



RAJALAKSHMI ENGINEERING COLLEGE CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING REGULATION 2023

Vision

To promote highly ethical and innovative computer professionals through excellence in teaching, training and research.

Mission

- To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.
- To promote research activities amongst the students and the members of faculty that could benefit the society.
- To impart moral and ethical values in their profession.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To equip students with essential background in computer science, basic electronics and applied mathematics.

PEO 2: To prepare students with fundamental knowledge in programming languages and tools and enable them to develop applications.

PEO 3: To encourage the research abilities and innovative project development in the field of networking, security, data mining, web technology, mobile communication and also emerging technologies for the cause of social benefit.

PEO 4: To develop professionally ethical individuals enhanced with analytical skills, communication skills and organizing ability to meet industry requirements.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Computer Science and Engineering Program will demonstrate

PSO 1: Foundation Skills: Ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, web design, machine learning, data analytics, and networking for efficient design of computer-based systems of varying complexity. Familiarity and practical competence with a broad range of programming language and open source platforms.

PSO 2: Problem-Solving Skills: Ability to apply mathematical methodologies to solve computational tasks, model real world problem using appropriate data structure and suitable algorithm. To understand the standard practices and strategies in software project development, using open-ended programming environments to deliver a quality product.

PSO 3: Successful Progression: Ability to apply knowledge in various domains to identify research gaps and to provide solution to new ideas, inculcate passion towards higher studies, creating innovative career paths to be an entrepreneur and evolve as an ethically social responsible computer science professional.

CURRICULUM
B.E. COMPUTER SCIENCE AND ENGINEERING
Regulation 2023 | Total Credits: 160

SEMESTER I								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	HS23111	Technical Communication I	HS	2	2	0	0	2
2.	MA23111	Linear Algebra and Calculus	BS	4	3	1	0	4
3.	GE23117	தமிழர் மரபு/Heritage of Tamils	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
4.	GE23131	Programming using C	ES	7	1	0	6	4
5.	EE23133	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
6.	PH23132	Physics for Information Science	BS	5	3	0	2	4
LABORATORY COURSES								
7	GE23121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1
NON CREDIT COURSES								
8.	MC23111	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
TOTAL				29	16	1	12	20

SEMESTER II								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA23213	Discrete Mathematical Structures	BS	4	3	1	0	4
2.	GE23217	தமிழரும் தொழில்நுட்பமும்/Tamils and Technology	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
3.	EC23232	Digital Logic and Microprocessor	ES	5	3	0	2	4
4.	GE23111	Engineering Graphics	ES	6	2	0	4	4
5.	CS23231	Data Structures	PC	7	3	0	4	5
LABORATORY COURSES								
6.	HS23221/ HS23222	Technical Communication II / English for Professional Competence	HS	2	0	0	2	1
7.	GE23122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1
8.	CS23221	Python Programming Lab	PC	4	0	0	4	2
NON CREDIT COURSES								
9.	MC23112	Environmental Science and Engineering	MC	3	3	0	0	0
TOTAL				34	15	1	18	22

SEMESTER III								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA23312	Fourier Series and Number Theory	BS	4	3	1	0	4
2.	CS23311	Computer Architecture	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	CS23331	Design and Analysis of Algorithms	PC	5	3	0	2	4
4.	CS23332	Database Management Systems	PC	7	3	0	4	5
5.	CS23333	Object Oriented Programming Using Java	PC	7	1	0	6	4
6.	CS23334	Fundamentals of Data Science	PC	5	3	0	2	4
				TOTAL	31	16	1	14
								24

SEMESTER IV								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Open Elective – I	OE	3	3	0	0	3
	BA23512	Fundamentals of Accounting	HS	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	MA23435	Probability, Statistics and Simulation	BS	4	3	0	2	4
4.	CS23431	Operating Systems	PC	7	3	0	4	5
5.	CS23432	Software Construction	PC	5	3	0	2	4
6.	CS23433	Design Thinking for Innovation in ComputerScience	EEC	3	1	0	2	2
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23421	Soft Skills-I	EEC	2	0	0	2	1
8.	CS23421	Industry Internship (2/4 weeks)	EEC	0	0	0	0	1
				TOTAL	27	16	0	12
								23

SEMESTER V								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	CS23511	Theory of Computation	PC	4	3	1	0	4
2.	CS23512	Fundamentals of Mobile Computing	PC	3	3	0	0	3
3.		Professional Elective-I	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS23531	Web Programming	PC	7	1	0	6	4
5.	CS23532	Computer Networks	PC	7	3	0	4	5
6.	AI23231	Principles of Artificial Intelligence	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23521	Soft Skills-II	EEC	2	0	0	2	1
TOTAL				31	16	1	14	24

SEMESTER VI								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-II	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
2.	CS23631	Compiler Design	PC	5	3	0	2	4
3.	CS23632	Cryptography and Network Security	PC	4	2	0	2	3
4.	CS23633	Cloud Computing	PC	4	2	0	2	3
5.	AI23331	Fundamentals of Machine Learning	PC	5	3	0	2	4
LABORATORY COURSES								
6.	CS23621	Mobile Application Development Laboratory	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23622	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				27	13	0	14	20

SEMESTER VII								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-III	PE	3	3	0	0	3
2.		Professional Elective-IV	PE	3	3	0	0	3
3.		Professional Elective-V	PE	3	3	0	0	3
		Professional Elective-VI	PE	3	3	0	0	3
4.		Open Elective – II	OE	3	3	0	0	3
LABORATORY COURSES								
5.	CS23721	Project Phase I	EEC	6	0	0	6	3
				TOTAL	21	15	0	6
								18

SEMESTER VIII								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-VII	PE	3	3	0	0	3
LABORATORY COURSES								
2.	CS23821	Project Phase II	EEC	12	0	0	12	6
				TOTAL	15	3	0	12
								9

TOTAL NO. OF CREDITS: 160

PROFESSIONAL ELECTIVES (PE)

Cyber Security								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	CR23A11	Security Assessment and Risk Analysis	PE	3	3	0	0	3
2.	CS23A11	Malware Detection and Analysis	PE	3	3	0	0	3
3.	CR23A31	Ethical Hacking and Security	PE	4	2	0	2	3
4.	CR23A32	Digital and Mobile Forensics	PE	4	2	0	2	3
5.	CR23A33	Cryptocurrency and Blockchain Technologies	PE	4	2	0	2	3
6.	CR23A34	Security and Privacy in Cloud	PE	4	2	0	2	3
7.	CR23A35	Social Network Security	PE	4	2	0	2	3
8.	CS23A35	Web Application Security	PE	4	2	0	2	3
9.	CR23A36	Information Security and Management	PE	4	2	0	2	3

Data Science								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	AI23A31	Social Network Analysis	PE	4	2	0	2	3
2.	AD23B33	Explorative and Forecasting Analytics	PE	4	2	0	2	3
3.	AI23A35	Recommendation System	PE	4	2	0	2	3
4.	IT23D31	Deep Learning Concepts	PE	4	2	0	2	3
5.	AD23B34	Text and Speech Analysis	PE	4	2	0	2	3
6.	CS23A31	Business Analytics	PE	4	2	0	2	3
7.	AD23A36	Image and Video Analytics	PE	4	2	0	2	3
8.	AD23A31	Image Processing and Computer Vision	PE	4	2	0	2	3
9.	AI23A36	Big Data Analytics	PE	4	2	0	2	3
10.	AD23A32	Natural Language Processing	PE	4	2	0	2	3

Virtual and Augmented Reality								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	CS23A37	Augmented Reality and Virtual Reality	PE	4	2	0	2	3
2.	CD23B21	Data Visualization	PE	6	0	0	6	3
3.	CS23A39	Game Development	PE	4	2	0	2	3
4.	CS23B31	Introduction to Metaverse	PE	4	2	0	2	3
5.	IT23B35	Graphics and Multimedia	PE	4	2	0	2	3
6.	CS23A38	Digital Marketing	PE	4	2	0	2	3
7.	CD23721	Visual Effects	PE	6	0	0	6	3
8.	CD23731	Film Making and Radio Podcasting	PE	4	2	0	2	3
9.	CS23A34	User Interface Design	PE	4	2	0	2	3

Emerging Technologies								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	CS23A31	Business Analytics	PE	4	2	0	2	3
2.	CS23A32	Robotic Process Automation	PE	4	1	0	4	3
3.	CS23A33	Cyber Security and Forensics	PE	4	2	0	2	3
4.	CS23A34	User Interface Design	PE	4	2	0	2	3
5.	CS23A35	Web Application Security	PE	4	2	0	2	3
6.	CS23A36	3D Printing and Design	PE	4	2	0	2	3
7.	CR23A33	Cryptocurrency and Blockchain Technologies	PE	4	2	0	2	3
8.	CB23G11	Quantum Computation and Quantum Information	PE	3	3	0	0	3

Full Stack Development								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT23431	Software Testing	PE	4	2	0	2	3
2.	IT23B33	DevOps	PE	4	2	0	2	3
3.	IT23B31	C# and .Net Framework	PE	4	2	0	2	3
4.	IT23A31	Internet of Things	PE	4	2	0	2	3
5.	IT23B32	UI and UX Design	PE	3	3	0	0	3
6.	IT23C12	Software Project Management	PE	3	3	0	0	3
7.	IT23C17	Ubiquitous Computing	PE	3	3	0	0	3
8.	IT23B35	Graphics and Multimedia	PE	4	2	0	2	3

Open Elective – Offered by CSE								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	CS23O31	Java Programming	OE	4	2	0	2	3
2.	CS23O32	Data Structures Using C	OE	4	2	0	2	3
3.	CS23O33	Assistive Technology	OE	4	2	0	2	3
4.	CS23O34	Web Design and Development	OE	4	2	0	2	3
5.	CS23O35	App Development	OE	4	2	0	2	3

COURSES OFFERED BY CSE TO OTHER DEPARTMENTS

SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	GE23233	Problem Solving and Python Programming	ES	6	2	0	4	4
2.	GE23231	Programming using Python	ES	5	1	0	4	3
3.	CS23232	Fundamentals of Data Structures using C	ES	7	3	0	4	5
4.	CS23422	Python Programming for Machine Learning	ES	4	0	0	4	2
5.	CS23336	Introduction to Python Programming	ES	5	1	0	4	3

Credit Distribution

Category	AICTE 2022	R2019	R2023
Humanities and Social Sciences including Management courses HS	16	6	8
Basic Science courses BS	23	27	20
Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. ES	29	22	18
Professional core courses PC	59	71	72
Professional Elective courses PE	12	18	21
Open Electives from other technical and /or emerging Courses OE	9	6	6
Project work, seminar and internship in industry or elsewhere EEC	15	14	15
Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] MC	Non-credit	0	0
Total	163	164	160

SUMMARY OF ALL COURSES

B.E. COMPUTER SCIENCE AND ENGINEERING										
S.NO	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3	2		3					8
2	BS	8	4	4	4					20
3	ES	9	9							18
4	PC		7	20	9	20	16			72
5	PE					3	3	12	3	21
6	OE				3			3		6
7	EEC				4	1	1	3	6	15
8	MC	✓	✓							
	Total	20	22	24	23	24	20	18	9	160

Semester – I

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
HS23111	TECHNICAL COMMUNICATION I	HS	2	0	0	2
Common to all branches of B.E/B. Tech programmes						

Objectives:

- To facilitate students develop their comprehension skills
- To enable students to improve their receptive skills
 - To equip learners with better vocabulary and enhance their writing skills
 - To aid students speak effectively in all kinds of communicative contexts.
 - To improve the learners' basic proficiency in workplace communication

UNIT-I	DEVELOPING COMPREHENSION SKILLS	6
Listening: Introduction to Informational listening – Listening to Podcasts, News		
Reading: Intentional Reading - Short Narratives and Passages.		
Speaking: Introducing Oneself, Narrating a Story / Incident.		
Writing: Sequential Writing – connecting ideas using transitional words (Jumbled Sentences), Process Description		
Grammar: Verbs – Main & Auxiliary: Simple Tenses – Form, Function and Meaning.		
Vocabulary: Word formation – Prefix, Suffix, Compound Words.		
UNIT-II	LISTENING AND EXTENDED READING	6
Listening: Deep Listening – Listening to Talk Shows and Debates		
Reading: In-depth Reading - Scanning Passages Speaking: Describing Current Issues, Happenings, etc., Writing: Note Making, Note Taking – Paragraph Writing Grammar: Continuous Tenses, Prepositions, Articles		
Vocabulary: One Word Substitutes, Phrasal Verbs.		
UNIT-III	FORMAL WRITING AND VERBAL ABILITY	6
Listening: Listening to Lectures and Taking Notes Reading: Interpretation of Tables, Charts and Graphs Speaking: SWOT Analysis on Oneself		
Writing: Formal Letter Writing and Email Writing		
Grammar: Perfect Tenses, Phrases and Clauses, Discourse Markers		
Vocabulary : Verbal Analogy / Cloze Exercise		
UNIT-IV	ENHANCING SPEAKING ABILITY	6
Listening: Listening to eminent voices of one's interest (Martin Luther King, APJ Abdul Kalam, etc.)		
Reading: Timed Reading, Filling KWL Chart. Speaking: Just a Minute, Impromptu Writing: Check-list, Instructions.		
Grammar: 'Wh' Questions / 'Yes' or 'No' Questions, Imperatives		
Vocabulary: Synonyms, Antonyms, Different forms of the same words.		
UNIT-V	LANGUAGE FOR WORKPLACE	6
Listening: Extensive Listening (Audio books, rendering of poems, etc.) Reading: Extensive reading (Jigsaw Reading, Short Stories, Novels) Speaking: Short Presentations on Technical Topics		
Writing: Recommendations, Essay Writing		
Grammar: Impersonal Passive, Reported Speech, Concord		
Vocabulary : Informal Vocabulary and Formal Substitutes		
Total Contact Hours: 30		
Course Outcomes: On completion of the course students will be able to		
<ul style="list-style-type: none"> • Apply their comprehension skills and interpret different contents effortlessly • Read and comprehend various texts and audio visual contents • Infer data from graphs and charts and communicate it efficiently in varied contexts • Participate effectively in diverse speaking situations • To present, discuss and coordinate with their peers in workplace using their language skills 		

SUGGESTED ACTIVITIES

- Ice breaker
- Just A Minute
- Ship wreck
- Hot seat
- Vocabulary building
- Chinese whispers
- Case study

SUGGESTED EVALUATION METHODS

- Assignment topics
- Quizzes
- Class Presentation/Discussion
- Continuous Assessment Tests

Text Book(s):

1.	Effective Technical Communication by M. Ashraf Rizvi, 2nd Edition, 2017
2.	Sylvan Barnet and Hugo Bedau, 'Critical Thinking Reading and Writing', Bedford/st. Martin's: Fifth Edition, 2004
3.	Meenakshi Upadhyay, Arun Sharma – Verbal Ability and Reading Comprehension.
4.	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine ChuenMeng Goh, Cambridge University Press

Reference Book(s):

1.	Basic Vocabulary in Use: 60 Units of Vocabulary Practice in North American English With Answers 2nd Edition by Michael McCarthy, Felicity O'Dell, John D. Bunting
2.	Reading Development and Difficulties By Kate Cain
3.	The 7 Habits of Highly Effective People by Stephen Covey, Simon and Schuster, UK
4.	Everybody Writes: Your Go-To Guide to Creating Ridiculously Good Content Hardcover by Ann Handley

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	HS23111. 1	-	-	-	1	-	-	-	-	3	-	-	-	2	-
HS23111. 2	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS23111. 3	-	1	-	1	-	-	-	-	-	3	-	-	2	-	-
HS23111. 4	-	-	-	2	-	-	-	-	1	3	-	-	3	-	1
HS23111. 5	-	-	-	1	-	-	-	-	1	3	-	-	1	-	-
Average	-	1.0	-	1.2	-	-	-	-	1	3	-	-	2.0	2	1.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
MA23111	LINEAR ALGEBRA AND CALCULUS	BS	3	1	0	4
Common to B.E. - CSE, EEE, ECE, BME and B.Tech. IT.						

Objectives:

- To introduce the matrix techniques and to explain the nature of the matrix.
- To collect the matrix algebra techniques and the concepts of basis and dimension in vector spaces.
- To construct normalization of vectors and ortho-normal vectors.
- To understand techniques of calculus which are applied in the Engineering problems.
- To apply the techniques of Integration in finding area and volumes.

UNIT-I	MATRICES	12
Matrices - Eigenvalues and eigenvectors - Diagonalization of matrices using orthogonal transformation - Cayley- Hamilton Theorem (without proof) - Quadratic forms - Reduction to canonical form using orthogonal transformation -Numerical computation of Eigen value using Power method.		
UNIT-II	LINEAR TRANSFORMATION	12
Vector spaces – Subspaces – Linear combinations and system of Linear equations – Linear independence and Linear dependence – Bases and Dimensions – Linear Transformation – Matrix representation of Linear Transformation – Null space, Range space and dimension theorem (without proof).		
UNIT-III	INNER PRODUCT SPACES	12
Inner product and norms - Gram Schmidt orthonormalization process - QR Factorization - Singular value decomposition.		
UNIT-IV	FUNCTIONS OF SEVERAL VARIABLES	12
Partial differentiation–Total derivative–Change of variables–Jacobians–Partial differentiation of implicit functions–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–Area enclosed by plane curves–Triple integrals–Volume of solids–Numerical computation of double integrals–trapezoidal rule.		
Total Contact Hours: 60		

Course Outcomes: On completion of the course, students will be able to

- Demonstrate the matrix techniques in solving the related problems in engineering and technology.
- Apply the concepts of basis and dimension in vector spaces to the solution of related complex engineering problems.
- Construct orthonormal basis by the concepts of normalization in inner products and to analyse complex engineering problems.
- Interpret the problems in Engineering and Technology using the principles of mathematical calculus.
- Evaluate multiple integrals to conduct investigations of complex problems.

Text Book(s):
1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. T Veerarajan , Linear Algebra and Partial Differential Equations, Mc Graw Hill Education,2019.
3. Friedberg, A.H., Insel, A.J. and Spence, L., Elementary Linear Algebra, a matrix approach,2 nd edition,Pearson, 2014.

