



RAJALAKSHMI
ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

REGULATION 2023

CURRICULUM AND SYLLABUS

B.Tech Information Technology

Department of Information Technology
Rajalakshmi Engineering College, Thandalam.

RAJALAKSHMI ENGINEERING COLLEGE
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Choice Based Credit System (CBCS)

REGULATIONS – 2023

DEPARTMENT OF INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABUS

Vision

To promote highly Ethical and Innovative Information Technology 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 provide essential background in science, basic Electronics, applied Mathematics and Information Sciences.
- PEO 2: To prepare students with fundamental knowledge in programming languages and to design and develop information systems and applications.

- PEO 3: To engage the students in life-long learning, to remain current in their profession and obtain additional qualifications to enhance their career positions in IT field.
- PEO 4: To enable students to implement computing solutions for real world problems and carry out basic and applied research leading to new innovations in Information Technology (IT) and related interdisciplinary areas.
- PEO 5: To familiarize students with ethical issues in engineering profession, issues related to the worldwide economy, nurturing of current job related skills and emerging technologies with a concern for society

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 p IT23C18

ractice.

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.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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 Information Technology Program will demonstrate

PSO 1: To identify and assess current technologies and review their applicability to meet user requirements and organizational needs.

PSO 2: To engage in the computing profession by working effectively and utilizing professional skills to make a positive contribution to society.

PSO 3: To take up research and entrepreneurship and embark on business in the IT field

CURRICULUM
B.Tech. Information Technology
Regulation 2023 | Total Credits: 162

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	□□□□□□ □□□□ / Heritage of Tamils	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
4.	GE23111	Engineering Graphics	ES	6	2	0	4	4
5.	EE23133	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
6.	GE23131	Programming using C	ES	7	1	0	6	4
LABORATORY COURSES								
7.	GE23122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1
NON CREDIT COURSES								
8.	MC23112	Environmental Science and Engineering	MC	3	3	0	0	0
TOTAL				30	15	1	14	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	□□□□□□□□ □□□□□□□□□□□□□□□□ / Tamils and Technology	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
1.	PH23132	Physics for Information Science	BS	5	3	0	2	4
4.	EC23331	Microprocessors and Microcontroller	ES	5	3	0	2	4
5.	CS23231	Data Structures	PC	7	3	0	4	5
LABORATORY COURSES								
6.	GE23121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1
7.	CS23221	Python Programming Lab	PC	4	0	0	4	2
8.	HS 23221 / HS 23222 /	Technical Communication II / English for Professional Competence	HS	2	0	0	2	1
NON CREDIT COURSES								
9.	MC23111	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
TOTAL				33	16	1	16	22

SEMESTER III								
SI. 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.	EC23314	Analog and Digital Communication	ES	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.	IT23331	Digital Logic and Computer Architecture	PC	5	3	0	2	4
TOTAL				31	16	1	14	24

SEMESTER IV								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	GE23311	Fundamentals of Management for Engineers	HS	3	3	0	0	3
2.		Open Elective – I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	MA23435	Probability, Statistics and Simulation	BS	5	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.	IT23431	MongoDB Essentials	PC	4	2	0	2	3
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23421	Soft Skills – I	EEC	2	0	0	2	1
8.	IT23421	Internship	EEC	0	0	0	2	1
TOTAL				29	17	0	14	24

SEMESTER V								
Sl. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective – I	PE	3	3	0	0	3
2.	IT23511	Automata Theory and Compiler Design	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	IT23531	Computer Vision	PC	5	3	0	2	4
4.	CS23531	Web Programming	PC	7	1	0	6	4
5.	AI23231	Principles of Artificial Intelligence	PC	5	3	0	2	4
6.	CS23532	Computer Networks	PC	7	3	0	4	5
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23521	Soft Skills - II	EEC	2	0	0	2	1
TOTAL				32	16	0	16	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
2.		Open Elective – II	OE	3	3	0	0	3
3.	CS23512	Fundamentals of Mobile Computing	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS23632	Cryptography and Network Security	PC	4	2	0	2	3
5.	AI23331	Fundamentals of Machine Learning	PC	5	3	0	2	4
LABORATORY COURSES								
6.	GE23627	Design Thinking and Innovation	EEC	3	0	0	4	2
7.	CS23621	Mobile Application Development Laboratory	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	GE23621	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				27	14	0	14	21

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
LAB ORIENTED THEORY COURSES								
3.	IT23731	Cloud and Big Data Architecture	PC	5	3	0	2	4
LABORATORY COURSES								
4.	IT23721	Data Science using R	PC	4	0	0	4	2
5.	IT23722	Project Phase I	EEC	6	0	0	6	3
TOTAL				21	9	0	12	15

SEMESTER VIII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective – V	PE	3	3	0	0	3
2.		Professional Elective – VI	PE	3	3	0	0	3
LABORATORY COURSES								
3.	IT23821	Project Phase II	EEC	12	0	0	12	6
TOTAL				18	6	0	12	12

TOTAL NO. OF CREDITS: 162

PROFESSIONAL ELECTIVES (PE)

EMERGING TECHNOLOGIES								
Sl. No.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT23A11	Internet of Things	PE	3	3	0	0	3
2.	CS23A32	Robotic Process Automation	PE	5	1	0	4	3
3.	CB23G11	Quantum Computation and Quantum Information	PE	3	3	0	0	3
4.	IT23A13	Edge Computing	PE	3	3	0	0	3
5.	IT23A32	AI based Conversational System	PE	4	2	0	2	3
6.	IT23A12	Introduction to Drone	PE	3	3	0	0	3
7.	AI23B32	Soft Computing	PE	4	2	0	2	3

FULL STACK DEVELOPMENT								
Sl. No.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT23B31	C# and .Net Programming	PE	4	2	0	2	3
2.	CS23A34	User Interface Design	PE	4	2	0	2	3
3.	IT23B32	Advanced Web Programming	PE	5	1	0	4	3
4.	IT23B33	DevOps	PE	4	2	0	2	3
5.	CS23A35	Web Application Security	PE	4	2	0	2	3
6.	IT23B14	Advanced Java Programming	PE	3	3	0	0	3

SOFTWARE TECHNOLOGY MANAGEMENT								
Sl. No.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT23C11	Business Intelligence	PE	3	3	0	0	3
2.	IT23C12	Software Project Management	PE	3	3	0	0	3
3.	IT23C13	Startup Management	PE	3	3	0	0	3
4.	IT23C14	Lateral Thinking Techniques	PE	3	3	0	0	3
5.	IT23C15	Software Quality Assurance	PE	3	3	0	0	3
6.	IT23C16	Green Computing	PE	3	3	0	0	3
7.	IT23C17	Ubiquitous Computing	PE	3	3	0	0	3
8.	IT23C18	Agile Methodologies	PE	3	3	0	0	3
9.	IT23C31	Software Testing	PE	4	2	0	2	3

Data Science								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	AD23A31	Customer Analytics and Opinion Mining	PE	4	2	0	2	3
2.	AD23A32	Explorative and Forecasting Analytics	PE	4	2	0	2	3
3.	AD23A33	Bio Informatics Systems	PE	4	2	0	2	3
4.	IT23D11	Deep Learning Concepts	PE	3	3	0	0	3
5.	AD23B32	Text and Speech Analysis	PE	4	2	0	2	3
6.	CS23A31	Business Analytics	PE	4	2	0	2	3
7.	AI23B34	Human Computer Interaction	PE	4	2	0	2	3
8.	AI23B12	Cognitive Science	PE	4	3	0	0	3
9.	AI23B31	Knowledge Representation and Reasoning	PE	4	2	0	2	3

Virtual and Augmented Reality								
SI. 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.	CD23C22	Data Visualization	PE	6	0	0	6	3
3.	AI23B11	Information Visualization	PC	3	3	0	0	3
4.	CS23A38	Digital Marketing	PE	4	2	0	2	3
5.	CD23721	Visual Effects	PE	6	0	0	6	3
6.	CD23731	Film Making and Radio Production	PE	4	2	0	2	3
7.	CS23A34	User Interface Design	PE	4	2	0	2	3
8.	IT23E31	Graphics and Multimedia	PE	4	2	0	2	3

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

OPEN ELECTIVE COURSES OFFERED BY IT

S. Nos.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	IT23O31	Data Science using Python	OE	4	2	0	2	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	25	21
Professional core Courses PC	59	67	74
Professional Elective Courses PE	12	15	18
Open Electives from other technical and /or emerging subjects OE	9	6	6
Project work, seminar and internship in industry or elsewhere EEC	15	17	15
Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] MC	Non-credit	0	0
Total	163	163	162

SUMMARY OF ALL COURSES

B.Tech INFORMATION TECHNOLOGY										
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	4	8	4	4					20
3	ES	13	5	3						21
4	PC		7	17	12	20	12	6		74
5	PE					3	3	6	6	18
6	OE				3		3			6
7	EEC				2	1	3	3	6	15
8	MC		0	0						0
	Total	20	22	24	24	24	21	15	12	162

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
HS23111	TECHNICAL COMMUNICATION I	HS	2	0	0	2
Common to	All branches of B.E/B. Tech Programmes – First Semester					

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
<p>Listening: Introduction to Informational listening – Listening to Podcasts, News</p> <p>Reading: Intentional Reading - Short Narratives and Passages.</p> <p>Speaking: Introducing Oneself, Narrating a Story / Incident.</p> <p>Writing: Sequential Writing – connecting ideas using transitional words (Jumbled Sentences), Process Description</p> <p>Grammar: Verbs – Main & Auxiliary: Simple Tenses – Form, Function and Meaning.</p> <p>Vocabulary: Word formation – Prefix, Suffix, Compound Words.</p>		
UNIT-II	LISTENING AND EXTENDED READING	6
<p>Listening: Deep Listening – Listening to Talk Shows and Debates</p> <p>Reading: In-depth Reading - Scanning Passages</p> <p>Speaking: Describing Current Issues, Happenings, etc.,</p> <p>Writing: Note Making, Note Taking – Paragraph Writing</p> <p>Grammar: Continuous Tenses, Prepositions, Articles</p> <p>Vocabulary: One Word Substitutes, Phrasal Verbs.</p>		
UNIT-III	FORMAL WRITING AND VERBAL ABILITY	6
<p>Listening: Listening to Lectures and Taking Notes</p> <p>Reading: Interpretation of Tables, Charts and Graphs</p> <p>Speaking: SWOT Analysis on Oneself</p>		

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
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 EVALUATION METHODS

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

Text Book(s):

1. Effective Technical Communication by M. Ashraf Rizvi (Author) 2nd Edition Paperback 2017
2. Sylvan Barnet and Hugo Bedau, 'Critical Thinking Reading and Writing', Bedford/st. Martin's: Fifth Edition (June 28, 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 Books(s) / Web links:

1. Basic Vocabulary in Use: 60 Units of Vocabulary Practice in North American English With Answers 2nd Edition by Michael McCarthy (Author), Felicity O'Dell (Author), John D. Bunting (Contributor)
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 (Author)

CO - PO – PSO MAPPING

PO / PSO	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
CO															
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: “-“

Subject Code	Subject Name (Theory Course)	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:
<ul style="list-style-type: none"> To gain knowledge in using matrix techniques and the concepts of rank and nature of the matrix.
<ul style="list-style-type: none"> To gain knowledge in using matrix algebra techniques and the concepts of basis and dimension in vector spaces.
<ul style="list-style-type: none"> To understand normalization finding ortho-normal vectors .
<ul style="list-style-type: none"> To understand the techniques of calculus which are applied in the Engineering problems.
<ul style="list-style-type: none"> To understand the techniques of Integration which are applied 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	VECTOR SPACES	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 and dimension theorem.		
UNIT-III	INNER PRODUCT SPACES	12
Inner product and norms - Gram Schmidt orthonormalization process - Modified Gram Schmidt ortho-normalization 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 INTEGRAL	12
Double integrals–Change of order of integration– 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:
<ul style="list-style-type: none"> Apply the concept of Eigenvalues and eigenvectors, diagonalization of a matrix for solving problems.
<ul style="list-style-type: none"> Use concepts of basis and dimension in vector spaces in solving problems
<ul style="list-style-type: none"> Use concepts of normalization in inner products solving problems and to construct orthonormal basis using inner products.
<ul style="list-style-type: none"> Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
<ul style="list-style-type: none"> Evaluate surface area and volume using multiple integrals.

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

- Problem solving sessions
- Activity Based Learning
- Implementation of small module(<https://www.wolframalpha.com/calculators/eigenvalue-calculator>)

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

- Tutorial problems
- Assignment problems
- Quizzes
- Class Discussion

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. T Veerarajan, Engineering Mathematics –I , Mc Graw Hill Education, 2018.

Reference Books(s) / Web links:

- Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt.Ltd, New Delhi, 2016.
- Friedberg, A.H., Insel, A.J. and Spence, L., —Linear Algebra, Prentice - Hall of India, New Delhi, 2004.
 - Erwin Kreyszig , " Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
 - <http://library.lol/main/507B45BE17BFBD29CDC32752A1AFCFB3>
 - <http://library.lol/main/3FE18B4BC738F2D3130E2FD17B3CBB3A>
 - <http://library.lol/main/D84CE246DE69AD78EFC9998B4045EB65>

CO - PO – PSO MAPPING

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
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: “-“

□□□□ V □□□□□□ □□□□□ □□□□□□□ □□□□□□ □□□□□□
 □□□□□□□□□□□□□□ □□□□□□□□□□ □□□□□□□□□□□:

3. □□□□□□ □□□□□□□□□□□□□□ □□□□□□□□□□ □□□□□ - □□□□□□□□□□□
 □□□□□□□□□□□□□□ □□□□□□ □□□□□□□□□□ □□□□□□ - □□□□□□□□□□□
 □□□□□□□ - □□□□□□ □□□□□□□□□□□□□□□□, □□□□□ □□□□□□□□□□□□□□□ □□□□□ -
 □□□□□□□□□□□□□□, □□□□□□□□□□□□□□□□□□ - □□□□□□ □□□□□□□□□□□□
 □□□□□ □□□□□□.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. □□□□□ □□□□□□ - □□□□□□□□ □□□□□□□□□□ - □□.□□. □□□□□□ (□□□□□□□□□□: □□□□□□□□□□ □□□□□□□ □□□□□□□ □□□□□□□□□□ □□□□□□ □□□□□□).
2. □□□□□□□ □□□□□ - □□□□□□□ □□. □□□□□□□□□□. (□□□□□□□ □□□□□□□□□□).
3. □□□□□□ - □□□□□ □□□□□□□□□□□□□□ □□□□□□□ □□□ □□□□□□□□□□ (□□□□□□□□□□ □□□□□ □□□□□□□□□□)
4. □□□□□□□ - □□□□□□□□□□□ □□□□□□□□□□. (□□□□□□□□□□ □□□□□ □□□□□□□□□□)
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.

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

Objectives:						
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> To construct different plane curves and to comprehend the theory of projection
<ul style="list-style-type: none"> To draw the basic views related to projection of lines and planes
<ul style="list-style-type: none"> To draw the projection of simple solids and to draw the projection of development of surfaces of Sectioned solids in simple vertical position
<ul style="list-style-type: none"> To draw the orthographic projection from pictorial objects and Isometric projections of simple solids
<ul style="list-style-type: none"> 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) / Web links:	
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 MAPPING

PO / PSO	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
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: “-“

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C		
EE23133	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4		
Objectives:								
• 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.								
						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, the 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 Edition , 2017
3	Thereja .B.L., “Fundamentals of Electrical Engineering and Electronics”, S. Chand & Co. Ltd., 2008
Reference Books(s) / Web links:	
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”, Elsevier, 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 Gabel, “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 Kirchoff’s Laws 1. DC Regulated Power supply (0 - 30 V variable) 2. Bread Board 3. Resistors 4. Multimeter 5. Connecting wires	1 1 As per Circuit diagram1 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 500 Ω, 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 Required1
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 K Ω , 100 Ω 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- 1k Ω , 470K Ω , 1M Ω 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- 100k Ω , 1k Ω 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.	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 MAPPING

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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: “-“

Subject Code	Subject Name (Lab oriented Theory 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 MAPPING

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	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: “-“

Subject Code	Subject Name (Laboratory 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 impart hands-on experience on various basic engineering practices in Electronics Engineering.						
List of Experiments							
A. ELECTRICAL ENGINEERING PRACTICE							
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	Measurement of resistance to earth of electrical equipment.						
6	Study of Ceiling Fan and Iron Box						
B. ELECTRONICS ENGINEERING PRACTICE							
1	Study of electronic components and equipment's – Resistor, colour coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.						
2	(a) Study of 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 HWR and FWR.						
					Total Contact Hours	:	30
Course Outcomes:							
On completion of the course, the students will be able to							
•	fabricate the electrical circuits						
•	construct the house wiring circuits						
•	fabricate the electronic circuits						
•	verify the truth table of logic gates						
•	design the AC-DC converter using diodes and passive components						

SUGGESTED EVALUATION METHODS

- Experiment based Viva

REFERENCES

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	Jeyapooan 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.	Name of the Equipment	Quantity Required
1	Residential house wiring using switches, fuse, indicator, lamp and energy	3 Nos
2	Fluorescent lamp wiring.	3 Nos
3	Stair case wiring	3 Nos
4	Measurement of electrical quantities – voltage, current, power & power	2 Nos
5	Study purpose items: Iron box, Ceiling fan.	2 each
6	Megger (250V/500V)	2 Nos.
7	Soldering guns	10 Nos.
8	Assorted electronic components for making circuits	50 Nos.
9	Small PCBs	10 Nos.
10	Multimeters	10 Nos.
11	Digital trainer kit	5 Nos.
12	CRO	8 Nos.
13	Transformer	8 Nos.
14	Function Generator	8 Nos.

CO PO PSO Mapping

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	2	3	-
GE23122.2	3	3	2	2	-	-	2	-	3	2	-	3	2	2	-
GE23122.3	3	3	3	2	-	-	2	-	3	2	-	3	2	2	-
GE23122.4	3	3	3	2	-	-		-	3	2	-	3	2	2	2
GE23122.5	3	3	3	2	-	-		-	3	2	-	3	2	2	2
Average	3	3	2.67	2	-	-	2	-	3	2	-	3	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: “-“

Subject Code	Subject Name (Theory Course)	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-life cycle 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	
CO1	associate air and noise quality standards with environment and human health.
CO2	illustrate the significance of water and devise control measures for water pollution.
CO3	analyze solid wastes and hazardous wastes.
CO4	outline the goals of sustainable development in an integrated perspective.
CO5	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 – 1 st Edition (Toxicology and Public Health Issues), 2017Elsevier

Web Links :
https://onlinecourses.nptel.ac.in/noc19_ge22/
NPTEL
https://news.mit.edu/2013/ewaste-mit

CO PO PSO Mapping

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
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: “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
MA23213	DISCRETE MATHEMATICAL STRUCTURES	BS	3	1	0	4
Common to	II Sem B.E., CSE, CSD, B.Tech. IT, AIDS and AIML					

Objectives:
<ul style="list-style-type: none"> To extend student's Logical and Mathematical maturity and ability to deal with abstraction.
<ul style="list-style-type: none"> To understand discrete structures of many levels and to know the principle of counting.
<ul style="list-style-type: none"> To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.
<ul style="list-style-type: none"> To familiarize the applications of algebraic structures.
<ul style="list-style-type: none"> To understand the basic concepts of graphs.

UNIT-I	LOGIC AND PROOFS	12
Logic: Propositional equivalence, predicates and quantifiers, Methods of proofs –mathematical induction		
UNIT-II	COUNTING PRINCIPLE	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 and normal subgroups, rings, integral domains and fields.		
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
<ul style="list-style-type: none"> Demonstrate the ability to write and evaluate a proof or outline the basic structure and give examples of each proof technique described.
<ul style="list-style-type: none"> Apply counting principles to determine probabilities in engineering problems.
<ul style="list-style-type: none"> Demonstrate the relations and functions and to determine their properties in solving engineering problems.
<ul style="list-style-type: none"> Analyse the concepts and properties of algebraic structures in the solving complex engineering problems.
<ul style="list-style-type: none"> Use different traversal methods for trees and graphs arising in the field of engineering and technology.

