translator - Type Systems-Specification of a simple type Checker- Equivalence of Type Expressions-Type Conversions. Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Back patching.

UNIT IV	**RUN-TIME ENVIRONMENT AND CODE GENERATION**	**9**

Runtime Environments – source language issues – Storage organization – Storage Allocation Strategies: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables - Dynamic Storage Allocation - Issues in the Design of a code generator – Basic Blocks and Flow graphs - Design of a simple Code Generator - Optimal Code Generation for Expressions– Dynamic Programming Code Generation.

UNIT V	**CODE OPTIMIZATION**	**9**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks - Global Data Flow Analysis - Efficient Data Flow Algorithm – Recent trends in Compiler Design.

45 PERIODS

LIST OF EXPERIMENTS:

1. Using the LEX tool, Develop a lexical analyzer to recognize a few patterns in C. (Ex.identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2. Implement a Lexical Analyzer using LEX Tool
3. Generate YACC specification for a few syntactic categories.

a. Program to recognize a valid arithmetic expression that uses operator +, -, * and /.

b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

c. Program to recognize a valid control structures syntax of C language (For loop, while loop,if-else, if-else-if, switch-case, etc.).

d. Implementation of calculator using LEX and YACC

4. Generate three address code for a simple program using LEX and YACC.
5. Implement type checking using Lex and Yacc.
6. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
7. Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

THEORY 45 PERIODS
PRACTICAL 30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

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

- recall key concepts of compilers and lexical analysis.
- explain parsers and apply grammar-based parsing methods.
- construct syntax trees and generate intermediate code.
- analyze runtime environments and design code generators.
- evaluate code optimization techniques.

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2014.

REFERENCES:

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation , Morgan Kaufmann‖Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler , Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design , Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C , Prentice-Hall Software Series, 1993

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

Intel based desktop PC with minimum of 166MHz or faster processor with at least 64 MB RAM and 100 MB free disk space.

SOFTWARE:

C ++ Compiler and JDK kit, Lex or Flex and YACC tools (Unix/Linux utilities)30 terminals

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	0	3	0	0	0	0	0	1	2	2
CO2	3	2	1	0	3	0	0	0	0	0	1	2	2
CO3	3	2	1	0	3	0	0	0	0	0	1	2	2
CO4	3	2	1	0	3	0	0	0	0	0	1	2	2
CO5	3	2	1	0	3	0	0	0	0	0	1	2	2

CS3602	**WEB TECHNOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To apply CSS, Bootstrap, and modern styling frameworks (TailwindCSS/SCSS) to design responsive websites.
- To develop interactive web applications using JavaScript, DOM manipulation, and TypeScript.
- To implement single-page applications using React with advanced state management (Redux/Context API).
- To architect and structure databases using SQL and NoSQL and build secure REST APIs using Express with JWT authentication.
- To deploy web applications on modern platforms (Netlify, Vercel, AWS, Docker).

UNIT I	**WEBSITE BASICS, HTML 5**	**9**

Web Browsers, Search Engine -Web Server vs Application Server, Clients, Servers and Communication- HTTP Request Message – HTTP Response Message - Inline Elements-Block Elements, Section, article, and aside Elements - nav and a Elements - header and footer Elements Tables -HTML5 control elements –Audio – Video controls - Backgrounds – Border Images – Colors – Shadows – Text – Transitions – Animations – DOM

UNIT II	**RESPONSIVE WEB DESIGN**	**9**

Hosting a Website and GIT-Introduction of UI Scripting Bootstrap-Overview, Bootstrap Grid System, Grid Classes, Basic Structure of a Bootstrap Grid, TailwindCSS – Utility-first responsive design - · SCSS – Modular CSS for scalable projects.

UNIT III	**CLIENT SIDE PROGRAMMING**	**9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation- Built-in objects-Event Handling- TypeScript introduction for type-safe client-side programming - JSON introduction – Syntax – Testing basics – Jest framework for unit testing.

UNIT IV	**ADVANCED CLIENT SIDE PROGRAMMING**	**9**

React JS: ReactDOM - JSX - Components - Properties – Fetch API - State and Lifecycle – Hooks - Events - Fetch API - -Virtual DOM-Single page application- Advanced State Management – Redux & Context API-Performance Optimization – Lazy Loading, Code Splitting- Next.js – Server-Side Rendering (SSR) & Static Site Generation (SSG).

UNIT V	ADVANCED DATABASE AND SERVER SIDE PROGRAMMING	9

SQL databases (MySQL/Postgres) & NoSQL databases (MongoDB)- Node.js with MongoDB/SQL – CRUD operations- Express.js framework – Routing, Middleware, Static files, Async/Await- Cookies, Sessions- REST API design with JWT authentication- Web Security – XSS, CSRF, password hashing/salting- Deployment – Vercel, Netlify, AWS basics, Docker.

45 PERIODS

COURSE OUTCOMES:

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

- Construct responsive websites using HTML, CSS, Bootstrap, TailwindCSS, and SCSS.
- Build scalable React applications with Redux/Context API and performance optimization.
- Develop RESTful APIs with authentication and security using Node.js & Express.
- Integrate SQL & NoSQL databases into web applications.
- Deploy full-stack applications using modern platforms and tools.

TEXT BOOKS:

1. David Flanagan, “Java Script: The Definitive Guide”, O’Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020
4. Marc Wandschneider, “Learning Node”, Addison-Wesley Professional, 2nd Edition, 2016

REFERENCES:

1. Paul Deitel, Harvey Deitel, Abbey Deitel, Internet and World Wide Web, 5e, Pearson, 2018.
2. Steven Holzner, The Complete Reference PHP, Tata McGraw-Hill, Indian Edition, 2017.
3. Robert W. Sebesta, Programming the World Wide Web, 8th Edition, Pearson Education India, 2020.

CS3603	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To acquire knowledge of AI in modelling intelligent agents, formulating problems, and implementing uninformed search algorithms.
- To learn and apply different informed search strategies, adversarial game strategies, and constraint satisfaction methods for solving complex AI problems.
- To gain knowledge of the concepts of machine learning and types of problems tackled by machine learning.
- To explore the different supervised learning techniques.
- To apply different aspects of unsupervised learning and reinforcement learning.

UNIT I	INTELLIGENT AGENT AND SEARCH TECHNIQUES	9

Introduction - Intelligent Agents - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - Uninformed Search -Depth Limited Search- Application of Breadth First Search ,

Depth First Search & uniform cost search-Informed Search - Greedy Best First - A* algorithm.

UNIT II	PROBLEM SOLVING AND REASONING	9

Adversarial Game and Search - Game theory - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - Constraint Satisfaction Problems (CSP) - Examples - Map Colouring - Job Scheduling - Backtracking Search for CSP-First Order Logic: Forward and Backward chaining-Resolution

UNIT III	INTRODUCTION TO MACHINE LEARNING	9

Machine Learning: Definitions –Types of learning - Classification - Regression - Generative and Discriminative Models - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance.

UNIT IV	SUPERVISED LEARNING	9

Neural Network: Introduction, Perceptron, Back Propagation Networks - Linear Regression - Logistic Regression -Decision Tree: Entropy, Information gain - Naïve Bayes classification - Support Vector Machines (SVM)- Ensemble Models

UNIT V	UNSUPERVISED AND REINFORCEMENT LEARNING	9

Clustering Algorithms - K – Means – Hierarchical Clustering- Cluster Validity - Dimensionality Reduction –Principal Component Analysis. Introduction to Reinforcement Learning – Models: Markov Decision Process, Q Learning.

LIST OF EXPERIMENTS:

1. Implementing Breadth-First Search (BFS).
2. Implementing Depth-First Search (DFS).
3. Solving Constraint Satisfaction Problem (CSP).
4. Implementing Min-Max Algorithm for Game Playing.
5. Implement the k-means algorithm.
6. Implement the concept of decision trees with suitable data sets from real world problem and classify the data set to produce new sample.
7. Detecting Spam mails using Support vector machine.
8. Implement facial recognition application with artificial neural network.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10. Implement the Dimensionality Reduction techniques.