Reference Books(s):
1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
2. Erwin Kreyszig , " Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MA23111.1	3	2	1	-	-	-	-	-	-	-	1	-	1	1	-
MA23111.2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
MA23111.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA23111.4	2	2	-	-	-	-	-	-	-	-	1	1	-	-	-
MA23111.5	2	2	-	-	-	-	-	-	-	-	-	1	1	-	-
Average	2.6	2.2	1	-	-	-	-	-	-	-	1	1	1	1	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
GE23117	தமிழர் மரபு/HERITAGE OF TAMILS	HS	1	0	0	1
Common to all branches of B.E/B. Tech programmes						

அலகு I	மமொழி மற்றும் இலக்கியம் :	3
இந்திய தமொழிக் குடும்பங்கள் - திரொவிட தமொழிகள் - தமிழ் ஒரு தெம் தமொழி - தமிழ் தெவ் விலக்கியங்கள் - எங் க இலக்கியத்தின் எமய எஃபார்பற்ற தன் மம - எங் க இலக்கியத்தில் பகிரத் ஸ் அறம் - திருக்குறளில் மமலொண் மமக் கருத்க்கள் - தமிழிக் கொப்பியங்கள், தமிழகத்தில் மெண் தபொத்த மெயங்களின் தொக்கம் - பக்தி இலக்கியம், ஆழ்வொரக் ஸ் மற்றும் நொயன் மொரக் ஸ் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பொருதியோர் மற்றும் பொருதிதொன் ஆகிமயோரின் பங்களிப்பு.		
அலகு II	மரபு - பொறுத ஓவியங்கள் முதல் நவீன ஓவியங்கள் வறர - சிற்பக் கறல்:	3
நடுகல் முதல் நவீன சிற்பங்கள் வமர - ஜம் தபொன் சிமலகள் - பழங் குடியினர் மற்றும் அவரக் ஸ் தயோரிக்கும் மகவிமனப் தபொருட்கள், தபொம்மகள் - மதர் தெய்யும் கமல் - சுடுமண் சிற்பங்கள் - நொட்டுப்புறத் தத்துவங்கள் - குமரிமுமனயில் திருவள்ளுவர் சிமல - இமைக் கருவிகள் மிருதங்கம், பமற, வீணை, யொழி, நொதஸ் வரம் - தமிழரக் ஸின் எழுக தபொருளொதொர வொழ்வில் மகொவில்களின் பங்கு.		
அலகு III	நொட்டுப்புறக் கறலைகள் மற்றும் வீர விறையொட்டுகள்:	3
ததருக்கூத்து, கரகொட்டம், வில்லுப்பொட்டு, கணியோன் கூத்து, ஓயிலொட்டம், மதொல் பொமவக் கூத்து, சிலம் பொட்டம், வளரி, புலியொட்டம், தமிழரக் ஸின் விமளையொட்டுகள்.		
அலகு IV	தமிழர்களின் திறைக் ககொட்டபொடுகள்:	3
தமிழகத்தின் தொவரங்களும், விலங் குகளும் - ததொல் கொப்பியம் மற்றும் எங் க இலக்கியத்தில் அகம் மற்றும் புறக் மகொட்டபொடுகள் - தமிழரக் ஸ் மபொற்றிய அறக்மகொட்டபொடு - எங் ககொலத்தில் தமிழகத்தில் எழுத்தறிவும், கல் வியும் - எங் ககொல நகரங்களும் மற முகங்களும் - எங் ககொலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நொடுகளில் மொழரக் ஸின் தவற்றி.		
அலகு V	இந்திய கதசிய இயக்கம் மற்றும் இந்திய பைபோட்டித்துத் தமிழர்களின் பங்களிப்பு:	3
இந்திய விடுதமலப்மபொரில் தமிழரக் ஸின் பங்கு - இந்தியைவின் பிறப்பகுதிகளில் தமிழ் ப்பன் பொட்டின் தொக்கம் - சுயமரியோமத இயக்கம் - இந்திய மருத்வுத்தில், சித்த மருத்வுத்தின் பங்கு - கல்தவட்டுகள், மகதயழுத்தப்படிகள் - தமிழ்ப் புத்தகங்களின் தீர்க்குமதி.		
Total Contact Hours: 15		

Text Book(s):
1. தமிழக வரலைறு - மக்களும் பண் பொடும் - மக.மக. பிள்மள (தவளியீடு: தமிழ்நோடு பொடநால் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முமனவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - மவமக நதிக்கமரயில் வெங்கெல நகர நொகரிகம் (ததொல் லியல் மூற தவளியீடு)
4. தபொருமந - ஆற்றங்கமர நொகரிகம். (ததொல் லியல் மூற தவளியீடு)
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 Civilization on 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 Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code	Subject Name (Lab oriented Courses)	Category	L	T	P	C
GE23131	PROGRAMMING USING C	ES	1	0	6	4

Objectives:

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To do searching and sorting algorithms in C
- To develop applications in C using user defined functions and recursive functions
- To develop applications in C using pointers and structures

List of Experiments		
1	Overview of C, Constants, Variables and Data Types	
2	Operators and Expressions, Managing Input and Output Operations	
3	Decision Making and Branching	
4	Decision Making and Looping	
5	Nested Loops - while and for, Jumps in Loops	
6	One-Dimensional Arrays	
7	Searching Algorithms - Linear and Binary	
8	Sorting Algorithms - Bubble and Selection	
9	Two-Dimensional and Multi-dimensional Arrays	
10	Character Arrays and Strings Handling Functions	
11	User-Defined Functions - Recursive Functions	
12	Passing Arrays and Strings to Functions	
13	Scope, Visibility and Lifetime of Variables	
14	Structures and Unions	
15	Pointers	
16	The Preprocessor	
Platform Needed: GCC Compiler for Windows/Linux		Total Contact Hours
		75

Course Outcomes: On completion of the course, the students will be able to

- Formulate simple algorithms for arithmetic and logical problems.
- Implement conditional branching, iteration and recursion.
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- Use arrays, pointers and structures to formulate algorithms and programs.
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Text Book(s):

1.	Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Second Edition, Pearson,2015
2.	Byron Gottfried, “Programming in C”, Second Edition, Schaum Outline Series,1996.

Reference Book(s):

1.	Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill,2017
2.	YashavantKanetkar, “Let Us C”, BPB Publications,15th Edition,2016.
3.	Balagurusamy, Programming in ANSI C, Tata McGraw-Hill,9th Edition,2019.
4.	NPTEL course , “Problem Solving Through Programming In C”, By Prof. Anupam Basu, IIT Kharagpur

Suggested Activities

- Practice small and tricky codes
- Practice problems in portals like Digital Café Debugging the codes
- Completing the function definitions etc

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
GE23131.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE23131.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE23131.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE23131.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE23131.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	2
Average	1.4	1.6	2.2	1.6	1.0	-	-	-	1.0	2.0	1.4	1.0	2.0	2.2	2.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EE23133	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4

Objectives:						
<ul style="list-style-type: none"> • To provide knowledge on the analysis of DC circuits. • To provide knowledge on the analysis of AC circuits • To expose the principles of electrical machines and electronic devices. • To teach the concepts of different types of electrical measuring instruments and transducers. • To experimentally analyze the electrical circuits and machines, electronic devices and transducers. 						

UNIT-I	DC CIRCUITS	9
Electrical circuit elements (R, L and C), Voltage and current sources, Kirchhoff's laws, Analysis of simple circuits with DC excitation, Superposition, Thevenin and Norton Theorems.		
UNIT-II	AC CIRCUITS	9
Representation of sinusoidal waveforms, Power and Power factor, Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations, Series resonance, Three phase balanced circuits		
UNIT-III	ELECTRICAL MACHINES	9
Construction, Principles of operation of DC machines, Single phase Transformers, Synchronous machines, Single phase induction motors. (Qualitative Treatment Only).		
UNIT-IV	ELECTRONIC DEVICES & CIRCUITS	9
Review of PN Junction diode – Forward and Reverse Bias – Bipolar Junction Transistor – Common Emitter characteristics – MOSFET - Introduction to operational Amplifier –Inverting and Non-Inverting Amplifier.		
UNIT-V	MEASUREMENTS & INSTRUMENTATION	9
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Piezoelectric, - Classification of instruments - PMMC and MI Ammeters and Voltmeters – Digital Storage Oscilloscope.		
Total Contact Hours: 45		

List of Experiments		
1	Verification of Kirchhoff's Laws.	
2	Load test on DC Shunt Motor (Virtual Lab)	
3	Load test on Single phase Transformer (Virtual Lab)	
4	Load test on Single phase Induction motor (Virtual Lab)	
5	Characteristics of P-N junction Diode.	
6	Characteristics of CE based NPN Transistor.	
7	Characteristics of MOSFET	
8	Characteristics of LVDT, RTD and Thermistor.	
Contact Hours :		30
Total Contact Hours :		75

Course Outcomes: On completion of the course, students will be able to		
• Analyse DC circuits and apply circuit theorems.		
• Calculate the power and power factor in AC circuits		
• Understand the principles of electrical machines.		
• Comprehend the principles of different types of electronic devices, electrical measuring instruments and transducers.		
• Experimentally analyze the electric circuits and machines, electronic devices, and transducers.		

Suggested Activities
• Problem solving sessions
Suggested Evaluation Methods
• Quizzes • Class Presentation / Discussion

Text Book(s):
1. J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Sons Publications, 2010.
2. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Schaum Series and Systems", Schaum's Outlines, Tata McGrawHill, Indian. 5th Edison , 2017
3. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

Reference Books(s):
1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2007
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, Third Edition, 2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, Third Edition, 2014
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
6. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
7. https://nptel.ac.in/courses/108108076

Lab Equipment Required:

Sl. No.	Name of the Equipment	Quantity Required (For a batch of 30 students)
1.	Verification of ohms and Kirchhoff's Laws 1. DC Regulated Power supply (0 - 30 V variable) 2. Bread Board 3. Resistors 4. Multimeter 5. Connecting wires	1 1 1 As Required
2.	Load test on DC Shunt Motor. 1. Ammeter MC (0-20A) 2. Voltmeter MC (0-300)V 3. Tachometer 4. Field Rheostat 500Ω , 1.5 A 5. Connecting wires	1 1 1 1 As Required
3.	Load Test on Induction Motor 1. Ammeter MI (0-20A) 2. Voltmeter MI (0-300)V 3. Wattmeter – 300V, 30 A 4. Tachometer – Digital 5. Connecting Wires 6. Single phase Induction motor	1 1 1 1 As Required 1

4.	Load test on Single phase Transformer 1. Ammeter (0-30) A, (0-5) A 2. Voltmeter (0-150)V, (0-300)V 3. Wattmeter – 300V, 5A, UPF 4. Autotransformer 5. Single phase Transformer 6. Connecting Wires	1 1 1 1 1 As Required
5.	Characteristics of PN and Zener Diodes 1. PN Diode (IN4007), Zener diode (6.8V, 1A) 2. Resistor 1 KΩ, 100Ω 3. Bread Board 4. DC Regulated Power supply (0 - 30 V variable) 5. Multimeter 6. Connecting wires	1 1 1 1 1 As Required
6.	Characteristics of BJT 1. Transistor (BC107) 2. Resistors- 1kΩ, 470KΩ, 1MΩ 3. Bread Board 4. DC Regulated Power supply (0 - 30 V variable) 5. Multimeter 6. Connecting wires	1 1 1 1 1 As Required
7.	Characteristics of MOSFET 1. MOSFET (IRF510) 2. Resistors- 100kΩ, 1kΩ 3. Bread Board 4. DC Regulated Power supply (0 - 30 V variable) 5. Multimeter 6. Connecting wires	1 1 1 1 1 As Required
8.	Measurement of displacement of LVDT, RTD and Thermistor 1. LVDT Kit 2. RTD 3. Thermistor 4. Multimeter	1 1 1 1 1

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
EE23133.1	3	3	3	3	-	3	1	1	2	1	1	1	2	2	2
EE23133.2	3	3	3	3	-	3	1	1	2	1	1	1	1	-	1
EE23133.3	3	3	3	3	-	3	1	1	2	1	1	1	2	2	2
EE23133.4	3	3	3	3	-	3	1	1	2	1	1	1	2	1	2
EE23133.5	3	3	3	3	-	3	1	1	2	1	1	1	2	3	2
Average	3	3	3	3	-	3	1	1	2	1	1	1	1.8	2.0	1.8

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
PH23132	PHYSICS FOR INFORMATION SCIENCE Common to -B.E.-CSE, CSD, Cyber Security & B. Tech.- IT, AIML, AI&DS.	BS	3	0	2	4

Objectives:

- To understand the principles of laser and fiber optics in engineering and technology.
- To analyze the properties of magnetic and superconducting materials.
- To understand the advanced concept of quantum theory and applications.
- To become proficient in semiconductor applications
- To become proficient in optoelectronic devices

UNIT-I	LASERS AND FIBER OPTICS	9
Lasers: Characteristics, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) –Nd-YAG Laser, Semiconductor lasers: Homojunction and Heterojunction- Applications of Lasers. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, mode and refractive index) –losses associated with optical fibers -Fiber optic communication system - fiber optic sensors: pressure and displacement.		
UNIT-II	MAGNETIC AND SUPERCONDUCTING MATERIALS	9
Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility -Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses— Magnetic principle in computer data storage. Superconductors: Properties - BCS theory (Qualitative)- Type-I and Type II superconductors - Magnetic levitation- SQUID-Cryotron.		
UNIT-III	QUANTUM PHYSICS	9
Introduction- Quantum free electron theory-De Broglie's concept-Schrodinger wave equation-Time independent and time dependent equations-Physical significance of wave function - Particle in a one dimensional box – electrons in metals - degenerate states – Fermi- Dirac statistics – Density of energy states -Size dependence of Fermi energy – Quantum confinement – Quantum wells, Quantum wires, Quantum dots and Quantum clusters - Band gap of nanomaterials.		
UNIT-IV	SEMICONDUCTOR PHYSICS	9
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – Band gap determination- extrinsic semiconductors (Qualitative)- Hall effect - determination of Hall co-efficient -Formation of P-N junction-Forward bias- Reverse bias –Ohmic contact-Schottky diode- Tunnel diode.		
UNIT-V	OPTOELECTRONICS	9
Classification of optical materials – carrier generation and recombination processes – Absorption, emission and scattering of light in metals, insulators and semiconductors (concepts only) – Photo electric effect-Photo current in a P-N diode – Photo transistor-solar cell - LED – Organic LED- Non Linear Optical materials-properties and applications.		
Total Contact Hours: 45		

List of Experiments

- Determine the wavelength of the laser using grating and size of the particle using diode laser.
- Determine the numerical aperture and acceptance angle of optical fiber.
- Study the permeability of the free space using Helmholtz coil.
- Determine the hysteresis loss in the transformer core using B-H curve unit.
- Determine the band gap of given semiconductor.
- Determine the Hall coefficient of semiconducting material.
- Determine specific resistance of the material of given wires using metre bridge.
- Study the resonance frequency in series connected LCR circuits.
- Determine the V-I characteristics of the solar cell.
- Determine the thickness of the given specimen by using air wedge method.

Contact Hours	30
Total Contact Hours	75

Course Outcomes: On completion of the course, students will be able to
● Use the concepts of Laser and Fiber optics in communication.
● Use the properties of magnetic and superconducting materials in data storage devices.
● Apply the concepts of electron transport in nanodevices.
● Analyse the physics of semiconductor devices
● Analyze the properties of optical materials for optoelectronic applications.

Suggested Activities
● Problem solving sessions
Suggested Evaluation Methods
● Quizzes
● Class Presentation / Discussion

Text Book(s):
1 Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2 Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.
3 Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.

Reference Books(s):
1. S. O. Pillai, Solid state physics, New Age International, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.

**List of Equipment Available
(Common to B.E. CSD and CSE & B.Tech. AI&DS, AI & ML, IT)**

S.No	Name of the Equipment	Quantity Required	Quantity Available
1	Wavelength of Laser and Characteristics -Laser source and grating plate	7	15
2	Laser - angle of divergence and NA acceptance angle	6	8
3	Determination of permeability of free space - Helmholtz coil setup	5	5
4	B-H curve Setup and CRO	6	7
5	Band gap of a semiconductor Setup	6	19
6	Hall coefficient of Semiconductor Setup	4	4
7	Determine specific resistance of the material of given wires-metre bridge	6	6
8	LCR circuit kit	6	7
9	Solar cell parameters setup	6	8
10	Thickness of thin wire-Air wedge method-Travelling Microscope, Glass Plate	8	13

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	PH23132.1	3	3	2	2	2	1	-	-	-	-	2	1	1	1
PH23132.2	3	3	2	2	3	1	1	-	-	-	-	2	1	1	1
PH23132.3	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
PH23132.4	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
PH23132.5	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
Average	3	3	2	2	2.80	1	1	-	-	-	-	2	1.80	1	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

Course Code	Subject Name (Lab oriented Courses)	Category	L	T	P	C
GE23121	ENGINEERING PRACTICES – CIVIL AND MECHANICAL	ES	0	0	2	1

Objectives:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

List of Experiments						
CIVIL ENGINEERING PRACTICE						
1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.					
2	Preparation of basic plumbing line sketches for wash basins, water heaters, etc.					
3	Hands-on-exercise: Basic pipe connections – Pipe connections with different joining components.					
Carpentry Works:						
4	Study of joints in roofs, doors, windows and furniture.					
5	Hands-on-exercise: Woodwork, joints by sawing, planning and chiselling.					
MECHANICAL ENGINEERING PRACTICE						
6	Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.					
7	Gas welding practice.					
Basic Machining:						
8	Simple Turning and Taper turning					
9	Drilling Practice					
Sheet Metal Work:						
10	Forming & Bending:					
11	Model making – Trays and funnels					
12	Different type of joints.					
Machine Assembly Practice:						
13	Study of centrifugal pump					
14	Study of air conditioner					
						Total Contact Hours : 30

Course Outcomes: On completion of the course, the students will be able to

- Able to perform plumbing activities for residential and industrial buildings considering safety aspects while gaining clear understanding on pipeline location and functions of joints like valves, taps, couplings, unions, reducers, elbows, etc.
- Able to perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of the joints in roofs, doors, windows and furniture.
- Able to produce joints like L joint, T joint, Lap joint, Butt joint, etc. through arc welding process while acquiring in depth knowledge in the principle of operation of welding and other accessories
- Able to perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
- Able to perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
GE23121.1	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.2	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.3	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.4	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.5	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
Average	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
MC23111	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0
	Common to all branches of B.E/B. Tech Programme					

Objectives:

- To apprehend the sacrifices made by the freedom fighters.
- To inculcate the values enshrined in the Indian constitution.
- To instil a sense of responsibility as the citizens of India.
- To familiarise about the functions of the various levels of Government.
- To be informed about Constitutional and Non- Constitutional bodies.