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic
<ul style="list-style-type: none"> Problem solving sessions
<ul style="list-style-type: none"> Visio for drawing graphs
<ul style="list-style-type: none"> Online Calculators for PDNF and PCNF, recurrence relations and sets. https://calculator-online.org/mathlogic
<ul style="list-style-type: none"> Calculators for Logic gates.
<ul style="list-style-type: none"> GeoGebra for Hasse diagrams and graphs. https://www.geogebra.org/?lang=en

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

- 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 Mapping

PO / PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO															
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	1	-

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

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

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

PH23132	PHYSICS FOR INFORMATION SCIENCE	BS	3	0	2	4	
Common to	B.E.-CSE, CSD, Cyber Security & B. Tech.- IT, AIML, AI&DS.						
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.							
					Contact Hours	:	45
List of Experiments							

1	Determine the wavelength of the laser using grating and size of the particle using diode laser.
2	Determine the numerical aperture and acceptance angle of optical fiber.
3	Study the permeability of the free space using Helmholtz coil.
4	Determine the hysteresis loss in the transformer core using B-H curve unit.
5	Determine the band gap of given semiconductor.
6	Determine the Hall coefficient of semiconducting material.
7	Determine specific resistance of the material of given wires using metre bridge.
8	Study the resonance frequency in series connected LCR circuits.
9	Determine the V-I characteristics of the solar cell.
10	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, the 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) / Web links:	

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	Deficiency
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	-

**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	Deficiency
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 Mapping

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
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: “-“

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EC23331	MICROPROCESSORS AND MICROCONTROLLERS	ES	3	0	2	4

Objectives:
<ul style="list-style-type: none"> To study the architecture, functions and programming of 8085 microprocessor.
<ul style="list-style-type: none"> To learn the concepts of 8086 architecture and multi-processor configuration.
<ul style="list-style-type: none"> To understand the methods of interfacing peripheral devices to a microprocessor.
<ul style="list-style-type: none"> To Recognize the functionality of 8051 microcontroller.
<ul style="list-style-type: none"> To interpret the PIC and Arduino usage and its applications.

UNIT-I	THE 8085 MICROPROCESSOR	9
8085 Architecture - Pin configuration - Instruction Set - Addressing modes – Interrupts - Assembly Language Programming.		
UNIT-II	THE 8086 MICROPROCESSOR	9
8086 architecture – 8086 signals – Addressing modes –Instruction set– Assembly Language Programming– Maximum mode and Minimum mode. Coprocessor, Closely coupled and Loosely Coupled multiprocessor configurations.		
UNIT-III	PERIPHERALS & INTERFACING	9
Introduction to IO – Programmable peripheral interface (8255)–Programmable Timer/controller (8253) –Keyboard /display controller (8279) – Serial communication interface (8251) – D/A and A/D Interface–Programmable Interrupt controller (8259).		
UNIT-IV	THE 8051 MICROCONTROLLER	9
Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports- Timers – Interrupts – Serial communication - Instruction set - Addressing modes - Assembly language programming.		
UNIT-V	CASE STUDY & ADVANCED PROCESSORS AND CONTROLLERS	9
Case study –Stepper motor & traffic light control using 8051, Arduino – Features – Architecture and Applications, PIC - Features – Architecture and Applications.		
		Total Contact Hour : 45

Description of the Experiments		Total Contact Hours: 60
8085 Microprocessor		
Writing and executing 8085 Program to realize basic operations		
1	8-bit Arithmetic Operations	
2	Searching an array of numbers	
3	Code conversion	
8086 Microprocessor		
Writing and executing 8086 Program to realize basic operations		
4	16-bit Arithmetic Operations	
5	Logical operations	
6	String manipulations	
8086 Programs using MASM		
7	Display a message	
8	Password checking	
Peripherals and Interfacing		
9	8279 - Key board and Display Controller	
10	8255 - Parallel interface	
11	8253– Timer interface	
8051 Microcontroller		
12	8-bit Arithmetic Operations	
13	Stepper Motor Control	

Course Outcomes:
<ul style="list-style-type: none"> • Write Assembly-language program to perform basic operations using 8085 Microprocessor.
<ul style="list-style-type: none"> • Compose Assembly-language program to perform basic operations using 8086 Microprocessor.
<ul style="list-style-type: none"> • Code and Interface various peripherals with 8085, 8086 and 8051.
<ul style="list-style-type: none"> • Perform Assembly-language program to perform basic operations using 8051 Microcontroller.
<ul style="list-style-type: none"> • Develop project for different applications using advanced Microcontrollers.

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic
<ul style="list-style-type: none"> • Problem solving sessions-Solving simple programming • Flipped classroom – Instruction set 8051

SUGGESTED EVALUATION METHODS

- Assignment problems – Programming of 8085, 8086, 8051
- Quizzes – Architecture, Instruction set topics
- class Presentation/Discussion- Architecture topics

Text Book(s):

1. Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Applications with 8085”, Sixth edition, Penram International Publishing, 2012.
2. A.K. Ray, K.M. Bhurchandi, - Advanced Microprocessor and Peripherals, Second edition, Tata McGraw-Hill, 2010.
3. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

Reference Books(s) / Web links:

- DouglasV.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012
- Kenneth J. Ayala, “The 8086 Microprocessor: Programming & Interfacing the PC”, Delmar Publishers, 2007.
- Krishna Kant, Microprocessor and Microcontroller Architecture, Programming and System design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2011

Lab equipment required:

S. No	Name of the Equipment	Quantity Required	Remarks
1	8085 Microprocessor trainer kit	18	
2	8086 Microprocessor trainer kit	18	
3	8051 Microcontroller trainer kit	18	
4	PC with MASM software	5	
5	8255 Parallel interface	3	
6	8253 timer interface	3	
7	8279 Keyboard display interface	3	
8	CRO	3	
9	Stepper motor interface	3	

SUGGESTED EVALUATION METHODS

- Experiment based viva
- Quizzes
- Mini Project

Web links for virtual lab (if any)

Real Time Embedded Systems Laboratory (iitkgp.ac.in)

CO PO PSO Mapping

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
EC23331.1	3	3	3	2	1	1	1	1	2	2	3	3	2	3	3
EC23331.2	3	3	3	2	1	1	1	1	2	2	3	3	2	3	3
EC23331.3	3	3	3	2	1	1	1	1	2	2	3	3	2	3	3
EC23331.4	3	3	3	2	1	1	1	1	2	2	3	3	3	3	3
EC23331. 5	3	3	2	3	2	1	1	1	2	2	3	3	2	3	3
Average	3	3	2.8	2.2	1.2	1	1	1	2	2	3	3	2.2	3	3

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 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 – Dijikstra'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.
•	Analyze 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.

Web links for Theory & Lab(if any)

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

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	

CO PO PSO Mapping

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
CS19241.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19241.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.5	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: “-“

Subject Code	Subject Name (Laboratory Course)	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 selling.
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:
<ul style="list-style-type: none"> ● 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.
<ul style="list-style-type: none"> ● 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.
<ul style="list-style-type: none"> ● 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
<ul style="list-style-type: none"> ● Able to perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
<ul style="list-style-type: none"> ● Able to perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

CO - PO – PSO Mapping

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	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: “-“

Subject Code	Subject Name (Laboratory Course)	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
<ul style="list-style-type: none"> Demonstrate various Python data structures like Lists, Tuples, Sets and dictionaries
<ul style="list-style-type: none"> Understand about Strings, Functions, Modules and Regular Expressions in Python Programming
<ul style="list-style-type: none"> Understand the concepts of file handling using Python
<ul style="list-style-type: none"> 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, re
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.
<ul style="list-style-type: none"> Use of Python Data structures such as List, Sets, Tuples, Dictionary for Compound Data
<ul style="list-style-type: none"> Use Strings, Functions, Modules and Regular Expressions in Python Programming
<ul style="list-style-type: none"> Implement the concepts of file handling and Exceptional handling.
<ul style="list-style-type: none"> Apply Numpy, Pandas and SciPy for numerical and statistical data

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

- Experiment based viva
- Quizzes
- Mind map
- Logical thinking – solving case study problems problems
- Implementation of small Systems

Web links for virtual lab (if any)

- <https://www.python.org/shell/>
- <https://python-iitk.vlabs.ac.in/>
- <https://www.hackerrank.com/domains/python>

CO - PO – PSO Mapping

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	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: “-“

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
HS23221 / HS23222	TECHNICAL COMMUNICATION II / ENGLISH FOR PROFESSIONAL COMPETENCE	HS	0	0	2	1
Common to	All branches of B.E/B. Tech programmes –Second Semester					

Objectives:
<ul style="list-style-type: none"> To facilitate students to improve their vocabulary for a better communication
<ul style="list-style-type: none"> To enable learners to understand and reproduce language
<ul style="list-style-type: none"> To aid students to write technical reports in a convincing manner
<ul style="list-style-type: none"> To expose students to different sentence structures
<ul style="list-style-type: none"> To equip learners to present their ideas in an efficient manner

UNIT-I	VOCABULARY FOR BETTER COMMUNICATION	6
<p>Listening: Telephonic Conversations and TV News</p> <p>Reading: Newspapers and Magazines</p> <p>Speaking: Conversational Practice: Speaking in a given situation, Asking permission and requesting etc.,</p> <p>Writing: Job Application Letter and Resume</p> <p>Grammar: Reference words: pronouns and determiners</p> <p>Vocabulary: Guessing meanings of words in different contexts.</p>		
UNIT-II	FUNCTIONAL LANGUAGE ASPECTS	6
<p>Listening: Motivational listening – listening to real life challenges</p> <p>Reading: Articles and Technical reports</p> <p>Speaking: Using Polite Expressions, Indirect Questions</p> <p>Writing: Paraphrasing a Text, Poem</p> <p>Grammar: Purpose Statements, Cause and Effect Expressions</p> <p>Vocabulary: Neologisms.</p>		
UNIT-III	TECHNICAL REPORTWRITING	6
<p>Listening: Empathetic Listening – Giving Solutions to Problems</p>		

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
<ul style="list-style-type: none"> ● communicate effectively using appropriate vocabulary
<ul style="list-style-type: none"> ● use the acquired language skills to comprehend various types of language contents
<ul style="list-style-type: none"> ● evaluate different texts and write effective technical content
<ul style="list-style-type: none"> ● use appropriate sentence structures to convey their thoughts in varied contexts
<ul style="list-style-type: none"> ● 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 Books(s) / Web links:

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 Mapping

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
HS23221. 1	-	-	-	1	-	1	-	2	2	2	-	2	-	-	-
HS23221. 2	-	-	-	1	-	1	-	2	2	2	-	2	-	-	-
HS23221. 3	-	2	-	1	-	1	-	2	2	2	-	2	-	-	-
HS23221. 4	-	-	-	1	-	1	-	2	2	2	-	2	-	-	-
HS23221. 5	-	-	-	1	-	1	-	2	2	2	-	2	-	-	-
Average	-	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: “-“

Subject Code	Subject Name (Theory Course)	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 Programmes – First / Second/third Semester					

Objectives:
<ul style="list-style-type: none"> To apprehend the sacrifices made by the freedom fighters.
<ul style="list-style-type: none"> To inculcate the values enshrined in the Indian constitution.
<ul style="list-style-type: none"> To instill a sense of responsibility as the citizens of India.
<ul style="list-style-type: none"> To familiarize about the functions of the various levels of Government.
<ul style="list-style-type: none"> 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 assessments (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. 21sted 2013.
3. P K Agarwal and K N Chaturvedi ,PrabhatPrakashan, New Delhi, 1sted , 2017.

Reference Books(s) / Web links:
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 Mapping

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															
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: "-"

Subject Code	Subject Name (Theory Course)	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:
<ul style="list-style-type: none"> To express Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
<ul style="list-style-type: none"> To represent continuous function arising in wave and heat propagation, signals and systems using Fourier Transforms
<ul style="list-style-type: none"> To provide various numerical methods in solving problems that occurs in the field of Engineering and Technology.
<ul style="list-style-type: none"> To introduce and apply the concepts of finite fields and congruences.
<ul style="list-style-type: none"> 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 :
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. Grewal B.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 Mapping

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
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
EC23314	ANALOG AND DIGITAL COMMUNICATION	ES	3	0	0	3

Objectives:
<ul style="list-style-type: none"> Acquire knowledge in analog modulation techniques .
<ul style="list-style-type: none"> Differentiate various digital modulation techniques .
<ul style="list-style-type: none"> Learn various data and pulse communication techniques.
<ul style="list-style-type: none"> Be familiarized with source and Error control coding.
<ul style="list-style-type: none"> Gain knowledge on multi-user radio communication.

UNIT-I	ANALOG MODULATION	9
Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).		
UNIT-II	DIGITAL MODULATION	9
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM– Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).		
UNIT-III	DATA AND PULSE COMMUNICATION	9
Data Communication systems, Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).		
UNIT-IV	SOURCE AND ERROR CONTROL CODING	9
Entropy, Source encoding theorem-Shannon-Fano coding, Huffman coding-Channel capacity, Shannon’s limit - Channel coding theorem- Error Control Coding, Linear block codes, Cyclic codes, Convolution codes, Viterbi decoding algorithm.		
UNIT-V	MULTI USER RADIO COMMUNICATION	9
Global System for Mobile Communications (GSM) – Overview of multiple access scheme - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handoff -Introduction to 3G,4G and 5G wireless systems		
Total Contact Hours:45		

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

- Describe various analog modulation techniques
- Explain various digital modulation techniques employed in communication systems
- Differentiate data communication and pulse modulation techniques.
- Analyze Source and Error control coding
- Demonstrate the multi-user radio communication.

SUGGESTED ACTIVITIES

- Problem solving sessions- Analog modulation , Information theory and coding
- Flipped classroom – GSM, Cellular Concept
- Practical demonstration in different modulation techniques
- Activity Based Learning – Role play –ASK,FSK,PSK,QPSK,QAM

SUGGESTED EVALUATION METHODS

- Tutorial problems – Analog modulation , Information theory and coding
- Assignment problems – AM, FM,PM, Shannon Fano coding and Huffman coding
- Quizzes – Unit 3
- Seminar – Multiple Access Techniques

Text Book(s):

1. Wayne Tomasi, “Electronic Communication Systems”, 5th Edition, Pearson Education, 2009.
2. SimonHaykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004.

Reference Books(s) / Web links:

1. B.Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition Pearson Education, 2007.
2. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
3. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.
4. H P Hsu, "Schaum Outline Series –Analog and Digital Communications", TMH 2006.
5. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, Prentice Hall of India, 2002.
6. <https://www.slideshare.net/sushilsudake/5-g-wireless-technology>

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:	
•	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 :		30
Total Contact Hours :		75

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 Mapping

PO / PSO	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
CO															
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:	
•	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 – Complex Queries.		
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 – Multi version – 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> <ol style="list-style-type: none"> Inventory Control System. Material Requirement Processing. Hospital Management System. Railway Reservation System. Personal Information System. Web Based User Identification System. Timetable Management System. Hotel Management System 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:

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'Reill 2014.
5. MongoDB: The Definitive Guide, 3rd Edition, by Kristina Chodorow, Shannon Bradshaw, Publisher: O'Reilly Media, 2019
6. ShashankTiwari, "Professional NoSQL", Wiley, 2011.
7. David Lane, Hugh.E.Williums, Web Database Applications with PHP and MySQL, O'Reilly Media; 2nd edition, 2004

CO - PO – PSO Mapping

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
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 :		60
Total Contact Hours :		75

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Develop Java programs using OOP principles and Strings.
<ul style="list-style-type: none"> • Develop Java programs with the concepts inheritance.
<ul style="list-style-type: none"> • Build Java applications using exceptions and interfaces.
<ul style="list-style-type: none"> • Develop Java applications using I/O and collections.
<ul style="list-style-type: none"> • 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 Mapping

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
CS23333.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS23333.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS23333.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS23333.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS23333.5	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
IT23331	Digital Logic and Computer Architecture	PC	3	0	2	4

Objectives:
To introduce basic postulates of Boolean algebra and the methods for simplifying Boolean expressions. To introduce Logic Gates and implementation of logic function using logic gates
To outline the formal procedures for the analysis and design of combinational and sequential circuits
To learn the basic structure and operation of digital computer.
To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations
To expose and make the students to learn about the memory system design and different ways of communicating with I/O devices and standard I/O interfaces.

UNIT-I	MINIMIZATION TECHNIQUES	9
Number System and Complements: Number System - Boolean postulates and Laws – De-Morgan’s Theorem – Principle of Duality – Boolean Expression – Minimization of Boolean expressions -Sum of Products (SOP) – Product of Sums (POS). Minimization Techniques: Minimization of Boolean expressions using Boolean laws - Karnaugh map - Don’t care conditions. Logic Gates : Basic Logic Gates- Universal Gates – Design of Digital Circuits		
UNIT-II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9
Combinational Circuits : Adder - Subtractor –Multiplexer- De multiplexer – Decoder – Encoder. Sequential Circuits: Latches – Flip Flops – Shift Registers – Counters		
UNIT-III	INTRODUCTION TO COMPUTER ARCHITECTURE & INSTRUCTIONS	9
Introduction: Eight Great ideas in Computer Architecture – Components of a computer system – Technology for building processor and memory – Performance – Power wall. Instructions: Operations of Computer Hardware – Operands of Computer Hardware - Representing instructions in Computer - Logical operations – Instructions for decision.		
UNIT-IV	ARITHMETIC AND LOGIC UNIT	9
Design of ALU, Integer Arithmetic: Addition, Subtraction, Multiplication and Division – Floating Point Arithmetic: Representation, Addition, subtraction, Multiplication.		
UNIT-V	MEMORY AND I/O SYSTEMS	9
Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory – TLBs, Input/output system, programmed I/O, DMA and interrupts, I/O processors.		
Total Contact Hours: 45		

Description of the Experiments	Total Contact Hours: 30
1. Design and Implementation Basic Logic Gates – AND, OR and NOT	
2. Design and Implementation Universal Gates – NAND and NOR	
3. Design and Implementation of Half Adder using logic gates	
4. Design and Implementation of Full Adder using logic gates	
5. Design and Implementation of Half Subtractor using logic gates	
6. Design and Implementation of Full Subtractor using logic gates	
7. Design and Implementation of Multiplexer using logic gates.	

8. Binary Multiplication using Booths Multiplication Algorithm
9. Binary Division using Restoring Algorithm
10. Binary Addition using Floating Point Values
Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization techniques. Understand the use of electronic circuits involved in the design of logic gates. • Apply the procedure to design and implement combinational and sequential circuits. • Understand the impact of instruction set architecture on cost-performance of computer design. • Perform computer arithmetic operations. • Evaluate the performance of memory systems.

SUGGESTED ACTIVITIES
<ul style="list-style-type: none"> • Problem Based Learning • Flipped classroom • Circuit Design using Simulator • Conceptual Online Quiz

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> • Continuous Assessment Test • Online Quiz Assignments • Offline Assignments • Experiment based VIVA

Text Book(s):
1. M. Morris Mano, Michael D. Ciletti “Digital Design”, 6 th Edition, Pearson, Prentice Hall, August 2018.
2. David A. Patterson and John L. Hennessey, “Computer Organization and Design”, Fifth edition, Elsevier, 2014.