45 PERIODS
30 PERIODS
TOTAL:75 PERIODS

COURSE OUTCOMES:

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

- Illustrate the intelligent agent and its environment and apply uninformed and informed search strategies.
- Analyse real-life problems using adversarial games, CSP and logical reasoning.
- Illustrate the problems for each type of machine learning and its concepts.
- Analyse the supervised learning algorithms for real life applications.
- Apply the clustering and reinforcement learning techniques for solving problems.

TEXT BOOKS:

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Fourth Edition, 2021.

2. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCES:

1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: Python/Java with ML Package/R

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	0	0	0	0	0	2	2	1	2
CO2	3	3	2	2	0	0	0	0	0	2	2	2	3
CO3	2	1	1	1	0	0	0	0	0	1	1	1	2
CO4	2	2	2	2	1	0	0	0	0	1	1	1	2
CO5	2	2	2	2	1	0	0	0	0	1	1	1	2

CS3604	WEB TECHNOLOGIES LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To develop the ability to design interactive web forms using HTML5 form controls for capturing registration and feedback data
- To apply frameworks like Bootstrap, Tailwind CSS and TypeScript for dynamic web development.
- To design and develop dynamic, database-driven web applications using Node.js, Express, and MongoDB/SQL.
- To equip students with the skills to build secure signup and login systems using Node.js, Express, MongoDB/SQL, and JWT authentication.
- To develop the ability to design and implement real-time web applications using Node.js, Express, and Socket.io.To evaluate and demonstrate complete mobile/web app solutions.

LIST OF EXPERIMENTS

1. Create a registration/feedback form using HTML5 form controls.
2. Build a personal portfolio website (HTML5 + CSS + TailwindCSS).
3. Develop a responsive website using Bootstrap/TailwindCSS.

4. Create a responsive e-commerce homepage with carousel, grid layout, and login modal.
5. Perform client-side validation & event handling (JavaScript/TypeScript).
6. Develop a ReactJS app using Hooks & Context API.
7. Extend React app with Redux for state management.
8. Build dynamic web apps with Express + MongoDB/SQL.
9. Create signup/login with JWT authentication (Node.js + Express + MongoDB/SQL).
10. Implement a real-time chat application using Node.js, Express, and Socket.io.
11. Deploy a React + Node app on Vercel/Netlify/AWS.

TOTAL:45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 terminals

SOFTWARE: VS Code,Nodejs,React JS,MongoDB,Express

TEXT BOOKS:

1. David Flanagan, “Java Script: The Definitive Guide”, O’Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020
4. Marc Wandschneider, “Learning Node”, Addison-Wesley Professional, 2nd Edition, 2016

REFERENCES:

1. Paul Deitel, Harvey Deitel, Abbey Deitel, Internet and World Wide Web, 5e, Pearson, 2018.
2. Steven Holzner, The Complete Reference PHP, Tata McGraw-Hill, Indian Edition, 2017.
3. Robert W. Sebesta, Programming the World Wide Web, 8th Edition, Pearson Education India, 2020.

COURSE OUTCOMES:

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

- Design interactive registration and feedback forms using HTML5 form controls.
- Apply Bootstrap, Tailwind CSS, and TypeScript to develop responsive and dynamic web interfaces.
- Design and implement database-driven web applications using Node.js, Express, and MongoDB/SQL.
- Build secure signup and login systems with JWT authentication in Node.js and Express.
- Design and deploy real-time web applications using Node.js, Express, and Socket.io.

CO’s-PO’s and PSO’s MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	3	0	0	0	0	3	2	1
CO2	3	3	3	2	1	2	1	0	0	0	3	2	1
CO3	3	3	3	3	1	2	0	0	0	0	3	2	1

CO4	3	3	3	2	1	1	0	0	0	0	3	2	1
CO5	3	3	3	3	1	1	1	0	0	0	3	2	1

CS3605	**MOBILE APPLICATION DEVELOPMENT LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES

- To understand PWA, React Native, Flutter, and Node.js with Firebase.
- To apply tools like Android Studio, Xcode, and VS Code for app development.
- To design and build responsive mobile apps using React Native and Flutter.
- To analyse and integrate backend services with Firebase Authentication & Fire store.
- To evaluate and demonstrate complete mobile/web app solutions.

LIST OF EXPERIMENTS

Practical Activities:

1.Setting up the environment and basic Progressive Web App (PWA).

2.Preliminary exercises on Development tools: Android Studio, Xcode, Visual Studio Code

REACT NATIVE

1.Build a cross-platform mobile app using React Native and Flexbox layouts.

2.Build a cross-platform mobile app prototype (e.g., event listing app) using React Native incorporating Flexbox layouts, navigation, and user gestures

FRONTEND DEVELOPMENT FOR MOBILE

1. Build a mobile app using Flutter widgets and state management.

2. Design a responsive mobile/web UI prototype using Flutter.

BACKEND INTEGRATION & API DEVELOPMENT

1.Build a Node.js API integrated with Firebase Authentication and Firestore.

2.Build and integrate a Node.js backend API with Firebase Authentication and Firestore in a mobile or web app.

TOTAL:45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE: 30 Terminals.

SOFTWARE:

Standalone desktops/laptops with Windows, macOS, or Linux operating systems, equipped with Android/iOS mobile application development tools, along with appropriate emulators and debuggers.

REFERENCES:

1. Icon Mikhail Sakhniuk, Icon Roy Derks, Icon Adam Boduch, React and React Native: Build cross-platform JavaScript and TypeScript apps for the web, desktop, and mobile, Fifth Edition, Packt, 2024.
2. Richard Rose, Flutter & Dart Cookbook, O'Reilly Media, Inc. 2023.
3. Ethan Brown, Web Development with Node and Express, 2nd Ed., O'Reilly, 2019
4. Adam D. Scott, Progressive Web Apps with React, O'Reilly, 2017.
5. Rahul Agarwal, Firebase for Flutter Developers: Authentication, Database and Storage Mastery

Paperback, Notion Press, 2023.

E-resources/E materials:

1. https://docs.flutter.dev/get-started/learn-flutter
2. https://cs50.harvard.edu/mobile/2018/
3. https://www.coursera.org/professional-certificates/meta-front-end-developer
4. https://www.freecodecamp.org/learn/2022/responsive-web-design/
5. https://www.coursera.org/learn/web-development

COURSE OUTCOMES:

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

- Develop basic Progressive Web Apps and cross-platform mobile apps using React Native and Flutter.
- Use development tools (Android Studio, Xcode, VS Code) effectively for mobile and web applications.
- Design responsive user interfaces with Flexbox layouts, Flutter widgets, navigation, and state management.
- Integrate backend services such as Firebase Authentication and Firestore with Node.js APIs.
- Build, test, and demonstrate complete mobile/web app solutions for real-world scenarios.

CO's-PO's and PSO's MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO**
CO1	3	0	0	0	0	0	0	1	2	0	1	0	0
CO2	3	2	1	0	0	0	0	1	2	0	1	2	0
CO3	3	2	1	0	0	0	0	1	2	0	1	2	0
CO4	3	2	1	0	0	0	0	1	2	0	1	2	0
CO5	3	2	1	0	0	0	0	1	2	0	1	2	0

PROFESSIONAL ELECTIVE I

CS3504	INFORMATION SECURITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify security devices and their functions.
- To resolve and test configuration issues in security devices.
- To prepare and coordinate for security audits.
- To improve organizational safety and data practices.
- To plan and review personal skill development.