UNIT-I	INDIAN FREEDOM MOVEMENT	9
British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Rule-Rise of Nationalism in India-Indian Freedom Struggle under Mahatma Gandhi-Non- Cooperation Movement-Civil Disobedience Movement- Quit India Movement-British Official response to National movement- Independence of India Act 1947- Freedom and Partition.		
UNIT-II	CONSTITUTION OF INDIA	9
Historical Background – Indian Constitution: Constitution’ meaning of the term, Sources and constitutional history, Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.		
UNIT-III	STRUCTURE AND FUNCTIONS OF CENTRAL GOVERNMENT	9
Union Government – Structure of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.		
UNIT-IV	STRUCTURE AND FUNCTION OF STATE GOVERNMENT AND LOCAL BODY	9
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati Raj: Introduction, Elected officials and their roles, Village level: Role of Elected and Appointed officials.		
UNIT-V	CONSTITUTIONAL FUNCTIONS AND BODIES	9
Indian Federal System – Centre – State Relations – President’s Rule – Constitutional Functionaries – Assessment of working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and other Constitutional bodies-. NITI Aayog, Lokpal, National Development Council and other Non –Constitutional bodies.		
Total Contact Hours		: 45

Course Outcomes: Upon completion of the course, students will be able to:

- Appreciate the sacrifices made by freedom fighters during freedom movement.
- Be responsible citizens and abide by the rules of the Indian constitution.
- Be aware of the functions of the Indian government.
- Be knowledgeable about the functions of the state Government and the Local bodies.
- Apply the knowledge on constitutional functions and role of constitutional bodies and non-constitutional bodies.

SUGGESTED ACTIVITIES

- Famous speeches from around the world relating to independence
- Case study
- Quiz on Portfolio and Cabinet
- Discussions on International Associations like the UN, BRICS, QUAD
- Presentation on issues around the world

SUGGESTED EVALUATION METHODS

- Assignment topics
- Quizzes
- Class Presentation/Discussion
- Continuous Assessment Tests (CAT)

Text Book(s):
1. M. Laxmikanth , “Indian Polity”, McGraw-Hill, New Delhi.
2. Durga Das Basu, “Introduction to the Constitution of India “, Lexis Nexis, New Delhi. 21 st ed 2013.
3. P K Agarwal and K N Chaturvedi ,PrabhatPrakashan, New Delhi, 1 st ed , 2017.

Reference Books(s):
1. Sharma, Brij Kishore, “Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar
3. Bipan Chandra, India’s Struggle for Independence, Penguin Books, 2016.
4. Maciver and Page, “Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.2 nd ed, 2014.
5. Bipan Chandra, History of Modern India, Orient Black Swan, 2009.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MC23111.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.3	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
MC23111.4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
MC23111.5	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Semester – II

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
MA23213	DISCRETE MATHEMATICAL STRUCTURES	BS	3	1	0	4
Common to B.E. - CSE and B. Tech. IT						

Objectives:
● To extend student's Logical and Mathematical maturity and ability to deal with abstraction.
● To provide discrete structures of many levels and to know the principle of counting.
● To give an understanding of relations and functions and to determine their properties.
● To provide the basic principles of sets and operations in sets and to Prove basic set equalities.
● To model problems in Computer Science using graphs and trees.

UNIT-I	LOGIC AND PROOFS	12
Logic: Propositional equivalence, predicates and quantifiers - Methods of proofs - mathematical induction		
UNIT-II	COMBINATORICS	12
Counting: The basics of counting - The pigeonhole principle - Permutations and Combinations -Recurrence relations: solving recurrence relations, generating functions - Inclusion-Exclusion principle : application of inclusion-exclusion		
UNIT-III	RELATIONS	12
Relations - Equivalence relations – Functions - Bijections - Binary relations and graphs- Posets and Lattices -Hasse Diagrams – Boolean algebra		
UNIT-IV	ALGEBRA	12
Group theory: Groups, subgroups, Cosets and Lagrange's theorem - Permutation groups and Burnside's theorem - Isomorphism – Automorphisms - Homomorphism - Normal subgroups - Rings, Integral domains and Fields(only definitions)		
UNIT-V	GRAPHS	12
Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism – Connectivity - Euler and Hamilton paths - Planar graphs - Graph coloring - Introduction to trees, application of trees.		
Total Contact Hours: 60		

Course Outcomes: On completion of the course, students will be able to
● Demonstrate the ability to write and evaluate a proof or outline the basic structure and give examples of each proof technique described.
● Apply counting principles to determine probabilities in engineering problems.
● Demonstrate the relations and functions and to determine their properties in solving engineering problems.
● Analyse the concepts and properties of algebraic structures in the solving complex engineering problems.
● Use different traversal methods for trees and graphs arising in the field of engineering and technology.

SUGGESTED ACTIVITIES
● Problem solving sessions
● Visio for drawing graphs
● Online Calculators for PDNF and PCNF, recurrence relations and sets
● Calculators for Logic gates
● GeoGebra for Hasse diagrams and graphs

SUGGESTED EVALUATION METHODS

- Problem solving in Tutorial sessions
- Assignment problems
- Quizzes and class test
- Discussion in classroom

Text Book(s):

1	Elements of Discrete Mathematics, (Second Edition) C. L. LiuMc Graw Hill, New Delhi.
2	Digital Logic & Computer Design, M. Morris Mano, Pearson.
3	Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd.,New Delhi, Special Indian Edition, 2011.
4	Tremblay, J.P. and Manohar. R, " Discrete Mathematical Structures with Applications to Computer Science",Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
5	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.

Reference Books(s) / Web links:

1	Introduction to linear algebra, 5th Edition, Gilbert Strang.
2	Introductory Combinatorics, R. A. Brualdi, North-Holland, New York
3	Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4	Introduction to Mathematical Logic,(Second Edition), E. Mendelsohn, Van-Nostrand, London.
5	Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore.
6	Topics in Algebra, I. N. Herstein, John Wiley and Sons.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	MA23213.1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
MA23213.2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23213.3	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-
MA23213.4	3	2	3	-	-	-	-	-	-	-	-	-	-	1	-
MA23213.5	3	2	3	-	-	-	-	-	-	-	-	-	1	1	-
Average	3	2.2	2.2	1	-	-	-	-	-	-	-	-	1	1	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
GE23217	தமிழ்ரும் மதொழில் நுட்பம்	HS	1	0	0	1
Common to all branches of B.E/B. Tech programmes						

அலகு I	மநசவு மற்றும் பொறனத் மதொழில் நுட்பம்:	3
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வெங்க கொலத்தில் தனிவுத் ததொழில் - பொமனத் ததொழில் நுட்பம் - கருப்பு சிவப்பு பொண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.

அலகு II	வடிவறமப்பு மற்றும் கட்டிடத் மதொழில் நுட்பம்:	3
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வெங்க கொலத்தில் வடிவமமப்பு மற்றும் கட்டுமொனங் கள் & வெங்க கொலத்தில் வீட்டுப்புதொருட்களில் வடிவமமப்பு - வெங்க கொலத்தில் கட்டுமொன தபொருட்களும் நடுகல் லும் - சிலப்பதிகொரத்தில் மமமட அமமப்பு பற்றிய விவரங் கள் - மொமல் லபுரெ சிற்பங் களும், மகொவில் களும் - மொழர் கொலத்தப் தபருங் மகொயில் கள் மற்றும் பிற வழிபொட்டுத் தலங் கள் - நொயக்கர் கொலக் மகொயில் கள் - மொதிரி கட்டமமப்புகள் பற்றி அறிதல், மெமர் மீணாட்சி அம் மன் ஆலயம் மற்றும் திருமல நொயக்கர் மஹூால் - தெட்டிநொடு வீடுகள் - பிரிட்டிஷ் கொலத்தில் தென் மனியில் இந்மதோ - வெளாமரோதெனிக் கட்டிடக் கமல்.

அலகு III	உற்பத்தித் மதொழில் நுட்பம்:	3
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கப்பல் கட்டும் கமல - உமலொகவியல் - இரும் புத் ததொழிற்வெளாமல - இரும் மப உருக்குதல், எஃகு - வரலொற்றுவெளான் ருகளொக தெம் பு மற்றும் தங் க நொணயங் கள் - நொணயங் கள் அறிஞ் டித்தல் - மணி உருவொக்கும் ததொழிற்வெளாமலகள் - கல் மணிகள், கண் ஜொடி மணிகள் - சுடுமண் மணிகள் - வெங்கு மணிகள் - எலும் புத்னை டுகள் - ததொல் லியல் வெளான் ருகள் - சிலப்பதிகொரத்தில் மணிகளின் வமககள்.

அலகு IV	கவளொலை றம மற்றும் நீர்ப்பொசனத் மதொழில் நுட்பம்:	3
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அமணை, ஏரி, குளங் கள், மதகு - மொழரக் வொலக் குழுழித் தூம் பின் முக்கியத்தவம் - கொல் நமட பரோமரிப்பு - கல் நமடகளுக்கொக வடிவமமக்கப்பட்ட கிணறுகள் - மவளொண் மம மற்றும் மவளொண் மமெம் வெளார்ந்த தெயல் பொடுகள் - கடல் வெளார் அறிவு - மீன் வளம் - முத்த மற்றும் முத்தக்குளித்தல் - தபருங் கடல் குறித்த பண் மடய அறிவு - அறிவுவெளார் வெழுகம்.

அலகு V	அறிவியல் தமிழ் மற்றும் கைத்தமிழ் :	3
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அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல் கமள மின் பதிப்பு தெய் தல் - தமிழ் தமன் தபொருட்கள் உருவொக்கம் - தமிழ் இமணயக் கல் விக்கழகம் - தமிழ் மின் நூலகம் - இமணயத்தில் தமிழ் அகரோதிகள் - தெதாற்குமவத் திட்டம்.

Total Contact Hours: 15

Text Book(s):

1. தமிழக வரலாறு - மக்களும் பண் பொடும் - மக.மக. பிள்மள (தவளியீடு: தமிழ்நொடு பொட்டால் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முமனவர் இல. சுந்தரம். (விகடன் பிரசரம்).
3. கீழடி - மவமக நதிக்கமரயில் வெங்கெலால் நகர நொகரிகம் (ததொல் லியல் மூற தவளியீடு)
4. தபொருமந் - ஆற்றங்கமர நொகரிகம். (ததொல் லியல் மூற தவளியீடு)
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 Civilization on 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 Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EC23232	DIGITAL LOGIC AND MICROPROCESSOR	ES	3	0	4	5

Objectives:

- To learn basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions.
- To illustrate the formal procedures for the analysis and design of Combinational and Sequential circuits.

- To understand the basic functionalities of 8085 and programming logic.
- To understand the concepts and basic functionalities of 8051 architecture and its functionalities.
- To peruse the knowledge of programming, peripherals and interface various devices.

UNIT-I	MINIMIZATION TECHNIQUES AND LOGIC GATES	9
Fundamentals: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Sum of Products (SOP), Product of Sums (POS).		
Minimization Techniques: Minimization of Boolean expressions using Boolean laws, Karnaugh map, Quine McCluskey method of minimization, don't care conditions.		
Logic Gates: Implementations of Logic Functions using gates, NAND–NOR implementations.		
UNIT-II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9
Combinational Circuits: Full Adder, Full Subtractor, Code Converters-Binary to Gray and Gray to Binary, 2-bit Magnitude Comparator, Multiplexer, Demultiplexer, Decoder, Encoder-Priority Encoder, Parallel Binary Adder/Subtractor.		
Sequential Circuits: Memory element: Flip-flops: RS, JK, D, T, Shift Registers - SISO, SIPO, PISO, PIPO. Design: Synchronous & Asynchronous counters - Up/Down counter, Modulo-N counter.		
UNIT-III	THE 8085 MICROPROCESSOR	9
8085 Architecture - Pin configuration - Instruction Set - Addressing modes – Interrupts- Assembly Language Programming.		
UNIT-IV	THE 8051 MICROCONTROLLER	9
8051 Architecture - SFR - Instruction Set - Addressing modes – Programming 8051 Timers, Serial Port, Interrupt handling, Assembly Language Programming.		
UNIT-V	INTERFACING & APPLICATIONS	9
Programmable Peripheral Interface (8255), Programmable Interval Timer (8253), DAC and ADC interfacing with 8085, Stepper Motor Control and Traffic Light Control interfacing with 8051.		
Total Contact Hours: 45		

Description of the Experiments		Total Contact Hours: 60
1.	Design and Implementation of adder, subtractor using logic gates.	
2.	Design and Implementation of Binary to Gray and Gray to Binary code converter	
3.	Design and Implementation of Multiplexer and De-multiplexer using logic gates.	
4.	Design and Implementation of 4-bit Synchronous counters.	
5.	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- Flop.	
6.	8-bit Arithmetic, Logical and Decimal Arithmetic Operations using 8085.	
7.	8 Searching an array of numbers using 8085.	
8.	8-bit Arithmetic, Logical operations using 8051.	
9.	8255 - Parallel interface with 8085.	
10.	8253– Timer interface with 8085.	
11.	Stepper Motor Control using 8051.	

Course Outcomes: On completion of the course students will be able to:

- Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization
- Apply the procedure to design and implement combinational and sequential circuits.
- Interpret the concepts of 8085 and develop programs using 8085.
- Analyze the concepts of 8051 and to infer the basic functionalities.
- Explore the knowledge of interfacing and use it for different applications.

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic

- Problem solving sessions- Tabulation Method
- Flipped classroom – 8051 architectures.
- **Activity based learning- Quiz- Instruction set**

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic

- Tutorial problems – K-map, Quine Mc-Cluskey method
- Assignment problems – Boolean expression based problems
- Quizzes- 8085, 8051 concepts
- Class Presentation/Discussion- Architecture topics

Text Book(s):

1	M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2	Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Applications with 8085”, Sixth edition, Penram International Publishing, 2012.
3	Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

Reference Book(s):

1	Charles H.Roth. “Fundamentals of Logic Design”, 7th Edition, Thomson Learning, 2014.
2	Krishna Kant, Microprocessor and Microcontroller Architecture, Programming and System design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2011.
3	Douglas V. Hall, “Microprocessor and Interfacing, Programming and Hardware”, Revised 2nd Edition 2006, eleventh reprint 2010. Tata McGraw Hill.

Lab equipment required:

S. No	Name of the Equipment
1	Digital IC Trainer Kit
2	8085 Microprocessor trainer kit
3	8051 Microcontroller trainer kit
4	8255 Parallel interface
5	8253 timer interface
6	CRO
7	Stepper motor interface

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	EC23232.1	3	3	3	3	3	2	2	2	3	2	3	3	3	2
EC23232.2	3	3	3	3	3	2	1	1	3	2	2	3	3	3	2
EC23232.3	3	3	2	3	3	2	2	2	2	1	2	2	3	3	1
EC23232.4	3	3	3	3	3	2	1	1	3	2	3	3	3	3	1
EC23232.5	3	3	3	3	3	2	2	1	3	2	3	3	3	3	1
Average	3.0	3.0	2.8	3.0	3.0	2.0	1.6	1.4	2.8	1.8	2.6	2.8	3.0	3.0	1.4

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
GE23111	ENGINEERING GRAPHICS	ES	2	0	4	4

Objectives:

- To understand the importance of the drawing in engineering applications
- To develop graphic skills for communication of concepts, ideas and design of engineering products
- To expose them to existing national standards related to technical drawings.
- To improve their visualization skills so that they can apply this skill in developing new products.
- To improve their technical communication skill in the form of communicative drawings

CONCEPTS AND CONVENTIONS (Not for Examination)		1
Importance of graphics in engineering applications–Use of drafting instruments– BIS conventions and specifications– Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.		
UNIT-I	PLANE CURVES AND PROJECTION OF POINTS	5+12
Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method – Cycloidal Curves–Construction of cycloid, epicycloid and hypocycloid – Construction of involutes of square and circle– Drawing of tangents and normal to the above curves.Principles of Projection and Projection of points.		
UNIT-II	PROJECTION OF LINES AND PLANE SURFACES	6+12
Projection of straight lines (First angle projection) 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 both the principal planes by rotating object method.		
UNIT-III	PROJECTION OF SOLIDS AND PROJECTION OF SECTIONED 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. Sectioning of solids in simple vertical position when the cutting plane is inclined to HP and perpendicular to VP –obtaining true shape of the section. Practicing three-dimensional modeling of simple objects by CAD software (Not for examination)		
UNIT-IV	DEVELOPMENT OF SURFACE AND ISOMETRIC PROJECTIONS	12
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones .Model making of isometric projection of combination of solids as assignment (Not for End semester)		
UNIT-V	FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS	12
Free Hand sketching: Freehand sketching of multiple views from pictorial views of objects - Freehand sketching of pictorial views of object from multiple views .Perspective projection of simple solids-Prisms, pyramids, cylinder and cone by visual ray method.		
Total Contact Hours: (L=30; P=60) 90 Periods		

Course Outcomes: After learning the course, the students should be able

- To construct different plane curves and to comprehend the theory of projection
- To draw the basic views related to projection of lines and planes
- To draw the projection of simple solids and to draw the projection of development of surfaces of Sectioned solids in simple vertical position
- To draw the orthographic projection from pictorial objects and Isometric projections of simple solids
- To visualize Perspective view of simple solids

Text Book(s):

- 1 Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
- 2 Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2017.
- 3 Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.

Reference Books(s) :

- 1 Varghese P I., “Engineering Graphics”, McGraw Hill Education (I) Pvt.Ltd., 2013.
- 2 V.B Sikka “Civil Engineering Drawing”, S.K Kataria & Sons, New Delhi.
- 3 Venugopal K. and PrabhuRaja V., “Engineering Graphics”, New Age International (P)Limited, 2008.
- 4 Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2017.
- 5 Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill Publishing Company Limited, New Delhi, 2018.

CO - PO – PSO matrices of course

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO															
GE23111.1	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
GE23111.2	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
GE23111.3	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
GE23111.4	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
GE23111.5	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
Average	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low)
- 2: Moderate (Medium)
- 3: Substantial (High) No correlation: “-“

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CS23231	DATA STRUCTURES	PC	3	0	4	5

Objectives:

- To apply the concepts of Linked List in the applications of various linear data structures.
- To demonstrate the understanding of stacks, queues and their applications.
- To apply the concepts of Linked List in the applications of various nonlinear data structures.
- To understand the implementation of graphs and their applications.
- To be able to incorporate various sorting and hashing techniques in real time scenarios

UNIT-I	LINEAR DATA STRUCTURES – LIST	9
Self-Referential Structures, Dynamic Memory Allocation, Linked list implementation - Singly Linked List, Doubly Linked List, Circular Linked List, Applications of List.		
UNIT-II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9
Stack – Operations, Array and Linked list implementation, Applications – Evaluation of Arithmetic Expressions, Queues-Operations, Array and Linked list Implementation.		
UNIT-III	NON LINEAR DATA STRUCTURES – TREES	9
Tree Terminologies, Binary Tree Representation, Tree Traversals, Binary Search Trees, Binary Heap, Height Balance trees – AVL Trees.		
UNIT-IV	NON LINEAR DATA STRUCTURES – GRAPHS	9
Representation of Graphs, Topological Sort, Depth First Search and Breadth-First Search , Minimum Spanning Tree – Prim's Algorithm, Shortest path algorithm – Dijkstra's Algorithm.		
UNIT-V	SEARCHING, SORTING AND HASHING TECHNIQUES	9
Sorting Techniques –Insertion Sort, Quick Sort, Merge Sort, Hashing- Hashing functions – Mid square, Division,Folding, Collision Resolution Techniques – Separate Chaining – Open Addressing – Rehashing.		
	Contact Hours	: 45

Course Outcomes: After learning the course, the students should be able

- Understand and apply the various concepts of Linear data Structures
- Understand and apply the various concepts of Non Linear data Structures.
- Understand and apply the various sorting and Hashing concepts.
- Analyse and apply the suitable data structure for their research.
- Choose efficient data structures and apply them to solve real world problems.