Reference Books(s) / Web links:
1. Charles H.Roth, “Fundamentals of Logic Design”, 7th Edition, Thomson Learning, 2014.
2. Thomas L. Floyd, “Digital Fundamentals”, 11th Edition, Pearson Education Inc, 2017.
3. Charles H.Roth. “Fundamentals of Logic Design”, 7th Edition, Cengage Learning, 2014.
4. Donald D.Givone, “Digital Principles and Design”, McGraw Hill Education, 2017.
5. Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, 2 nd Edition, Pearson Education,2008.
6. Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications”, 2 nd edition, Tata McGraw Hill, New Delhi, 2017.
7. John P Hayes, “Computer Architecture and Organization”,3rd edition, McGraw Hill, 2017.
8. V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organisation”, 5th edition, Mc Graw-Hill Inc, 2017.
9. William Stallings, “Computer Organization and Architecture Designing for performance”, 10th Edition, PHI Pvt. Ltd., Eastern Economy Edition 2016

Web Links for Virtual Lab (If any)<http://vlabs.iitkgp.ernet.in/coa/><https://www.vlab.co.in/broad-area-computer-science-and-engineering><https://cse11-iiith.vlabs.ac.in/>**CO - PO – PSO Mapping**

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
IT23333.1	3	3	3	3	3	2	1	2	2	2	2	2	3	3	3
IT23333.2	3	3	3	3	3	2	-	2	2	2	2	2	3	2	2
IT23333.3	3	3	2	3	3	2	1	2	2	2	2	1	3	3	3
IT23333.4	3	3	3	-	3	2	-	2	2	2	2	1	3	3	2
IT23333.5	3	3	3	3	3	2	-	2	2	2	2	2	2	2	3
Average	3	3	2.8	3	3	2	1	2	2	2	2	2	2.8	2.66	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 (Theory course)	Category	L	T	P	C
GE23311	Fundamentals of Management for Engineers (Common to IT, CSE, Aero, Auto, FT, MCT)	HS	3	0	0	3

Objectives:
<ul style="list-style-type: none"> • Application of problem solving techniques and to make decisions for management
<ul style="list-style-type: none"> • Implementation of division and authority for coordination of departments
<ul style="list-style-type: none"> • Device recruit methods and provide trainings
<ul style="list-style-type: none"> • Measuring and managing performance through appraisal systems
<ul style="list-style-type: none"> • Leadership with communication and control system

UNIT-I	INTRODUCTION	9
Management - Definition, Nature And Scope, Functions, Managerial Roles, Levels Of Management, Managerial Skills, Challenges Of Management, General Framework For Planning – Planning Process, Types Of Plans, Management By Objectives (MBO); Problem Solving And Decision Making.		
UNIT-II	ORGANIZATION POLICY	9
Process Of Organization-Principles Of Organising- Span Of Management- Departmentalisation– Delegation Of Authority- Decentralization Of Authority- Empowerment- Need For Coordination – Requisites – Types & Techniques Of Coordination		
UNIT-III	HUMAN RESOURCES	9
Staffing – Manpower Planning – Recruitment Sources – Selection Procedure – Placement & Induction – Training And Development - Training Methods , Performance Appraisal – Methods ,Mentoring – Career Planning And Development.		
UNIT-IV	ORGANIZATIONAL CULTURE	9
Organizational Culture- Motivation – Maslow need hierarchy theory, Personality- Types, Attitude, Emotional Intelligence, Leadership – Characteristics , Team and Group Cohesiveness, Organizational change and development – Process.		
UNIT-V	COMMUNICATION	9
Communication – Purpose – Formal Communication – Forms – Barriers – Principles Of Effective Communication – Leadership – Characteristics – Functions - Need For Control System – Essentials Of Effective Control System		
Total Contact Hours: 45		

Course Outcomes:**Student will be able to,**

- Apply problem solving techniques and make decisions for management
- Implement optimal division and authority for effective coordination of departments
- Recruit suitably and provide right trainings and evaluate appropriately
- Measure and manage performance with effective appraisal system
- Lead with proper communication and exercise apt control system

SUGGESTED ACTIVITIES

- Case Study Discussion

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

- Assignment problems -
- Quizzes – All units
- Class Presentation/Discussion – 5th Unit

Text Book(s):

1. Principles of Management, Prakash Chandra Tripathi, Tata McGraw-Hill Education, 7th Edition , 2021.
2. Essentials of Management, Koontz Kleihrich, Tata Mc – Graw Hill., 11th Edition, 2020

Reference Books(s) / Web links:

- Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.

CO - PO – PSO Mapping

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
GE23311.1	2	3	2	2	1	-	-	-	-	-	-	2	2	1	2
GE23311.2	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
GE23311.3	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
GE23311.4	2	3	3	3	3	-	-	-	-	-	1	2	3	1	2
GE23311.5	2	3	3	3	2	-	-	-	-	-	2	2	3	1	2
Average	2.4	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
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:
<ul style="list-style-type: none"> To introduce the basic concepts of probability, one dimensional random variables.
<ul style="list-style-type: none"> To solve the problems those are faced in testing of a hypothesis with reference to the errors in decision making.
<ul style="list-style-type: none"> To construct and analyse models using Markov Chains.
<ul style="list-style-type: none"> To acquire skills in analysing queuing models.
<ul style="list-style-type: none"> 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 ‘queuing ’ 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 Mapping

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
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
<ul style="list-style-type: none"> • 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:
<ul style="list-style-type: none"> • 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 and 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 Mapping

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
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:

- 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 metrics -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-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
<ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> 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:
<ul style="list-style-type: none"> • 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, Martin Beck, 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 MAPPING

PO / PSO	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
CO															
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 (Lab oriented Theory Course)	Category	L	T	P	C
IT23431	MongoDB Essentials	PC	2	0	2	3

Objectives	
✓	To understand the significance and installation of MongoDB.
✓	To create and practice MongoDB database Schema and Creations.
✓	To learn about the Document structure, Patterns and Indexing.
✓	To get insights from the Aggregation framework and data transformation
✓	To establish a connection between Java and MongoDB.

UNIT - I	Introduction of MongoDB	6
Overview of NoSQL Databases - Introduction to NoSQL vs. SQL databases - Types of NoSQL databases (Key-Value, Document, Column-Family, Graph). Introduction to MongoDB -MongoDB Features and Use Cases-MongoDB Ecosystem: MongoDB Atlas, Compass, and Shell-Installation and Setup of MongoDB.		
UNIT - II	CRUD Operations	6
Database and Collections - Understanding Databases and Collections -Creating and Dropping Databases and Collections. CRUD Operations -Insert Operations: insertOne(), insertMany() - Querying Data: find(), Projections, and Filtering-Update Operations: updateOne(), updateMany(), replaceOne() - Delete Operations: deleteOne(), deleteMany().		
UNIT - III	Data Modeling in MongoDB	6
Document Structure -BSON Format and Key-Value Pairs-Embedded and Referenced Documents. Schema Design Patterns - One-to-One, One-to-Many, Many-to-Many Relationships-Best Practices for Schema Design. Indexing -Basics of Indexing-Single Field and Compound Indexes-Text and Geospatial Indexes.		
UNIT IV	Aggregation Framework	6
Introduction to Aggregation -Pipelines and Stages-Common Operators: \$match, \$group, \$project, \$sort, \$limit, \$skip. Data Transformation -Using \$lookup for Joins -Bucket and Facet Operations.		
UNIT - V	MongoDB Integration	6
MongoDB with Programming Languages -MongoDB Driver Overview-Integration with Java. Building Applications -CRUD Applications with MongoDB		
Contact Hours		30 Hours

List of Experiments:	
1. MongoDB Installation and Basic setup the environment.	
2. Creating and Dropping Tables with various constraints.	
3. Performing CRUD operations.	
4. Applying CRUD operations	
5. Applying Filtering and Projections.	
6. Perform Schema Design and Indexing.	
7. Building Aggregation Pipelines.	
8. Performing Data Transformation.	
9. Establishing connection between MongoDB and Java.	
10. Mini Project : Develop a CRUD Application using MongoDB.	
Contact Hours:	30 Hours
Total Hours:	60 Hours

Course Outcomes : Students will be able to
<ul style="list-style-type: none"> • Create a MongoDB Database and understand the collections. • Understand the CRUD operations by creating database and collections. • Create a Document Structure by applying Data Modeling. • Practice the Aggregation framework and Data Transformation. • Connect a MongoDB database with front End application (JAVA).

Suggested Activities
1. Conduct Quizzes
2. Project based learning
3. Invite Speakers from Industry to show real time applications

Suggest Evaluations Methods
1. Conduct Quizzes
2. Hands-on Practical test.
3. Project with Java and MongoDB.

Text Books:
1. Mastering MongoDB 6.x - Second Edition by Alex Giamas 30 August 2022.
2. MongoDB Complete Guide by Manu Sharma 1 July 2021.
3. Mastering MongoDB 7.0 - Fourth Edition: Achieve data excellence by unlocking the full potential of MongoDB by Marko Aleksendric, Arek Borucki ,5 January 2024.

Reference Books(s) / Web links:
1. https://www.w3schools.com/mongodb/
2. https://www.mongodb.com/resources/products/fundamentals/basics
3. https://www.tutorialspoint.com/mongodb/index.htm
4. https://www.geeksforgeeks.org/mongodb-tutorial/
5. https://www.w3resource.com/mongodb-exercises/

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23431.1	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23431.2	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23431.3	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23431.4	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23431.5	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
Average	3	3	-	2	3	2	-	-	1	-	1	1	3	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 (Laboratory Course)	Category	L	T	P	C
GE23421	Soft Skills - I	EEC	0	0	2	1

Course Objectives:

The major course objectives are:

- To help students break out of shyness.
- To build confidence
- To enhance English communication skills.
- To encourage students' creative thinking to help them frame their own opinions,

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.
5	Debate	Is competition necessary in regards to the learning	The aim of this activity is to develop

		process?	the students ability to debate and think out of the box
6	Short Talks	Here the students are given topics for which they take one minute to prepare and two minutes to speak. They can write down points but can't read them out they can only use it as a reference.	The activity aims at breaking the students' shyness and encouraging them to standup in front of the class and speak. It also aims at creating awareness that they are restricted for time so they only speak points that are relevant and important.
7	Debate	Will posting students' grades on bulletin boards publicly motivate them to perform better or is it humiliating?	This activity aims at enhancing the students unbiased thought process when it comes to exams and grades as well as develop their skills to debate
8	The Art of diplomacy	The facilitator proceeds to share multiple concepts of conversation and helps the participants to identify the various methods of being diplomatic and how do deal with misinformation.	The aim of the lesson is to provide an opportunity for the participants to learn about body language and choosing the appropriate words for conversation.
9	Debate	Are humans too dependent on computers?	The aim of this activity is to test the students debating skills and thought process with a topic that affects everybody in daily life.
10	Story Completion	The teacher starts to tell a story but after 2 sentences he/she asks students to work in groups to create the rest of the story which includes the plot and the ending.	This activity aims at building their narrating skills as well as their creativity and ability to work in a team.
11	Role play debate	Students scrutinize different points of view or perspectives related to an issue. For example, a debate about the question "Should students be required to wear uniforms at school?" might yield a range of opinions. Those might include views expressed by a student (or perhaps two students – one representing each side of the issue), a parent, a school principal, a police officer, a teacher, the owner of a clothing store, and others.	The aim of this activity is to get students to speak based on other people's perspective instead of their own. The students take the role of various characters and debate accordingly.
12	I Couldn't Disagree More	This is a game where students practice rebuttal techniques where one student provides a thought or an idea and the other students starts with the phrase I couldn't disagree more and continues with his opinion	The aim of this activity is to improve general communication skills and confidence.
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.

Course Learning Outcome:

On successful completion of the course, students should be able to:

1. Be more confident
2. Speak in front of a large audience
3. Be better creative thinkers
4. Be spontaneous
5. Know the importance of communicating in English.

Subject Code	Subject Name(Theory Course)	Category	L	T	P	C
IT23511	Automata Theory and Compiler Design	PC	3	0	0	3

Objectives:
<ul style="list-style-type: none"> Learn the design principles of a Compiler
<ul style="list-style-type: none"> Familiar with the basics of the theory of automata
<ul style="list-style-type: none"> Understand the various parsing techniques and different levels of translation
<ul style="list-style-type: none"> Learn intermediate code generation
<ul style="list-style-type: none"> Learn code optimization strategies and the process of code generation

UNIT-I	INTRODUCTION TO COMPILER	9
Translators - Compilers and Interpreters - Language processors - The Phases of Compiler – Symbol table – Errors encountered in different phases – Grouping of phases – Compiler Construction tools		
UNIT-II	AUTOMATA THEORY	9
Introduction to Finite Automata - Regular Languages – Operations - Regular Expressions – Recognition of Tokens – Transition Diagrams – Converting Regular Expressions to NFA and to DFA – Minimization of DFA – Lex Tool.		
UNIT-III	CONTEXT FREE GRAMMARS AND PARSING	9
Context Free Grammars – derivation - parse tree - Top Down Parsing - Recursive Descent Parser Predictive Parser- LL(1) Parser – Bottom up parsing - Shift Reduce Parser – LR parser – SLR – CLR – LALR – YACC Specification.		
UNIT-IV	SEMANTICS AND RUN TIME ENVIRONMENT	9
Syntax directed translation – S-attributed and L-attributed grammars - applications of SDT – Intermediate Languages: Syntax Tree, Three Address Code- types – Implementation. Storage organization - storage allocation strategies		
UNIT-V	CODE OPTIMIZATION AND CODE GENERATION	9
Principal Sources of Optimization - Optimization of Basic Blocks –Flow Graphs - Data Flow Analysis of Flow Graphs - DAG representation of basic block – Issues in the design of Code Generation - Generic code generation algorithm - Peephole Optimization.		
Total Contact Hours: 45		

Course Outcomes: Students will be able to

- Learn the major concept areas of language translation and phases of compiler design
- Understand automata theory and use it in token recognition
- Identify the similarities and differences among various parsing techniques and grammar transformation techniques
- Infer knowledge on run time environment and intermediate code.
- Apply various optimization techniques and develop target code.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Implementations of LEX
- implementation of YACC
- Activity Based Learning
- Implementation of small module

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", Updated 2nd Edition, Pearson Education, April 2024.
2. Michael Sipser. "Introduction to the Theory of Computation", PWS Publishing Company, 3rd Edition, Cengage India Private Limited, Paperback – 1 October 2014.
3. David Livingston J, Introduction to Theory of Automata & Compiler Design : Beginner's Handbook for Designing Finite State Machines using Automata Paperback – 28 June 2022, Notion Press Publiser,

Reference Books(s) / Web links:

1. Douglas Thain, Introduction to Compilers and Language Design, 2nd edition, 2020.
2. A.A. PUNTAMBEKAR, Compiler Design for BE Anna University Paperback – 28 May 2023, Technical Publications

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23511.1	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23511.2	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23511.3	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23511.4	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23511.5	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
Average	3	3	-	2	3	2	-	-	1	-	1	1	3	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 Oriented Theory Course)	Category	L	T	P	C
IT23531	Computer Vision (Common to IT, CSBS, AIML)	PC	3	0	2	4

Objectives:
<ul style="list-style-type: none"> Understand the basics of computer vision and its applications
<ul style="list-style-type: none"> Understand the basic image processing operations to enhance the image quality
<ul style="list-style-type: none"> Develop skills to extract and analyze significant features from images
<ul style="list-style-type: none"> Apply various segmentation algorithm to segment images into multiple regions
<ul style="list-style-type: none"> Latest advancements and future trends in computer vision are explored for real time applications

UNIT-I	Overview of Computer Vision	9
Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation, Computer Vision and its Applications .		
UNIT-II	Digital Image Processing	9
Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal		
UNIT-III	Feature Detection	9
Edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations .		
UNIT-IV	Segmentation	9
Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized Cut.		
UNIT-V	Motion Analysis	9
Background Subtraction and Modeling, Optical Flow, KLT, Spatio Temporal Analysis, Dynamic Stereo, Motion parameter estimation.		
Total Contact Hours: 45		

List of Experiments:
1. Implementing various basic image processing operations Reading image, writing image and conversion of images
2. Implement contrast adjustment of an image.
3. Implement Histogram processing and Equalization.
4. Implement the various low pass and high pass filtering mechanisms
5. Use of Fourier transform for filtering the image.
6. Utilization of SIFT and HOG features for image analysis
7. Implement various image segmentation algorithm
8. Implement optical flow computation algorithm.
9. Face Detection on available online human face image datasets
10. Object Recognition on available online image datasets
Contact Hours : 30
Total Contact Hours :75

Course Outcomes: Students will be able to
• Learn fundamentals of computer vision and its applications
• Understand techniques are available to process the image.
• Understand how to analyze the image and extract required features
• Apply different segmentation techniques to different images
• Understand how computer vision solves real world problems

SUGGESTED EVALUATION METHODS
• Continuous Assessment Test
• Online Quiz Assignments
• Offline Assignments
• Experiment based VIVA

SUGGESTED ACTIVITIES

- Problem Based Learning
- Flipped classroom
- Conceptual Online Quiz
- Capstone Projects

Text Book(s):

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson, 2019.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Second Edition, Springer, 2022.
3. "Computer Vision: A Modern Approach", 2nd Edition, Pearson Education, Paperback – 1 January 2015.

Reference Books(s):

1. B Cyganek, "An Introduction to 3D Computer Vision Techniques and Algorithms", 1st edition, John Wiley & Sons, 2009
2. V Kishore Ayyadevara & Yeshwanth Reddy, "Modern Computer Vision with PyTorch", Packt Publishing, 2020.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23531.1	3	–	3	–	3	–	–	–	–	2	–	–	–	–	2
IT23531.2	3	3	3	–	3	2	–	–	–	–	–	3	–	3	2
IT23531.3	3	3	3	–	3	2	–	–	–	2	–	3	–	3	2
IT23531.4	2	3	3	3	3	2	–	1	2	2	–	3	3	3	3
IT23531.5	3	3	3	3	3	2	2	1	2	2	3	3	3	3	3
Average	2.8	3	3	3	3	2	2	1	2	2	3	3	3	3	2.4

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
CS23531	Web Programming	PC	1	0	6	4
For B.E Programme CSE ,CSECS,CSD and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> To convey the Internet and Its Application in Real world. To introduce the fundamentals of web programming through HTML and CSS. To establish the application of Javascript in designing interactive web pages. To investigate various elements of ReactJS and design user interfaces to deploy in the real time.

UNIT-I	WEB BASICS, HTML AND CSS	4
<p>Introduction World wide web and its evolution - E-mail, Telnet, FTP, E-commerce, Cloud Computing, Video conferencing - Internet service providers, IP Address, URL, Domain Name Servers - Web Browsers, Search Engine - Web Server vs Application Server, HTML Tags, Structure - Block Elements, Text Elements- Lists, Images, section, article, and aside Elements</p> <p>CSS Overview - CSS Rules, CSS Syntax and Style - Class Selectors, ID Selectors, span and div Elements - Cascading, style Attribute, style Container, External CSS Files - CSS Properties: Color Properties, Font Properties, line-height Property, Text Properties, Border Properties. Element Box, padding Property, margin Property - Hosting a Website and GIT</p>		
UNIT-II	Client Side Programming - Java Script	2
<p>Hello World Web Page - Buttons, Functions, Variables, Identifiers - Assignment Statements and Objects - Document Object Model, Forms: form Element, Controls, Text Control Accessing a Form's Control Values, reset and focus Methods – Event Handler Attributes: onchange, onmouseover, onmouseout. While Loop, External JavaScript Files, do Loop, Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements- Manipulating CSS with JavaScript- Using z-index to Stack Elements-Textarea Controls - Pull-Down Menus- List Boxes- Canvas and Drawing - Event Handler and Listener.</p>		
UNIT-III	Server Side Programming - PHP	5
<p>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.</p> <p>Bootstrap Background and Features - Getting Started with Bootstrap - Grids - Components - Menus and Navigations - Plugins - Flexbox& Layouts.</p>		
UNIT-IV	REACTJS	2
<p>React Environment Setup - ReactJS Basics - React JSX - React Components: React Component API - React Component Life Cycle - React Constructors - React Dev Tools - React Native vs ReactJS.</p>		

UNIT-V	REACT DATAFLOW	2
React Dataflow: React State - React Props - React Props Validation - Styling React - Hooks and Routing - Deploying React - Case Studies for building dynamic web applications.		
Total Contact Hours: 15		

List of Experiments	
1	Explore various terminologies related to Internet (ISP, Email, Telnet, FTP, Web browsers, Search Engines)
2	Experiment the use of basic HTML elements.
3	Demonstrate the applications of Lists, Tables, Images, Section, article and aside elements.
4	Investigate the various components of CSS.
5	Develop web pages using HTML and various elements of CSS.
6	Designing simple dynamic webpages using Javascript.
7	Build web pages using While Loop, External JavaScript Files, do Loop, Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements.
8	Manipulating CSS with JavaScript- Using z-index to Stack Elements-Textarea Controls - Pull-Down Menus- List Boxes- Canvas and Drawing - Event Handler and Listener.
9	React Environment Setup - ReactJS Basics - React JSX - React Components: React Component API.
10	Understand React Component Life Cycle and apply React Constructors - React Dev Tools - React Native vs ReactJS
11	Envisage React Dataflow: React State - React Props - React Props Validation - Styling React - Hooks and Routing
12	Deploying React - Case Studies for building dynamic web applications.
Contact Hours : 60	
Total Contact Hours : 75	

Course Outcomes: At the end of this course students will be able to
<ul style="list-style-type: none"> ● Apply various elements of HTML and CSS.
<ul style="list-style-type: none"> ● Design interactive web pages using JavaScript.
<ul style="list-style-type: none"> ● Create Dynamic Web Applications using ReactJS.
<ul style="list-style-type: none"> ● Deploy and host web applications in Local Servers or Cloud platforms.
<ul style="list-style-type: none"> ● Building React Applications

Textbooks:	
1.	1. Dean, J., Web Programming with HTML5, CSS, and JavaScript. Jones & Bartlett Learning, 2018. 2. Minnick
2.	C. Beginning ReactJS foundations building user interfaces with ReactJS: An Approachable Guide, OReilly, 2022.