UNIT I	INFORMATION SECURITY DEVICES	9

Identify And Access Management (IdAM), Networks (Wired And Wireless) Devices, Endpoints/Edge Devices, Storage Devices, Servers, Infrastructure Devices (e.g. Routers, Firewall Services) , Computer Assets, Servers And Storage Networks, Content management, IDS/IPS. Different types of information security devices and their functions

UNIT II	SECURITY DEVICE CONFIGURATION AND MANAGEMENT	9

Common issues in installing or configuring information security devices, Methods to resolve these issues, Methods of testing installed/configured information security devices, Technical and configuration specifications, architecture concepts and design patterns and how these contribute to the security of design and devices.

UNIT III	INFORMATION SECURITY AUDIT TEAM WORK AND COMMUNICATION	9

Establish the nature and scope of information security audits, Roles and responsibilities, Identify the procedures/guidelines/checklists, Identify the requirements of information security, audits and prepare for audits in advance, Liaise with appropriate people to gather data/information required for information security audits. Communicate with colleagues clearly, concisely and accurately , Work with colleagues to integrate their work effectively, Pass on essential information to colleagues in line with organizational requirements, Identify any problems they have working with colleagues and take the initiative to solve these problems, Follow the organization's policies and procedures for working with colleagues

UNIT IV	DATA AND INFORMATION MANAGEMENT	9

Comply with organization's current health, safety and security policies and procedures, Report any identified breaches in health, safety, and Security policies and procedures, Identify, report and correct any hazards, Organization's emergency procedures, Identify and recommend opportunities for improving health, safety, and security, Fetching the data/information from reliable sources, Checking that the data/information is accurate, complete and up-to-date, Rule-based analysis of the data/information, Insert the data/information into the agreed formats, Reporting unresolved anomalies in the data/information.

UNIT V	LEARNING AND SELF DEVELOPMENT	9

Identify accurately the knowledge and skills needed, Current level of knowledge, skills and competence and any learning and development needs, Plan of learning and development activities to address learning needs, Feedback from appropriate people, Review of knowledge, skills and competence regularly and appropriate action taken

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Identify the key security concepts, access control and authentication.
- Can the use of security techniques for securing the information.

- Apply the various data privacy policies in different areas of web based security systems.
- Differentiate the needs and application of security in Operating System and Firewalls.
- Critique the various method of securing databases.

TEXT BOOKS:

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, Wiley, 2017
2. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, . Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
3. Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004.

REFERENCES:

1. Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, KonstantinV. Gavrilenko, Assessing Information Security: Strategies, Tactics, Logic and Framework, ITGovernance Ltd, O'Reilly 2010
2. Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004
3. Chuck Easttom , System Forensics Investigation and Response, Second Edition, Jones&Bartlett Learning, 2014
4. David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, Metasploit The5. Penetration Tester's Guide, No Starch Press, 2014

RESOURCES:

https://www.iso.org/isoiec-27001-information-security.html
https://www.sans.org/reading-room/whitepapers/threats/paper/34180
https://csrc.nist.gov/publications/detail/sp/800-40/version-20/archive/2005-11-
https://www.sscnasscom.com/qualification-pack/SSC/Q0901/

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	0	0	0	0	1	1	1	1
CO2	3	3	3	2	2	0	0	0	0	1	1	1	1
CO3	3	3	3	2	2	0	0	0	0	1	1	1	1
CO4	3	3	3	2	2	0	0	0	0	1	1	1	1
CO5	3	3	3	2	2	0	0	0	0	1	1	1	1

CS3505	BUSINESS ANALYTICS	L	T	P	C

		3	0	0	3

COURSE OBJECTIVES:

- 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	9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats .

UNIT II	BUSINESS INTELLIGENCE	9

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	9

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	9

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	9

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze real-world business problems and construct appropriate analytical models to propose solutions.
- Identify and evaluate business processes for extracting meaningful Business Intelligence.
- Apply predictive analytics techniques to develop accurate business forecasting models.
- Utilize analytics to optimize supply chain and logistics management processes.
- Design and implement analytics solutions for enhancing marketing strategies and sales performance.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	1	1	0	0	0	1	2	1	3	2

CO2	3	3	3	2	3	0	0	0	1	2	2	3	1
CO3	2	2	3	3	2	0	0	0	3	1	1	3	1
CO4	2	1	1	2	2	0	0	0	3	3	2	1	3
CO5	2	3	2	3	2	0	0	0	3	3	1	3	1

CS3506	**MULTIMEDIA AND ANIMATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I	**INTRODUCTION TO MULTIMEDIA**	9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II	**MULTIMEDIA FILE FORMATS AND STANDARDS**	**9**

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III	**MULTIMEDIA AUTHORING**	**9**

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV	**ANIMATION**	**9**

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V	**MULTIMEDIA APPLICATIONS**	**9**

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Get the bigger picture of the context of Multimedia and its applications
- Use the different types of media elements of different formats on content pages
- Author 2D and 3D creative and interactive presentations for different target multimedia applications.
- Use different standard animation techniques for 2D, 21/2 D, 3D applications
- Identify the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
2. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
3. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
4. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
5. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
6. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
7. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	2	3	0	0	0	3	2	1	3	2
CO2	3	3	3	3	3	0	0	0	3	3	2	3	2
CO3	3	3	3	3	3	0	0	0	3	3	2	3	2
CO4	3	3	3	3	3	2	0	0	3	3	3	3	3
CO5	3	3	3	3	3	2	0	0	3	3	3	3	3

CS3507	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To discuss on basics of 3D printing
- To understand the principles of 3D printing technique
- To apply and demonstrate inkjet technology
- To infer and illustrate laser technology
- To outline the applications of 3D printing

UNIT I	INTRODUCTION	9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats .

UNIT II	PRINCIPLE	9

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitation.

UNIT III	INKJET TECHNOLOGY	9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNIT IV	LASER TECHNOLOGY	9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V	INDUSTRIAL APPLICATION	9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

45 PERIODS

COURSE OUTCOMES:

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

- Describe how 3D printing technology works, highlighting its core concepts.
- summarize and interpret the workflow of 3D printing
- Apply the concepts and working principles of 3D printing using the inkjet technique to a suitable product example.
- Illustrate the working principles of 3D printing using the laser technique with a practical example.
- Analyze various methods of designing and modeling for industrial applications by comparing their features and effectiveness.

TEXT BOOKS:-

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007 3. Joan Horvath, Mastering 3D Printing, APress, 2014

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1		1	2	1		1			2	1
CO2	3	2	1		2	1	1		1			2	1
CO3	3	1	3		2	1	1	1	2			3	2
CO4	3	1	3		2	1	1	1	2			3	2
CO5	3	3	3	2	1	3	1	1	2		2	3	3

CS3508	**UI /UX Design and Human Centered Design**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To Explore basics of UI, UX and Human-Centered Design.
- To Learn user research, persona creation, and empathy mapping.
- To Gain knowledge in information architecture and wireframing.
- To Apply visual design, interaction, and accessibility principles.
- To Develop skills in prototyping, usability testing, and explore future UX trends.

UNIT I	**INTRODUCTION TO UI/UX & HUMAN-CENTERED DESIGN**	**9**

Definitions and differences between UI and UX - Importance of Human Centered Design - UX lifecycle and design thinking.

UNIT II	**USER RESEARCH AND PERSONA DEVELOPMENT**	**9**

User research methods (interviews, surveys, observations) -Creating user personas and empathy maps - Understanding user goals and pain points.

UNIT III	**INFORMATION ARCHITECTURE AND WIREFRAMING**	**9**

Navigation design and content organization - Card sorting, site maps - Wireframing tools and methods.

UNIT IV	**VISUAL DESIGN AND INTERACTION PRINCIPLES**	**9**

Visual hierarchy, color theory, typography - Responsive and interactive design principles- Accessibility and inclusive design.