SUGGESTED ACTIVITIES

- Role play- Linked List (Unit 1).
- Mind Map, Poster Design - Stack and Queue (Unit 2).
- Flipped Classroom - Binary Heap (Unit 3).
- Poster Design - Graph (Unit4).
- Implementation of small module- Hashing (Unit5).

SUGGESTED EVALUATION METHODS

- Assignment problems - Linked List (Unit 1).
- Tutorial problems - Applications – Evaluation of Arithmetic Expressions (Unit 2).
- Quizzes - BST and Binary Heap (Unit 3).
- Tutorial problems- Graph traversal (Unit 4).
- Quizzes - Hashing and Sorting(Unit5) .

Text Book(s):

1	"Data Structures and Algorithm Analysis in C", Mark Allen Weiss, 2nd Edition, Pearson Education, 2005
2	"Data Structures and Algorithm Analysis in C++ - Anna University, Mark Allen Weiss, Pearson Education, 2017.

Reference Books(s) :

1	“Data Structures Using C and C++”, Langsam, Augenstein and Tanenbaum, 2nd Edition, Pearson Education, 2015.
2	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms”, Fourth Edition, McGraw Hill/ MIT Press, 2022.

List of Experiments

1	Implementation of Single Linked List (Insertion, Deletion and Display).
2	Implementation of Doubly Linked List (Insertion, Deletion and Display).
3	Implementation of Stack using Array and Linked List implementation.
4	Implementation of Queue using Array and Linked List implementation.
5	Implementation of Binary Search Tree and perform Tree Traversal Techniques.
6	Program to perform Quick Sort
7	Program to perform Merge Sort
8	Program to perform Linear Probing.
9	Program to perform Rehashing.
10	Mini Project: <ul style="list-style-type: none"> ● Contact book application using Linked List. ● Dictionary using Binary search trees. ● Snake Game. ● Chess Game. ● Travel Planner (Shortest Path Algorithm). ● Tic-Tac-Toe Game. ● Library Management System. ● Project Management System. ● other projects .
Contact Hours : 60	
Total Contact Hours : 105	
Platform Needed: GCC Compiler for Windows/Linux	

Web links for Theory & Lab(if any)

1	Data Structures - GeeksforGeeks
2	Data Structures DS Tutorial - javatpoint
3	Data Structure and Types (programiz.com)

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CS23231.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS23231.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
HS23222	TECHNICAL COMMUNICATION II	HS	0	0	2	1
Common to all branches of B.E/B. Tech programmes						

Objectives:

- To facilitate students to improve their vocabulary for a better communication
- To enable learners to understand and reproduce language
- To aid students to write technical reports in a convincing manner
- To expose students to different sentence structures
- To equip learners to present their ideas in an efficient manner

UNIT-I	VOCABULARY FOR BETTER COMMUNICATION	6
Listening: Telephonic Conversations and TV News		
Reading: Newspapers and Magazines		
Speaking: Conversational Practice: Speaking in a given situation, asking permission and requesting etc.,		
Writing: Job Application Letter and Resume		
Grammar: Reference words: pronouns and determiners		
Vocabulary: Guessing meanings of words in different contexts.		
UNIT-II	FUNCTIONAL LANGUAGE ASPECTS	6
Listening: Motivational listening – listening to real life challenges		
Reading: Articles and Technical reports		
Speaking: Using Polite Expressions, Indirect Questions		
Writing: Paraphrasing a Text, Poem		
Grammar: Purpose Statements, Cause and Effect Expressions		
Vocabulary: Neologisms.		
UNIT-III	TECHNICAL REPORTWRITING	6
Listening: Empathetic Listening – Giving Solutions to Problems		
Reading: Inferential Reading		
Speaking: Dialogues – Interviewing Celebrities / Leaders / Sportspersons, etc.,		
Writing: Report Writing		
Grammar: Functional Usage of Expressions – used to, gone / been, etc.,		
Vocabulary: Words Often Confused		
UNIT-IV	STRUCTURAL GRAMMAR	6
Listening: Comprehension (IELTS practice tests) Reading: Intensive Reading for specific information		
Speaking: Pick and Talk		
Writing: Proposals		
Grammar: Sentence Structures – Simple, Compound, Complex Sentences		
Vocabulary: Replacing dull words with vivid ones		
UNIT-V	PRESENTATION SKILLS	6
Listening: Discriminative listening – sarcasm, irony, pun, etc., Reading: Practice of chunking – breaking up reading materials		
Speaking: Mini presentation on some topic		
Writing: Minutes of the meeting		
Grammar: Correction of Errors		
Vocabulary: Advanced vocabulary – fixing appropriate words in the given context.		
Total Contact Hours: 30		

Course Outcomes: On completion of the course students will be able to

- Communicate effectively using appropriate vocabulary
- Use the acquired language skills to comprehend various types of language contents
- Evaluate different texts and write effective technical content
- Use appropriate sentence structures to convey their thoughts in varied contexts
- Present their concepts and ideas in an effective manner

SUGGESTED ACTIVITIES

- Story Lines
- One truth and two lies
- Hang Man
- Pictionary
- Word Scramble
- Case study

SUGGESTED EVALUATION METHODS

- Assignment topics
- Quizzes
- Class Presentation/Discussion
- Continuous Assessment Tests

Text Book(s):

1	Raymond Murphy, "Intermediate English Grammar," Second Edition , Cambridge University Press, 2018
2	Meenakshi Raman & Sangeeta Sharma, "Technical Communication" Third Edition, Oxford University Press, 2015
3.	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine ChuenMeng Goh, Cambridge University Press

Reference Book(s):

1	Michael McCarthy (Author), Felicity O'Dell (Author), John D. Bunting (Contributor), "Basic Vocabulary in Use: 60 Units of Vocabulary Practice in North American English With Answers" 2nd Edition
2	Dale Carnegie, "The Art of Public Speaking," Insight Press
3.	Jack C. Richards & Theodore S. Rodgers, "Approaches and Methods in Language Teaching, Second Edition, Cambridge University Press

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
HS23221. 1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
HS23221. 2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221. 3	-	2	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221. 4	-	-	-	1	-	-	-	-	2	3	-	-	-	-	-
HS23221. 5	-	-	-	1	-	-	-	-	2	2	-	-	-	-	-
Average	-	2	-	1	0	0	0	0	2	2.6	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
HS23223	ENGLISH FOR PROFESSIONAL COMPETENCE	HS	0	0	2	1
Common to all branches of B.E/B. Tech programmes						

Objectives:

- To facilitate the learners in acquiring listening and reading competence
- To enable the learners to communicate effectively through written and oral medium
- To assist the learners in preparing for competitive examinations
- To train the students in acquiring corporate skills
- To inculcate professional standards among the students and make them realize their responsibility in addressing the challenges

UNIT-I	RECEPTIVE SKILLS	6
Listening – Comprehensive Listening – Watching the news – Listening to a peer giving presentation, etc. – Critical Listening – Watching a televised debate, Listening to poems – Reading – Extensive Reading – Short stories and One-act Plays – Intensive Reading – Articles or Editorials in Magazines, Blog posts on topics like science and technology, arts, etc.		
UNIT-II	PRODUCTIVE SKILLS	6
Speaking – Demonstrative Speaking – Process description through visual aids – Persuasive Speaking – Convincing the listener with the speaker's view – Writing – Descriptive Writing - Describing a place, person, process – CourseiveWriting – Autobiography, Writing based on personal opinions and interpretations.		
UNIT-III	ENGLISH FOR COMPETITIVE EXAMS	6
An introduction to International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Graduate Record Examination (GRE) – Civil Service, Indian Economic Service Examination, Indian Statistical Service Examination, Combined Defence Services Examination, Staff Selection- (Language Related) –Aptitude tests.		
UNIT-IV	CORPORATE SKILLS	6
Critical Thinking and Problem Solving – Case Study, Brainstorming, Q & A Discussion – Team work and Collaboration – Activities like Office Debates, Perfect Square, Blind Retriever, etc. – Professionalism and Strong Work Ethics – Integrity, Resilience, Accountability, Adaptability, Growth Mind set.		
UNIT-V	PROJECT WORK	6
Case Study based on the challenges faced by the employers and the employees – Devise Plan, Provide Solution.		
Total Contact Hours: 30		

Course Outcomes: After learning the course, the students should be able

- Interpret and respond appropriately in the listening and reading contexts.
- Express themselves effectively in spoken and written communication
- Apply their acquired language skills in writing the competitive examinations
- Exhibit their professional skills in their work place
- Identify the challenges in the work place and suggest strategies solutions

SUGGESTED ACTIVITIES

- Online Quizzes on Vocabulary
- Online Quizzes on grammar
- Communication Gap Exercises
- Presentations
- Word Building Games
- Case study

SUGGESTED EVALUATION METHODS

- Assignment topics
- Quizzes
- Class Presentation/Discussion
- Continuous Assessment Tests

Text Book(s):	
1	How to Read Better & Faster, Norman Lewis, Goyal Publishers
2	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine Chuen Meng Goh, Cambridge University Press
3	The Official Cambridge Guide To IELTS by Pauline Cullen, Cambridge University Press
4	The 7 Habits of Highly Effective People by Stephen Covey, Simon and Schuster, UK

Reference Books(s) :	
1	Board of Editors. Sure Outcomes. A Communication Skills Course for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad, 2013.
2	Hartley, Mary. "The Power of Listening," Jaico Publishing House; First Edition (2015).
3	Chambers, Harry. "Effective Communication Skills for Scientific and Technical Professionals," Persues Publishing, Cambridge, Massachusetts, 2000.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
HS23222. 1	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 2	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 4	-	-	-	-	-	-	2	2	-	3	-	-	-	-	-
HS23222. 5	-	-	1	-	-	-	2	-	-	3	-	-	-	-	-
Average	-	1	1	-	-	-	2	2	-	3	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-

Course Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
GE23122	ENGINEERING PRACTICES - ELECTRICAL AND ELECTRONICS	ES	0	0	2	1

Objectives:

- To provide hands-on experience on various basic engineering practices in Electrical Engineering.
- To provide hands-on experience on various basic engineering practices in Electronics Engineering.

List of Experiments

A. ELECTRICAL ENGINEERING PRACTICE

- 1 Residential house wiring using switches, fuses, indicators, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of electrical quantities – voltage, current, power & power factor in RL circuit.
- 5 Measurement of earth resistance using Megger.
- 6 Study of Ceiling Fan and Iron Box

B. ELECTRONICS ENGINEERING PRACTICE

- 1 Study of electronic components and equipment – Resistor, colour coding, measurement of AC signal parameters (peak-peak, rms period, frequency) using CRO/DSO.
- 2 (a) Measurement of electrical quantities using Multimeter
(b) Testing of electronic components.
- 3 Study of logic gates : AND, OR, EXOR and NOT.
- 4 Generation of Clock Signals.
- 5 Soldering practice – Components Devices and Circuits – Using general purpose PCB.
- 6 Measurement of ripple factor of Half-wave and Full-wave Rectifiers.

	Total Contact Hours	:	30
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Course Outcomes: On completion of the course, the students will be able to

- Fabricate the basic electrical circuits
- Implement the house wiring circuits
- Fabricate the electronic circuits
- Verify the truth table of logic gates
- Design the Half-wave and Full-wave Rectifiers using diodes and passive components

Reference Books(s) / Web links:

- 1 Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
- 2 Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
- 3 Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, 2006.
- 4 Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", SreeSai Publication, 2002.

Lab Equipment Required:

S. No.	Name of the Equipment
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring
4	Measurement of electrical quantities – voltage, current, power & power factor in RL circuit.
5	Study purpose items: Iron box, Ceiling fan.
6	Megger (250V/500V)
7	Soldering guns
8	Assorted electronic components for making circuits
9	Small PCBs
10	Multimeters
11	Digital trainer kit
12	CRO
13	Transformer
14	Function Generator

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
GE23122.1	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.2	3	3	2	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.3	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.4	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
GE23122.5	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
Average	3	3	2.67	2	-	-	2	-	3	2	-	3	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-

Course Code	Subject Name (Lab oriented Courses)	Category	L	T	P	C
CS23221	PYTHON PROGRAMMING LAB	PC	0	0	4	2

Objectives:						
<ul style="list-style-type: none"> • Learn the basics of Python Programming and Control statements • Demonstrate various Python data structures like Lists, Tuples, Sets and dictionaries • Understand about Strings, Functions, Modules and Regular Expressions in Python Programming • Understand the concepts of file handling using Python • Understand the concepts of Numpy, Pandas, sciPy modules 						

Description of the Experiments						
1. Experiments based on Variables, Datatypes and Operators in Python.						
2. Implement various control statements in python.						
3. Implement various String & List operations.						
4. Implement Inbuilt functions, User-defined functions and Lambda functions.						
5. Implementation of Tuples, sets, Dictionary and its operations.						
6. Implementation of Exception Handling and I/O files.						
7. Experiments based on Packages : math, datetime, platform.						
8. Experiments based on Packages : NumPy, pandas, matplotlib						
9. Experiments based on Packages : collections						
10. Experiments based on Packages :sciPy						
11. Mini Project						
						Total Contact Hours : 60

Course Outcomes: On completion of the course students will be able to:						
<ul style="list-style-type: none"> • Use the basics of Python Programming in problem solving and conditionals and loops. • Use of Python Data structures such as List, Sets, Tuples, Dictionary for Compound Data • Use Strings, Functions, Modules and Regular Expressions in Python Programming • Implement the concepts of file handling and Exceptional handling. • Apply Numpy, Pandas and SciPy for numerical and statistical data 						

Text Book(s):						
1.1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.						
2.2. Martin C. Brown, Python: The Complete Reference, Osborne/McHraw Hill, 2001						
3.3. Wesley J. Chun, “Core Python Programming”, Pearson Education, Second Edition, 2007						

Web links for virtual lab (if any)						
<ul style="list-style-type: none"> • https://www.python.org/shell/ 						
<ul style="list-style-type: none"> • https://python-iitk.vlabs.ac.in/ 						
<ul style="list-style-type: none"> • https://www.hackerrank.com/domains/python 						

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CS23221.1	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.2	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.3	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.4	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.5	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
Average	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
MC23112	ENVIRONMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0

Objectives:

- To develop the understanding of environmental and associated issues
- To develop an attitude of concern for the environment
- To promote enthusiasm in participating environmental protection initiatives
- To develop skills to solve environmental degradation issues

UNIT-I	AIR AND NOISE POLLUTION	9
Definition –sources of air pollution –chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, ozone depletion, particulate pollutants-Air quality standards-Air quality indices - control of particulate air pollutants-gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP)-catalytic converters. Noise pollution-Sources; Health Effects-Standards- Measurement and control methods		
UNIT-II	WATER POLLUTION AND ITS MANAGEMENT	9
Definition-causes-effects of water pollution-point and nonpoint sources of wastewater-marine pollution-thermal pollution-control of water pollution by physical, chemical and biological methods-wastewater treatment-primary, secondary and tertiary treatment-sources and characteristics of industrial effluents- zero liquid discharge		
UNIT-III	SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT	9
Solid waste – types- municipal solid waste management: Sources, characteristics, collection, and transportation- sanitary landfill, recycling, composting, incineration, energy recovery options from waste - Hazardous waste – Types, characteristics, and health impact - Hazardous waste management: neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration and final disposal. E-waste-definition-sources-effects on human health and environment- E-waste management- recovery of metals-Role of E-waste management within the initiatives of the Govt.of India- Swachh Bharat Mission.		
UNIT-IV	SUSTAINABLE DEVELOPMENT	9
Sustainable development- concept-dimensions-sustainable development goals-value education- gender equality-food security- poverty-hunger-famine-Twelve principles of green chemistry- green technology- definition, importance, Cleaner development mechanism- carbon credits, carbon trading, carbon sequestration, eco labeling-International conventions and protocols-Disaster management.		
UNIT-V	ENVIRONMENTAL MANAGEMENT AND LEGISLATION	9
Environmental Management systems - ISO 14000 series- Environmental audit-Environmental Impact Assessment- lifecycle assessment- human health risk assessment - Environmental Laws and Policy- Objectives - Polluter pays principle, Precautionary principle - The Environment (Protection) Act 1986 - Role of Information technology in environment and human health.		
Total Contact Hours		: 45

Course Outcomes: On completion of the course, the students will be able to

- Associate air and noise quality standards with environment and human health.
- Illustrate the significance of water and devise control measures for water pollution.
- Analyze solid wastes and hazardous wastes.
- Outline the goals of sustainable development in an integrated perspective.
- Comprehend the significance of environmental laws.

Text Book(s):	
1	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016
2	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
3	Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi

Reference Books(s) :

1	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. Edition 2010.
2	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3	Fowler B, Electronic Waste – 1st Edition (Toxicology and Public Health Issues), 2017Elsevier

Web links for virtual lab (if any)

- https://onlinecourses.nptel.ac.in/noc19_ge22/
- <https://news.mit.edu/2013/ewaste-mit>

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MC23112. 1	-	-	-	1	-	-	-	-	-	3	-	-	-	2	-
MC23112. 2	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 3	-	1	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 4	-	-	-	2	-	-	-	-	1	3	-	-	3	-	1
MC23112. 5	-	-	-	1	-	-	-	-	1	3	-	-	1	-	-
Average	-	1.0	-	1.2	-	-	-	-	1	3	-	-	2.0	2	1.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation : “-“

Semester - III

Course Code	Subject Name (Theory Courses)	Category	L	T	P	C
MA23312	FOURIER SERIES AND NUMBER THEORY	BS	3	1	0	4
Common to III Sem. B.E. – Electrical and Electronics Engineering, Electronics and Communication Engineering, Biomedical Engineering, Computer Science and Engineering & Computer Science and Engineering (Cyber Security) and B.Tech. – Information Technology						

Objectives:

- To express Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- To represent continuous function arising in wave and heat propagation, signals and systems using Fourier Transforms
- To provide various numerical methods in solving problems that occurs in the field of Engineering and Technology.
- To introduce and apply the concepts of finite fields and congruences.
- To present a rigorous development of Number Theory using axioms, definitions, examples, theorems and their proofs.