Reference books:	
1.	Harvey M Deitel, Paul J Deitel and Tem R Nieto, Internet and World Wide Web How to Program, Pearson, 6th Edition, 2020.
2.	Rebah, H.B., Boukthir, H. and Chedebois, A., Website Design and Development with HTML5 and CSS3. John Wiley & Sons, 2022.
3.	Laura Lemay, Rafe Colburn and Jennifer Kyrnin, Mastering HTML, CSS and Javascript Web Publishing, BPB Publication, 1st Edition, 2016.
4.	Alex Banks and Eve Porcello, Learning React: Functional Web Development with React and Redux, O'Reilly Publishers, 1st Edition, 2017

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23531.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CS23531.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CS23531.3	3	3	3	3	3	-	-	2	2	-	2	2	3	3	3
CS23531.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CS23531.5	3	3	3	3	3	2	2	2	-	-	3	3	3	3	3
Average	3	3	3	3	3	1.8	2	2	2.3	2	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: “-“

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
AI23231	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	PC	3	0	2	4

Objectives:
• Understand the various characteristics of a problem solving agent
• Learn about the different strategies involved in problem solving
• Learn about solving problems with various constraints.
• Apply A.I to various applications like expert systems etc.
• Understand the different models of learning

UNIT-I	Introduction to Artificial intelligence and Problem-Solving Agent	9
Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.		
UNIT-II	Search techniques	9
Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.		
UNIT-III	Constraint satisfaction problems and Game Theory	9
Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		
UNIT-IV	Knowledge & reasoning	9
Statistical Reasoning: Probability and Bays ^{''} Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.		
UNIT-V	Introduction to Machine Learning	9
Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.		
Contact Hours		45

List of Experiments					
1	Programs on Problem Solving				
a	Write a program to solve 8 Queens problem.				
b	Solve any problem using depth first search.				
c	Implement MINIMAX algorithm.				
d	Implement A* algorithm				
2	Programs on Decision Making and Knowledge Representation				
a	Introduction to PROLOG				
b	Implementation of Unification and Resolution Algorithm.				
c	Implementation of Backward Chaining				
d	Implementation of Forward Chaining				
3	Programs on Planning and Learning				
a	Implementation of Blocks World program				
b	Implementing a fuzzy inference system				
c	Implementing Artificial Neural Networks for an application using python				
d	Implementation of Decision Tree				
e	Implementation of K-mean algorithm				
			Contact Hours	:	30
			Total Contact Hours	:	75

Lab Specifications:

- The lab can be implemented using Python or C.
- Knowledge representation experiments can be performed using a PROLOG TOOL.

Course Outcomes: On completion of the course, the students will be able to
➤ Basic knowledge representation, problem solving, and learning methods of artificial intelligence.
➤ Provide the apt agent strategy to solve a given problem
➤ Represent a problem using first order and predicate logic
➤ Design applications like expert systems and chat-bot.
➤ Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

Text Books(s):
1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978- 1558605350.

Reference Book(s) / Web link(s):
1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2017.
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, Pearson, 1st ed. 2015
3. Logic & Prolog Programming, Saroj Kaushik, New Age International, 1st edition, 2002.
4. Expert Systems: Principles and Programming, 11 March 1998. Edition: 4th. ISBN: 9788131501672

CO - PO – PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
AI19341.01	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.02	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.03	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.04	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.05	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average Mapping	2.4	2.4	1.25	2.0	2.4	1.5	1.2	1.3	1.0	-	2.4	1.8	2.0	2.0	2.0

Note: Enter correlation levels 1, 2 or 3 as defined below:
 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23532	Computer Networks	PC	3	0	4	5
For B.E Programme CSE ,CSECS,CSD and B.Tech Programme in IT ,AIML & AIDS						

Objectives:
<ul style="list-style-type: none"> ● Understand the concepts of computer networks and error detection-correction of data. ● Be exposed to various addressing schemes and routing protocols. ● Learn the Transport Layer, flow control and congestion control algorithms ● Be familiar with real time applications of networking devices and tools. ● To configure different devices and trace the flow of information between nodes in the network using various tools

UNIT I	FUNDAMENTALS AND DATA LINK LAYER	9
Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Application Programming Interface (sockets) – Performance – Link layer Services - Framing - Error Detection and Correction – Reliable Transmission		
UNIT II	MEDIA ACCESS AND INTERNETWORKING	9
Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP Fragmentation - Global Addresses – ARP– DHCP – ICMP		
UNIT-III	ROUTING	9
Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) – BGP– IPv6 – Multicast routing - DVMRP- PIM – Case Study-Software Defined Networking (SDN)		
UNIT IV	TRANSPORT LAYER	9
Overview of Transport layer – UDP – TCP - Segment Format - Connection Management – Adaptive Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements.		
UNIT-V	APPLICATION LAYER	9
E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – Web Services – SNMP - MIB – RMON– SIP		
Total Contact Hours		: 45

List of Experiments	
1	Basic Networking Commands in Linux and Windows operating systems
2	Learning and Assignment of IP Address manually to computers
3	Study of different types of Network Cables and Crimping of cable with RJ45 connector
4	Implement packet sniffing using raw sockets in python
5	Develop a customized ping command to test the server connectivity
6	Building anonymous FTP Scanner using ftplib module
7	Develop a simple calculator using XMLRPC
8	Develop a program to create reverse shell using TCP sockets
9	Design a simple topology and configure with one router, two switches and PCs using Cisco Packet Tracer
10	Customize Switch with Network Modules using Cisco Packet Tracer
11	Examine Network Address Translation (NAT) using Cisco Packet Tracer
12	Nmap to discover live hosts using ARP scan, ICMP scan, and TCP/UDP ping scan in TryHackMe Platform.
13	Demonstrate network forensics using PcapXray tool
14	To capture, save, and analyze network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DNS using Wireshark Tool
15	To Analyze the different types of servers using Webalizer tool
Contact Hours : 60	
Total Contact Hours : 105	

Course Outcomes: On completion of course you will be able to	
•	Choose the required functionality at each layer for given application
•	Trace the flow of information from one node to another node in the network
•	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
•	Monitor the traffic within the network and analyze the transfer of packets.
•	Develop real time applications of networks using different tools

Suggested Activities:

- Assignment problems based on GATE, Quiz.
- Class presentation/Discussion

Text Books(s):

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2021.
2. Behrouz A. Forouzan, “Data Communications and Networking”, Fifth Edition, McGrawHill, 2017.

Reference Books (s)/Web links:

1. William Stallings, “SNMP, SNMPv2, SNMPv3 and RMON 1 and 2”, Third Edition, Pearson Education, 2009.
2. James F. Kurose, Keith W. Ross,” Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2017.
3. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, 5th Edition, Prentice Hall publisher, 2010.
4. William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2011.
5. Manuel Ortega, “Mastering Python for Networking and Security”, Second Edition, Packt, 2021

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23532.1	0	2	1	0	3	1	1	1	1	0	1	1	2	1	1
CS23532.2	2	2	1	0	2	1	1	0	0	0	2	2	1	1	1
CS23532.3	3	3	1	0	3	0	1	0	0	0	2	1	2	3	2
CS23532.4	2	3	0	0	3	1	1	1	0	0	2	2	1	2	3
CS23532.5	3	2	2	2	3	0	1	1	0	0	3	3	3	3	3
Average	2.6	2.4	1.3	2.0	2.8	1.0	1.0	1.0	1.0	0.0	2.0	1.8	1.8	2.0	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 (Laboratory Course)	Category	L	T	P	C
GE23521	Soft Skills - II	EEC	0	0	2	1

Course Objectives:

The major course objectives are:

- e. To help students break out of shyness.
- f. To build confidence
- g. To enhance English communication skills.
- h. To encourage students' creative thinking to help them frame their own opinions,

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

Week	Activity Name	Description	Objective
1	The News hour	Students are made to read news articles from the English newspapers. The students also have to find words and their meaning from the article they have not come across before and share it with the group. They then use these words in sentences of their own	The aim of this activity is not only to get the students to read the newspaper but also aims at enhancing the students' vocabulary.
2	Court Case	The facilitator provides the participants the premise of a story and proceeds to convert the story into a court case. The students are required, department-wise to debate and provide their points to win the case for their clients.	The aim of the lesson is to encourage creative and out-of-the -box thinking to ensure a good debate and defense skills.
3	The ultimate weekend	The students design activities they are going to do over the weekend and they have to invite their classmates to join in the activity. The students move around the class and talk to other students and invite them.	The aim of this activity is to develop the art of conversation among students. It also aims at practicing the grammatical structures of "going to" "have to" and asking questions.
4	The Four Corners	This is a debate game that uses four corners of the classroom to get students moving. The following is written on the 4 corners of the room "Strongly Agree, Somewhat Agree, Somewhat Disagree and Strongly Disagree". The topics are then given to the class and students move to the corner that they feel best explains their opinions	This activity aims at getting students to come up with their own opinions and stand by it instead of being overshadowed by others and forcing themselves to change based on others opinions.

5	Debate	Boarding school or day school? Which is more beneficial for a student?	The aim of this activity is to encourage students to draw up feasible points on the advantages and benefits of both. And enhance their debating ability
6	Grand Master	The facilitator starts the session by keeping an individual in mind, upon which the students guess it only through "Yes or No" questions. Post few trials the students are given same opportunity to do the same with the crowd.	The aim of the lesson is designed to teach the art of questioning. It also helps to enhance the students' speaking and listening skills.
7	Debate	Does violence on the TV and Video games influence children negatively?	This activity aims at encouraging the students to debate on real life scenarios that most students spend a lot of time on.
8	Turn Tables	This is a speaking activity where the students need to speak for and against the given topics when the facilitator shouts out 'Turn Table'.	The aim of this activity is to make the participants become spontaneous and have good presence of mind.
9	Debate	Do marks define the capabilities of a student?	This debate activity aims at allowing the students to argue on this worrisome adage of marks.
10	FictionAD	The Participants are asked to create an Ad for a challenging topic only using fictional characters.	The activity aims at developing their creativity and presentation skills.
11	Debate	Are social networking sites effective, or are they just a sophisticated means for stalking people?	This activity aims at refining the students debating skills on a very real life situation.
12	Talent Hunt	Talent Hunt is a fun activity where the students are selected at random and supported to present any of their own skills.	The aim of this activity is designed to evoke their inner talents and break the shyness and the fear of participating in front of a crowd.
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits.	The aim is to do both give feedback to students as well as obtain feedback on the course from them.

Course Learning Outcome:

On successful completion of the course, students should be able to:

1. Be more confident
2. Speak in front of a large audience without hesitation
3. Think creatively
4. Speak impromptu
5. Communicate in English

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS23512	Fundamentals of Mobile Computing	PC	3	0	0	3
For B.E Programme CSE and For B.Tech IT						

Objectives:
<ul style="list-style-type: none"> To learn about the principles, characteristics, trends, latest development, systems issues in mobile technology
<ul style="list-style-type: none"> To understand the fundamentals of mobile computing and background knowledge to understand quantum computing concepts and their relevance to mobile computing.
<ul style="list-style-type: none"> To infer knowledge about the various technologies used in mobile computing
<ul style="list-style-type: none"> To be familiar with wireless technologies and learn about Quantum encryption for mobile security in Mobile devices
<ul style="list-style-type: none"> To gain knowledge about different mobile platforms and application development

UNIT I	INTRODUCTION TO QUANTUM COMPUTING FOR MOBILE OPTIMIZATION	9
Mobility of bits and bytes - Beginning of wireless – Technology 1G to 5G- Mobile computing - Dialogue control, Networks - Middleware and Gateways - Application and services - Developing mobile computing applications - Security in mobile computing - Architecture for Mobile computing - Mobile computing through internet, Quantum-inspired algorithms for mobile applications, Quantum-enhanced Mobile Devices.		
UNIT II	WIRELESS TECHNOLOGIES	8
Bluetooth – RFID – WIMAX – Mobile IP – IPV6 – GSM – Architecture – Call routing – Mobile Computing over SMS – GPRS – GPRS network architecture - Applications of GPRS – Introduction to WAP.		
UNIT-III	WIRELESS LAN AND INTERNETWORKING	10
Wireless LAN – Advantages - IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in Wireless LAN - Deploying Wireless LAN - Mobile Ad hoc and Sensor network – Wireless LAN security – WIFI versus 3G - Intelligence in the Networks – SS#7 Signaling – IN Conceptual model – softswitch – Programmable networks – Virtual Private Network(VPN), Integration of cloud-based quantum computing with mobile devices.		
UNIT IV	CLIENT PROGRAMMING AND OS	9
Client Programming – Introduction – Hardware Overview – Mobile Phones -PDA – Recent Developments in Client Technologies – Palm OS Architecture – Application Development – Symbian OS Architecture – Application for Symbian, Quantum programming frameworks for mobile applications.		
UNIT-V	APPLICATIONS	9
Voice Over IP – H.323 framework – Session Initiation Protocol (SIP) – Real time protocols – Voice Over applications – IP Multimedia Systems (IMS) – Networked Multimedia Applications – Next generation networks.		
Total Contact Hours		: 45

Course Outcomes: On completion of course, students will be able to
<ul style="list-style-type: none"> • Discover the characteristics of mobile computing applications including the major system components
<ul style="list-style-type: none"> • To explore the working model and characteristics of mobile computing
<ul style="list-style-type: none"> • To propose solutions with comparisons for problems related to mobile computing system through system investigations
<ul style="list-style-type: none"> • To identify the use of wireless technologies in appropriate applications and Quantum programming frameworks for mobile applications
<ul style="list-style-type: none"> • Develop a mobile application using mobile technologies and Emerging research level understanding at the intersection of mobile and quantum computing

Textbooks:
1. Asoke Talukder, Hasan Ahmed and Roopa R yavagal “Mobile computing Technology, Application and service creation”, Second edition, McGraw Hill, 2010
2. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson, 2004
3. Eleanor G. Rieffel and Wolfgang H. Polak, “Quantum Computing: A Gentle Introduction”

Reference Books (s)/Web links:
1. Frank Adelstein, Sandeep KS Gupta, Golden Richard, Loren Schwiebert, “Fundamentals of Mobile and pervasive computing”, McGraw-Hill, 2005.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi, 2012.
3. Wei Meng Lee, “Beginning for Android 4 Application Development “, Wiley India Edition, 2012.

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23512.1	3	2	-	-	2	2	2	2	2	1	-	1	2	1	1
CS23512.2	3	2	-	-	-	1	2	1	2	-	-	2	1	1	1
CS23512.3	3	2	-	-	2	1	1	2	2	-	-	1	1	2	1
CS23512.4	3	1	-	-	2	1	3	2	3	1	-	1	2	2	2
CS23512.5	3	2	-	-	2	1	2	1	3	1	-	2	3	3	3
Average	3	1.8	-	-	1	1	2	1.6	2.4	1	-	1.4	1.8	1.8	1.6

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
CS23632	Cryptography and Network Security	PC	2	0	2	3
For B.E Programme CSE , CSD and B.Tech Programme IT						

Objectives:
<ul style="list-style-type: none"> • Learn basics of encryption and Number Theory. • Understand the methods of public key encryption. • Acquire knowledge of hash functions and digital signatures. • Apply techniques of system level securities. • Know the current trends in e-mail, IP and web security

UNIT I	INTRODUCTION AND NUMBER THEORY	6
OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography)-Number Theory: Modular arithmetic- Euclid's algorithm-Fermat's and Euler's theorem -The Chinese Remainder theorem		
UNIT II	BLOCK CIPHERS AND PUBLIC KEY CRYPTOGRAPHY	6
Data Encryption Standard (DES) – Advanced Encryption Standard (AES) – Triple DES – Public key cryptography- Principles of public key cryptosystems-The RSA algorithm-Key management-Attacks on RSA – Diffie Hellman Key exchange – Elliptic curve arithmetic-Elliptic Curve Cryptography (ECC)		
UNIT-III	HASH FUNCTIONS AND DIGITAL SIGNATURES	6
Authentication requirement – MAC – Hash function – MD5 - SHA - HMAC - Merkle Hash Tree—Digital signature and authentication protocols - DSS – Zero Knowledge Proofs (ZKP) and its Use Cases		
UNIT IV	SECURITY PRACTICE AND SYSTEM SECURITY	6
Kerberos – Firewall types and design - Intrusion detection system – Malicious software – Antivirus – Case Study - WannaCry Ransomware – Kaspersky Antivirus Scan Engine – Federated Identity Management		
UNIT-V	E-MAIL, IP AND WEB SECURITY	6
E-mail Security – Pretty Good Privacy-S/MIME – IPSecurity- Overview of IPsec - IP and IPv6-Authentication Header - Encapsulation Security Payload (ESP) – Web Security - SSL/TLS Basic Protocol-computing the keys- client authentication – Case Study - Unified Payment Interface (UPI)		
Contact Hours:		30

List of Experiments		
1	Installation and Configuration of Kali Linux/Parrot OS in a VMware/VirtualBox.	
2	Encryption Crypto 101 in TryHackMe Platform	
3	Perform Man-in-the-middle (MITM) attacks using the Ettercap tool.	
4	Demonstrate hash cracking using John the Ripper tool.	
5	Perform various configurations of Iptables Firewall in Linux.	
6	Snort IDS/IPS to detect and prevent real time threats in TryHackMe Platform.	
7	Perform Code Injection on Application Process using Ptrace.	
8	Privilege Escalation in TryHackMe Platform	
9	Demonstrate various exploits of Window OS using Metasploit Framework	
10	Perform Wireless Audit on routers and decrypt the WPA keys using Aircrack-ng	
	Contact Hours:	30
	Total Contact Hours :	60

Course Outcomes: On completion of course you will be able to	
	● Grasp concepts in classical encryption techniques and number theory.
	● Thoroughly understand Public Key Encryption and apply to real-world applications.
	● Apply hashing algorithms and digital signatures.
	● Comprehend system level securities.
	● Perceiving the best in email, IP and Web Security.

Textbooks:
1. William Stallings, “Cryptography and Network Security-Principles and Practices”, Seventh Edition, Pearson Education, 2017.
2. Christo Paar and Jan Pelzl, “Understanding Cryptography: A Textbook for Students and Practitioners”, First Edition, Springer, 2010

Reference Books (s)/Web links:
1. JoxeanKoret and Elias Bachaalany,” The Antivirus Hackers Handbook”, First Edition, Wiley, 2015
2. Douglas R. Stinson,” Cryptography: Theory and Practice”, Third Edition, by, CRC Press, Taylor and Francis Group (Indian Edition), 2006
3. https://blockonomi.com/merkle-tree/
4. https://chain.link/education/zero-knowledge-proof-zkp
5. https://www.npci.org.in/what-we-do/upi/product-overview , https://content.kaspersky-labs.com/fm/site-editor/53/5388886ff3e57f1181c2f8191aef4810/source/ksendatasheet2024.pdf

CO - PO – PSO Mapping

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
CS23632.1	3	3	1	2	-	2	-	-	1	-	-	3	2	2	2
CS23632.2	3	3	2	1	-	-	-	-	1	-	-	3	2	2	2
CS23632.3	3	3	2	2	2	-	-	2	0	-	-	3	1	1	2
CS23632.4	0	1	2	2	2	-	-	0	2	-	-	3	1	1	2
CS23632.5	0	2	2	2	2	-	-	0	2	1	-	3	1	1	2
Average	3.0	2.4	1.8	1.8	2.0	2.0	-	2.0	1.5	1.0	-	3.0	1.4	1.4	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 Courses)	Category	L	T	P	C
AI23331	FUNDAMENTALS OF MACHINE LEARNING	PC	3	0	2	4
Common to AIML & AIDS						

Objectives:	
•	To know the fundamentals of machine learning.
•	Be exposed to linear models.
•	Be familiar with basic machine learning algorithms with classification.
•	To understand machine learning algorithms with clustering.
•	To learn and apply reinforcement learning techniques.