UNIT V	**PROTOTYPING AND USABILITY TESTING**	**9**

Building interactive prototypes - Usability testing methods and metrics - Iterative - testing and design updates.Emotion-driven design - Ethical issues in UX - Future trends: voice UI, AR/VR in UX.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Apply Human Centered Design principles in product design
- Conduct user research and develop personas
- Create wireframes and interactive prototypes

- Evaluate designs through usability testing
- Design accessible and inclusive digital interfaces

TEXT BOOKS:

1. Don Norman, "The Design of Everyday Things", MIT Press,2013

REFERENCES:

1. Alan Cooper, "About Face: The Essentials of Interaction Design", Wiley,2014
2. Jenny Preece et al., "Interaction Design: Beyond Human-Computer Interaction", Wile, 2023
3. Jesse James Garrett, "The Elements of User Experience", New rider, 2010
4. Steve Krug, " Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability", New rider, 2014

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	-	-	1	1	2	2	2	2
CO2	2	2	3	2	2	-	-	-	1	2	2	2	2
CO3	3	3	2	2	1	1	1	1	2	2	2	2	3
CO4	3	3	3	3	3	-	-	1	2	3	2	3	3
CO5	3	2	3	3	2	1	1	1	3	3	2	3	3

PROFESSIONAL ELECTIVE II

CS3509	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand mobile forensics concepts, evidence types, and legal considerations.
- To explore mobile device architecture, OS, and security features.
- To apply methods for acquiring and preserving mobile evidence.
- To analyze Android and iOS forensic techniques and reporting.
- To evaluate app and cloud forensics, challenges, and case studies.

UNIT I	INTRODUCTION TO MOBILE FORENSICS	9

Overview of digital and mobile forensics- Types and sources of digital evidence in mobile devices- Mobile forensics process: identification, collection, examination, analysis, and presentation- Legal, ethical, and privacy considerations

UNIT II	MOBILE DEVICE ARCHITECTURE AND OPERATING SYSTEMS	9

Mobile device hardware components- Mobile operating systems: Android, iOS, and others- File systems and data storage in mobile devices- Security features and implications for forensics

UNIT III	EVIDENCE ACQUISITION AND PRESERVATION	9

Forensic acquisition methodologies: manual, logical, physical, and cloud-based methodologies- SIM card and removable media forensics- Evidence handling, chain of custody, and integrity preservation- Overview of forensic tools (open- source and commercial)

UNIT IV	ANDROID AND iOS FORENSICS	9

Android forensics: rooting, acquisition, and analysis of app data and logs- iOS forensics: jailbreaking, acquisition, and analysis of file systems and application data- Data extraction, recovery, and anti-forensics- Reporting and documentation

UNIT V	MOBILE APPS AND CLOUD ARTIFACTS AND ADVANCED TOPICS AND CASE STUDIES	9

Investigating popular apps: WhatsApp, Telegram, Instagram, Snapchat, Signal- Hidden/deleted data recovery- Cloud storage (iCloud, Google Drive, OneDrive) artifact recovery- Mobile browser and email analysis. Challenges in mobile forensics: device diversity, encryption, anti-forensics-Forensic readiness frameworks and standards- Emerging trends: IoT device forensics, cloud- based evidence- Case studies and practical challenges in mobile evidence acquisition**.**

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Identify sources of digital and mobile evidence and explain forensic investigation frameworks.
- Compare and contrast acquisition methods and tools for different types of digital devices
- Perform forensic examination of mobile and cloud artifacts using appropriate methodologies.
- Demonstrate effective documentation, reporting, and communication of forensic finding
- Propose innovative forensic solutions considering future challenges, IoT, and cloud forensics.

TEXT BOOKS:

1. Satish Bommisetty, Rohit Tamma, Heather Mahalik, Practical Mobile Forensics, 5th Edition, Packt Publishing, 2023.
2. Lee Reiber, Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation, 2nd Edition, McGraw Hill, 2021.

REFERENCES:

1. Chuck Easttom, An In-depth Guide to Mobile Device Forensics, CRC Press, 2022.
2. Eoghan Casey (Ed.), Handbook of Digital Forensics and Investigations, Academic Press, 2010.
3. Andre Arnes, *Digital Forensics*, Wiley, 2018.

CO's-PO's and PSO's MAPPING:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PSO 1**	**PSO 2**
CO1	3	2	1		1	1	1					3	
CO2	1	3		2	2	1							2
CO3	1	1	2		3	1	1						
CO4	1	1	1	1	1	2				3			
CO5	1	1	1	1	1	1	2					2	

CS3510	**SOCIAL NETWORK ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the evolution of the Semantic Web and apply social network analysis concepts and tools.
- To represent and reason about social network data using ontologies and Semantic Web technologies.
- To extract, detect, and evaluate communities in web social networks using data mining techniques.
- To analyze user behavior, manage privacy concerns, and assess trust in online social environments.
- To apply graph-based techniques for visualizing social networks and explore real-world applications.

UNIT I	**INFORMATION**	**9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion

networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II	MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	9

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 - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	9

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 - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Knowledge of Semantic Web evolution and core concepts of social network analysis
- Understanding of ontology-based knowledge representation and social network data modeling
- Techniques for detecting, analyzing, and evaluating communities in web-based social networks
- Concepts of user behavior, trust, and privacy issues in online social environments
- Visualization methods and real-world applications of social network structures

TEXT BOOKS:

1. Peter Mika, “Social Networks and the Semantic Web”, , First Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and

Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	-	-	-	2	2	-	2	2
CO2	3	3	2	3	3	-	-	-	2	2	-	2	1
CO3	3	3	2	3	3	-	-	-	2	2	-	2	2
CO4	3	3	3	3	3	-	-	-	2	2	-	2	2
CO5	3	2	3	3	3	-	-	-	3	3	-	2	2

CS3511	**AUGMENTED REALITY AND VIRTUAL REALITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I	**INTRODUCTION**	**9**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II	**VR MODELING**	**9**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III	**VR PROGRAMMING**	**9**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV	**APPLICATIONS**	**9**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V	AUGMENTED REALITY	9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and AnnotationNavigation-Wearable devices

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Comprehend the basic concepts of AR and VR
- Recognize the tools and technologies related to AR/VR
- Know the working principle of AR/VR related Sensor devices
- Design of various models using modeling techniques
- Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016

REFERENCES:

1. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003

45 PERIODS

CO's-PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	2	2	1	1	2
CO2	3	2	2	1	3	-	-	-	2	2	3	1	2
CO3	3	3	2	2	3	-	-	-	3	2	1	2	2
CO4	3	3	2	2	3	-	-	-	3	2	2	2	2
CO5	3	3	3	3	3	-	-	-	3	3	3	3	3

CS3512	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II	AUTOMATION PROCESS ACTIVITIES	9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III	APP INTEGRATION, RECORDING AND SCRAPING	9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining

UNIT IV	EXCEPTION HANDLING AND CODE MANAGEMENT	9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine

UNIT V	DEPLOYMENT AND MAINTENANCE	9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Enunciate the key distinctions between RPA and existing automation techniques and platforms.
- Use UiPath to design control flows and work flows for the target process
- Implement recording, web scraping andprocess mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020**.**

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, "Robotic Process Automation RPA Complete Guide ", 2020

CO's-PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	3	-	-	-	1	3	3	2	2
CO2	1	1	2	3	3	-	-	-	1	2	3	-	2
CO3	2	3	2	3	3	-	-	-	2	3	1	3	3
CO4	1	2	1	2	2	-	-	-	1	2	1	3	3
CO5	3	3	3	3	3	-	-	-	3	1	1	3	2

CS3513	**SOFTWARE TESTING AND AUTOMATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- 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**	**9**

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**	**9**

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**	**9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, 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**	**9**

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	9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Comprehend the basic concepts of software testing and the need for software testing
- Design Test planning and different activities involved in test planning
- Design effective test cases that can uncover critical defects in the application
- Carry out advanced types of testing
- Automate the software testing using Selenium and TestNG

TEXT BOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

CO’s-PO’s and PSO’s MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	1	1	2	3	2
CO2	2	3	1	1	1	-	-	-	2	2	1	1	2
CO3	2	2	1	3	1	-	-	-	1	3	1	2	3
CO4	2	1	3	2	1	-	-	-	1	1	1	1	2
CO5	2	2	1	3	1	-	-	-	1	2	1	2	1

PROFESSIONAL ELECTIVE III

CS3606	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for
- Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I	INTRODUCTION	9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT II	CONTENT-BASED RECOMMENDATION SYSTEMS	9

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III	COLLABORATIVE FILTERING	9

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V	EVALUATING RECOMMENDER SYSTEMS	9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures.