UNIT-I	FOURIER SERIES	12
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic analysis.		
UNIT-II	FOURIER TRANSFORMS	12
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application to boundary value problems.		
UNIT-III	NUMERICAL SOLUTIONS OF BOUNDARY VALUE PROBLEMS	12
Finite difference method for solving second order differential equations - Finite difference techniques for the solution of two-dimensional Laplace and Poisson equations on rectangular domain – One dimensional heat flow equation by implicit and explicit methods – One Dimensional Wave Equation by Explicit method		
UNIT-IV	CONGRUENCES	12
Finite Fields -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 IN NUMBER THEORY	12
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions.		
Total Contact Hours:60		

Course Outcomes: On completion of the course, students will be able to

- Demonstrate Fourier series to study the behaviour of periodic functions and their applications in engineering problems such as system communications, digital signal processing and field theory.
- Apply the shifting theorems, Fourier integral theorems, Inverse Fourier sine and cosine transforms appropriate problems in engineering and technology.
- Solve differential equations numerically that arise in course of solving complex engineering problems.
- Explain the fundamental concepts of finite fields and congruence, and their role in modern mathematics and applied contexts.
- Work effectively as part of a group to solve challenging problems in Number Theory.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Tutorial Sessions by involving two faculty members

SUGGESTED EVALUATION METHODS

- Problem solving in Tutorial sessions
- Assignment problems
- Quizzes and class test
- Discussion in classroom

Text Books :

1	Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2015.
2	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd.,New Delhi, Second reprint, 2016.
3	Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
4	Koshy, T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002.
5	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.

Reference Books / Web links:

1	Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
2	Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016
3	GrewalB.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 11th Edition, Khanna Publishers, New Delhi, 2013.
4	Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
5	Niven, I., Zuckerman.H.S., and Montgomery, H.L., "An Introduction to Theory of Numbers", John Wiley and Sons , Singapore, 2004.

CO - PO – PSO matrices of course

COs/POS&PSOs	PO1	PO2	PO3	PO4	PO5	PO ₆	PO7	PO ₈	PO ₉	PO ₁₀	PO ₁₁	PO ₁₂	PS _{O1}	PS _{O2}	PSO3
MA23312.1	3	3	3	2	1	-	-	-	-	-	-	1	2	1	2
MA23312. 2	3	3	3	2	1	-	-	-	-	-	-	1	2	1	2
MA23312. 3	3	3	3	2	2	-	-	-	-	-	1	2	1	2	2
MA23312. 4	3	3	3	2	2	-	-	-	-	-	1	2	1	2	2
MA23312.5	3	3	3	3	2	-	-	-	-	-	-	2	1	2	2
Average	3	3	3	2.2	1.6	-	-	-	-	-	1	1.6	1.4	1.6	2

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation : “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS23311	COMPUTER ARCHITECTURE	PC	3	0	0	3

Objectives:						
•	To learn the basic Instructions, its operations and the concept of runtime in a system.					
•	To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.					
•	To create a pipelined MIPS processor with optimized data and control paths and how the pipeline processor works based on the execution of overlapping instructions					
•	To explore instruction-level parallelism with the aim of comprehending and enhancing the efficiency of multicore processors.					
•	To expose students to memory system design and methods of interfacing with I/O devices and standard I/O interfaces to facilitate learning and understanding.					

UNIT-I	PROCESSOR ARCHITECTURES & PERFORMANCE	9
RISC, CISC Architecture, Eight ideas, Technologies for Building Processors and Memory, Performance in a computer system – CPU Performance and its factors, Instruction Performance, Classic CPU Performance Equation, Power wall, Instructions – Operations & Operands, Representing instructions, Logical operations, Instructions for decision making, Addressing Modes. Case Study: ARM Architecture.		
UNIT-II	ALU DESIGN & ARITHMETIC: INTEGER, FLOATING POINT	9
Design of ALU, Integer Arithmetic: Addition, Subtraction, Multiplication-Sequential multiplication algorithm, Booth's algorithm- Recoding Technique, Bit pair Recoding Technique, and Division– Restoring and Non Restoring algorithm, Floating Point Arithmetic: Representation, Addition, subtraction, Multiplication.		
UNIT-III	MIPS IMPLEMENTATION & PIPELINING	9
MIPS implementation, Building data path- Creating a Single Data path, Simple Data path with the Control Unit, Pipelining- Pipeline stages with advantages and its disadvantages, Pipelined data path, Pipeline Hazards and its types-Data hazards and its types, Methods of minimizing data hazards, Control Hazard- schemes for resolving control hazards, Branch prediction algorithms, Exceptions.		
UNIT-IV	ADVANCED TECHNIQUES OF PARALLELISM	9
Instruction level parallelism, Superscalar processors–Policies in Instruction Issue, Register renaming, Superscalar Implementation, VLIW processors-Planning by the compiler, Comparison Superscalar vs. VLIW processor– Flynn's classification, The difficulty of parallel programs, Shared memory multiprocessors, Introduction to graphics processors, Case Study: Optimizing Performance in AMD Ryzen Processors.		
UNIT-V	MEMORY ORGANIZATION AND STRUCTURE: CACHES AND VIRTUAL MEMORY	9
Memory hierarchy - Memory technologies, Basic principles of the cache, Multi-level cache, Organizations: fully associative, direct mapped and set associative, Replacement algorithms, Virtual memory – Operation of virtual memory: paging, segmentation, paged segments, Translation of virtual addresses to physical or real addresses, Translation Look-aside Buffer (TLB), Input/output system, programmed I/O, DMA and interrupts, I/O processors. Case Study: multicore processors in modern smartphones.		
		Contact Hours : 45

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the impact of instruction set architecture on cost-performance of computer design.
•	Perform computer arithmetic operations.
•	Design and analyze pipelined control units and hazards.
•	Develop the system skills in parallelism and multithreading.
•	Evaluate the performance of memory systems.

Text Books:	
1	David A. Patterson and John L. Hennessy, “Computer organization and design”, 5th edition, Elsevier, 2014.

Reference Books:	
1	V.CarlHamacher, Zvonko G. Varanescic and Safat G. Zaky, “Computer Organisation”, 6th edition, Mc Graw-Hill Inc, 2012.
2	William Stallings, “Computer Organization and Architecture Designing for performance”, 10th Edition, PHI Pvt Ltd., Eastern Economy Edition2016.
3	Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, 2nd Edition, Pearson Education, 2005.
4	Computer Architecture: A Quantitative Approach. J.L. Hennessy y D.A. Patterson. Morgan Kaufmann. 4 th edition. 2007.
5	John P Hayes, “Computer Architecture and Organization”, 3rd edition, McGraw Hill, 2002.
6	Digital Design and Computer Architecture. D.M. Harris y S.L. Harris. Elsevier.2007.

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23311.1	2	2	1	1	-	-	1	-	-	-	-	-	2	2	2
CS23311.2	3	3	1	2	-	-	-	-	2	-	1	-	2	2	2
CS23311.3	2	2	3	1	2	1	2	-	-	-	2	-	2	2	2
CS23311.4	2	2	2	1	2	2	2	-	-	-	2	1	2	2	2
CS23311.5	2	2	3	1	2	2	2	-	-	-	2	-	3	3	2
Average	2.2	2.2	2.0	1.2	2.0	1.7	1.8	-	2.0	-	1.8	1.0	2.2	2.2	2.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation : “-“

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23331	DESIGN AND ANALYSIS OF ALGORITHMS	PC	3	0	2	4

Objectives:						
<ul style="list-style-type: none"> • Learn and understand the algorithm analysis techniques and complexity notations • Become familiar with the different algorithm design techniques for effective problem solving in computing. • Learn to apply the design techniques in solving various kinds of problems in an efficient way. • Understand the limitations of Algorithm power. • Solve variety of problems using different design techniques 						

UNIT I	INTRODUCTION TO ANALYSIS OF ALGORITHMS AND EXHAUSTIVE SEARCH	9
Introduction- Algorithm-Fundamentals of Algorithmic Problem Solving-Analysis: Space Complexity - Time Complexity: Counter method, Mathematical Analysis of non-recursive algorithms- Asymptotic Notations - Using Limits for Comparing Orders of Growth – Basic Efficiency Classes-Brute Force Technique-Exhaustive Search-Travelling Salesperson Problem-Knapsack Problem		
UNIT II	RECURRENCE RELATION AND GREEDY TECHNIQUE	10
Mathematical Analysis of Recursive algorithms -Recurrence Relation-Solving Recurrence Relations: Substitution methods and Master Theorem Method. Greedy Method – Minimum Spanning Trees: Kruskal's Algorithm– Fractional Knapsack - Huffman Codes-Activity Selection Problem.		
UNIT-III	DIVIDE AND CONQUER TECHNIQUE	7
Divide and Conquer Method-Introduction-Binary Search-Finding Min Max-Maximum Subarray Problem-Towers of Hanoi Problem-Finding the kth element-Analysis of Quick and Merge Sort.		
UNIT IV	DYNAMIC PROGRAMMING TECHNIQUE	9
Dynamic Programming-Rod Cutting-Longest Common Subsequence-Traveling Sales Person Problem-String Editing-Longest Common Substring-Longest non-decreasing subsequence-Stair Case Problem.		
UNIT-V	BACKTRACKING BRANCH AND BOUND AND NP COMPLETE & NP HARD	10
Backtracking-Graph Coloring-n Queen's Problem-Branch and Bound-Knapsack Problem-- NP Complete and NP Hard Problems: Basic Concepts - Non-Deterministic Algorithms - Class of NP Complete and NP Hard Problems-Approximation Algorithm- TSP.		
	Total Contact Hours	: 45

List of Experiments	
1	Finding Time Complexity of algorithms
2	Design and implement algorithms using Divide and Conquer Technique
3	Design and implement algorithms using Greedy Technique
4	Design and implement algorithms using Dynamic Programming
5	Competitive Programming-Certain Techniques
Contact Hours :	
Total Contact Hours :	

Course Outcomes: On completion of course you will be able to	
• Analyse the time and space complexity of various algorithms and compare algorithms with respect to complexities.	
• Decide and apply Divide and Conquer design strategy to Synthesize algorithms for appropriate computing problems.	
• Decide and Apply Greedy technique to Synthesize algorithms for appropriate computing problems.	
• Decide and Apply Dynamic Programming technique to Synthesize algorithms for appropriate computing problems.	
• Decide and Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing problems.	

Suggested Activities:

- Complexity Analysis Exercises: Assign exercises where students practice calculating the space and time complexity of given algorithms using the counter method and mathematical analysis.
- Asymptotic Notations Quiz: Organize quizzes focusing on understanding and applying asymptotic notations to compare algorithm efficiency.
- Greedy technique and Divide and Conquer Technique-Problem-Solving Contests-Host contests where students solve problems like the activity selection problem using greedy techniques, encouraging competitive learning.
- Dynamic Programming-Case Studies on Optimization Problems-Discuss in-depth various optimization problems solved using dynamic programming, highlighting the strategy and solution steps.
- Approximation Algorithm Projects: Assign projects where students explore and implement approximation algorithms for problems

Textbooks:

1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2.	Ellis Horowitz, Shani, Sanguthevar Rajasekaran, "Computer Algorithms" Universities Press, Second Edition 2008.
3.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

Reference Books (s)/Web links:

1.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2.	Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
3.	Sara Baase Allen Van Gelder, "Computer Algorithms - Introduction to Analysis" Pearson Education Asia, 2010
4.	https://www.geeksforgeeks.org/fundamentals-of-algorithms/
5.	https://www.hackerrank.com/domains/algorithms

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 01	PS 02	PSO3
CS23331.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
CS23331.2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.5	1	2	2	2	-	-	-	-	-	-	-	1	3	3	1
Average	2.0	2.8	2.0	2.0	-	-	-	-	-	-	-	1.0	3.0	2.8	1.2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation : “-“

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23332	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5

Objectives:						
<ul style="list-style-type: none"> Understand the role of a database management system and construct simple and moderately advanced database queries using Structured Query Language (SQL). Apply logical database design principles, including E-R diagrams, Relational Algebra, Tuple Relational calculus Representation and Query Processing Know the importance of functional dependency and normalization, and what role it plays in the database design process and File Organization. Understand the concept of a database transaction including concurrency control, backup and recovery, and data object locking and handling deadlocks. Work with the foundation for No SQL technologies and web page designing 						

UNIT I	DATABASE SYSTEMS AND SQL QUERY	9
Introduction – Purpose of Database Systems - View of Data –Database Architecture -Database Schema – Keys – Codd’s Rule –RDBMS- SQL: Data Definition – Domain types – Structure of SQL Queries - Modifications of the database – Set Operations – Aggregate Functions – Null Values- SQL Nested Subqueries – Complex Queries – Views – Joined relations.		
UNIT II	PL/SQL, DATA MODEL AND QUERY PROCESSING	9
PL/SQL: Functions, Procedures, Triggers, Cursors –Dynamic SQL–Relational Algebra-Tuple Relational calculus- Domain Relational Calculus– Entity Relationship Model – Constraints -Entity Relationship Diagram - Design Issues of ER Model – Extended ER Features – Mapping ER Model to Relational Model– Query Processing – Heuristics for Query Optimization.		
UNIT- III	NORMAL FORMS AND INDEXING	9
Motivation for Normal Forms – Functional dependencies – Armstrong’s Axioms for Functional Dependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF-File Organization-Indexing B+ tree - B-Tree		
UNIT IV	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 – Shadow paging – ARIES Algorithm.		
UNIT-V	NOSQL DATABASE	9
NoSQL Database vs.SQL Databases – CAP Theorem –Migrating from RDBMS to NoSQL – MongoDB – CRUD Operations– MongoDB Sharding – MongoDB Replication – Web Application Development using MongoDB with Python and Java.		
		Total Contact Hours : 45

List of Experiments	
1	Introduction to SQL: DDL, DML, DCL, TCL. SQL clause :SELECT FROM WHERE GROUPBY,HAVING,ORDERBY Using SQLite/MySQL/Oracle
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.
3	Creating an Employee database to set various constraints and subqueries.
4	Optimize a SQL query construct considering time complexity.

5	Write a PL/SQL block to specify constraints by accepting input from the user.
6	Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
7	Implementation of PL/SQL Function.
8	Implementation of PL/SQL Cursor.
9	Implementation of PL/SQL Trigger, Packages.
10	Implementation of NoSQL basic commands using Cassandra/Mongo DB.
11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation , Indexes in NoSQL.
13	<p>MINI PROJECT</p> <p>Database Connectivity with Front End Tools(Python/C/C++/JAVA)and Back End Tools(MySQL/SQLite/CASSANDRA/MONGO DB)</p> <p>For any problem selected, write the ER Diagram, apply ER mapping rules, normalize the relations, and follow the application development process.</p> <p>Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool.</p> <p>Indicative areas include</p> <ul style="list-style-type: none"> a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System i) Library Management System.
Contact Hours:	
30	
Total Contact Hours:	
75	

Course Outcomes: On completion of course you will be able to
• Understand the use of the Relational model and apply SQL Queries
• Apply PL/SQL, Dynamic SQL, understand the representation of Relational Algebra, Calculus and Query Processing
• Understand the concept of normalization, Indexing and apply as a case study
• Understand concurrency control and recovery mechanisms.
• Use MongoDB NoSQL Database to Maintain Data of an Enterprise

Textbooks:
1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Seventh Edition, Mc Graw Hill, March 2019.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2013.

Reference Books (s)/Web links:
1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016.
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4. Steven Feuerstein with Bill Pribyl, "Oracle PL/SQL Programming", sixth edition, Publisher: O'Reilly 2014.
5. MongoDB: The Definitive Guide, 3rd Edition, by Kristina Chodorow, Shannon Bradshaw, Publisher: O'Reilly Media, 2019
6. Shashank Tiwari, "Professional NoSQL", Wiley, 2011.
7. David Lane, Hugh.E.Williams, Web Database Applications with PHP and MySQL, O'Reilly Media; 2nd edition, 2004

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO3
CS23332.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS23332.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS23332.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS23332.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS23332.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	1.3	1.4	1.8	1.7

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation : “-“

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23333	OBJECT ORIENTED PROGRAMMING USING JAVA	PC	1	0	6	4

Objectives:

- To understand Object Oriented Programming concepts and characteristics of Java.
- To know the principles of classes, abstraction and inheritance.
- To create packages, define exceptions and use interface.
- To use I/O streams and collections in applications.
- To design and build simple programs using Streams, Lambda and JDBC

UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	3
Introduction to Object Oriented Programming – An overview of Java - Java Architecture - Data Types - Variables- Operators.		
UNIT II	CLASSES AND INHERITANCE	3
Classes – Class Fundamentals - A Simple Class - Declaring Objects - Methods – Constructors Inheritance - Inheritance Basics - Member Access - Method Overriding - Abstract Classes - Object Class		
UNIT-III	PACKAGES, INTERFACE & EXCEPTION HANDLING	3
Packages - Defining a Package - Access Protection - Imports - Interfaces - Implements - Nested Interfaces - Exception Handling - Types - try - catch - throw - throws – finally.		
UNIT IV	I/O AND COLLECTIONS	3
Input / Output Basics – Streams – Byte streams and Character streams – Collection Interfaces – Collection Classes.		
UNIT-V	STREAMS API, LAMBDA AND JDBC	3
Stream API – Reduction – Parallel – mapping – Collecting – Iterator - Lambda Expressions Functional Interfaces - Predefined Functional Interfaces - Accessing Databases with JDBC		
	Total Contact Hours	: 15

List of Experiments

1	Programs using control structures.
2	Programs using arrays.
3	Programs using strings and string buffer.
4	Programs using classes and objects.
5	Programs using inheritance.
6	Programs using default & static methods in interfaces.
7	Programs using functional interface.
8	Programs to create user defined exceptions.
9	Programs to implement Object Serialization.
10	Programs using collections-LIST.
11	Programs using collections-SET.
12	Programs using collections-MAP.
13	Programs using STREAMS.
14	Programs using LAMBDA.
15	Simple applications using JDBC.
Contact Hours :	
Total Contact Hours :	

Course Outcomes: On completion of the course, the students will be able to

- Develop Java programs using OOP principles and Strings.
- Develop Java programs with the concepts inheritance.
- Build Java applications using exceptions and interfaces.
- Develop Java applications using I/O and collections.
- Develop interactive Java applications using Streams and JDBC.

Suggested Activities:

- **Quizzes** – basic concepts of JAVA & language basics.
- **Tutorial** – Class & Inheritance .
- **Flipped Classroom** – Packages & Interface .
- **Mind Map, Poster Design** – IO & Collections .
- **Implementation of small Systems- JDBC** .