UNIT-I	FOUNDATIONS OF LEARNING	8
Components of learning – learning models – geometric models – probabilistic models – logical models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization trade off – bias and variance – learning curve.		
UNIT-II	LINEAR MODELS	9
Linear classification – univariate linear regression - bivariate regression – multivariate linear regression – regularized regression – Logistic regression. Naïve Baye’s – Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models – Bayesian Logistic Regression.		
UNIT-III	SUPERVISED LEARNING	10
Perceptron: – multilayer neural networks – back propagation - learning neural networks structures – support vector machines: – soft margin SVM – going beyond linearity – generalization and over fitting – regularization – validation. Decision trees: Training and Visualizing a Decision Tree - Making Predictions - Estimating Class Probabilities - The CART Training Algorithm - Computational Complexity - Gini Impurity or Entropy - Ensemble methods: Bagging- Boosting- Boosting AdaBoost - Gradient Boosting – Xg boost.		
UNIT-IV	UNSUPERVISED LEARNING	10
Clustering: Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees. Dimensionality Reduction: – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis.		
UNIT-V	REINFORCEMENT LEARNING	8
Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal-difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control.		
		Contact Hours : 45

List of Experiments	
1	A python program to implement univariate regression, bivariate regression and multivariate regression.
2	A python program to implement Simple linear regression using Least Square Method
3	A python program to implement logistic model.
4	A python program to implement single layer perceptron.
5	A python program to implement multi layer perceptron with back propagation.
6	A python program to do face recognition using SVM classifier.
7	A python program to implement decision tree.
8	A python program to implement boosting.
9	A python program to implement KNN and K-means.

10	A python program to implement dimensionality reduction – PCA.				
11	Mini project – develop a simple application using tensorflow / keras.				
			Contact Hours	:	30
			Total Contact Hours	:	75
Course Outcomes:					
On completion of the course, the students will be able to					
•	Understand fundamentals of machine learning.				
•	Apply the linear models for tuning parameters.				
•	Understand and explore the machine learning algorithms with classification.				
•	Apply machine learning algorithms with clustering and feature extraction.				
•	Apply reinforcement learning techniques for various applications.				

Text Books:	
1	Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. September 21019, Reilly Media, Inc., ISBN: 9781492032649.
2	Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3	Shai Shalev-Shwartz and Shai Ben-David, ” Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press 2014.

Reference Books:	
1	Alex Smola and S.V.N. Vishwanathan, ” Introduction to Machine Learning”, Cambridge University Press 2011.
2	Andreas C. Müller and Sarah Guido, ” Introduction to Machine Learning with Python: A Guide for Data Scientists”, O’Reilly Media, Inc, 2016.
3	S. Russel and P. Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Prentice Hall, 2009.
4	C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.

Web links for virtual lab:	
1	https://www.coursera.org/lecture/python-machine-learning/introduction-4f2So
2	https://nptel.ac.in/courses/106/106/106106139/

PO & PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2	PSO 3
AI23331.1	3	3	2	-	-	-	-	-	1	-	-	-	3	1	-
AI23331.2	3	3	3	2	-	2	-	-	-	-	-	2	2	3	-
AI23331.3	3	3	3	2	3	-	-	2	2	-	-	-	-	3	-
AI23331.4	3	3	3	-	3	1	-	-	-	-	1	2	2	-	-
AI23331.5	3	3	2	3	2	-	-	1	3	-	3	3	3	3	1
Average	3	3	2.6	1.4	1.4	0.6	-	0.6	0.8	-	0.6	1.4	2	2	0.2

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
GE23627	Design Thinking and Innovation	EEC	0	0	4	2

Objectives:
• To understand the design thinking concepts and deep understanding of user needs and experiences.
• To find the problem statement and To develop innovative design solutions that address identified user challenges
• To master the process of prototyping and iterating on designs.
• To conduct thorough market analysis and financial planning
• To effectively communicate design concepts and findings.

Unit-I: Introduction to Design Thinking : The design thinking concepts - Different design thinking models - Details of Stanford Design thinking process: Empathize, Define, Ideate, Prototype, Test

Activities:

- Case studies of successful domain based Design Thinking and Innovative projects
- Group discussions on design thinking

Unit 2: Empathize and Define : User research methods (interviews, surveys, observation, contextual inquiry) - Persona development- Journey mapping – Brainstorming Defining the design problem statement

Activities:

- Conducting user interviews and surveys
- Creating user personas and journey maps
- Identifying key user needs and pain points
- Analyze the user needs and Brainstorming to define problem statement

Unit 3: Ideate and Create : Brainstorming techniques (e.g., mind mapping, SCAMPER) - Ideation tools (e.g., design thinking tools, concept sketching) - Concept generation and evaluation (e.g. Brainstorming)

Activities:

- Group brainstorming sessions to select the best idea
- Creating concept sketches and prototypes
- Evaluating ideas based on user needs and feasibility

Unit 4: Prototype and Test : Low, Medium and high level fidelity for prototyping-Usability testing -Iterative design

Activities:

- Building low-fidelity prototypes (e.g., paper prototypes)
- Conducting usability tests with users
- Iterating on designs based on feedback

Unit 5: Market Analysis and Implementation : Market research and analysis - Business model development- Financial planning-Implementation strategies

Activities:

- Conducting market research
- Developing a business model canvas
- Creating a financial projection
- Developing an implementation plan

Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Construct design challenge and reframe the design challenge into design opportunity.
<ul style="list-style-type: none"> • 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.
<ul style="list-style-type: none"> • Develop ideas and prototypes by brainstorming.
<ul style="list-style-type: none"> • Organize the user walkthrough experience to test prototype
<ul style="list-style-type: none"> • Develop smart strategies and implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.

Assessment:

- Encourage students to work on real-world design challenges based on the user needs
- Group presentations
- Quizzes and exams
- Evaluation of Project report and viva and also encourage the students for filing patent/ copyright / presenting in conference / publishing in journal

Text Book(s):	
1	Handbook of Design Thinking by Christian Müller-Roterberg, Kindle Direct Publishing, 2018.
2	Design Thinking – A Beginner’s Perspective, by E Balagurusamy, Bindu Vijakumar, MC Graw Hill, 2024

Reference Books:	
1	Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work – by Beverly Rudkin Ingle, Apress; 1st ed. Edition, 2013
2	Design Thinking: Understanding How Designers Think and Work by Nigel Cross, Bloomsbury Visual Arts; 2 edition 2023

Web links	
1	Design thinking Guide https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf
2	NPTEL Course on Design Thinking and Innovation By Ravi Poovaiah ; https://onlinecourses.swayam2.ac.in/aic23_ge17/preview
3	IITB Design course tools and Resources https://www.dsource.in/

CO - PO – PSO Mapping

PO/PSO CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE23627.1	3	2	3	3	3	2	2	3	3	3	3	3	2	1	1
GE23627.2	3	2	3	3	3	2	2	3	3	3	3	3	1	1	1
GE23627.3	3	2	3	3	3	2	2	3	3	3	3	3	1	2	1
GE23627.4	3	2	3	3	3	2	2	3	3	3	3	3	2	2	2
GE23627.5	3	2	3	3	3	2	2	3	3	3	3	3	3	3	3
Average	3	2	3	3	3	2	2	3	3	3	3	3	1.8	1.8	1.6

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 Course)	Category	L	T	P	C
CS23621	Mobile Application Development Laboratory	PC	0	0	4	2
For B.E Programme CSE ,CSE CS and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> ● Get started developing in Kotlin, and learn the basics of the Kotlin programming language: data types, operators, variables, control structures, and nullable versus non-nullable variables.
<ul style="list-style-type: none"> ● Get an introduction to Android development and UI basics.
<ul style="list-style-type: none"> ● Learn Android app architecture using Kotlin.
<ul style="list-style-type: none"> ● Learn best practices, guidelines, and tools for effective Android app design.
<ul style="list-style-type: none"> ● To understand the capabilities and limitations of mobile devices

List of Experiments		
1.	Kotlin Basics	
2.	Functions	
3.	Classes and Objects	
4.	Build First Android App	
5.	Layouts	
6.	App Navigation	
7.	Activity and Fragment Lifecycles	
8.	App Architecture (UI Layer)	
9.	App Architecture (Persistence)	
10	Advanced RecyclerView Use Cases	
11.	Connect to the Internet	
12.	Repository Pattern and WorkManager	
13.	App UI Design	
14.	Mini Project	
	Contact Hours:	30
	Total Contact Hours :	60

Course Outcomes: On completion of the course, students will be able to
<ul style="list-style-type: none"> • Learn the basics of Kotlin, including data types, operators, variables, control structures, and handling nullable and non-nullable variables.
<ul style="list-style-type: none"> • Develop Android apps and the basics of user interface design.
<ul style="list-style-type: none"> • Become familiar with the architecture of Android apps and how to structure them using Kotlin.
<ul style="list-style-type: none"> • Learn the best practices, guidelines, and essential tools needed for designing effective Android apps.
<ul style="list-style-type: none"> • Develop an understanding of what mobile devices can and cannot do, which is crucial for mobile app development.

Text Books:
1. Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin, by Dawn Griffiths, David Griffiths, Shroff/O'Reilly, Third Edition.
2. Learn Kotlin for Android Development: The Next Generation Language for Modern Android Apps Programming, Peter Späth, Apress, First Edition.

Reference Books:
1.Android Development with Kotlin: Enhance your skills for Android development using Kotlin, Marcin Moskala, Igor Wojda, Packt Publishing Limited, 2017.
2. Learn Android Studio 3 with Kotlin: Efficient Android App Development, Ted Hagos, Apress, First Edition.
3. How to Build Android Apps with Kotlin: A hands-on guide to developing, testing, and publishing your first apps with Android, Alex Forrester, Eran Boudjnah, Alexandru Dumbravan, Jomar Tigcal, Packt Publishing Limited, 2021.
4. Mastering Android Development with Kotlin, Milos Vasic, Packt Publishing Limited, 2017.

PO & PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23621.1	3	2	-	-	3	-	-	-	-	-	2	3	3	3	2
CS23621.2	3	3	3	2	3	2	2	-	-	2	2	3	3	3	3
CS23621.3	3	3	3	3	3	2	2	-	-	2	2	3	3	3	3
CS23621.4	3	3	3	3	3	3	3	2	-	2	2	3	3	3	3
CS23621.5	3	3	3	2	3	3	3	-	-	2	2	3	3	3	3
Average	3	2.8	3	2	3	2	2	2	-	2	2	3	3	3	2.8

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
IT23731	Cloud and Big Data Architecture (Common to IT, AIML)	PC	3	0	2	4

<ul style="list-style-type: none"> To understand and appreciate the evolution of cloud from the existing technologies.
<ul style="list-style-type: none"> To be familiar with cloud computing and have knowledge on the various service models.
<ul style="list-style-type: none"> To introduce cloud platforms used in industry.
<ul style="list-style-type: none"> To introduce the concepts of Big Data and Hadoop, and implement map reduce.
<ul style="list-style-type: none"> To describe the data stream analytics methodologies.
<ul style="list-style-type: none"> To understand and appreciate the evolution of cloud from the existing technologies.

UNIT-I	CLOUD ENABLING TECHNOLOGIES	9
Technologies for Network-Based Systems - System Models for Distributed and Cloud Computing - Implementation Levels of Virtualization - Virtualization Structures/Tools and Mechanisms - Virtualization of CPU, Memory, and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Data-Centre Automation.		
UNIT-II	CLOUD ARCHITECTURE AND SERVICES	9
Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture - Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS - Architectural Design of Compute and Storage Clouds -Public Cloud Platforms: GAE, AWS, and Azure.		
UNIT-III	CLOUD PLATFORMS IN INDUSTRY	
Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure.		
UNIT-IV	INTRODUCTION TO BIG DATA AND HADOOP	9
Introduction to Big Data, Types of Digital Data, Challenges of conventional systems - Web data, Evolution of analytic processes and tools, Analysis Vs reporting - Big Data Analytics, Introduction to Hadoop - Distributed Computing Challenges - History of Hadoop, Hadoop Eco System - Use case of Hadoop – Hadoop Distributors – HDFS – Processing Data with Hadoop – Map Reduce.		
UNIT-V	MINING DATA STREAMS	9
Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real time Analytics Platform (RTAP) applications - case studies - real time sentiment analysis, stock market predictions.		
Contact Hours:45		

Description of the Experiments	
1.	Install Virtual box /VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3.	Install Google App Engine. Create hello world app and other simple web applications using python/java.
4.	Use GAE launcher to launch the web applications.
5.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6.	Find a procedure to transfer the files from one virtual machine to another virtual machine
7.	Find a procedure to launch virtual machine using try stack (Open stack Demo Version)
8.	Install Hadoop single node cluster and run simple applications like word count.
9.	Deploy a Web Application with AWS Elastic Beanstalk.
10.	Launching and configuring EC2 instances.
	Contact Hours : 30
	Total Contact Hours :75

Course Outcomes: Students will be able to	
•	Learn the key and enabling technologies that help in the development of the cloud.
•	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
•	To understand cloud platforms usage in industry.
•	Understand the usage scenarios of Big Data Analysis and Hadoop framework and apply Mapreduce over HDFS.
•	Apply stream data models for mining big data

SUGGESTED ACTIVITIES

- Problem Based Learning
- Flipped classroom
- Circuit Design using Simulator
- Conceptual Online Quiz

SUGGESTED EVALUATION METHODS

- Continuous Assessment Test
- Online Quiz Assignments
- Offline Assignments
- Experiment based VIVA

Text Book(s):

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, First Edition, 2013.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley India; Second Edition , 2019.
3. Tamara Munzner, "Visualization Analysis and Design", AK Peters Visualization Series, CRC Press, Nov. 2014.
4. Anand Rajaraman and Jeffrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, Second Edition , 2016
5. Jiawei Han, Micheline Kamber —Data Mining Concepts and Techniques, Fourth Edition, Elseiver, November 2022.

Reference Books(s) / Web links:

1. Gerardus Blokdijk, AWS Certified Solutions Architect A Complete Guide - 2020 Edition.
2. Iman Ghanizada, "Google Cloud Certified Professional Cloud Arcitect", McGraw-Hill Education Publisher, 23rd April 2021.
3. Dr. Jugnesh Kumar , Dr. Anubhav Kumar , Dr. Rinku Kumar, "Big Data and Analytics: The key concepts and practical applications of big data analytics", 1st Edition, BPB Publications, March 2024

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23731.1	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23731.2	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23731.3	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23731.4	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
IT23731.5	3	3	-	2	3	2	-	-	1	-	1	1	3	2	2
Average	3	3	-	2	3	2	-	-	1	-	1	1	3	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 (Laboratory Course)	Category	L	T	P	C
IT23721	Data Science using R	PC	0	0	4	2

Objectives:
<ul style="list-style-type: none"> To understand the techniques and processes of data science.
<ul style="list-style-type: none"> To apply descriptive data analytics.
<ul style="list-style-type: none"> To visualize data for various applications.
<ul style="list-style-type: none"> To understand inferential data analytics.
<ul style="list-style-type: none"> To analysis and build predictive models from data .

List of Experiments
1. R Data types and classes
1. Functions
2. Reading and writing Data from Files Variables
3. R Programming using Control Structures
4. R Programming to illustrate Input and Output operations
5. Implementation of Graphics using R
6. Data Visualization using R
7. Simulation-Generating Random Numbers, Setting the random number seed
8. Simulating a Linear Model
9. Random Sampling
10. Data Analysis Case Study.
Contact Hours: 60

Course Outcomes: Students will be able to
<ul style="list-style-type: none"> Understanding the types, classes and functions of R Programming.
<ul style="list-style-type: none"> Accessing and Processing of Data.
<ul style="list-style-type: none"> Understanding the I/O interface programming
<ul style="list-style-type: none"> Study and Analyze Data Visualization.
<ul style="list-style-type: none"> Implement any application level simulation using R

SUGGESTED ACTIVITIES

- Case study Discussion
- Flipped classroom – Comparing of various visualization tools.

SUGGESTED EVALUATION METHODS

- Mini Projects
- Assignment problems
- Quizzes

Text Book(s):

1. John Mount , Nina Zumel, “Practical Data Science with R“, Second Edition 2nd Edition, Manning Publisher, 17 November 2019.

2. Mark Andrews_“Doing Data Science in R: An Introduction for Social Scientists“, Paperback – 31 March 2021.

Reference Books(s) / Web links:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16).
URL: <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>.

2. Atmajitsinh Gohil, ”R Data Visualization Cookbook”, open source, <https://cicerocq.wordpress.com/wp-content/uploads/2020/03/gohil-a.-r-data-visualization-cookbook-.pdf>.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23721.1	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23721.2	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23721.3	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23721.4	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23721.5	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
Average	3	3	-	2	3	2	-	-	2	-	1	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: “-“

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
IT23722	PROJECT PHASE I	EEC	0	0	6	3

OBJECTIVES:

To enable the students to do analysis and design of the industry- relevant and real-time projects on various core domains of information technology.

Course Outcomes	Course Outcome Statements
CO1	Analyze complex Engineering problems related Information Technology to reach substantiated conclusions by applying knowledge of Mathematics, Engineering fundamentals and Engineering specialization.
CO2	Create research based solutions for complex computer Engineering or multidisciplinary problems, and design system components or processes by applying appropriate techniques, resources, and modern IT tools.
CO3	Apply contextual computer science engineering solutions in the sustainable development towards environmental, societal, health, safety, legal, cultural issues and needs
CO4	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
CO5	Perform effectively as an individual, and as a member or leader in diverse teams, Communicate effectively and write effective reports and design documentation, ability to engage themselves in life-long learning

CO-PO-PSO Mapping

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
IT23722. 1	3	3	3	3	3	3	2	2	-	2	-	2	3	2	2
IT23722. 2	3	3	3	3	3	3	2	2	-	2	-	2	3	2	2
IT23722. 3	3	3	3	3	3	3	2	2	3	-	3	-	3	2	-
IT23722. 4	-	-	-	-	-	3	3	3	3	-	3	3	2	3	3
IT23722. 5	-	2	2	-	2	3	3	3	3	3	3	3	2	3	3
Average	3	2.8	2.8	3	2.8	3	2.4	2.4	3	2.3	3	2.5	3.8	2.4	2.5

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
IT 23821	PROJECT PHASE II	EEC	0	0	12	6

OBJECTIVES

To enable the students to do the implementation of the industry- relevant and real-time projects on various core domains of information technology.

Course Outcomes	Course Outcome Statements
CO1	Analyze complex Engineering problems related Information Technology to reach substantiated conclusions by applying knowledge of Mathematics, Engineering fundamentals and Engineering specialization.
CO2	Create research based solutions for complex computer Engineering or multidisciplinary problems, and design system components or processes by applying appropriate techniques, resources, and modern IT tools.
CO3	Apply contextual computer science engineering solutions in the sustainable development towards environmental, societal, health, safety, legal, cultural issues and needs
CO4	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
CO5	Perform effectively as an individual, and as a member or leader in diverse teams, Communicate effectively and write effective reports and design documentation, ability to engage themselves in life-long learning

CO-PO-PSO Mapping

PO / PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
IT 23821. 1	3	3	3	3	3	3	2	2	-	2	-	2	3	2	2
IT 23821. 2	3	3	3	3	3	3	2	2	-	2	-	2	3	2	2
IT 23821. 3	3	3	3	3	3	3	2	2	3	-	3	-	3	2	-
IT 23821. 4	-	-	-	-	-	3	3	3	3	-	3	3	2	3	3
IT23821. 5	-	2	2	-	2	3	3	3	3	3	3	3	2	3	3
Average	3	2.8	2.8	3	2.8	3	2.4	2.4	3	2.3	3	2.5	3.8	2.4	2.5

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
IT23A11	Internet of Things (Common to IT, AITL, AIDS, CSE, CSE CS,)	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To understand the basics of Internet of Things and communication protocols..
<ul style="list-style-type: none"> To understand the basic principles, architecture, and components, Methods of IoT systems.
<ul style="list-style-type: none"> To explore the hardware aspects, including microcontrollers (e.g., Arduino, Raspberry Pi) and sensors commonly used in IoT projects.
<ul style="list-style-type: none"> To gain hands-on experience with popular IoT platforms, Physical servers and cloud.
<ul style="list-style-type: none"> To learn how to process, analyze, and visualize data collected from IoT devices to derive actionable insights

Unit – I	Introduction to Internet of Things	9
Introduction – Definition and characteristics of IoT – How IoT Works? – IoT Applications- Challenges of IoT – Advantages and Disadvantages of IoT - IoT Protocols – Logical Design of IoT: IoT Functional blocks – IoT Communication Models – IoT Communication APIs.		
UNIT-II	Internet of Things Architecture and Design Methodologies	9
IoT Architecture – IoT Reference Architecture – IOT Design Methodology: Domain Specification- Functional View, Information View, Operation and deployment, Device and Component Integration, Application development and deployment UNIT-III IOT ELEMENT		
UNIT-III	Internet of Things Hardware and Management	9
Building blocks of an IoT Device – Raspberry Pi, Arduino – Sensors, Communication Modules: Bluetooth, Zigbee, RFID - Power Sources –Data Management, Business Processes in IoT		
UNIT-IV	IOT Platforms and Cloud Management	9
Physical servers and cloud - XaaS, M2M , WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django – Designing a RESTful Web API –Google cloud for IoT.		
UNIT-IV	Tools and Applications	9
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home		
Contact Hours: 45		

Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Know about IoT and its functionalities.
<ul style="list-style-type: none"> • Interpret IoT Architecture.
<ul style="list-style-type: none"> • Implement the various IoT elements and design the system.
<ul style="list-style-type: none"> • Understand the IoT physical servers and cloud integration.
<ul style="list-style-type: none"> • Design and develop the various applications in IoT

SUGGESTED ACTIVITIES

Case Study Analysis: Analyze case studies that implement Internet of Things on the following Sectors- Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart homes.