45 PERIODS

COURSE OUTCOMES:

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

- Recall the basic concepts of recommender systems.
- Explain machine-learning and data-mining algorithms in recommender systems data sets.
- Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
- Analyze and implement a simple recommender system.
- Justify about advanced topics of recommender systems.

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),

4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	2	1	-	-	-	1	-	-	1	-
CO2	1	2	-	-	1	-	-	-	-	-	-	1	-
CO3	2	3	1	-	1	-	-	-	2	-	-	-	-
CO4	3	2	2	2	1	-	-	-	2	-	-	2	-
CO5	1	1	-	2	1	-	-	-	-	-	-	1	-

CS3607	**VIDEO CREATION AND EDITING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT I	**FUNDAMENTALS**	**9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression – risks associated with altering reality through editing.

UNIT II	**STORYTELLING**	**9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III	**USING AUDIO AND VIDEO**	**9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV	**WORKING WITH FINAL CUT PRO**	**9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V	**WORKING WITH AVID XPRESS DV**	**9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

45 PERIODS

COURSE OUTCOMES:

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

- Compare the strengths and limitations of Nonlinear editing.
- Identify the infrastructure and significance of storytelling.
- Apply suitable methods for recording to CDs and VCDs.
- Address the core issues of advanced editing and training techniques.
- Design and develop projects using AVID XPRESS DV.

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.

REFERENCES:

1. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

CO's-PO's and PSO's MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	PSO2
CO1	3	1	2	1	1	-	-	-	1	2	3	2	1
CO2	2	3	3	3	2	-	-	-	1	2	2	1	1
CO3	2	2	3	3	1	-	-	-	3	1	1	1	1
CO4	2	2	2	2	1	-	-	-	3	1	1	1	1
CO5	2	1	3	3	1	-	-	-	3	2	1	2	1

CS3608	**FUNDAMENTALS OF INTERNET OF THINGS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the concepts of Internet of Things and Arduino programming.
- To understand the architecture and protocols of Internet of Things.
- To learn about connectivity and support technologies in IoT.
- To illustrate IoT applications using case studies.
- To describe the IoT security, privacy issues.

UNIT I	**INTRODUCTION TO IOT, BASIC CONCEPTS OF PROGRAMMING**	**9**

IoT Overview–Introduction, Sensing & Actuating, Wireless Sensor Networks, Machine-to-Machine Communications, IoT versus M2M, IoT versus WoT. Basic Components – Introduction to Arduino Programming – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT II	**IOT ARCHITECTURE AND PROTOCOLS**	**9**

IoT architecture reference models, Different views of IoT architectures and frameworks design. Protocols- Application protocols, Service discovery protocols, Infrastructure protocols, and other

protocols. Understanding types of protocols like HTTP, MQTT, CoAP, AMQP, 6LoWPAN.

UNIT III	IOT TECHNOLOGIES	9

IoT connectivity Technologies - RFID, NFC, Wi-Fi, Bluetooth low energy, IEEE 802.15.4, Zigbee, Thread, Wireless HART, Z-Wave, LoRa, NB-IoT, 6LoWPAN. Support Technologies - Big Data, Data Analytics, Artificial Intelligence, Mobile, Cloud, Software defined networks, 5G, and Fog/Edge computing. IoT integration with recent technologies

UNIT IV	APPLICATIONS OF IOT	9

Industry 4.0, Society 5.0 basics. Design and Applications - examples like smart cities, smart homes, smart grids, smart agriculture, smart healthcare, smart transportation, smart manufacturing, and other smart systems. Conceptualizing the new IoT-based smart systems using a case study.

UNIT V	IOT SECURITY & PRIVACY	9

IoT Security and Privacy issues and challenges, Risks involved with IoT infrastructures, Data aggregation, storage, retrieval, and management issues including fault tolerance, interoperability, security, and privacy

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the concepts of IoT and programming Arduino.
- Interpret the concepts Architecture and Protocols of IoT.
- Illustrate the connectivity and supporting technologies in IoT.
- Illustrate IoT applications in real life.
- Describe security, privacy issues in IoT.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Raj Kamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Higher Education, 2022.
3. Edited by: Buyya, Rajkumar, and Amir Vahid Dastjerdi, Internet of Things: Principles and paradigms. Elsevier/Morgan Kaufmann,2016.

CO’s-PO’s and PSO’s MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	2						1	1	2	2
CO2	2	3	2	2						1	3	2	2
CO3	2	3	2	2						1	3	2	2
CO4	2	3	2	1						1	3	2	2
CO5	2	3	1	2						1	2	2	2

CS3609	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of web application security
- 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
- To address privacy, trust, and legal aspects relevant to web security

UNIT I	FUNDAMENTALS OF WEB APPLICATION SECURITY	9

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 API DEVELOPMENT	9

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 III	WEB SECURITY STANDARDS	9

Web security standards: OWASP Top 10, HTTPS, TLS/SSL-Manual vs automated testing- Web vulnerability scanners: OWASP ZAP, Burp Suite, Nikto- Penetration testing basics- Secure code review-Rate limiting and throttling- Logging, monitoring, and alerting-

UNIT IV	HACKING TECHNIQUES AND TOOLS	9

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 etc.

UNIT V	PRIVACY, TRUST, LEGAL ISSUES, AND CASE STUDIES	9

Privacy preservation in web data - Trust models and reputation systems - Legal, ethical, and regulatory aspects - Incident response, forensics, and real-world case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understanding the basic concepts of web application security and the need for it
- Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- Identify and analyze vulnerabilities in web applications systems
- Acquire the skill to think like a hacker and to use hackers tool sets
- Assess privacy, trust, and legal issues through analysis of real-world case studies.

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	2	1	3						1		
CO2	1	1	1	2	3						1		3
CO3	1	2	1	1	2								
CO4	1	2	2	2	2						1		
CO5	1	2	2	2	2	2	2				1	2	

PROFESSIONAL ELECTIVE IV

CS3611	NETWORK FIREWALL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To define basic firewall concepts, types, and filtering mechanisms.
- To describe firewall setup, PfSense implementation, and cyber threats.
- To apply firewall strategies, configure rules, and manage network security.
- To analyze VPN technologies and deployment models for secure access.
- To evaluate VPN solutions and emerging tools for secure network design.

UNIT I	INTRODUCTION TO FIREWALL SYSTEMS	9

Introduction – Need– Working Principles –Types– Individual and SOHO Options – Uses of Host Software– Uses – Virtual – Dual – Homed and Triple – Homed Firewalls – Ingress and Egress Filtering- Types of Filtering- Selecting Firewall.

UNIT II	FIREWALL IMPLEMENTATION AND DEPLOYMENT	9

Examining Network Security – Implementation Procedure – Constructing, configuring and Managing Firewall. PfSense : Introduction - Requirements – Planning a Firewall implementation – Installing – Configuring. Hackers: Motivation –Targets –Process – Common IT Infrastructure Threats – Malware- Types of Attacks – Covert Channels – Network and Resource Availability Threats

UNIT III	FIREWALL DEPLOYMENT AND CONFIGURATION	9

Deployment: Elements – Security Strategies – Authentication, Authorization and Accounting – Placement of Network Firewalls – Reverse Proxy – Port Forwarding – Selecting Bastion Host OS – Monitoring and Logging – Understand and Interpret logs, Alerts. Configuration: Firewall Rules – Composing Rules – Ordering Rules- Access controls – Firewall Policy Elements – Firewall Limitations – Improving Performance.