Textbooks:

- | | |
|----|---|
| 1. | Herbert Schildt, “Java The Complete Reference”, 9th Edition, McGraw Hill Education, 2014 |
| 2. | Cay S. Horstmann, Gary Cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013. |

Reference Books (s)/Web links:

- | | |
|----|--|
| 1. | Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015. |
| 2. | Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011. |
| 3. | Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000. |
| 4. | SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill. |
| 5. | https://www.javatpoint.com/java-tutorial |
| 6. | https://java-iitd.vlabs.ac.in/ |
| 7. | https://www.hackerrank.com/domains/java . |

CO - PO – PSO matrices of course

COs/Pos&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PS O1	PSO 2	PSO3
CS23333.1	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23333.2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23333.3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CS23333.4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CS23333.5	3	3	3	3	3	-	2	-	2	2	3	3	3	3	3
Average	3	3	3	2.6	3	-	2	-	2	2	3	3	3	3	2.6

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation : “-“

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23334	FUNDAMENTALS OF DATA SCIENCE	PC	3	0	2	4

Objectives:

- To understand the fundamental concepts of data science.
- To understand data cleaning and processing for data science.
- To learn the fundamentals of exploratory data analysis (EDA).
- To understand inferential data analytics
- To understand the Machine Learning concepts.

UNIT I	INTRODUCTION TO DATA SCIENCE	9
Evolution of Data Science-Data Science Roles-Various fields of application- Types of Data- Introduction and terminology-Classification and characteristics of data types-Understanding structured, unstructured, and semi-structured data- Data Security Issues- Example applications showcasing real-world scenarios.		
UNIT II	DATA CLEANING AND DATA PRE-PROCESSING	7
Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview–Data Cleaning–Data Integration and Transformation–Data Reduction–Data Discretization.		
UNIT-III	EXPLORATORY DATA ANALYTICS FUNDAMENTALS	9
EDA Significance and Comparison- Tools and Visual Aids for EDA-Data Transformation Techniques-Grouping and Aggregating Datasets-Pivot Tables, Cross-Tabulations, Heat Maps.		
UNIT IV	STATISTICAL INFERENCE AND ANALYSIS	11
Populations, Samples, and Random Sampling- Sampling Distribution and Standard Error of the Mean -Hypothesis Testing: Z-Test, Procedure, Decision Rule, Interpretations - One-tailed and Two-tailed Tests- T-Test: One Sample, Two Independent Samples, Two Related Samples - F-Test and ANOVA: One-way and Two-way - Introduction to Chi-square Tests.		
UNIT-V	MACHINE LEARNING BASICS	9
Introduction to Machine Learning- supervised, unsupervised, and semi-supervised learning- Model Evaluation and Validation- Overfitting, Underfitting, Bias-Variance Tradeoff- Linear regression, Logistic regression for classification tasks, Time Series Analysis- Techniques for analyzing time series data.		
	Total Contact Hours	: 45

List of Experiments

- 1.Do a data exploratory analysis to develop deep insights from a dataset.
- 2.A python program to perform pre-processing on tabular and text data.
- 3.A python program to perform augmentation on Image data.
- 4.A python program to analyse Linear & logistic Regression
- 5.A python program to do classification using Support Vector Machines

Contact Hours : 30

Total Contact Hours : 75

Course Outcomes: On completion of course, students will be able to

- Explore the fundamental concepts of data science
- Explain how data is collected, managed and processed for data science
- Understand the fundamentals of exploratory data analysis.
- Perform Statistical Inference and Analyze Variance in Data
- Understand various machine learning algorithms used in data science process.

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

Textbooks:

1.	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022
2.	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

Reference Books (s)/Web links:

1.	David Dietrich, Barry Heller and Beibei Yang, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, Reprint 2015, Wiley.
2.	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
3.	Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.
4.	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Taylor& Francis Group, Second Edition, 2015, Chapman & Hall / CRC Press.

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO3
CS23334.1	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
CS23334.2	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
CS23334.3	2	2	1	2	2	1	1	-	1	2	1	3	2	2	3
CS23334.4	3	2	2	1	2	-	-	-	1	1	2	2	3	3	2
CS23334.5	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
Average	2.2	1.8	1.25	1.6	1.8	1	1	-	1.2	1.2	1.2	2.2	2.2	2.4	2

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation : “-“

Semester – IV

Course Code	Course Title (Theory course)	Category	L	T	P	C
BA23512	FUNDAMENTALS OF ACCOUNTING	HS	3	0	0	3

Objectives

- To create an awareness about the importance and usefulness of the accounting concepts and financial reports prepared by the company.
- To develop an understanding of the recording of accounts and the underlying principles and learn to know financial reports.
- To understand how financial statement information can help to solve business problems and increase the ability to interpret and analyse financial statements.
- To understand the basic concept of cost accounting and its managerial implications.
- To develop skills in analysing various investment projects.

UNIT-I	Unit I: Introduction to Accounting and Reports	4
Accounting Meaning & Types- Accounting Concepts and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. -Annual Reports- Audit Reports, Directors Report and Statutory Requirements. Introduction to Accounting Standards.		
UNIT-II	Unit II: Concepts of Accounting Cycle	6
Book Keeping and Record Maintenance, Fundamental Principles and Double Entry-Journal format - Ledger format-Trial Balance format (Only theory) - Final accounts (Only format)		
UNIT-III	Unit III: Analysis of Financial Statements	6
Contents of Financial Statements, Techniques of Financial Statements Analysis: Comparative, Common Size, Trend percentage and Ratio Analysis – Cash flow statement (Theory).Class room discussion: A Case study of Satyam.		
UNIT-IV	Unit IV: Cost Accounting Techniques	6
Elements of Cost, Cost Sheet, Cost Behaviour, Cost Allocation, Overhead Allocation, Absorption Costing: ABC Analysis Marginal Costing, Cost Volume Profit Analysis, Budgets: Techniques for budgeting in technology projects, – Class Discussion: Application of costing concepts in the Service Sector.		
UNIT-V	Unit V: Appraisal of Investment Projects	8
Capital Budgeting Techniques: Discounted and Non-Discounted methods (Elementary level) – Ranking & Selection of projects - Appraisal of Risky Investment: Certainty Equivalent, Risk Adjusted Discounted Rate & Decision tree approach.		
Total Contact Hours: 30		

Course Outcomes: On completion of the course, the students will be able to

- Students will be able to understand the fundamental principles and concepts of accounting and able to know about annual report of the company.
- Students will be able to understand the fundamental principles of accounting and their application in recording financial transactions.
- Students will be able to understand the purpose and significance of financial statements in communicating the financial performance and position of a business entity.
- Students will be able to understand various costing techniques.
- Students will be able to analyse various investments projects through capital budgeting techniques.

Text Book (s):	
1.	Robert N Anthony, David Hawkins, Kenneth Marchant, "Accounting: Texts and Cases", Thirteenth Edition, McGraw-Hill, 2017.
2.	M.Y. Khan & P.K. Jain, "Management Accounting", Tata McGraw Hill, 2011.
3.	R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi, 2011
4.	"Cost Accounting: A Managerial Emphasis" by Charles T. Horngren, Srikant M. Datar, and Madhav V. Rajan
5.	I.M.Pandey, Financial Management – Pearson India Education services Pvt Ltd., , Twelfth edition

Reference Books(s):	
1	Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", Fifteenth Edition, Tata McGraw Hill Publishers, 2010.
2	Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting", Sixteenth Edition, PHI Learning, 2014.
3	Stice & Stice, "Financial Accounting Reporting and Analysis", Eight Edition, Cengage Learning, 2010.
4	Singhvi Bodhanwala, "Management Accounting -Text and cases", Third Edition, PHI Learning, 2018
5	Ashish K. Bhattacharya, Introduction to Financial Statement Analysis, Elsevier, 2009.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BA23512.1	1	2	1	2	2	3	2	3	1	3	3	2	2	2	3
BA23512.2	2	1	2	3	2	2	3	3	1	3	3	2	3	3	2
BA23512.3	2	3	2	3	2	2	2	3	2	3	3	2	2	2	1
BA23512.4	2	1	2	3	2	2	1	1	2	2	3	2	3	3	3
BA23512.5	2	2	2	3	3	1	2	1	3	2	3	2	3	2	2
Average	1.8	1.8	1.8	2.8	2.2	2	2	2.2	1.8	2.6	3	2	2.6	2.4	2.2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

Course Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
MA23435	PROBABILITY, STATISTICS AND SIMULATION	BS	3	0	2	4
Common to IV Sem. B.E. – Computer Science and Engineering & Computer Science and Engineering (Cyber Security) and B.Tech. – Information Technology						

Objectives:

- To introduce the basic concepts of probability, one dimensional random variables.
- To solve the problems those are faced in testing of a hypothesis with reference to the errors in decision making.
- To construct and analyse models using Markov Chains.
- To acquire skills in analysing queuing models.
- To set up appropriate simulation models together with their parameterization and the analysis of simulator output data.

UNIT-I	PROBABILITY	9
One dimensional Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Uniform and Normal distributions, Two dimensional Discrete and continuous random variables – Conditional and Marginal densities.		
UNIT-II	STATISTICAL TESTING	9
Maximal Likelihood estimation – Parameters of Binomial and Poisson distribution - Tests of significance – Z test: Single mean, difference of means- Chi square - F test.		
UNIT-III	MARKOV MODELS	9
Introduction to Discrete stochastic process - Definition and examples - Markov Process – Discrete Parameter Markov chain – Chapman Kolmogorov theorem (without proof) -State transitions- state probabilities - properties – steady state analysis – absorbing chains – Case study: Markov Analysis of Dynamic memory allocations, Markov models for Manufacturing production capability.		
UNIT-IV	QUEUING THEORY	9
Markovian queues – Birth and Death processes – Queueing Models - (M/M/1):(GD/ ∞/∞), (M/M/1):(GD/K/ ∞), (M/M/C):(GD/ ∞/∞), (M/M/C):(GD/K/ ∞), (M/G/1) :(GD/ ∞/∞).		
UNIT-V	SIMULATION	9
Simulation: simulation concepts, simulation of a queuing system using event list - Pseudo random numbers - Multiplication Congruential Algorithm - Inverse transformation method - Basic ideas of Monte-Carlo simulation.		
Total Contact Hours: 45		

S.No	List of Experiment (using R Software)	Total Contact Hours: 30
1	Basic Functions in R and plotting	
2	Mathematical functions in R – Integration	
3	Control flow – Loops in R	
4	Probability Distributions using R- PDF, CDF for Binomial, Poisson, Exponential, Uniform and Normal Distributions.	
5	Testing of Hypothesis – Z and t testing	
6	Testing of Hypothesis – F and chi square testing	
7	Markov chains analysis – using ‘markovchain’ package in R	
8	Queuing model analysis – using ‘queueing ’ package in R	
9	Monte Carlo simulation –predicting stock prices using package ‘MonteCarlo’ in R	
10	Reading , Writing data in R and working with inbuilt data sets in R	

Course Outcomes: On completion of the course, the students will be able to

- Apply the basic concepts of probability, one dimensional random variables in engineering and technology problems.
- Use different testing tools like t-test, F-test, chi-square test to analyse the relevant problems in engineering and technology.
- Construct and analyse models using Markov Chains.
- Characterize features of a queuing system and analyse different queuing models.
- Practice critical work skills in a controlled environment.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Smart Class room sessions

SUGGESTED EVALUATION METHODS

- Assignment problems
- Quizzes
- Class Presentation
- Discussion

Text Book(s):

1.	Hamdy A Taha, Operations Research: An Introduction, Prentice Hall India, Tenth Edition, 2019.
2.	Hwei Hsu, "Schaums Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata Mcgraw Hill Edition, New Delhi, 1997.
3.	Al-Begain. H., and Bargiela, A., Eds., "Seminal Contributions to Modelling and Simulation." Springer, 2016.
4.	Thomas L. Saaty Elements of Queueing theory with applications, 1983.
5.	M. W. Carter, C. C. Price and G. Rabadi, "Operations research a practical introduction " second edition, 2019. CRC Press.

Reference Books(s) / Web links:

1.	Veerarajan T, 'Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks'.
2.	McGraw Hill, 2016. 2 Johnson R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3.	Jhon Wiley & Sons .Erwin Kreyszig, "Advanced Engineering Mathematics", Pearson Education, Asia, 7th Edition, 2007.
4.	Ramana. B.V., "Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO ₆	PO7	PO ₈	PO ₉	PO ₁₀	PO ₁₁	PO ₁₂	PS _{O1}	PS _{O2}	PSO3
MA23435.1	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA23435.2	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA23435.3	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
MA23435.4	3	3	3	3	3	-	-	-	-	-	1	2	3	1	2
MA23435.5	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
Average	3.0	3.0	2.6	2.6	1.8	-	-	-	-	-	1.7	2.0	2.6	1.0	2.0

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-”

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23431	OPERATING SYSTEMS	PC	3	0	4	5

Objectives:

- To study the basic concepts and functions of operating systems.
- To learn about Processes, Threads, Scheduling algorithms
- To understand the process of synchronization and deadlock issues
- To learn and understand the Memory management systems.
- To learn I/O Management and File Systems.

UNIT I	OPERATING SYSTEMS OVERVIEW	9
Introduction – Computer System Organization – Computer System Architecture – Operations – Resource Management – Security and Protection – Virtualization – Computing Environments. Operating Systems Structures: Services – User and OS Interface – System Calls – Linkers and Loaders – Operating system Structure – Building and Booting OS.		
UNIT II	PROCESS MANAGEMENT	9
Process Concepts– Process Scheduling - Operations – Inter process Communication- Shared Memory and Message Passing Systems Threads: Overview- multithreading models-issues. CPU Scheduling: – FCFS – SJF – Priority – RR – Multilevel Queue Scheduling - Multilevel Feedback Queue.		
UNIT-III	PROCESS SYNCHRONIZATION AND DEADLOCKS	9
Process Synchronization – Critical Section Problem – Peterson’s Solution – Hardware Synchronization – Semaphores- Monitors - Classic Problems of Synchronization, Deadlocks: Characterization-Prevention – Avoidance – Detection – Recovery.		
UNIT IV	MEMORY MANAGEMENT	11
Main Memory: Background - Contiguous Memory Allocation – Paging - Structure of a page table – Segmentation - Virtual Memory – Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames – Thrashing - Mass Storage Management-Disk scheduling.		
UNIT-V	FILE MANAGEMENT	9
File System -Concepts - Access Methods- Directory Structure - Protection - Discretionary Access control and Mandatory Access Control - File System structure- Directory Implementation – Allocation Methods – Free-Space Management- Virtual File System. Case studies: Linux		Total Contact Hours : 45

List of Experiments

1	Basic Unix/Linux commands
2	Study of Unix editors : sed,vi,emacs
3	Text processing using Awk script
4	System calls –fork(), exec(), getpid(), opendir(), readdir()
5	Scheduling algorithms – FCFS, SJF, Priority and RR
6	Inter-process Communication using Shared Memory
7	Producer Consumer Problem Solution using Semaphore
8	Bankers Deadlock Avoidance algorithm
9	Contiguous Memory Allocation - First Fit and Best Fit
10	Page Replacement Algorithms - FIFO & LRU
11	File Organization Technique- single and Two level directory
12	Installation and Configuration of Linux in a Virtual Machine
13	Schedule Cron Tasks – scripts to run on boot, backup and shutdown at a particular time
14	Building a Simple Loadable Kernel Module for basic operations
15	Building Linux RPM package from source
	Contact Hours : 60
	Total Contact Hours : 105

Course Outcomes: On completion of course, students will be able to

- Interpret the evaluation OS functionality, structure and layers.
- Analyze the various Scheduling algorithms and design a model scheduling algorithm.
- Apply and analyze Intercrosses communications, synchronization and Deadlock
- Compare and contrast various memory management schemes.
- Mount file systems and evaluate various disk scheduling techniques.

Suggested Activities:

- Compare the DOS and Linux Commands
- Design and Analysis of various CPU scheduling algorithm
- Implement an algorithm for synchronization
- Analysis various page replacement algorithms
- Study the various management algorithms used in Windows, Linux am Android OS

Textbooks:

- | | |
|----|--|
| 1. | Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018. |
|----|--|

Reference Books (s)/Web links:

1.	William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Pearson, 2018.
2.	Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson, 2016.
3.	Achyut Godbole and Atul Kahate, "Operating System", 3rd Edition, Tata McGraw Hill, 2017.
4.	Pavel Y., Alex I., Mark E., David A., "Windows Internal Part I - System Architecture, Processes, Memory Management and More", 7th Edition, Microsoft Press, 2017.

CO - PO – PSO matrices of course

COs/Pos&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23431.1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
CS23431.2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
CS23431.3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
CS23431.4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
CS23431.5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Average	2.0	2.0	1.7	1.0	2.2	-	1.0	1.0	1.4	2.0	2.0	2.0	2.6	2.7	1.6

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-”

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23432	SOFTWARE CONSTRUCTION	PC	3	0	2	4

Objectives:						
<ul style="list-style-type: none"> Students can gain a comprehensive understanding of Azure's infrastructure, including virtual machines, networking, storage, and security services, to effectively deploy and manage software applications. Students can learn cloud-native development practices and principles, leveraging Azure services such as Azure App Service, Azure Functions for building scalable and resilient software solutions. Students can explore CI/CD pipelines using Azure DevOps, GitHub Actions, or Azure Pipelines to automate the build, test, and deployment processes, ensuring rapid and reliable software delivery. Students can develop skills in monitoring and diagnostics using Azure Monitor and Application Insights, enabling proactive identification and resolution of performance issues and errors in software applications. Students can understand security best practices for software construction in Azure, including identity and access management (IAM), data encryption, network security to build secure and compliant software solutions. 						