SUGGESTED EVALUATION METHODS

- Mini Projects
- Assignment problems
- Quizzes

Text Book(s):

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective“, CRC Press,First Edition, 2012
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian, “Architecting the Internet Of Things“, 2011 Edition. Springer, April 2011.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key Applications and Protocols“, Second Edition, John Wiley & Sons Inc, 2012.

Reference Books(s) / Web links:

1. Vijay Madiseti and ArshdeepBahga, —Internet of Things (A Hands-on-Approach)l,1st Edition, Orient Blackswan Private Limited, 201 5
2. Amit Kumar Tyag, Internet of Things Theory and Practice: Build Smarter Projects to Explore the IoT Architecture and Applications, BPB Publications, 27 July 2022

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23A11.1	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A11.2	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A11.3	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A11.4	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A11.5	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
Average	3	3	-	2	3	2	-	-	2	-	1	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: “-“

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CS23A32	Robotic Process Automation	PE	1	0	4	3
For B.E Programme CSE , CSECS, CSD and B.Tech Programme in IT,AIML & AIDS						

Objectives:
<ul style="list-style-type: none"> ● Prepare to become Junior RPA Developers. ● Learn the basic concepts of Robotic Process Automation. ● Develop familiarity and deep understanding of UiPath tools. ● Develop the ability to design and create robots for business processes independently. ● Develop skills required to pass UiPath Automation Developer Associate v1.0.

List of Experiments	
1.	Downloading and Installing UiPath Academic Alliance and connect to Orchestrator.
2.	Installing UiPath Extension in Browsers.
3.	Installing Activity Packages in UiPath Studio - Manage Packages feature to find, install, update and remove packages.
4.	Experiments based on variables and arguments.
5.	Algorithmic Approach: Selection control structures.
6.	Algorithmic Approach: Iteration control structures.
7.	Debugging - Debug modes, debug actions and the debug ribbon option to debug a file or the entire Project and simple and conditional breakpoints and simple and conditional trace points.
8.	Exception Handling - Try Catch, Throw, Rethrow and Retry Scope.
9.	Logging - Apply logging best practices during development.
10.	UI Automation – Modern Recorder, Modern UI Automation Input Activities and Input Methods, Modern UI Automation Output Activities and Output Methods, UI Synchronization with activities available in the Modern Design Experience, static and dynamic Descriptors.
11.	Excel Automation.
12.	Email Automation.
13.	PDF Automation.
14.	Working with Files and Folders.
15.	Data Manipulation.

16.	Version Control Integration.
17.	Libraries and Templates.
18.	Workflow Analyzer
19.	Orchestrator: Invoice Processing – Dispatcher.
20.	Orchestrator: Invoice Processing – Performer.
Contact Hours	
	: 45

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

- Start working as Junior RPA Developers.
- Understand the fundamental principles of robotic process automation.
- Become familiar with and gain a thorough knowledge of UiPath's software tools.
- Design and build automation robots for business tasks on their own.
- Successfully pass the UiPath Automation Developer Associate v1.0 certification exam.

Text Books:

1. UiPath Associate Certification Guide: The go-to guide to acing your Associate certification exam with the help of mock tests and quizzes, Niyaz Ahmed, Lahiru Fernando, Rajaneesh Balakrishnan, Packt Publishing Limited, 2022.
2. Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath, Alok Mani Tripathi, Packt Publishing Limited, 2018.

Reference Books:

1. Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.
2. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, Tom Tauli, Apress, 2020.
3. Democratizing Artificial Intelligence with UiPath: Expand automation in your organization to achieve operational efficiency and high performance, Fanny IP, Jeremiah Crowley, Packt Publishing Limited, 2022.
4. UiPath Administration and Support Guide: Learn industry-standard practices for UiPath program support and administration activities, Arun Kumar Asokan, Packt Publishing, 2022.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A32.1	3	2	2	1	3	-	-	-	1	3	3	2	2	2	1
CS23A32.2	1	1	2	3	3	-	-	-	1	2	3	1	3	2	1
CS23A32.3	2	3	2	3	3	-	-	-	2	3	1	1	3	3	3
CS23A32.4	1	2	1	2	2	-	-	-	1	2	1	3	3	3	2
CS23A32.5	3	3	3	3	3	-	-	-	3	1	1	1	3	2	1
Average	2	2.2	2	2.4	2.8	-	-	-	1.6	2.2	1.8	1.6	2.8	2.4	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 (Theory Course)	Category	L	T	P	C
CB23G11	Quantum Computation and Quantum Information	PE	3	0	0	3

Objectives:	
<input type="checkbox"/>	To learn about Quantum information.
<input type="checkbox"/>	To gain knowledge about Quantum algorithms.
<input type="checkbox"/>	To understand and learn about Quantum random number generators.
<input type="checkbox"/>	To study the basis of post-Quantum cryptography.

UNIT-I	INTRODUCTION TO QUANTUM INFORMATION	9
States, Operators, Measurements, Quantum Entanglement: Quantum Teleportation, Super-dense coding, CHSH Game, Quantum gates and circuits.		
UNIT-II	QUANTUM ALGORITHMS	9
Deutsch-Jozsa, Simon, Grover, Shor, Implication of Grover's and Simon's algorithms towards classical symmetric key cryptosystems, Implication of Shor's algorithm towards factorization and Discrete Logarithm based classical public key cryptosystems.		
UNIT-III	QUANTUM TRUE RANDOM NUMBER GENERATORS	9
Detailed design and issues of quantum Ness, Commercial products and applications.		
UNIT-IV	QUANTUM KEY DISTRIBUTION	9
BB84, Ekert, Semi-Quantum QKD protocols and their variations, Issues of Device Independence, Commercial products.		
UNIT-V	INTRODUCTORY TOPICS IN POST-QUANTUM CRYPTOGRAPHY	9
API-Public-key Signatures, Key Encapsulation Mechanism (KEM), Digital Signature standard, Pair-Wise Key Establishment-Discrete Logarithm Cryptography, Integer Factorization Cryptography.		
		Total Contact Hours : 45

Course Outcomes: On completion of the course, the students will be able to	
<input type="checkbox"/>	Apply quantum gates and circuits using quantum information.
<input type="checkbox"/>	Apply quantum algorithms in cryptosystems.
<input type="checkbox"/>	Understand the importance of Quantum random number generator.
<input type="checkbox"/>	Understand the importance of Quantum key distribution.
<input type="checkbox"/>	Apply the concept of post-quantum cryptography.

Text Book (s):
1. M. A. Nielsen and I. L. Chuang, “Quantum Computation and Quantum Information”, Cambridge University Press, 10th Edition, 2010.
2. Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

Reference Books(s) :
1. P. Kaye, R. Laflamme, and M. Mosca, “An Introduction to Quantum Computing”. Oxford University Press, New York, 2006.
2. N. David Mermin, “Quantum Computer Science”, Cambridge University Press, 2007.
3. Quantum Cryptography. D. Unruh., Available online: https://courses.cs.ut.ee/all/MTAT.07.024/2017_fall/uploads/
4. SAPV Tharrmashastha, D. Bera, A. Maitra and S. Maitra, “Quantum Algorithms for Cryptographically Significant Boolean Functions - An IBMQ Experience”, Springer, 2020.
5. Quantum Algorithm Zoo. https://quantumalgorithmzoo.org/
6. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, “Handbook of Applied Cryptography”, CRC Press, 2018.

CO \ PO/PSO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CB23G11.1	3	3	3	3	3	2	-	-	-	-	2	2	3	3	1
CB23G11.2	3	3	3	3	2	1	-	-	-	-	2	2	3	3	1
CB23G11.3	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
CB23G11.4	3	3	2	3	2	1	-	-	-	-	1	1	3	3	1
CB23G11.5	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
Average	3.0	3.0	2.4	2.6	2.2	1.2	-	-	-	-	1.4	1.4	3.0	3.0	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 (Theory Course)	Category	L	T	P	C
IT23A13	Edge Computing	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To gain knowledge in Edge computing basics and opportunities and challenges
<ul style="list-style-type: none"> To understand Edge computing Middleware system
<ul style="list-style-type: none"> To understand Edge integration with IoT and Cloud
<ul style="list-style-type: none"> To understand the techniques of Fog computing and its applications
<ul style="list-style-type: none"> To analyze and implement the applications of edge computing as a case study

UNIT-I	Edge Computing Basics	9
Introduction - Edge computing purpose and definition, , Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M.- Relevant Technologies –Fog and Edge Computing Completing the Cloud- Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges - Addressing the Challenges in Federating Edge Resources - Integrating IoT, Fog and Cloud Infrastructures: System Modeling and Challenges - Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds		
UNIT-II	Middleware System	9
Middleware for Fog and Edge Computing: Design Issues - Need for Fog and Edge Computing Middleware - Design Goals - State-of-the-Art Middleware Infrastructures - System Model – Architecture- Case Study Example .		
UNIT-III	Edge Integration with Cloud and IoT	9
Lightweight Container Middleware for Edge Cloud Architectures - Clusters for Lightweight Edge Clouds - Architecture Management – Storage and Orchestration - IoT Integration - Security Management for Edge Cloud Architectures		
UNIT-IV	Fog Computing	9
Data Management in Fog Computing – Background- Fog Data Management - Predictive Analysis to Support Fog Application Deployment - Smart Building - Predictive Analysis with FogTorch - Exploiting Fog Computing in Health Monitoring : Architecture of a Health Monitoring IoT-Based System with Fog Computing - Fog Computing Services in Smart E-Health Gateways - System Implementation - Case Studies, Experimental Results, and Evaluation - Related Applications in Fog Computing.		
UNIT-V	Case Study	9
Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking - Human Object Detection - Object Tracking - Lightweight Human Detection - Case Study .		
Total Contact Hours: 45		

Course Outcomes:
On completion of the course students will be able to:
<ul style="list-style-type: none"> Apply the concept of Basics of Fog and Understanding Challenges
<ul style="list-style-type: none"> Use concepts of Edge Middleware system
<ul style="list-style-type: none"> Use concepts of Edge Integration with Cloud and IoT
<ul style="list-style-type: none"> Analyze, sketch and case study the fog computing basics and implementation

SUGGESTED ACTIVITIES

- Problem Based Learning
- Flipped classroom
- Conceptual Online Quiz
- Capstone Projects
- Fog computing real time applications case study

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Discussion

Text Book(s):

1. Rajkumar Buyya, Sathish Narayana, “Fog and Edge Computing: Principles and Paradigms“ , 1st Edition, Wiley Publications, 2019
2. Alex Marcham ,“Understanding Infrastructure Edge Computing: Concepts, Technologies, and Considerations“, 1st Edition, Wiley Publications, 2021

Reference Books(s) / Web links:

1. M. Kumari, K. Anitha | Sadasivam, G. Sudha | Dharani, D. | Niranjnamurthy, Edge Computing Hardcover – Import, 1st Edition, 23 December 2021.
2. Amit Kumar Tyag, Internet of Things Theory and Practice: Build Smarter Projects to Explore the IoT Architecture and Applications, BPB Publications, 27 July 2022

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23A13.1	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A13.2	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A13.3	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A13.4	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A13.5	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
Average	3	3	-	2	3	2	-	-	2	-	1	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: “-“

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
IT23A32	AI based Conversational System	PE	2	0	2	3

Objectives:
1. Understand the fundamentals of natural language processing (NLP) and its applications in conversational systems.
2. Learn about different dialogue management techniques and strategies.
3. Gain hands-on experience in developing conversational agents using machine learning approaches
4. Explore ethical considerations and challenges in the design and deployment of conversational systems.
5. Develop critical thinking skills to evaluate and improve conversational agents.

UNIT-I	TEXT SEARCH	6
Text Search Using Regular Expressions - Text to List – Preprocessing the Text - Accessing Text from the Web - Removal of Stop words - Counter Vectorization - TF-IDF Score - Text Classifier		
UNIT-II	WORD EMBEDDING	6
Introduction to Word Embedding - Neural Language Model - Word2vec - Skip-Gram Model - Model Components: Architecture, Hidden Layer and Output Layer - CBOW Model - Subsampling Frequent Words - Negative Sampling - Word2vec Code - Skip-Gram Code - CBOW Code		
UNIT-III	NATURAL LANGUAGE PROCESSING	6
Natural Language Processing and Recurrent Neural Networks - RNNs Mechanism - Long Short-Term Memory Networks - Sequence-to-Sequence Models - Introduction to Chatbot - Conversational Bot - Chatbot: Automatic Text Generation		
UNIT-IV	USER INTERFACE	6
Voice User Interface (VUIs) - Conversational User Interfaces- Designing for Mobile Devices Versus IVR Systems - Conversational Design - Design Tools - Command-and-Control Versus Conversational - Novice and Expert Users - Personas, Avatars, Actors, and Video Games- Speech Recognition Technology		
UNIT-V	USER TESTING	6
Advanced Voice User Interface Design - User Testing for Voice User Interfaces – Prerelease Testing- Measuring Performance - Logging - Transcription - Release Phases - Voice-Enabled Devices and Cars		
Total Contact Hours: 30		

List of Experiments:
1. Implement the text preprocessing and feature extraction using Counter Vectorization.
2. Build and evaluate a text classifier using TF-IDF scores for feature extraction.
3. Implement and train a Skip-Gram and CBOW model using a sample text corpus
4. Implement a Word2Vec model with negative sampling and subsampling of frequent words
5. Develop a Text-to-Speech Conversion system that converts given Tamil and English text into audio output.
6. Building a Conversational Chatbot Using LSTM and Sequence-to-Sequence Models
7. Develop a basic voice-controlled application to demonstrate the principles of Voice User Interfaces (VUIs) and conversational design
8. Create a Text-to-Speech Conversion system that converts user-input text into speech in real-time.
9. Perform pre-release testing for a voice-enabled application
10. Implement a logging system to track performance during the release phases of a voice user interface (VUI) for a voice-enabled device
Contact Hours : 30
Total Contact Hours :75

SUGGESTED ACTIVITIES
<ul style="list-style-type: none"> ● Solving problem using NLP. ● Comparing the various tools ● Survey on various models ● Activity Based Learning ● Implementation of small module

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> ● Tutorial problems ● Assignment problems ● Quizzes ● Class Presentation/Discussion

Text Book(s):
1. Palash Goyal, Sumit Pandey, Karan Jain " Deep Learning for Natural Language Processing: Creating Neural Networks with Python “ Apress, 2018.
2. Cathy Pearl "Designing Voice User Interfaces: Principles of Conversational Experiences" O'Reilly Media,2017.
3. Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python" O'Reilly Media,2011.

Reference Books(s) / Web links:
1. James H. Martin, Daniel Jurafsky "speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition" pearson , Second Edition, 2000.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville "Deep Learning", MIT Press,2013

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23A32.1	3	3	-	2	3	2	-	1	2	2	1	2	3	2	3
IT23A32.2	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A32.3	3	3	-	2	3	2	-	1	2	-	1	2	3	2	3
IT23A32.4	3	3	1	2	3	2	-	-	2	2	1	2	3	2	3
IT23A32. 5	3	3	1	2	3	2	-	-	2	2	1	2	3	2	3
Average	3	3	1	2	3	2	-	1	2	2	1	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: “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
IT23A12	Introduction to Drone	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To understand the fundamental principles of drone technology
<ul style="list-style-type: none"> To learn drone design and assembly of drone components.
<ul style="list-style-type: none"> To understand about drone motors and ESC
<ul style="list-style-type: none"> To understand the basic principles of Flight Mechanics and Dynamics
<ul style="list-style-type: none"> To learn about real time application of Drone

UNIT I	Introduction to Drone	9
Definition and history of drones, Types of drones and their applications, Drone components and terminology, Regulations and Guidelines for drone usage.		
UNIT II	Drone Design and Assembly	9
Design considerations for drone airframe and propulsion systems, Selecting and assembling drone components such as motors, batteries, flight controllers, and cameras, Basic wiring and soldering techniques.		
UNIT III	Drone Motors and Electronic Speed Controller	9
Working, Types: Brush and Brushless Motors, motor sizing and identification, mounting patterns and thread size, Thrust to Weight ratio, KV ratings, advanced motor selection, Electronic Speed Controller (ESC).		
UNIT IV	Flight Mechanics and Dynamics	9
Basic principles of flight mechanics, flight controller board, Selection of drone controller with example, Factors affecting drone flight performance and efficiency.		
UNIT V	Applications of Drone	9
Overview of commercial and industrial drone applications, Case studies and examples of successful drone deployments, GPS based navigation system, Drone Camera Systems, Agro application, Drone Delivery, Future trends and developments in the drone industry		
		Total Contact Hours : 45

Course Outcomes: On completion of course students will be able to
<ul style="list-style-type: none"> Learn about the various types of Drones and its applications.
<ul style="list-style-type: none"> Learn about the various components of drone design.
<ul style="list-style-type: none"> Design basic types of drone systems
<ul style="list-style-type: none"> Understand the working of drones motors and ESC
<ul style="list-style-type: none"> Apply drone design to real world applications

SUGGESTED ACTIVITIES

- Problem solving sessions
- Mini Projects

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

TextBooks :

1. M. LaFay, Building Drones for Dummies, John Wiley & Sons, Inc., 2021
2. E. Tooley, Practical Drones: Building, Programming, and Applications, Apress, 2021
3. S. K. Koppaarth, Drone Technology: Theory and Practice, Springer, 2020.
4. K. Sundar and R. V. Rajakumar, Multicopters: Principles and Applications, Springer, 2021.

Reference Books :

1. D. Saxby, Drone Aerial Photography and Video: Techniques and Stories from the Field, Cengage Learning, 2018
2. D. McLeod, Getting Started with Drone: How to Build, Fly, and Program Your Own Drone, Apress, 2019.
3. G. C. Camara Leal, Flying Robots: An Introduction to Autonomous Aerospace Systems, Springer, 2017

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23A12.1	3	2	2	1	3	-	-	-	-	1	1	2	-	-	2
IT23A12.2	3	3	3	2	3	1	-	-	-	1	1	3	-	3	2
IT23A12.3	3	3	3	3	3	2	-	-	1	1	2	3	2	3	2
IT23A12.4	3	3	3	3	3	2	1	1	2	2	2	3	3	3	3
IT23A12.5	3	3	3	3	3	1	2	1	2	2	2	3	3	3	3
Average	3	2.8	2.8	2.4	3	1.5	1.5	1	1.7	1.4	1.6	1.8	2.7	3	2.4

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
AI23B32	SOFT COMPUTING	PE	2	0	2	3

OBJECTIVES:
<ul style="list-style-type: none"> Understand the basics and types of neural networks for supervised and unsupervised learning.
<ul style="list-style-type: none"> Learn fuzzy logic principles and apply them to fuzzy decision-making and control systems.
<ul style="list-style-type: none"> Apply genetic algorithms to solve optimization problems, such as maximizing a function.
<ul style="list-style-type: none"> Explore and apply hybrid systems integrating neural networks, fuzzy systems, and genetic algorithms.
<ul style="list-style-type: none"> Apply soft computing techniques to real-world problems like image fusion, optimization, and control systems

UNIT I	ARTIFICIAL NEURAL NETWORK	6
Fundamental Concept, McCulloch - Pitts Neuron, Hebb Network. Supervised Learning- Network-Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons (Madaline). Associative memory Network - Bidirectional Associative Memory (BAM) ,Hopfield Networks, Linear Autoassociative Memory (LAM). Unsupervised Learning Networks, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization		
UNIT II	FUZZY SYSTEMS	6
Introduction-fuzzy logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership Functions. Defuzzification, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Decision Making, Fuzzy Logic Control Systems.		
UNIT III	GENETIC ALGORITHM	6
Biological Background, Search Technique, Search Space. Terminologies in Genetic Algorithm- Genes, Fitness, Population, Operators- Encoding, Selection, Crossover, Mutation. Problem Solving Using Genetic Algorithm- Maximizing a Function.		
UNIT IV	HYBRID SOFT COMPUTING TECHNIQUES	6
Neuro - Fuzzy Hybrid Systems- Characteristics, Adaptive Neuro, Fuzzy Inference System (ANFIS).Genetic Neuro – Hybrid Systems- Back-Propagation Network (BPN). Genetic Fuzzy Rule Based Systems (GFRBSs). Supervised ARTMAP System.		
UNIT V	APPLICATIONS	6
Fusion Approach of Multi-spectral Images with SAR (Synthetic Aperture Radar),Optimization Salesman Problem using Genetic Algorithm Approach, Genetic Algorithm-Based Internet Search Technique, Soft Computing Based Hybrid Fuzzy Controllers.		
		TOTAL : 30

List of Experiments	
1. Implementation of fuzzy control/ inference system	
2. Programming exercise on classification with a discrete perceptron	
3. Implementation of XOR with back propagation algorithm	
4. Implementation of self organizing maps for a specific application	
5. Programming exercises on maximizing a function using Genetic algorithm	
6. Implementation of two input sine function	
7. Implementation of three input non linear function	
8. Mini Project - Develop a simple application using Hybrid Neural Network and Fuzzy Logic	
Contact Hours :	30
Total Contact Hours :	60

COURSE OUTCOMES:	
•	Understand the advanced neural networks for AI applications.
•	Understand the fundamentals of fuzzy logic operators and inference mechanisms.
•	Learn the functionality of Genetic Algorithms in Optimization problems.
•	Use hybrid techniques involving Neural networks and Fuzzy logic.
•	Apply soft computing techniques in real world applications.