UNIT IV	VIRTUAL PRIVATE NETWORKS	9

Introduction – Benefits – Limitations – Policies – Deployment Models and Architecture – Tunnel Versus Transport Mode – Authentication – Authorization. VPN Management: Best Practices – VPN Policies – Deployment Plan – Threats. Technologies: Difference between Hardware and Software Solutions, Layer 2 and Layer 3 VPNs – IPSec – L2TP – Secure Shell Protocol.

UNIT V	VPN IMPLEMENTATION, SECURITY AND EMERGING TECHNOLOGIES	9

Operating System – Based VPNs – Applied Appliances – Remote Desktop Protocol –Remote Control Tools and Access– Remote Desktop Services – DMZ, Extranet and Intranet VPN Solutions – Online Remote VPN Options- Planning VPN Implementation –Firewall Management Practices – Mitigating Firewall Threats- Testing Firewall Security – Managing and Monitoring Tools- Network Security Firewall and VPNs: Future – tools – Uses of Security Technologies.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- To recall the essential principles, types, and roles of firewall systems.
- To explain firewall implementation steps and common network threats.
- To configure and manage firewalls using appropriate deployment methods.
- To distinguish between VPN architectures and assess management practices.
- To critique firewall and VPN solutions to address modern security needs.

TEXT BOOKS:

1. Stewart, J. M., & Kinsey, D. (2020). Network Security, Firewalls, and VPNs (3rd ed.). Jones & Bartlett Learning.
2. Cybellium TM. (2024). Understanding Firewalls and VPNs. Cybellium TM Publications.

REFERENCES:

1. Noonan, W., & Dubrawsky, I. (2006). Firewall Fundamentals. Cisco Press.
2. Stubbig, M. (2023). Practical OPNsense: Building Enterprise Firewalls with Open Source. Books on Demand.
3. Garg, N. K. (2024). Beyond Firewalls: Security-at-Scale. Naveen Garg.
4. Russell, C. (2018). Web Application Firewalls. O'Reilly Media. ISBN-13: 978-1492038260
5. Kent, K., & Souppaya, M. (2021). Guide to Firewalls and VPNs. National Institute of Standards and Technology (NIST) Special Publication 800-41 Revision 1. (Government Publication)

CO's-PO's and PSO's MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3											2	2
CO2	3	3		2								2	3
CO3		2	3		3							3	3
CO4		3	3		3								3
CO5			3	3	3	2					2	3	3

CS3612	TEXT AND SPEECH ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand basics of NLP, linguistics, and text preprocessing.
- Learn text classification, clustering, and semantic analysis.
- Study fundamentals of speech processing and synthesis.
- Explore speech recognition techniques and sequence labeling.
- Apply deep learning methods in text and speech analytics.

UNIT I	INTRODUCTION TO TEXT ANALYTICS AND NLP	9

Introduction to Natural Language – Linguistics - Language Syntax and Structure - Language Semantics - Text Corpora - Natural Language Processing - Text Analytics - Text Tokenization – Text Normalization - Understanding Text Syntax and Structure.

UNIT II	TEXT CLASSIFICATION AND CLUSTERING	9

Text Summarization and Information Extraction - Keyphrase Extraction – Topic Modeling - Automated Document Summarization - Semantic Analysis – Exploring WordNet - Word Sense Disambiguation - Named Entity Recognition – Analyzing Semantic Representations - Sentiment Analysis

UNIT III	FUNDAMENTALS OF SPEECH PROCESSING	9

Introduction to Speech Analytics - The Speech Chain - Applications of Digital Speech Processing - The Speech Signal - Hearing and Auditory Perception - Digital Speech Coding - Text-to-Speech Synthesis Methods

UNIT IV	SPEECH RECOGNITION TECHNIQUES	9

Automatic Speech Recognition and Text-to-Speech - Feature Extraction for ASR: Log Mel Spectrum - Speech Recognition Architecture - Connectionist Temporal Classification - ASR Evaluation -Text-To-Speech (TTS) system - Hidden Markov Models (HMM) -Sequence Labelling for Parts of Speech and Named Entities

UNIT V	DEEP LEARNING FOR TEXT AND SPEECH ANALYTICS	9

Introduction to Deep Learning in NLP and Speech - Word Embeddings: Word2vec, GloVe, FastText - Recurrent Neural Networks (RNN), LSTM, GRU - Introduction to Transformer Architecture - Deep Learning for Speech Analytics: CNN on Spectrograms, RNN for Sequences - Case studies: Emotion Detection from Speech using CNN and RNN and Fake News Detection Using Word2Vec and Deep Neural Networks.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Demonstrate understanding of NLP fundamentals and text preprocessing techniques.
- Perform text classification, clustering, and semantic analysis tasks.
- Explain key concepts in speech processing and text-to-speech synthesis.
- Apply speech recognition methods and sequence labeling models.
- Utilize deep learning techniques for text and speech analytics in practical scenarios.

TEXT BOOKS:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data”, Apress, 2016.
2. Lawrence R. Rabiner and Ronald W. Schafer, “Introduction to Digital Speech Processing”, now Publishers Inc, 2007.
3. Daniel Jurafsky & James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models”,third edition, Online manuscript released January 12, 2025.
4. Feldman, R., & Sanger, J., “The Text Mining Handbook”, Cambridge University Press, 2007.
5. Weiss S.M., Indurkhya N., Zhang T., Damerau F., “Text Mining: Predictive Methods forAnalyzing Unstructured Information”, Springer, 2005

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1. https://archive.nptel.ac.in/courses/117/105/117105145/
2. https://onlinecourses.nptel.ac.in/noc22_ee117/preview
3. https://cmusphinx.github.io/
4. https://nlp.stanford.edu/
5. https://web.stanford.edu/~jurafsky/slp3

CO’s-PO’s and PSO’s MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	0	0	2	0	0	0	0	0	2	3	2
CO2	3	3	3	0	3	0	0	2	0	2	2	3	3
CO3	3	3	2	3	3	0	0	0	2	0	2	3	3
CO4	2	0	0	2	2	0	0	0	0	0	2	2	2

CO5	3	3	3	3	3	2	0	0	2	0	2	3	3

CS3613	**VISUAL EFFECTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Understand the principles and techniques of animation and the VFX production pipeline.
- Explore CGI concepts, color theory, lighting techniques, and 3D modeling and rendering.
- Learn various special effects methods including practical and particle effects.
- Apply advanced visual effects techniques such as motion capture, match moving, and rotoscoping.
- Gain proficiency in compositing methods and VFX tools used for integrating visual elements.

UNIT I	**ANIMATION BASICS**	**9**

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths

UNIT II	**CGI, COLOR, LIGHT**	**9**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading mode

UNIT III	**SPECIAL EFFECTS**	**9**

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT IV	**VISUAL EFFECTS TECHNIQUES**	**9**

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V	**COMPOSITING**	**9**

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- implement animation in 2D / 3D following the principles and techniques
- use CGI, color and light elements in VFX applications
- create special effects using any of the state of the art tools
- apply popular visual effects techniques using advanced tools
- use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition,2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014

REFERENCES:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual storytelling, Routledge, 1st Edition, 2016.
5. EranDinur, "The Complete guide to Photorealism, for Visual Effects, Visualization".
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, " The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	1	-	-	-	1	2	1	3	3
CO2	1	3	3	2	1	-	-	-	3	2	2	1	1
CO3	2	3	3	2	1	-	-	-	1	2	1	2	2
CO4	3	3	2	2	3	-	-	-	3	3	2	2	3
CO5	1	2	1	1	2	-	-	-	1	3	2	2	3

CS3614	**MERN STACK**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- This course aims to equip students with foundational and practical knowledge of fullstack web development using the MERN stack.
- Students will learn essential front-end and back-end technologies with Git, server-side programming, and database integration.
- By the end of the course, students will be able to develop, integrate, and deploy dynamic web applications through hands-on activities and project-based learning.