UNIT I	INTRODUCTION TO SOFTWARE ENGINEERING	9
Software Process-Requirements to Maintenance-Perspective and Specialized Process Models-Projects on On-Prem/On Cloud (Azure, AWS, GCP)-Projects on cloud (cloud providers AWS, Azure)-Agile methods with associated metrics-Software metrices -AI and Data Science -Software Security- DevOps /DevSecOps.		
UNIT II	SOFTWARE REQUIREMENTS	9
How to do Requirements in Agile-Understand Themes, Epic, Features, User Stories and Tasks-How to identify Themes, Epics, Features, User Stories-How to document the same in Microsoft Azure Boards-How to use Poker Planning Estimation Technique -Non Functional Requirements - its purpose, different attributes of the same, and examples - Document the same in Microsoft Azure Boards.		
UNIT-III	SYSTEM MODELING	9
System Modeling-Context Model-Interaction Model-Interaction Model-Structural Model-Behavioral Model-Architectural patterns-Architectural patterns-continuation-Data Flow Diagrams-ER Diagram-Tools Practice (Azure) -Prototypes / MVP.		
UNIT IV	TESTING	9
Testing Using AZURE-AZURE Test Plan Preparation-Manual and Exploratory Testing-Automated Testing-Traceability-Reporting and Analysis.		
UNIT-V	SOFTWARE CONFIGURATION MANAGEMENT	9
Software Configuration Management-Introduction-Tools for SCM and Version Control-Visual Source Safe (VSS) – Introduction-Advanced Software Engineering Models-Case Study		
	Total Contact Hours	: 45

List of Experiments		
1	Develop User Stories for the respective projects that has been assigned (both FR and NFR) in Azure Board	
2	Develop the Business Architecture, Conceptual and Logical Model for the entities defined in the project	
3	Develop the Class Diagram for these defined entities with all attributes and the associated methods	
4	Develop the Sequence diagram for atleast 2 use stories for the respective project	
5	Develop the Architecture diagram (using MVC) for the respective project (picking a template for Azure Architecture Center)	
6	Identify which SOLID design principles would be applicable and write the design document for the same	
7	Develop a view of the github repository in terms of code, design, test plans, test cases etc and showcase the same in Azure Repos	
8	Develop Test Plans, test cases for the user stories	
9	Develop a CI/CD pipeline using Azure DevOps to test the Architecture and Design	
10	Showcase the CI/CD pipeline using Azure DevOps for a single user story	
	Contact Hours	30
	Total Contact Hours	75

Course Outcomes: On completion of course, students will be able to

- Demonstrate proficiency in leveraging Azure services and tools for software construction, including virtual machines, containers, serverless computing, and databases, enabling them to design and deploy scalable and resilient applications on the Azure platform.
- Implement end-to-end CI/CD pipelines using Azure DevOps, GitHub Actions, or Azure Pipelines, automating the build, test, and deployment processes for software applications, resulting in increased efficiency and reliability of software delivery.
- Optimizing software applications for performance and scalability on Azure, employing techniques such as auto-scaling, caching strategies, and performance tuning to ensure optimal performance under varying workloads.
- Develop skills in monitoring and diagnostics using Azure Monitor and Application Insights, enabling them to proactively monitor the health, performance, and availability of software applications, and diagnose and troubleshoot issues efficiently.
- Deeply understand security best practices for software construction in Azure, including identity and access management, data encryption, network security, and compliance standards, enabling them to build secure and compliant software solutions. Gain practical experience in designing, developing, and deploying software applications on Azure, preparing them for real-world scenarios and equipping them with the skills needed to succeed in software development roles in industry.

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

Textbooks:

1. Design Patterns, Elements of Reusable Object Oriented Software (Gang of Four) (Erich Gamma, Richard Helm, Ralph Johnson etc.)
2. Patterns of Enterprise Application Architecture (Martin Fowler)
3. Beginning Software Engineering by Rod Stephens
4. Fowler, MartinBeck, Kent, Roberts, Refactoring Improving the Design of Existing Code
5. Clean Architecture by Robert C. Martin
6. Head First Design Patterns by Eric Freeman, Elisabeth Robson
7. Building Microservices Designing Fine-Grained Systems by Sam Newman
8. Vladimir Khorikov. Unit Testing Principles, Practices, and Patterns

Reference Books (s)/Web links:

1. Code Complete A Practical Handbook of Software Construction by Steve McConnell
2. The Pragmatic Programmer Your Journey to Mastery by David Thomas, Andrew Hunt

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO3
CS23432.1	2	2	3	2	2	2	2	2	2	2	3	2	1	3	-
CS23432.2	2	3	1	2	2	1	-	1	1	1	2	-	1	2	-
CS23432.3	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1
CS23432.4	2	2	3	2	2	2	1	0	2	2	2	1	1	2	1
CS23432.5	2	2	2	1	1	1	1	0	2	1	1	1	2	1	-
Average	2.0	2.2	2.0	1.6	1.6	1.4	1.3	1.3	1.6	1.4	1.8	1.3	1.4	2.0	1.0

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-”

Subject Code	Subject Name (Project based learning)	Category	L	T	P	C
CS23433	DESIGN THINKING FOR INNOVATION IN COMPUTER SCIENCE AND ENGINEERING	PC	0	0	4	2

Objectives:

- To observe and understand the user needs.
- To think the design to find solutions for the user needs
- To develop prototype or proof of concepts
- To test the prototype and rethink , redesign to implement
- To understand the financial need and market survey

Activities:

	Hrs
• Understand the Design thinking concepts	4
• Study and understand the innovative solutions in the IT field for the past 2 decades	4
• Observe and understand the user and their needs using empathy. User may be from any groups : Toddler (Upto Age 5 years), Kids (Age 5 – 8 years), Children(Age 8-12 years), Adults, Young Professionals, Elderly, For Boys or Girls, Physically, marginalized, Persons with disability and etc., Persona, Road Maps, Big Picture / cartography can be developed	8
• Define the problem statements after deep analysis	4
• Generate the possible ideas and identify the best one	4
• Develop a prototype with Low/ Medium /high fidelities	10
• Test the prototype in all aspects	2
• If required rethink and redesign to bring the best one	4
• Find the financial needs and market survey	4
• Implement an innovative product / service / process based on the prototype	16
Total contact hours	60

Course Outcomes: On completion of the course, the students will be able to

CO1	Construct design challenge and reframe the design challenge into design opportunity.
CO2	Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.
CO3	Develop ideas and prototypes by brain storming using the ideation tools.
CO4	Organize the user walkthrough experience using ideal user experience journey.
CO5	Develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.

Text Book(s):

1	Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing, 2018.
2	Walter Brenner and Falk Uebenickel, "Design Thinking for Innovation: Research and Practice, 2018

Reference Books:

1	Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work – 2013 by Beverly Rudkin Ingle
2	Change by Design, Revised and Updated: How Design Thinking Transforms Organizations and Inspires Innovation Kindle Edition by Tim Brown

Web links :

1	Design thinking Guide https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf
2	IDEO Design Thinking https://designthinking.ideo.com/
3	IITB Design course tools and Resources https://www.dsoures.in/resource

CO - PO – PSO matrices of course

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
CO2	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
CO3	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
CO4	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
CO5	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
Avera ge	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
- 3: Substantial (High) No correlation: “-”

Open Elective – Offered by CSE

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23O31	JAVA PROGRAMMING	OE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To understand Object Oriented Programming concepts and characteristics of Java.
<ul style="list-style-type: none"> To know the principles of classes, abstraction and inheritance.
<ul style="list-style-type: none"> To create packages, define exceptions and use interface.
<ul style="list-style-type: none"> To use I/O streams and Generics in applications.
<ul style="list-style-type: none"> To learn how to organize and handle data effectively in Java programs, making them faster and easier to manage using Collections

UNIT-I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	6
Introduction to Object Oriented Programming – Basic concepts of OOP - The History and Evolution of Java - An overview of Java - Java Architecture - Data Types - Variables- Arrays- Operators - Control Statements - String – String Buffer.		
UNIT-II	CLASSES AND INHERITANCE	6
Classes – Class Fundamentals - A Simple Class - Declaring Objects - Assigning Object Reference Variables - Methods - Constructors – this - Inheritance - Inheritance Basics - Member Access - super - Method Overriding - Dynamic Method Dispatch - Abstract Classes - final - Object Class.		
UNIT-III	PACKAGES, INTERFACE & EXCEPTION HANDLING	6
Packages - Defining a Package - Access Protection - Imports - Interfaces - Implements - Nested Interfaces - Exception Handling - Types - try - catch - throw - throws - finally - User Defined Exceptions.		
UNIT-IV	I/O AND GENERIC PROGRAMMING	6
Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files – Generic Programming – Generic Classes – Generic Methods.		
UNIT-V	COLLECTIONS	6
Collection – Iterable - List Iterable - Collections - List – ArrayList - LinkedList- Vector – Stack - Set - HashSet – LinkedHashSet – SortedSet- TreeSet - Queue - PriorityQueue - Map - HashMap – TreeMap.		
Total Contact Hours:		30

List of Experiments (If applicable)	
1	Programs using data types and Operators.
2	Programs using control structures.
3	Programs using arrays.
4	Programs using strings and string buffer.
5	Programs using classes and objects.
6	Programs using inheritance.
7	Programs using Packages.
8	Programs using Interfaces.
9	Programs to create user defined exceptions.
10	Programs using Files.

11	Programs to implement Object Serialization.
12	Programs using collections-LIST.
13	Programs using collections-Stack and Queue.
14	Programs using collections-SET.
15	Programs using collections-MAP.
	Contact Hours: 60
	Total Contact Hours: 90

Course Outcomes: On completion of the course, the students will be able to

- Develop Java programs using OOP principles and Strings.
- Develop Java programs with the concepts inheritance.
- Build Java applications using exceptions and interfaces.
- Develop Java applications using I/O and collections.
- Learning how to organize and handle data effectively in Java programs, making them faster and easier to manage using Collections.

SUGGESTED ACTIVITIES

- **Quizzes** – basic concepts of JAVA & language basics
- **Tutorial** – Class & Inheritance
- **Flipped Classroom** – Packages & Interface
- **Mind Map, Poster Design** – IO & Generics
- **Implementation of small Systems**- Collections

SUGGESTED EVALUATION METHODS

- **Quizzes** – basic concepts of JAVA & language basics .
- **Tutorial problems** - Applications & Implementations using Inheritance
- **Implementation** – small applications using exception handling
- **Logical thinking** – solving problems using generics
- **Mini Project** – Collections

Web links for Theory & Lab

1	https://java-iitd.vlabs.ac.in/
2	https://www.hackerrank.com/domains/java

Text Books(s):

1	Herbert Schildt, “Java The complete reference”, 9th Edition, McGraw Hill Education, 2014
2	Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

Reference Books:	
1	Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2	Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3	Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.
4	SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.
5	https://www.javatpoint.com/java-tutorial

CO - PO – PSO matrices of course

COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23O31.1	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23O31.2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23O31.3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CS23O31.4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CS23O31.5	3	3	3	3	3	-	2	-	2	2	3	3	3	3	3
Average	3	3	3	2.6	3	-	2	-	2	2	3	3	3	3	2.6

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

Course Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23O32	DATA STRUCTURES USING C	ES	2	0	2	3

Objectives:						
• To introduce the basics of C programming language.						
• To learn the concepts of advanced features of C.						
• To understand the concepts of ADTs and linear data structures						
• To know the concepts of non-linear data structure and hashing.						
• To familiarize the concepts of sorting and searching techniques.						

UNIT-I	C PROGRAMMING FUNDAMENTALS	6
Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.		
UNIT-II	C PROGRAMMING - ADVANCED FEATURES	6
Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Pre-processor Directives.		
UNIT-III	LINEAR DATA STRUCTURES	6
Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly- Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.		
UNIT-IV	NON LINEAR DATA STRUCTURES	6
Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
UNIT-V	SEARCHING AND SORTING TECHNIQUES	6
Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.		
	Contact Hours :	30

List of Experiments		
1.	C programs using single and multidimensional arrays	
2.	C program using Pointers	
3.	C program using structures	
4.	C programs for file handling	
5.	Implementation of Singly, Doubly, Circular Linked List	
6.	Implementation of Stack and Queue	
7.	Implementation of Binary Search Tree	
8.	Implementation of Hashing Techniques	
9.	Implementation of Searching algorithms using C	
10.	Implementation of Sorting algorithms using C	
	Contact Hours:	30
	Total Contact Hours :	60

Course Outcomes: On completion of course you will be able to
• Develop C programs for any real world/technical application.
• Apply advanced features of C in solving problems.
• Suggest and use appropriate linear/non-linear data structure operations for solving a given problem.
• Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.
• Appropriately use sort and search algorithms for a given application.

Textbooks:
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.

Reference books:
1 Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
2 Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, University Press, 2008.
3 https://www.hackerrank.com/

CO - PO - PSO matrices of course

COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23O32.1	2	2	-	-	-	-	-	-	-	-	-	2	3	2	2
CS23O32.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2
CS23O32.3	3	3	3	3	3	3	2	-	-	-	2	3	3	3	3
CS23O32.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3	2
CS23O32.5	3	3	3	3	3	3	2	-	2	2	2	3	3	3	3
Average	2.8	2.8	3	3	2.6	3	2	-	2	2	2	2.4	3	2.8	2.4

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

Course Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23O33	ASSISTIVE TECHNOLOGY	OE	2	0	2	3

Objectives:

- To learn assistive technologies for individuals with disabilities and to understand how technologies aid human activity within different contexts
- To understand ethical considerations surrounding assistive technology, and learn effective service delivery strategies.
- To explore user inputs, control interfaces, mainstream ICT, web technologies, and seating integration to enhance functionality and participation in assistive technology contexts.
- To analyze technologies enabling mobility, transportation assistance, and manipulation/control of the environment.
- To investigate sensory aids for visual and auditory impairments, cognitive augmentation technologies, and augmentative communication systems.

UNIT-I	Principles of Assistive Technology	6
Definitions of Assistive Technology-Principles of Assistive Technology Service Delivery-The Human Activity Assistive Technology Model-Application of the Human Activity Assistive Technology Model-Technologies That Assist People Who Have Disabilities- Activity, Human, and Context: The Human Doing an Activity in Context.		
UNIT-II	Legal and Ethical Foundations of Assistive Technology Services	6
The Ethical Context-Application of Ethical Concepts in Assistive Technology-Professional Ethics - Delivering Assistive Technology Services to the Consumer.		
UNIT III	Comprehensive Integration of Assistive Technologies for Enhanced Accessibility	6
Making the Connection: User Inputs for Assistive Technologies - Control Interfaces for Assistive Technologies-Accessing Mainstream Information and Communication Technologies: The Technology and the Web.		
UNIT-IV	Enhancing Mobility and Environmental Control through Assistive Technologies	6
Technologies That Enable Mobility -Technologies That Aid Transportation-Technologies That Aid Manipulation and Control of the Environment.		
UNIT V	Empowering Sensory and Cognitive Abilities through Assistive Technologies	6
Sensory Aids for Persons with Visual Impairments - Sensory Aids for Persons with Auditory Impairment - Assistive Technologies for Cognitive Augmentation.		
		Contact hours: 30

Course Outcomes: On completion of the course, the students will be able to

- Evaluate and apply assistive technologies effectively to support individuals with disabilities in diverse activities and contexts.
- Integrate law, policy, role and function related to the assistive technology
- Enhance accessibility and participation by integrating user inputs, control interfaces, mainstream ICT access, and seating technologies effectively in assistive technology contexts
- Analyze and recommend the assistive technology for persons with disabilities
- Equip learners with proficiency in implementing assistive technologies to enhance sensory perception, cognitive abilities, and communication for individuals with diverse impairments.

Text Books:

1	Cook, Albert M., and Jan Miller Polgar. Cook & Hussey's Assistive Technologies: Principles and Practice. 4th ed. Mosby Elsevier, 2015. ISBN: 978-0-323-09631-7
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Reference Books:

1.	Bouck, E. C. (2017). Assistive technology. Sage Publications
2.	Draper, Sharon M. (2010). Out of my mind. Atheneum Books for Young Readers.

Suggested Activities:

- Class lecture and discussion
- Small group activities and assignments
- Video and other media supports
- Visit to special schools

- | |
|--|
| <ul style="list-style-type: none"> • Peer reviews • Research and presentation activities |
|--|

Suggested Assessment Methods:

- Interactive Activities
- Quiz
- Mini Project
- CAT & Final Exams

List of the Experiments

1.	Customized seat cushion for wheelchair users.
2.	Mobile app for detecting clothing colors and patterns to help a blind person dress independently.
3.	Smart stick with sensing and a haptic interface designed for a blind person.
4.	Android-based task-reminder
5.	Customized mouse event handler for someone using only his eyes to control the mouse.
6.	Voice-controlled tablet-based software to control various aspects of the user's environment.
7.	Custom "no-spill" spoon for a person with a spinal cord injury to eat more easily.
8.	Software/tools for improving cognitive functions
9.	Development of multi-sensory games transcending to life skills
10.	Development of AR technologies to learn with enjoyment
11.	Diagnostic tools for assessing the levels of hearing impairment.
12.	Identification of medicines, knowing expiry dates on packages including
Contact Hours: 30	
Total Contact Hours: 60	

Platform Needed: Linux	
HARDWARE:	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

CO - PO – PSO matrices of course

COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23O33.1	3	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CS23O33.2	3	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CS23O33.3	3	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CS23O33.4	3	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CS23O33.5	3	1	1	1	1	-	-	-	-	-	-	-	-	-	-
Average	3	1	1	1	1	-									

Correlation levels 1, 2 or 3 are as defined below:

- | | |
|-----------------------|----------------------|
| 1: Slight (Low) | 2: Moderate (Medium) |
| 3: Substantial (High) | No correlation: “-” |

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23O34	Web Design and Development	OE	2	0	2	3

Objectives:

- To understand the basic concepts in Web Design.
- To understand a dynamic web page using JavaScript
- To learn how to develop server-side programs using PHP
- To learn how to create Animations & Effect using JQuery
- To learn responsive websites using Bootstrap

UNIT I	WEB BASICS, HTML AND CSS	6	
Web Basics: Clients, Servers, and Communication-Internet Overview-Basic Internet Protocols – HTML 5.0: Tables – Lists - Image - HTML5 control elements - Semantic elements - Drag and Drop - Audio - Video controls. CSS3.0: Inline, embedded and external style sheets - Rule cascading - Inheritance - Backgrounds - Border Images - Colors - Shadows - Text - Transformations – Animations.			
UNIT II	CLIENT-SIDE SCRIPTING – JAVA SCRIPT	6	
JavaScript Introduction – Variables and Data Types - Statements - Operators – Literals - Expressions and Control Flow in JavaScript - JavaScript Functions, Objects and Arrays - Regular Expression- Document Object Model (DOM) - Event handling – Validation.			
UNIT-III	SERVER-SIDE SCRIPTING - PHP	6	
Introduction- Working principle of PHP -Variables - Constants - Operators - Flow Control and Looping - Arrays - Strings - Functions - File Handling -PHP and HTML - Simple PHP scripts - Databases with PHP.			
UNIT IV	JQUERY	6	
JQUERY: Introduction to jQuery – Selectors – Elements: Manipulations, Changing and Setting elements – Event Models: Event handlers – Animations & Effects – Functions – Plugins.			
UNIT-V	BOOTSTRAP 5	6	
Bootstrap Background and Features - Getting Started with Bootstrap - Grids - Components - Menus and Navigations - Plugins - Flexbox& Layouts.			
	Total Contact Hours	:	30

List of Experiments

1	Create a web page to embed a map along with hot spot frames & links.
2	Create a web page using an embedded, external, and inline CSS file.
3	Create an online job registration page along with java script validations.
4	Write a PHP program for Employee Details, which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.
5	Create an online application in any of the web application like PHP for Tourism management like the available trip details in season based. Type of mode, Concession details for passengers and Booking / Cancelling tickets.
6	Develop a Simple game using jQuery
7	Develop an Attractive web pages using Bootstrap.
8	Design a Web page with Navigation menu, Inline editor, Order form, Instant Search & Switchable Grid using Bootstrap
Contact Hours :	
Total Contact Hours :	

Platform Needed: Linux	
HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

Course Outcomes: On completion of course you will be able to

- Know the basic concepts in Web Design.
- Develop a dynamic web page using JavaScript
- Develop a server-side programs using PHP
- Design an Animations & Effect using JQuery
- Develop a responsive website using Bootstrap

Textbooks:

1.	Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reillypublishers, 2014.
2.	Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web – How to Program", 7th edition, Pearson Education, 2012.