TEXT BOOKS:	
1	S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
2	Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.

REFERENCES BOOKS:	
1.	Soft Computing And Its Applications By Matthew N. O Sadiku , Philip O. Adebo , Uwakwe C. Chukwu.,2023
2.	Soft Computing Engineering Applications Edited By <u>Pradip Debnath</u> , <u>Binod Chandra Tripathy</u> Copyright 2025
3.	S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO11	PO12	PSO 1	PSO2	PSO3
AI23B32.1	3	3	2	2	2	1	0	0	1	1	1	3	3	2	1
AI23B32.2	3	3	2	2	3	1	0	0	1	1	2	2	2	3	1
AI23B32.3	3	3	3	3	2	1	0	0	1	1	2	3	2	3	2
AI23B32.4	3	3	3	3	3	2	1	1	1	2	2	3	3	3	3
AI23B32.5	3	2	3	2	2	2	0	2	2	2	2	3	3	3	3
Average	3	2.8	2.6	2.4	2.4	1.4	0.2	0.6	1.2	1.4	1.8	2.8	2.6	2.8	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
IT23B31	C# and .NET Programming (Common to IT, AIML, AIDS, CSE, CSBS, CSE CS)	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To learn basic programming in C# and the object oriented programming concepts.
<ul style="list-style-type: none"> To study the advance programming concepts in C#.
<ul style="list-style-type: none"> To understand the working of base class libraries, their operations and manipulation of data using XML.
<ul style="list-style-type: none"> To update and enhance skills in writing Windows application, WPF, WCF and WWF with C# and .NET.
<ul style="list-style-type: none"> To implement mobile applications using .Net compact framework.

UNIT-I	C# LANGUAGE BASICS	6
.Net Architecture – Core C#– Objects and Types- – Inheritance- Generics – Arrays and Tuples – Operators and Casts.		
UNIT-II	C# ADVANCED FEATURES	6
Delegates – Lambdas – Events– Strings and Regular Expressions – Collections –Asynchronous Programming- Memory Management and Pointers – Errors and Exceptions – Reflection.		
UNIT-III	BASE CLASS LIBRARIES AND DATA MANIPULATION	6
Diagnostics -Tasks, Threads and Synchronization – Manipulating XML–ADO.NET- Peer-to-Peer Networking –Core Windows Presentation Foundation (WPF).		
UNIT-IV	WINDOW BASED APPLICATIONS, WCF AND WWF	6
Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)– Introduction to Web Services – .Net Remoting -Windows Service – Windows Workflow Foundation (WWF)		
UNIT-V	.NET FRAMEWORK AND COMPACT FRAMEWORK	6
Assemblies – Custom Hosting with CLR Objects – Core XAML – .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance .		
		Contact Hours: 30

List of Experiments			
1	Write a console application that obtains four int values from the user and displays the product. Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a double; the equivalent command to convert from a string to an int is Convert.ToInt32().		
2	Write an application that receives the following information from a set of students: Student Id: Student Name: Course Name: Date of Birth: The application should also display the information of all the students once the data is Entered. Implement this using an Array of Structures.		
3	Write a program to declare a class “staff” having data members as name and post. Accept this data 5 for 5 staffs and display names of staff who are HOD.		
4	Write a program to implement multilevel inheritance from following figure. Accept and display data for one student.		
5	Write a program to create a delegate called TrafficDel and a class called TrafficSignal with the following delegate methods. Public static void Yellow(){ Console.WriteLine(“Yellow Light Signal To Get Ready”); } Public static void Green(){ Console.WriteLine(“Green Light Signal To Go”); } Public static void Red(){ Console.WriteLine(“Red Light Signal To Stop”); } Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array.		
6	Write a program to accept a number from the user and throw an exception if the number is not an even number.		
7	Create an application that allows the user to enter a number in the textbox named “getnum”. Check whether the number in the textbox “getnum” is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button “check”.		
8	Create a project that calculates the total of fat, carbohydrate and protein. Allow the user to enter into text boxes. The grams of fat, grams of carbohydrate and grams of protein. Each gram of fat is 9 calories and protein or carbohydrate is 4 calories. Display the total calories of the current food item in a label. Use other labels to display and accumulated some of calories and the count of items entered. The form food have 3 text boxes for the user to enter the grams for each category include label next to each text box indicating what the user is enter.		
9	Database programs with ASP.NET and ADO.NET. Create a Web App to display all the Empname and Deptid of the employee from the database using SQL source control and bind it to GridView . Database fields are(DeptId, DeptName, EmpName, Salary).		
10	Programs using ASP.NET Server controls. Create the application that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within 21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters.		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Write various applications using C# Language.
<ul style="list-style-type: none"> • Write various applications using advanced C# concepts.
<ul style="list-style-type: none"> • Create window services, libraries and manipulating data using XML.
<ul style="list-style-type: none"> • Develop distributed applications using .NET Framework.
<ul style="list-style-type: none"> • Create mobile applications using .NET compact Framework.

Text Books(s)
1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, “Professional C# 2012 and .NET 4”, Wiley, 2012.
2. Andy Wigley, Daniel Moth, Peter Foot, “Mobile Development Handbook”, Microsoft Press, 2007.

Reference Books
1. Ian Gariffiths, Mathew Adams, Jesse Liberty, “Programming C# 4.0!”, OReilly, Fourth Edition, 2010.
2. D Andrew Troelsen, “Pro C# 5.0 and the .NET 4.5 Framework”, Apress publication, 2012.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	P O5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23B31.1	2	2	1	1	1	-	-	-	1	-	-	1	2	1	-
IT23B31.2	2	2	1	2	1	-	-	-	1	-	2	2	2	2	-
IT23B31.3	2	2	2	1	1	-	-	-	1	-	-	1	2	1	-
IT23B31.4	2	2	2	2	2	-	-	-	2	-	2	2	2	2	2
IT23B31.5	3	2	2	2	3	-	-	-	3	-	2	2	2	2	2
Average	2.2	2.0	1 6	1 6	1.6	-	-	-	1 6	-	2.0	1.6	2.0	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: “-“

Subject Code	Subject Name (Theory oriented Laboratory Course)	Category	L	T	P	C
CS23A34	User Interface Design (Common to CSE ,CSECS and IT)	PE	2	0	2	3

Objectives:

- Analyze application structures to organize content clearly.
- Construct Navigation that enables users to easily accomplish tasks.
- Design page layouts that support findability of hierarchical content and task completion.
- Determine how to display data to meet user needs.
- Construct effective forms with focused input controls.

UNIT I	INTRODUCTION	9
An overview of the user interface. Human factors in interface design: memory, chunking, recognition vs. recall. User interface design principles: user familiarity, consistency, minimal surprise, recoverability, user guidance, user diversity. Characteristics of Graphical User Interface: command line, menu selection, form fill-in, direct manipulation, anthropomorphic. Models of user interface - Generation of user interfaces-Graphical User Interface (GUI), Web User Interface (WUI), Voice User Interfaces (VUI), Tangible User Interfaces (TUI), Ubiquitous User Interfaces(UUI. Next generation of user interfaces.		
UNIT II	INTERFACE DESIGN METHODS	9
Interface Design Methods: Characteristics of a GUI. Information presentation. Interaction styles. Direct manipulation. Direct Manipulation advantages. Indirect manipulation. Command interfaces. Problems with command interfaces. Command languages. Natural language interfaces. User interface design process. Lifecycle models. A simple interaction design model. Traditional ‘waterfall’ life cycle. A life cycle for RAD (Rapid Applications Development). The Star lifecycle model. Usability engineering lifecycle model: features. Menu systems. Problems with menu systems. Multiple user interfaces. Help and message system. Guidelines for error messages. Task analysis and modeling. Content analysis. Work environment analysis.		
UNIT-III	IMPLEMENTATION OF GRAPHICAL USER INTERFACES	9
Correctly designed software- Software layers. Widgets, buttons, callbacks. Working principles of widgets. Project plan. UI design. Low-level prototypes. Evaluation: user-centered. Users’ steps.Evolving user understanding. Result. Colors. Layout.		
UNIT IV	DIALOG AND STORYBOARDS	9
Alignment on grids. I/O. Dialogs. Dialogs and storyboards. Input prototyping and design. Checks for inputs. Output. Data visualization. Examples. Challenges of visualization. Error messages.		
UNIT-V	TESTING AND USABILITY ASSESSMENT	9
Testing and Usability Assessment: User interface evaluation. Guiding principles for evaluation. Simple evaluation techniques. Process of evaluation. Approaches to evaluation. User observation. Preparing for user observation. Advantages of observation. Disadvantages of observation. Observation research tips. Importance of usability. Usability testing. Usability testing methods. Qualitative vs. Quantitative observation. Usability attributes. Testing.		

Formal vs. informal testing. Testing basics process.		
		Total Contact Hours : 45

Experiment No:	Title	Tools
1	Design a UI where users recall visual elements (e.g., icons or text chunks). Evaluate the effect of chunking on user memory.	Pencil Project, Figma.
2.	Develop and compare CLI, GUI, and Voice User Interfaces (VUI) for the same task and assess user satisfaction.	Python (Tkinter for GUI, Speech Recognition for VUI), Terminal
3.	Create a prototype with familiar and unfamiliar navigation elements. Evaluate ease of use with different user groups.	Proto.io, Wireflow
4	Design two interfaces: one with direct manipulation (drag-and-drop) and another with indirect commands. Compare usability.	JavaScript (with libraries like D3.js), HTML/CSS.)
5.	Conduct task analysis for an app (e.g., online shopping) and document user flows. Create corresponding wireframes.	Lucid chart (free tier), Dia (open source).
6.	Simulate the lifecycle stages for UI design using the RAD model and develop a small interactive interface.	Axure RP, OpenProj.
7.	Implement a form-based GUI using widgets (e.g., radio buttons, text inputs). Add event handling for user interactions.	PyQt, Tkinter.
8.	Experiment with different layouts and color schemes for an app. Collect user feedback on aesthetics and usability.	Figma (free version), GIMP (open source for graphics).
9.	Develop low-fidelity paper prototypes for a banking app and convert them into digital wireframes.	Pencil Project, Inkscape.
10.	Create storyboards to represent the user flow for a mobile app (e.g., food delivery app).	Balsamiq, OpenBoard
11.	Design input forms that validate data (e.g., email, phone number) and display error messages.	HTML/CSS, JavaScript (with Validator.js).
12.	Create a data visualization (e.g., pie charts, bar graphs) for an inventory management system.	Java Script
	Conduct a heuristic evaluation of a simple website based on Jakob	UsabilityHub, Google Sheets

13.	Nielsen's usability principles.	for evaluation recording.
14.	Perform usability testing on a small application, observing user interactions and documenting issues	OBS Studio for recording, Excel for data analysis.
15.	Execute both formal (structured) and informal (ad hoc) testing on a web application. Compare results.	Selenium, Jupyter Notebook

Suggested Activities:
<ul style="list-style-type: none"> ● Assignment problems, Quiz. ● Class presentation/Discussion
Course Outcomes: On completion of course you will be able to
<ul style="list-style-type: none"> ● Understand the importance of user interface and benefits of good design. ● Understand the user interface design process and business function ● Understand the types of system menus and navigation schemes. ● Understand the characteristics of windows and device based controls. ● Understand the screen based controls and kinds of tests.

Textbooks:
1. Wilbert O. Galitz The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, 3rd Edition
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction" Pearson, 5th Edition, 2015

Reference Books (s)/Web links:
1. SendPoints, GUI: Graphical User Interface Design, 2015
2. Jeff Johnson, Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines, Morgan Kaufmann

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A34.1	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS23A34.2	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS23A34.3	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS23A34.4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS23A34.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3	3	2.8	2.6	2.3	2.8	2.8	3	3	2.7	3	2.7	3	3

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
IT23B32	Advanced Web Programming (Common to IT, CSD)	PE	1	0	4	3

Objectives	
•	Understand the fundamentals of React Native and its integration with MERN stack technologies.
•	Learn the basics of Node.js, Express.js, and Next.js to build full-stack applications.
•	Gain hands-on experience in building real-world applications using modern web and mobile development tools.
•	Implement the techniques of integrating backend and front end.
•	Develop and test deployable applications with a focus on asynchronous workflows, REST APIs, and advanced React Native features.

UNIT - I	React Native Application with MERN	4
Mern Stack, Relevance of MERN, Range of MERN Applications, Selecting Developmental Tools, Setting up MERN Stack Technologies- Integrating Figma with React Native		
UNIT - II	NodeJs	3
Introduction to Node Js-Installing NodeJs-NodeJs core Modules-Synchronouous and Asynchronous File Operations – Integrating Nodejs and MangoDB		
UNIT - III	ExpressJS	3
Introduction to ExpressJs- Introduction to REST API and POSTMAN-Sending HTML and JSON Data Using ExpressJs- Partials in ExpressJs – Quesry Strings in ExpressJs		
UNIT IV	NextJS	3
Setting up nextjs, Styling the applications, Built-in Next JS Components, Pre rendering and publishing		
UNIT - V	Generative AI and ChatGPT	2
ChatGPT for Web Design- Prompt Engineering-integrating ChatGPT with React Native		
Contact Hours		15 Hours
List of Experiments		
1. Build a React Native app to help users manage their personal finances by tracking expenses, incomes, and budgets.		

<p>Features:</p> <ul style="list-style-type: none"> • User authentication (Sign up, Login, Logout) using Firebase or JWT. • Add, edit, and delete expense and income entries. • Categorize transactions (e.g., food, rent, entertainment). • Visualize spending patterns using charts (use libraries like react-native-chart-kit). • Sync data with a backend (Node.js/Express.js) for persistence.
<p>2. Create an app similar to Uber Eats or Swiggy for food delivery.</p> <p>Features:</p> <ul style="list-style-type: none"> • User registration and login. • Display a list of restaurants with their menus. • Add items to the cart and place orders. • Track order status (e.g., Pending, Delivered). • Payment gateway integration using Razorpay or Stripe.
<p>3. Develop an app for online education with video tutorials and quizzes.</p> <p>Features:</p> <ul style="list-style-type: none"> • User authentication and profile management. • Browse courses and view video content. • Take quizzes and view results. • Progress tracking for completed modules.
<p>4. Develop a system to manage employee data, including CRUD operations.</p> <p>Features:</p> <ul style="list-style-type: none"> • REST API to add, update, delete, and retrieve employee records. • Store employee data in a MongoDB or PostgreSQL database. • Include fields like name, role, department, and salary. • Implement role-based access control (e.g., admin, HR).
<p>5. Build the backend for an e-commerce platform.</p> <p>Features:</p> <ul style="list-style-type: none"> • Product management: Add, update, delete, and view products. • User registration and authentication. • Shopping cart and order management. • Payment gateway integration (e.g., Stripe, PayPal).
<p>6. Build an API to fetch and display weather data.</p> <p>Features:</p> <ul style="list-style-type: none"> • Fetch real-time weather data using a third-party API (e.g., OpenWeatherMap). • Store user preferences for location-based weather.

<ul style="list-style-type: none"> • Provide forecast data for multiple cities. • Cache weather data to reduce API calls.
<p>7. Build a Library Management System using Express.js with synchronous workflows.</p> <p>Features:</p> <ul style="list-style-type: none"> • CRUD operations for books and members. • View available books and their details. • Allow users to issue and return books. • Generate static reports for issued/available books.
<p>8. Build an Asynchronous real-time notification service for a task management app.</p> <p>Features:</p> <ul style="list-style-type: none"> • Create tasks and assign deadlines. • Send notifications to users when deadlines are near. • Use WebSocket or socket.io for real-time notifications. • Store tasks and notifications in a MongoDB database.
<p>9. Develop a fully functional e-commerce platform to sell products. The project will leverage Next.js features like SSR, static generation, and API routes to enhance user experience and improve search engine visibility.</p>
<p>10. Build a simple To-Do List app to test and deploy while focusing on core features and workflows.</p> <p>Features:</p> <ul style="list-style-type: none"> • Add, edit, delete, and mark tasks as complete. • Store tasks locally using AsyncStorage. • Include basic navigation using react-navigation. <p>Testing Focus:</p> <ul style="list-style-type: none"> • Unit Testing: Test individual components like TaskItem, AddTaskForm using React Native Testing • Integration Testing: Test the navigation and interaction between screens. • End-to-End Testing: Automate adding, editing, and deleting tasks using Detox. <p>Generate APK and AAB for Android and web deployment.</p>
Contact Hours : 60
Total Contact Hours : 75

Course Outcomes :
On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Build and deploy React Native applications using the MERN stack.
<ul style="list-style-type: none"> • Develop robust server-side applications with Node.js and Express.js.
<ul style="list-style-type: none"> • Create Next.js-based web applications with pre-rendering and publishing features.
<ul style="list-style-type: none"> • Integrate Generative AI and ChatGPT into React Native projects.
<ul style="list-style-type: none"> • Demonstrate skills in testing, debugging, and deploying full-stack applications.

Suggested Activities

Coding Competitions: Organize a coding competition where students solve real-world problems using the MERN stack.

Case Studies: Analyze and present solutions for existing applications, focusing on their architecture and implementation.

Code Reviews: Peer review sessions to improve coding standards and ensure best practices.

Suggest Evaluations Methods

1. Project Evaluation:

- Assess the progress of individual and group projects throughout the semester.
- Evaluate based on functionality, design, code quality, and presentation.

2. Final Project Presentation:

- Assess the final application based on completeness, innovation, deployment, and documentation.

3. Viva Voce:

- Oral examinations to test conceptual understanding and problem-solving abilities.

Text Books

1. Martin Krause, The Complete Developer Master Full Stack, No Scratch Press, Google Books, 2024.
2. Gaurav Garg, Full Stack Web Development With Next.js And Express.js, Amazon, Entrustech Inc , 2023.

References

1. Shama Hoque, Full-Stack React Projects: Modern web development using React 16, Node, Express, and MongoDB, Packt Publishers, 2018.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23B32.1	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B32.2	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B32.3	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B32.4	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B32. 5	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
Average	3	3	-	2	3	1	-	-	-	-	2	3	1	2	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
IT23B33	DevOps (Common to IT, AIML,AIDS,CSE, CSE CS,CSD,CSBS)	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> Understand the principles and practices of DevOps. Gain proficiency in using DevOps tools like Git, Jenkins, Docker, Kubernetes, and Helm. Learn to implement CI/CD pipelines for automation and efficiency. Explore advanced topics like DevSecOps, security testing, and reducing deployment downtime. Apply DevOps concepts to real-world applications and projects.