UNIT I	**INTRODUCTION TO WEB DEVELOPMENT AND HTML FUNDAMENTALS**	**8**

Overview of web technologies and architecture (Frontend, Backend, Full Stack)- MERN (MongoDB, Express.js, React, Node.js)- Setting up the development environment (VS Code, Node.js, npm, browser tools)- HTML Structure and Boilerplate- Elements, Tags, and Attributes- Block vs Inline Elements, Semantic vs Non-semantic Elements- Common Tags: headings, paragraphs, links, lists, images, tables,

forms- Form elements and attributes (input, textarea, button, select, etc.)- Media tags (audio, video, iframe)- Meta tags and accessibility basics.

Activity:

Flipped Class Room about basic terminologies.

UNIT II	CSS, RESPONSIVE DESIGN AND BOOTSTRAP FRAMEWORK	8

CSS Syntax, Selectors, and Properties- Colors, backgrounds, borders, margins, padding- Box Model (content, border, padding, margin)- Typography (fonts, sizes, weights, line-height)- Layouts: display, position, float, flexbox, grid- Responsive Design: media queries, mobile-first approach- CSS Units (px, em, rem, %, vh, vw)- Adding CSS to HTML (inline, internal, external)- Introduction to Bootstrap and its advantages- Bootstrap setup and CDN usage- Grid system and responsive layouts- Common components: Navbar, Buttons, Alerts, Cards, Tables, Jumbotron- Carousel, Dropdowns, Pagination- Utility classes for spacing, display, text, etc.- Customizing Bootstrap themes.

Activity:

Responsive Web Page Creation Assignment

UNIT III	JAVASCRIPT, ES6 ESSENTIALS AND VERSION CONTROL WITH GIT	8

JavaScript basics: variables (var, let, const), data types, operators- Control structures: conditionals, loops (for, while, do-while)- Functions: declarations, expressions, arrow functions- Arrays and objects, array/object methods- DOM manipulation and events- ES6 features: template literals, destructuring, spread/rest, modules- (import/export), classes, inheritance- Practical exercises: form validation, interactive UI elements- Introduction to Git and GitHub- Basic commands: init, add, commit, push, pull- Branching and merging.

Activity:

Quiz about Scripts

UNIT IV	NODE.JS & EXPRESS.JS AND MongoDB	9

What is Node.js? Event-driven architecture, npm- Creating a simple server- Introduction to Express.js: routing, middleware, REST APIs- Handling requests and responses- Serving static files- Basic CRUD operations with in-memory data- Introduction to NoSQL and MongoDB- Documents, collections, and databases-CRUD operations (create, read, update, delete)- Connecting MongoDB with Node.js (using Mongoose)- Data modeling and schema basics.

Activity: Think-Pair Shareabout Query Operations

UNIT V	React.js FUNDAMENTALS & PROJECT WORK & INTEGRATION	12

Introduction to React and JSX- Components: functional and class-based- Props and state management- Event handling- Conditional rendering, lists, and keys –React hooks (useState, useEffect)- Routing with React Router- Simple form handling and validation. Building a mini MERN application (e.g., To-Do App, Blog, Student Management System)- Integrating frontend (React) with backend (Express, Node.js, MongoDB)- Deploying the project (overview of cloud deployment options)- Presentation and code review

Activity: Project Based Learning

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand and apply core web technologies such as HTML, CSS, and JavaScript to create structured and responsive web pages.
- Demonstrate proficiency in using the MERN stack by building full-stack applications using MongoDB, Express.js, React, and Node.js.
- Utilize version control systems like Git and GitHub for collaborative development, code management, and project tracking.
- Implement client-server interactions using RESTful APIs and manage data using CRUD operations in MongoDB.
- Design, integrate, and deploy a complete web application by combining frontend and back-end technologies and presenting the project effectively.

TEXT BOOKS:

1. Greg Lim, "Beginning MERN Stack Development", July 2021

REFERENCES:

1. Chirag Meghwal, "Mastering MERN Stack Development: From Beginner to Pro: A Comprehensive Guide to Building Modern Web Applications with MongoDB, Express.js, React, and Node.js", June 2024

2. Nabendu Biswas, "Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS", Dec 2023

45 PERIODS

CO's-PO's and PSO's MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2									1	2
CO2	2	2	2	1	2							1	2
CO3	1	2	2									1	2
CO4	1	2	3									1	2
CO5	2	2	3									1	2

CS3615	**DIGITAL MARKETING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- Understand online marketing and content strategies.
- Learn SEO and SEM techniques.
- Explore email and mobile marketing.
- Analyze social media marketing and engagement.
- Understand digital transformation and emerging trends.

UNIT I	**INTRODUCTION TO ONLINE MARKET**	**9**
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing- Content Marketing Tools.		
UNIT II	**SEARCH ENGINE OPTIMISATION**	**9**

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- Ad Copy Creation -PPC advertising -Display Advertisement.

UNIT III	E- MAIL MARKETING	9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

UNIT IV	SOCIAL MEDIA MARKETING	9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V	DIGITAL TRANSFORMATION	9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, WebAnalytics - Changing your strategy based on analysis- Recent trends in Digital marketing- AI & Generative AI Take Center Stage.

45 PERIODS

COURSE OUTCOMES:

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

- Examine the role and importance of digital marketing in today's business environment.
- Understand how organizations use digital marketing and measure its effectiveness.
- Learn the key elements of digital marketing strategy.
- Study methods to evaluate digital marketing campaign performance.
- Demonstrate practical skills in tools like SEO, SEM, social media, and blogs.

TEXT BOOKS:-

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition, 2017.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press, 2015.
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition, 2017.
4. Ryan, D. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited, 2014.
5. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning, 2017.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education .

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	1	2	3	3	3
CO2	2	2	2	1	3	-	-	-	1	2	3	3	3
CO3	1	1	1	2	2	-	-	-	1	2	1	3	2
CO4	3	2	2	3	1	-	-	-	1	3	2	2	3

CO5	2	3	1	3	3	-	-	-	2	3	1	1	2

OCS3501	**RELATIONAL DATABASE SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the fundamentals of 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**	**9**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features - Embedded SQL– Dynamic SQL.

UNIT II	**DATABASE DESIGN**	**9**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III	**TRANSACTIONS**	**9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update.

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**

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Construct SQL Queries using relational algebra
- Design database using ER model and normalize the database
- Construct queries to handle transaction processing and maintain consistency of the database
- Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
- Appraise how 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.

CO's-PO's and PSO's MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	1				2	1	1	2	1
CO2	3	1	1	1	1				2	3	3	3	1
CO3	3	2	3	2	1				2	1	1	2	3
CO4	1	2	3	2					3	2	2	2	2
CO5	1	1	3	3	2				1	3	2	2	1

OCS3502	**CREATIVE WEB DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To design a basic website using web architecture, protocols, and standards.
- To build a web page using HTML tags and CSS for layout and styling.
- To evaluate CSS layout techniques to create responsive web designs.
- To develop interactive web pages using JavaScript and JQuery.
- To create dynamic web applications using PHP and MySQL.