Reference Books (s)/Web links:

1.	Jeffrey C. Jackson, "Web Technologies–A Computer Science Perspective", PearsonEducation, 2006.
2.	Fritz Schneider, Thomas Powell, "JavaScript – The Complete Reference", 3rd Edition, McGraw Hill Publishers, 2017
3.	Steven Holzener , "PHP – The Complete Reference", 1st Edition, Mc-Graw Hill, 2017
4.	Bear Bibeault and Yehuda Katz, jQuery in Action, 2008
5.	Matt Lambert, Learning Bootstrap 4, Second Edition, Packt Publishing, 2016

CO - PO – PSO matrices of course

COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23O34.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CS23O34.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CS23O34.3	3	3	3	3	3	-	-	2	2	-	2	2	3	3	3
CS23O34.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CS23O34.5	3	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average	3	3	3	3	3	2.0	2.0	2.0	2.3	2.0	1.8	2.4	3	3	2.6

Correlation levels 1, 2 or 3 are as defined below:

- | | |
|-----------------------|----------------------|
| 1: Slight (Low) | 2: Moderate (Medium) |
| 3: Substantial (High) | No correlation: “-” |

Course Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23O35	APP DEVELOPMENT	OE	2	0	2	3

Objectives:						
• Understand Various App Development Paradigms.						
• Master Native App Development.						
• Explore Hybrid App Development.						
• Develop Skills in Cross-Platform Application Development.						
• Evaluate Non-Functional Aspects of Application Development.						

Unit-I	Fundamentals of Mobile and Web Application Development	6
Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.		
Unit-II	Native App Development	6
Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks.		
Unit-III	Hybrid App Development	6
Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks.		
Unit-IV	Cross-Platform App Development	6
What is Cross-platform App?, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks.		
Unit-V	Non-Functional Characteristics of App Frameworks	6
Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability.		
		Contact Hours: 30

List of Experiments		
1.	Introduction to MIT App Inventor.	
2.	Develop an application for a BMI calculator.	
3.	Develop an application for a simple expense manager, which allows entering expenses and income on each day and displays category wise weekly income and expense.	
4.	Develop an application to convert units from imperial system to metric system (km to miles, kg to pounds etc.).	
5.	Design an application for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.	
6.	Build a Music and Video application.	
7.	Create an Alarm application.	
8.	Develop an accelerometer and Shaking, Random Numbers and Dolphin Game.	
9.	Develop a Find my Phone application.	
10.	Develop an interactive quiz application.	
11.	Develop a browser app.	
12.	Develop a list picker app with DB.	
13.	Design and develop an application for day-to-day task (to-do) management.	
14.	Design and develop an application to find and display the current location of the user.	
15.	Mini Project.	
		Contact Hours: 30
		Total Contact Hours : 60

Platform Needed: Linux	
HARDWARE :	PC with 8 GB RAM, i3 Processor
SOFTWARE :	Android Studio, Flutter SDK, MIT App Inventor.

Course Outcomes: On completion of course you will be able to

- Proficiently Develop Various Types of Apps.
- Utilize Development Tools Effectively.
- Create Responsive and Progressive Web Apps.
- Analyze and Compare App Development Frameworks.
- Implement Best Practices in App Development.

Textbooks:

1.	Head First Android Development, Dawn Griffiths, O'Reilly, 1 st edition.
2.	Apache Cordova in Action, Raymond K. Camden, Manning, 2015.
3.	Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing.

Reference Books (s)/Web links:

1.	Android Programming for Beginners, John Horton, Packt Publishing, 2 nd Edition.
2.	Native Mobile Development by Shaun Lewis, Mike Dunn.
3.	Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras.
4.	Apache Cordova 4 Programming, John M Wargo, 2015.
5.	React Native Cookbook, Daniel Ward, Packt Publishing, 2 nd Edition.

CO - PO – PSO matrices of course

COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23O35.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CS23O35.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CS23O35.3	3	3	3	3	3	-	-	2	2	-	2	2	3	2	3
CS23O35.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CS23O35.5	2	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average	2.8	3	3	3	3	3.0	2.0	2.0	2.3	2.0	1.8	2.4	3	2.8	2.6

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

COURSES OFFERED BY CSE TO OTHER DEPARTMENTS

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
GE23233	PROBLEM SOLVING AND PYTHON PROGRAMMING	ES	2	0	4	4

Objectives:

- To know the basics of algorithmic problems solving
- To develop Python programs with conditionals and loops
- To define Python functions and call them
- To use Python data structures –lists, tuples, dictionaries
- To do input/output with files in Python

UNIT-I	ALGORITHMIC PROBLEM SOLVING	6	
Introduction to computers-characteristics-basic organization of a computer— algorithms-building blocks of algorithms (instructions / statements, state, control flow, functions)-notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion).			
UNIT-II	DATA, EXPRESSIONS, STATEMENTS AND CONTROL FLOW	6	
Python interpreter and interactive mode - values and types - data types – variables – keywords – expressions and statements- python I/O - operators- precedence of operators– comments. Conditionals: conditional (if)-alternative (if-else)-chained conditional (if- elif- else)-nested conditional.			
UNIT-III	CONTROL FLOW – II AND FUNCTIONS	7	
Iteration: while – for - break – continue – pass. Illustrative programs: exchange the values of two variables- circulate the values of n variables-test for leap year. Function calls – type conversion– math function– composition- definition and use - flow of execution - parameters and arguments. Fruitful functions: return values – parameters - scope: local and global - recursion.			
UNIT-IV	STRINGS	5	
Strings: string slices – immutability - string functions and methods – string comparison. Illustrative programs: square root- GCD- exponentiation-sum the array of numbers linear search- binary search.			
UNIT-V	LISTS, TUPLES AND DICTIONARIES	6	
Lists - list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists - list parameters. Tuples – immutable - tuple assignment - tuple as return value. Dictionaries: operations and methods– dictionaries and tuples– dictionaries and lists. Advanced list processing- list comprehension. Illustrative programs: Sorting.			
	Contact Hours	:	30

List of Experiments			
1	Introduction to Python Programming and Python IDLE/Anaconda distribution.		
2	Experiments based on Variables, Data types and Operators in Python.		
3	Coding Standards and Formatting Output.		
4	Algorithmic Approach: Selection control structures.		
5	Algorithmic Approach: Iteration control structures.		
6	Experiments based on Strings and its operations.		
7	Experiments based on Lists and its operations.		
8	Experiments based on Tuples and its operations.		
9	Experiments based on Sets and its operations.		
10	Experiments based on Dictionary and its operations.		
11	Functions: Built-in functions.		
12	Searching techniques: Linear and Binary.		
13	Sorting techniques: Bubble and Merge Sort.		
	Contact Hours	:	60
	Total Contact Hours	:	90

Course Outcomes: On completion of the course, the students will be able to
• Understand the working principle of a computer and identify the purpose of a computer programming language and ability to identify an appropriate approach to solve the problem.
• Write, test, and debug simple Python programs with conditionals and loops.
• Develop Python programs step - wise by defining functions and calling them.
• Use Python lists, tuples, dictionaries for representing compound data.
• Apply searching, sorting on data and efficiently handle data using flat files.

Text Books:
1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido Van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python3.2, Network Theory Ltd., 2011.

Reference Books:
1. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt.Ltd. 2016.
3. Timothy A.Budd, Exploring Python, Mc-Graw Hill Education (India) PrivateLtd. 2015.
4. Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.
5. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python3, Second edition, Pragmatic Programmers, LLC, 2013.

CO -PO–PSO matrices of course

PO/PSOCO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE23233.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
GE23233.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
GE23233.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
GE23233.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
GE23233.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	-	-	0.0	0.2	1	1.4	1	2.4	2.4	2

1-Slight (Low), 2- Moderate (Medium),
 3- Substantial (High) , “-“ No correlation

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE23231	PROGRAMMING USING PYTHON Common to all branches of B. E. / B.Tech program (Except-CSE, CSBS, CSD, IT, AI/ML, CYBER SECURITY, AI/DS)	ES	1	0	4	3

Objectives:

- To understand computers, programming languages and their generations and essential skills for a logical thinking for problem solving.
- To write, test, and debug simple Python programs with conditionals, and loops and functions
- To develop Python programs with defining functions and calling them
- To understand and write python programs with compound data-lists, tuples, dictionaries
- To search, sort, read and write data from /to files in Python.

List of Experiments	
1.	Study of algorithms, flowcharts and pseudocodes.
2.	Introduction to Python Programming and Python IDLE/Anaconda distribution.
3.	Experiments based on Variables, Data types and Operators in Python.
4.	Coding Standards and Formatting Output.
5.	Algorithmic Approach: Selection control structures.
6.	Algorithmic Approach: Iteration control structures.
7.	Experiments based on Strings and its operations.
8.	Experiments based on Lists and its operations.
9.	Experiments based on Tuples and its operations.
10.	Experiments based on Sets and its operations.
11.	Experiments based on Dictionary and its operations.
12.	Functions: Built-in functions.
13.	Functions: User-defined functions.
14.	Functions: Recursive functions.
15.	Searching techniques: Linear and Binary.
16.	Sorting techniques: Bubble and Merge Sort.
17.	Experiments based on files and its operations.

Contact Hours : 75

Platform Needed: Linux	
HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

Course Outcomes: On completion of the course, students will be able to:	
• Understand the working principle of a computer and identify the purpose of a computer programming language and ability to identify an appropriate approach to solve the problem.	
• Write, test, and debug simple Python programs with conditionals and loops.	
• Develop Python programs step - wise by defining functions and calling them.	
• Use Python lists, tuples, dictionaries for representing compound data.	
• Apply searching, sorting on data and efficiently handle data using flat files.	

Text Books:	
1.	Allen B. Downey, Think Python:How to Think Like a Computer Scientist, Second edition,UpdatedforPython3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2.	Guido Van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python3.2, Network Theory Ltd., 2011.

Reference Books:														
1.	John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.													
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd. 2016.													
3.	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd. 2015.													
4.	Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.													
5.	Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.													
6.	Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python3, Second edition, Pragmatic Programmers, LLC, 2013.													

CO -PO-PSO matrices of course

PO/PSOCO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE23231.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
GE23231.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
GE23231.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
GE23231.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
GE23231.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	-	-	-	1	1	1.4	1	2.4	2.4	2

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low) 2: Moderate (Medium)
 3: Substantial (High) No correlation: “-”

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23232	FUNDAMENTALS OF DATA STRUCTURES USING C (with effect from 2023 batch onwards) (For Biomedical Engineering)	ES	3	0	4	5

Objectives:

- To learn the features of C
- To learn about functions, pointers and structures
- To explore the applications of linear data structures list
- To explore the applications of linear data structures stack and queue
- To learn the basic sorting and searching algorithms and about hashing

UNIT-I	PROGRAMMING BASICS	10
Structure of a C program – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. Strings - String operations		
UNIT-II	FUNCTIONS, POINTERS AND STRUCTURES	9
Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Structures and unions - definition – Structure within a structure - Programs using structures.		
UNIT-III	LINEAR DATA STRUCTURES – LIST	9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists– applications of lists –Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal)		
UNIT-IV	LINEAR DATA STRUCTURES – STACKS, QUEUES	8
Stack ADT – Evaluating arithmetic expressions- Balancing Symbols- Queue ADT – circular queue implementation – applications of queues		
UNIT-V	SORTING, SEARCHING AND HASH TECHNIQUES	9
Sorting algorithms: Insertion sort – Selection sort – Bubble sort – Quick sort – Merge sort – Searching: Linear search – Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing		
	Contact Hours	:
		45

List of Experiments		
1	Programs using I/O statements and expressions.	
2	Programs using decision-making statements	
3	Programs using Arrays and Strings	
4	Programs using Functions	
5	Programs using Structures	
6	Linked list implementation of List	
7	Array implementation of Stack and Queue ADTs	
8	Linked list implementation of Stack and Queue ADTs	
9	Applications of List, Stack and Queue ADTs	
10	Implementation of Searching and Sorting algorithms	
11	Hashing –Linear probing	
	Contact Hours	:
		60
	Total Contact Hours	:
		105

Platform Needed: Linux		
HARDWARE:	PC with 2 GB RAM, i3 Processor	
SOFTWARE :	GCC compiler	

Course Outcomes: On completion of the course, the students will be able to		
• Formulate simple algorithms and programs using branching and looping.		
• Use arrays, pointers and structures to formulate algorithms and programs.		
• Implement linear data structure operations using C.		
• Suggest appropriate linear data structures for any given data set.		
• Appropriately choose the sorting and searching algorithm for an application and apply hashing concepts for a given problem.		

Text Books(s):	
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India, Second Edition, 2015.
2	Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2002

Reference Book(s):	
1	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 2009.
3	Reema Thareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.
4	Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla, — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
5	Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, University Press, 2008.
6	Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.

Web Link(s):	
1	https://www.tutorialspoint.com/compile_c_online.php
2	https://www.codechef.com/ide
3	https://www.jdoodle.com/c-online-compiler
4	https://rextester.com/l/c_online_compiler_gcc
5	http://vlabs.iitb.ac.in/vlab/labscse.html
6	https://www.hackerrank.com/
7	https://www.geeksforgeeks.org/
8	https://leetcode.com/

CO -PO-PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CS23232.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
CS23232.2	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
CS23232.3	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS23232.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23232.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.2	1.6	2.0	1.6	1.0	-	-	-	1	2	1.5	1.2	1.6	2.2	2

Correlation levels 1, 2 or 3 are as defined below:

- 1: Slight (Low)
- 2: Moderate (Medium)
- 3: Substantial (High)
- No correlation: “-”

Subject Code	Subject Name (Lab Course)	Category	L	T	P	C
CS23422	Python Programming for Machine learning (with effect from 2023 batch onwards)	ES	0	0	4	2

Objectives:

- To understand the relationship of the data collected for decision making.
- To know the concept of principal components, factor analysis and cluster analysis for profiling and interpreting the data collected.
- Lay the foundation of machine learning and its practical applications and prepare students for real-time problem-solving in data science.
- Develop self-learning algorithms using training data to classify or predict the outcome of future datasets.
- Distinguish overtraining and techniques to avoid it such as cross-validation.

List of Experiments for practice

1.	NumPy Basics: Arrays and Vectorized Computation
2.	Getting Started with pandas
3.	Data Loading, Storage, and File Formats
4.	Data Cleaning and Preparation
5.	Data Wrangling: Join, Combine, and Reshape
6.	Plotting and Visualization
7.	Data Aggregation and Group Operations
8.	Time Series
9.	Supervised Learning
10.	Unsupervised Learning and Pre-processing
11.	Representing Data and Engineering Features
12.	Model Evaluation and Improvement

Contact Hours : 60

Platform Needed: Linux

HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

Course Outcomes: On completion of the course, students will be able to:

- Develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
- Analyze and perform an evaluation of learning algorithms and model selection.
- Compare the strengths and weaknesses of many popular machine learning approaches.
- Appreciate the underlying mathematical relationships within and across machine learning algorithms and the paradigms of supervised and unsupervised learning.
- Design and implement various machine learning algorithms in a range of real-world applications.

Text Books:

1.	Wes McKinney, Python for Data Analysis - Data wrangling with pandas, Numpy, and ipython, Second Edition, O'Reilly Media Inc, 2017.
2.	Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python - A Guide for Data Scientists, First Edition, O'Reilly Media Inc, 2016.

Reference Books:

1.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition,O'Reilly Media Inc, 2019.
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CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CS23422.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
CS23422.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
CS23422.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
CS23422.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
CS23422.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	0.0	0.0	0.0	0.2	0.2	1.4	1	2.4	2.4	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-“

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
CS23336	INTRODUCTION TO PYTHON PROGRAMMING	ES	1	0	4	3

Objectives:

- To understand computers, programming languages and their generations and essential skills for a logical thinking for problem solving.
- To write, test, and debug simple Python programs with conditionals, and loops and functions
- To develop Python programs with defining functions and calling them
- To understand and write python programs with compound data-lists, tuples, dictionaries
- To search, sort, read and write data from /to files in Python.

List of Experiments	
1.	Study of algorithms, flowcharts and pseudocodes.
2.	Introduction to Python Programming and Python IDLE/Anaconda distribution.
3.	Experiments based on Variables, Data types and Operators in Python.
4.	Coding Standards and Formatting Output.
5.	Algorithmic Approach: Selection control structures.
6.	Algorithmic Approach: Iteration control structures.
7.	Experiments based on Strings and its operations.
8.	Experiments based on Lists and its operations.
9.	Experiments based on Tuples and its operations.
10.	Experiments based on Sets and its operations.
11.	Experiments based on Dictionary and its operations.
12.	Functions: Built-in functions.
13.	Functions: User-defined functions.
14.	Functions: Recursive functions.
15.	Searching techniques: Linear and Binary.
16.	Sorting techniques: Bubble and Merge Sort.
17.	Experiments based on files and its operations.

Contact Hours : : **75**

Platform Needed: Linux

HARDWARE :	Personal Computer with Dual Core Processor with 4 GB RAM.
SOFTWARE :	Gcc Compiler

Course Outcomes: On completion of the course, students will be able to:

- Understand the working principle of a computer and identify the purpose of a computer programming language and ability to identify an appropriate approach to solve the problem.
- Write, test, and debug simple Python programs with conditionals and loops.
- Develop Python programs step - wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Apply searching, sorting on data and efficiently handle data using flat files.

Text Books:

1.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2.	Guido Van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python3.2, Network Theory Ltd., 2011.

Reference Books:															
1.	John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.														
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd, 2016.														
3.	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.														
4.	Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.														
5.	Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.														
6.	Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python3, Second edition, Pragmatic Programmers, LLC, 2013.														

CO -PO-PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CS23336.1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CS23336.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
CS23336.3	2	2	3	2	1	-	-	-	1	-	2	1	2	2	-
CS23336.4	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
CS23336.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	-
Average	1.5	1.5	2.25	1.5	1.0	-	-	-	1.0	-	1.5	1.0	1.8	1.8	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”