UNIT I	**INTRODUCTION TO WWW**	**9**

Understanding the working of Internet-Web Application Architecture-Brief history of Internet- Web Standards – W3C-Technologies involved in Web development – Protocols-Basic Principles involved in developing a website-Five Golden Rules of Web Designing

UNIT II	**INTRODUCTION TO HTML and CSS**	**9**

HTML Documents - Understanding Markup Languages - Structure of HTML Documents - Markup Tags - Basic Markup Tags - Working with Text - Working with Images – Hyperlinks - Tables and Lists - HTML5 Video and Audio Tags. **Cascading Style Sheets (CSS):** Need for CSS - Importance of Separating

Document Structure and Style - Basic CSS Selectors and Properties - CSS Properties: Colors, Fonts - Classes, IDs, Tags.

UNIT III	Advanced CSS3 and Web Page Layouts	9

Web Page Layouts with CSS3 - CSS Specificity - Linking CSS to HTML (Internal, External, Inline) - CSS Pseudo Selectors - Understanding the Box Model: Margins, Padding, Border - Inline and Block Elements - Structuring Pages Using Semantic Tags - Positioning with CSS: Static, Relative, Absolute – Fixed - Floats and Clear - z-index - Layouts with Flexbox - Advanced CSS Effects: Gradients, Opacity, Box-shadow - CSS3 Animations: Transforms and Transitions.

UNIT IV	JAVA SCRIPT	9

Basic JavaScript syntax-JavaScript Objects and JSON-Understanding the DOM-JavaScript Events and Input validation-Modifying CSS of elements using JavaScript-JavaScript Local Storage and Session Storage-Cross domain data transfer with AJAX-Using JQuery to add interactivity-JQuery Selectors-JQuery Events-Modifying CSS with JQuery -Adding and removing elements with JQuery-AJAX with JQuery-Animations with JQuery (hide, show, animate, fade methods, Slide Method)

UNIT V	SERVER-SIDE PROGRAMMING WITH PHP	9

PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing connectivity with MySQL using PHP

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Demonstrates knowledge of web architecture and standards.
- Creates web pages using HTML and CSS.
- Applies advanced CSS3 for responsive layouts.
- Develops interactive web features with JavaScript and JQuery.
- Implements server-side programming with PHP and MySQL.

TEXT BOOKS:

1. David Flanagan, “JavaScript: The Definitive Guide”, 7th Edition, O’Reilly Publications,2020
2. Danny Goodman, “Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript” , O’Reilly Publications, 3rd Edition,2007
3. Robin Nixon; “Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating Dynamic Websites”, O’Reilly Publications, 2nd Edition,2018
4. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition,2018
5. Elizabeth Castrol, “HTML5 & CSS3 Visual Quick start Guide”, Peachpit Press, 7th Edition, 2012.
6. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How to Program”, Fifth Edition, Pearson Education, 2012

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1. https://developer.mozilla.org/en-US/
2. https://learn.shayhowe.com/

CO’s-PO’s and PSO’s MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2				2								3
CO2		2	2	2								2	
CO3						2	2						2
CO4				2	3							2	
CO5							3				3		

OCS3601	**PRINCIPLES OF OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To explain the concepts of processes, threads, and their states.
- To apply scheduling algorithms to manage CPU processes efficiently.
- To analyze inter-process communication and synchronization mechanisms.
- To solve classical synchronization problems like Producer–Consumer and Dining Philosophers.
- To evaluate deadlock handling techniques including prevention, avoidance, detection, and recovery.

UNIT I	**OPERATING SYSTEM OVERVIEW**	**9**

Introduction – Computer System Structure – OS Functions and Services – System Calls – Operating System Architecture – Types of Operating Systems – Case Study: UNIX/Linux basics.

UNIT II	**PROCESS AND THREAD MANAGEMENT**	**10**

Process Concept – Process States – Process Control Block – Threads – Scheduling Algorithms (FCFS, SJF, Priority, Round Robin, Multilevel Queue) – Inter-Process Communication (IPC) – Process Synchronization – Classical Problems (Producer–Consumer, Readers–Writers, Dining Philosophers) – Deadlocks: Characterization, Prevention, Avoidance, Detection, Recovery.

UNIT III	**MEMORY MANAGEMENT**	**8**

Memory Allocation: Contiguous and Non-Contiguous – Paging – Segmentation – Virtual Memory Concepts – Demand Paging – Page Replacement Algorithms – Thrashing.

UNIT IV	**STORAGE AND FILE SYSTEMS**	**9**

File System Interface – File Operations – Directory Structure – File System Implementation – Disk Structure – Disk Scheduling Algorithms (FCFS, SSTF) – I/O Systems – Protection and Security Concepts.

UNIT V	**VIRTUALIZATION AND MOBILE OPERATING SYSTEMS**	**9**

Virtual Machines – Hypervisors – Containerization Basics (Docker overview) – Mobile OS: iOS and Android Architecture – Comparison of Features – Security in Mobile Operating Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze various scheduling algorithms and process synchronization.
- Apply process management concepts to use scheduling, synchronization, IPC, and deadlock handling techniques.
- Apply memory management techniques such as paging, segmentation, and page replacement

algorithms to solve problems in virtual memory systems.

- Analyze file system implementations, evaluate disk scheduling algorithms, and examine rotection and security mechanisms in I/O systems.
- Analyze virtualization and containerization technologies, compare mobile operating system architectures, and evaluate their security mechanisms.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts'II,10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, " Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

CO's-PO's and PSO's MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	2	2					3	2	3	1	2
CO2	2	2	3	1	1				2	1	1	2	1
CO3	1	3	2	2	1				2	2	1	1	2
CO4	1	3	3	3					1	2	1	1	3
CO5	3	1	2	1	1				3	2	3	2	2

OCS3602	**SOFTWARE ENGINEERING METHODOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To explain software engineering processes and agile methodologies.
- To apply cost estimation and project planning techniques.
- To analyze and specify software requirements using modeling tools.
- To design software systems and implement coding standards.
- To perform software testing and manage maintenance activities.

UNIT I	**SOFTWARE PROCESS**	**9**

Introduction to Software Engineering, scope – software crisis – principles of software engineering - Software process – Life cycle models – Traditional and Agile Models - Agile Manifesto and Principles- Agile Processes - Team organization.

UNIT II	**PLANNING AND ESTIMATION**	**9**

Planning and the software process – cost estimation: LOC, FP Based Estimation, COCOMO I & II Models – Duration estimation and tracking – Gantt chart - Software Project Management – plan –risk analysis and management.

UNIT III	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9**

Software Requirements: Functional and Non-Functional, Software Requirements specification– Structured system Analysis – modeling: UML based tools, DFD - Requirement Engineering Process. Agility and Requirement Engineering.

UNIT IV	SOFTWARE DESIGN AND IMPLEMENTATION	9

Design process – Design principles and guidelines – design techniques – coupling and cohesion - metrics – tools. Implementation: choice of programming language, programming practices – coding standards – code walkthroughs and inspections.

UNIT V	TESTING AND MAINTENANCE	9

Software testing fundamentals- Testing techniques: white box, black box, glass box testing - unit testing – integration testing –system testing – acceptance testing – debugging. Postdelivery maintenance: Types – objectives- metrics - Reverse Engineering.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Differentiate among various software life cycle models and their uses.
- Conduct detailed software requirements analysis.
- Implement systematic methods for software design and deployment.
- Assess testing techniques and address maintenance issues effectively.
- Develop project schedules and accurately estimate cost and effort.

TEXT BOOKS:

1. Roger S. Pressman, “Software Engineering – A Practitioner‟s Approach”,Nineth Edition,Mc Graw-Hill International Edition, 2020.

2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.

REFERENCES:

1. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.

2. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.

3. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.

4. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited,2007.

5. http://nptel.ac.in/

CO’s-PO’s and PSO’s MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2		1			1	2	1	1	1	2
CO2	2	2	2		1			1	2	1	1	1	2
CO3	2	2	2		1			1	2	1	1	1	2
CO4	2	2	2		1			1	2	1	1	1	2
CO5	2	2	2		1			1	2	1	1	1	2