Unit – I	Introduction to DevOps	6
What is DevOps- DevOps Roots and Origin- Why Is DevOps Required- The DevOps Lifecycle and Workflow- DevOps Practices- DevOps Tools		
UNIT-II	DevOps CI/CD Pipeline	6
Managing Your Source Code with Git - Overviewing Git and its principal command lines- Understanding the Git process and Gitflow pattern- Continuous Integration and Continuous Delivery- CI/CD principles- Creating a CD pipeline – the release- Using GitLab CI- Using Jenkins for CI/CD implementation- Deploying Infrastructure as Code with CI/CD Pipelines-		
UNIT-III	Microservices with Docker and Kubernetes	6
Containerizing Your Application with Docker- Installing Docker- An overview of Docker's elements- Building and running a container on a local machine- Using Docker for running command-line tools- Docker Compose- Installing Kubernetes- Installing the Kubernetes dashboard- Using Helm as a package manager- Creating a CI/CD pipeline for Kubernetes with Azure Pipelines		
UNIT-IV	More on DevOps	6
Security in the DevOps Process with DevSecOps- Testing Azure infrastructure- Writing InSpec tests- Reducing Deployment Downtime- Blue-green deployment concepts and patterns- DevOps for Open Source Projects- pull requests- Sharing binaries- GitHub Actions- Analyzing code with SonarCloud		
UNIT-IV	DevOps Best Practices	6
Choosing the right tool- Writing all your configuration in code- Designing the system architecture- Building a good CI/CD pipeline- Shifting security left with DevSecOp- Applying web security and penetration testing with ZAP- Running performance tests with Postman		
Contact Hours:		30

List of Experiments	
1.	Exploring Git Commands through Collaborative Coding.
2.	Implement GitHub Operations
3.	Exploring Git Commands through Collaborative Coding.
4.	Implement GitHub Operations
5.	Applying CI/CD Principles to Web Development Using Jenkins, Git, and Local HTTP Server
6.	Exploring Containerization and Application Deployment with Docker
7.	Applying CI/CD Principles to Web Development Using Jenkins, Git, using Docker Containers
8.	Demonstrate Container Orchestration using Kubernetes.
9.	Create the GitHub Account to demonstrate CI/CD pipeline using Cloud Platform.
10.	Reduce the Downtime using Blue-Green Deployment
11.	Testing Project with ZAP and Postmen
	Contact Hours : 30
	Total Contact Hours : 60

Course Outcomes: Students will be able to	
•	Apply DevOps principles and lifecycle workflows to software development.
•	Build and manage CI/CD pipelines for application development and deployment.
•	Utilize tools like Docker and Kubernetes for containerization and orchestration.
•	Implement DevSecOps practices for secure and reliable deployments.
•	Demonstrate advanced DevOps practices such as blue-green deployment and testing.

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic	
•	Lab assessment:
•	Quizzes and Assignments
•	Group project

SUGGESTED ACTIVITIES

Case Study:

Evolution of DevOps in industry-leading companies. Group discussion on the DevOps lifecycle and workflow.

Code walkthrough:

Implementing a blue-green deployment strategy. Conducting security analysis using SonarCloud and GitHub Actions and walkthrough the code to the group.

Text Book(s):

1. Mark Reed, " DevOps The ultimate beginners guide to learn DevOps step by-step", Amazon,2019.
2. Craig Berg , "DevOps For Beginners: A Complete Guide To DevOps Best Practices, Second edition, Amazon , 2020.
3. Mikael Krief, "Learning Devops" , Second Edition, Packt Publisher, 2022.

Reference Books(s) / Web links:

1. DevOps Tutorial | Microsoft Azure
2. DevOps Fundamentals- Defining DevOps Principles - GitHub - GitHub Resources

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23B33.1	3	2	2	-	3	-	-	2	3	2	-	-	2	2	-
IT23B33.2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
IT23B33.3	3	3	3	3	3	2	3	3	3	3	2	3	3	3	3
IT23B33.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
IT23B33.5	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
Average	3	2.8	2.8	3	3	2	3	2.8	3	2.8	2.75	2.8	2.6	2.8	3

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
CS23A35	Web Application Security	PE	2	0	2	3
For B.E Programme CSE ,CSECS,CSD and B.Tech Programme in IT,AI ML & AIDS						

Objectives:
<ul style="list-style-type: none"> • To understand the fundamentals of Web Application Security • To know about web application authentication and authorization mechanism • To identify common web application vulnerabilities • To focus on wide aspects of secure development and deployment of web applications • To get insight about mitigations and countermeasures against web application attacks

UNIT I	INTRODUCTION	6
History of Software Security – OWASP Top Ten List 2021 – Input Validation – Attack Surface Reduction – Classifying and Prioritizing Threats		
UNIT II	WEB APPLICATION SECURITY PRINCIPLES	6
Authentication - Access Control Overview - Two Factor and Three Factor Authentication - Web Application Authentication – Authorization - Session Management Fundamentals - Securing Web Application Session Management		
UNIT-III	COMMON WEB APPLICATION VULNERABILITIES	6
Cross Site Scripting- Reflected XSS- Stored XSS- DOM based XSS- Mutation based XSS – Cross Site Request Forgery - SQL Injection – Code Injection – Insecure Direct Object References (IDOR)		
UNIT IV	SECURE DEVELOPMENT AND DEPLOYMENT	6
Application Security- Training- Threat Modelling- Secure Coding Libraries- Code Review- Security Testing- Security Incident Response Planning – Microsoft Security Development Lifecycle (SDL) – OWASP Comprehensive Lightweight Application Security Process (CLASP) – Software Assurance Maturity Model (SAMM)		
UNIT-V	MITIGATIONS AND COUNTERMEASURES	6
Anti XSS Coding Best Practices- Sanitizing User Input – Anti CSRF Coding Best Practices – Mitigating Against SQL Injection – Generic Injection Defenses – Defending Against IDOR – Architecture Level Mitigations		
Total Contact Hours		: 30

List of Experiments		
1	Identify security issues in web application – Walking An Application in TryHackMe Platform	
2	Burp Suite Basics in TryHackMe Platform	
3	OWASP ZAP to scan authenticated web application in TryHackMe Platform	
4	SQL Injection Lab in TryHackMe Platform	
5	Explore OWASP Top Ten -2021 Vulnerabilities in TryHackMe Platform	
6	SQLmap to exploit web application in TryHackMe Platform	
7	Exploit File Inclusion and Path Traversal Vulnerabilities in TryHackMe Platform	
8	Server Side Template Injection in TryHackMe Platform	
9	DejaVu Code Injection Vulnerability in TryHackMe Platform	
10	NoSQL Injection on MongoDB in TryHackMe Platform	
Contact Hours :		30
Total Contact Hours :		60

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

- Understand the fundamentals of web application security
- Apply security principles in developing a secure web application
- Identify common web vulnerabilities that are exploited by hackers
- Identify the secure model for web application development and deployment
- Apply best practices for mitigations of vulnerabilities

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

Textbooks:

1. Andrew Hoffman, “Web Application Security: Exploitations and Countermeasures for Modern Web Applications”, 2nd Edition, O’Reilly, 2024
2. Brian Sullivan and Vincent Liu, “Web Application Security: A Beginners Guide”, 1st Edition, McGrawHill, 2012

Reference Books (s)/Web links:
1. Ron Lepofsky, "The Manager's Guide to Web Application Security: A Concise Guide to the Weaker Side of the Web", Apress, 2015
2. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, Wiley, 2011
3. Joseph Marshall, "Hands-On Bug Hunting for Penetration Testers: A practical guide to help ethical hackers discover web application security flaws", Packt, 2018
4. https://owasp.org/www-project-top-ten/
5. https://tryhackme.com/r/hacktivities/search
6. https://portswigger.net/web-security/learning-paths

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A35.1	1	2	2	1	3	-	-	-	-	-	-	1	-	-	-
CS23A35.2	2	1	2	1	3	-	-	-	-	-	-	-	-	-	-
CS23A35.3	1	1	1	2	3	-	-	-	-	-	-	1	-	-	-
CS23A35.4	1	2	1	1	2	-	-	-	-	-	-	-	-	-	-
CS23A35.5	1	2	2	2	2	-	-	-	-	-	-	1	-	-	-
Average	1.2	1.6	1.6	1.4	2.6	-	-	-	-	-	-	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	Category	L	T	P	C
IT23B14	Advanced Java Programming (Common to IT, CSD)	PE	3	0	0	3

Objectives	
•	To understand the concepts of Multithreading.
•	To establish a connection between Java and database.
•	To learn and practice the Java servlets concepts.
•	To emphasis working architecture of Java Server Pages.
•	To understand the Model-View-Controller architecture implementing using Spring.

UNIT - I	Multithreading	9
Introduction to Threads- Thread Life Cycle- Thread Creation- Synchronization- Thread Safety and Deadlock.		
UNIT - II	Networking and Java Database Connectivity (JDBC)	9
Basics of networking- socket programming-Simple chat application - Establishing database connections - Executing SQL queries- PreparedStatement and CallableStatement.		
UNIT - III	Java Servlets	9
Introduction to Servlets- Servlet life cycle- Servlet containers-Servlet Configurations and Parameters- Initialization parameters- Context parameters-Handling Form Data- GET and POST methods- HTML forms and servlets.		
UNIT IV	Java Server Page (JSP)	9
Introduction to JSP-JSP life cycle-JSP expressions and declarations-Directives and Actions-Page directives-JSP actions and implicit objects-JSP Tag Libraries-Standard and Custom Tag Libraries-Expression Language (EL).		
UNIT - V	Model-View-Controller (MVC) Architecture	9
MVC Design Pattern-Separation of concerns-Implementing MVC in Java web applications- Introduction to Spring-Dependency Injection (DI) and Inversion of Control (IoC)-Spring AOP (Aspect-Oriented Programming)- Spring MVC -Configuring Spring MVC-Handling web requests.		
Contact Hours		45 Hours

Course Outcomes :	
On completion of the course, the students will be able to	
✓	Create programs to implement multithreading concepts
✓	Establish a connection between Java and Database.
✓	Develop a Java Servlets program using GET and POST methods
✓	Code, Create to implement Java Server page with simple applications.
✓	Develop a MVC applications with Spring MVC.

Suggested Activities
<ol style="list-style-type: none"> 1. Conduct Quizzes 2. Project based learning 3. Invite Speakers from Industry to show real time applications

Suggest Evaluations Methods
<ol style="list-style-type: none"> 1. Assign Individuals project and Team based projects to test their understand level. 2. Mini Project to implement JSP and MVC Spring 3. Conduct Quizzes.

Text Books:
1. Herbert Schildt, Dr. Danny Coward " Java: The Complete Reference", Thirteenth Edition, McGraw-Hill Publisher, January 2024
2. John Carnell " Spring Micro services in Action", Manning Publisher, July 2017
3. Kathy Sierra, Bryan Basham, Bert Bates ," Head First Servlets and JSP ", Publisher: O'Reilly Media, Inc, March 2008

References:
1. https://www.geeksforgeeks.org/multithreading-in-java/
2. https://www.javatpoint.com/example-to-connect-to-the-mysql-database
3. https://www.javatpoint.com/servlet-tutorial
4. https://www.tutorialspoint.com/jsp/index.htm
5. https://www.geeksforgeeks.org/mvc-framework-introduction/
6. https://www.javatpoint.com/spring-tutorial

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23B14.1	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B14.2	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B14.3	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B14.4	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
IT23B14.5	3	3	-	2	3	1	-	-	-	-	2	3	1	2	1
Average	3	3	-	2	3	1	-	-	-	-	2	3	1	2	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 (Theory course)	Category	L	T	P	C
IT23C11	Business Intelligence	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To understand the basics and advantages of business intelligence. To be able to incorporate Data Integration and Enterprise Application Integration.
<ul style="list-style-type: none"> To understand Transaction Processing and Analytical applications and the need for Business Intelligence. To create actionable business information for managing multidimensional data modelling concepts To create enterprise reporting and dashboard to enable students to make better and more informed business decisions.

UNIT-I	INTRODUCTION TO BUSINESS INTELLIGENCE	9
Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities		
UNIT-II	BASICS OF DATA INTEGRATION	9
Information integration, Enterprise Application integration, Web Services-Management Issues- Parallelism Granularity-Dependence, Data Enhancement-Incremental Enhancement- Batch Enhancements-Standardized Enterprise Application Ingratiation.		
UNIT-III	EXTRACTION TRANSFORMATION LOADING	9
Introduction to ETL using SSIS, Data Quality-Data Cleansing-data profiling -Knowledge Discovery and Data Mining-Public Data-Unstructured Data-Data Resources-Source data transformation-Reconciliation-ETL Testing.		
UNIT-IV	INTRODUCTION TO MULTI-DIMENSIONAL DATAMODELING	9
Introduction to data and dimension modelling, multidimensional data model, ER Modelling vs. multi-dimensional modelling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.		
UNIT-V	BASICS OF ENTERPRISE REPORTING	9
Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS		
Total Contact Hours:45		

Course Outcomes:

- To apply business intelligence concepts in business.
- To understand Data Integration and Enterprise Application Integration concepts.
- To Differentiate between Transaction Processing and Analytical applications and the need for Business Intelligence
- To understand actionable business information for managing multidimensional data modelling concepts.
- Design an enterprise dashboard as the key performance indicators to help in decision making.

Text Book(s):

1. David Loshin and David Loshin, “Business Intelligence”, First Edition, 2003.
2. Mike Biere, “Business intelligence for the enterprise”, Pearson Publication, First Edition, June 2003.

Reference Books(s) / Web links:

1. Larissa Terpeluk Moss, ShakuAtre , “Business intelligence roadmap” , First Edition, Addison-Wesley Professional, February 2003
2. CindiHowson, “Successful Business Intelligence: Secrets to making Killer BI Applications” McGraw-Hill Education, Second Edition, 2013.
3. Brain, Larson, “Delivering business intelligence with Microsoft SQL server 2008”, McGraw-Hill Education, 2008.
4. Lynn Langit, “Foundations of SQL Server 2005 Business Intelligence”, 2007.
5. Stephen Few, “Information dashboard design”, McGraw-Hill Education, 2000.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning
- Implementation of small module

SUGGESTED EVALUATION METHODS

- Assignment problems
- Quizzes
- Class Presentation/Discussion

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23C11.1	3	3	-	2	3	1	-	-	-	-	2	3	3	2	2
IT23C11.2	3	3	-	2	3	1	-	-	-	-	2	3	3	2	2
IT23C11.3	3	3	-	2	3	1	-	-	-	-	2	3	3	2	2
IT23C11.4	3	3	-	2	3	1	-	-	-	-	2	3	3	2	2
IT23C11.5	3	3	-	2	3	1	-	-	-	-	2	3	3	2	2
Average	3	3	-	2	3	1	-	-	-	-	2	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: “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT23C12	Software Project Management (Common to IT, CSE, AIDS, CSD)	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> This course describes the key aspects of a software project. It introduces the basic principles of Engineering Software Projects. Most, if not all, students' complete projects as part of assignments in various courses undertaken. The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development.

UNIT-I	SOFTWARE DEVELOPMENT PROCESS	9
Defining of Software Development Process - Process - Tailoring the Process – Improving the process discipline - Need for implementing discipline. Software Production Process - Identify the Software Model - Software Process Models : Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model - Software Life Cycle.		
UNIT-II	SOFTWARE PROJECT MANAGEMENT	9
Introduction to Software Project Management- Software Projects – ways of categorizing software projects – problems with software projects – Project Life Cycle– Management -Setting objectives –Stakeholders – Project Team- Step-wise : An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.		
UNIT-III	SOFTWARE PLANNING	9
Activity planning– project schedules – sequencing and scheduling projects – Network planning model – AON and AOA-identifying critical activities-Crashing And Fast Tracking-,Risk management—Categories , Risk planning, Management and Control – Evaluating risks to the schedule. PERT- Resource Allocation, Monitoring and Tracking – Monitoring and control – allocation – identifying resource requirements – scheduling resources – creating critical paths – publishing schedule – cost schedules- sequence schedule.		
UNIT-IV	SOFTWARE SPECIFICATIONS	9
Product Specifications - Defining the Final Product - Data Flow Diagram, Data Dictionary, Structured English, Decision Trees, Decision Tables - Feasibility Study. Software Testing : Test Plan - Development Testing : Verification and Validation - General Testing Methods : White Box and Black Box Testing - Unit Testing – System Integration Testing - Validation Testing - System testing.		
UNIT-V	SOFTWARE QUALITY	9
Software Quality - Quality Measures - FURPS - Software Quality Assurance – Software Reviews - Format Technical Review (FTR) Formal Approaches to SQA – Software Reliability - Introduction to SQA - The Software Quality Assurance Plan – Formal approaches to SQA - Clean room Methodology.		
Total Contact Hours:45		

Course Outcomes:

- Apply project management concepts and techniques to an IT project.
- Identify issues that could lead to IT project success or failure.
- Explain project management in terms of the software development process.
- Describe the responsibilities of IT project managers.
- Apply project management concepts through working in a group as team leader

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning
- Implementation of small module

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Fifth Edition, Tata McGraw Hill, New Delhi, 2017.
2. Pressman R S, "Software Engineering - A Practitioner's Approach", 9th Edition, Tata McGrawHill Book Company, 2023.

Reference Books(s) / Web links:

1. Gerardus Blokdyk, "Software Project Management: A Complete Guide", 5STARCOOKS, 2020
2. Harold Kerzner, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", 13th Edition, Wiley, 2022
3. Project Management Institute (PMI), "A Guide to the Project Management Body of Knowledge", Seventh Edition, Project Management Institute, 2021

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23C12.1	1	2	3	-	1	-	-	1	2	2	3	3	2	2	2
IT23C12.2	2	1	2	-	2	-	-	-	1	2	2	2	3	2	1
IT23C12.3	2	2	2	-	1	-	-	1	-	2	2	2	2	2	2
IT23C12.4	1	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C12.5	2	2	3	-	1	-	-	1	-	2	2	1	2	1	2
Average	1.7	1.8	2.6	-	1.4	-	-	1	1.3	2	2	1.8	2.4	1.7	1.8

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
IT23C13	Startup Management	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To develop a start-up Enterprise with Big Idea Generation.
<ul style="list-style-type: none"> To analyse start-up capital requirement by analysing legal factors.
<ul style="list-style-type: none"> To interpret feasibility Analysis towards funding issues.
<ul style="list-style-type: none"> To access growth stages in new venture and reasons for scaling ventures.
<ul style="list-style-type: none"> To evaluate the application of theory to start up business.

UNIT-I	Opportunities	9
The New Industrial Revolution – The Big Idea- Generate Ideas with Brainstorming- Business Start-up - Ideation- Venture Choices - The Rise of the Start-up Economy - The Six Forces of Change- The Start-up Equation – The Entrepreneurial Ecosystem – Entrepreneurship in India. Government Initiatives.		
UNIT-II	Start-up Capital Requirements and Legal Environment	9
Identifying Start-up capital Resource requirements - estimating Startup cash requirements - Develop financial assumptions -Constructing a Process Map - Positioning the venture in the value chain - Launch strategy to reduce risks- Start-up financing metrics - The Legal Environment- Approval for New Ventures Taxes or duties payable for new ventures.		
UNIT-III	Financial Issues	9
Feasibility Analysis - The cost and process of raising capital – Unique funding issues of a high-tech ventures - Funding with Equity – Financing with Debt- Funding start-ups with bootstrapping- crowd funding- strategic alliances.		
UNIT-IV	Support Institutions and Management Process	9
Director of Industries; DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUED; State Financial Corporation SFC; Information: assistance from different organizations in setting up a new venture, technology parks, industrial corporations, directorate of industries / cottage and small scale industries, SISI, Khadi & Village Industries Corporation / Board. Laws : Liabilities under the Factories Act, Shops & Establishment Act, Industrial Employment (Standing Orders) Act, Environment Protection Act, Sale of Goods Act, maintenance & submission of statutory records & returns, understanding labour - management relationship.		
UNIT-V	Case Studies	9
Diagnostic case studies of successful / unsuccessful entrepreneurs, key variables explaining success / failures, industrial sickness, industrial reconstruction, technology obsolescence, technology, transfer.		
Total Contact Hours: 45		

Course Outcomes:

- Develop a start-up Enterprise with Big Idea Generation.
- Analyze start-up capital requirement by analyzing legal factors.
- Interpret feasibility Analysis towards funding issues.
- Access growth stages in new venture and reasons for scaling ventures.
- Evaluate the application of theory to start up business .

Text Book(s):

1. Aurangabadkar P, Singh S, Startup and New Venture Management. Nirali Prakashan. Edition 1, 2018.
2. Fred Haney, The Fundable Startup: How Disruptive Companies Attract Capital. Select Books, Edition 1, 2018.
3. David S. Rose, Angel Investing: The Gust Guide, Wiley, Edition 2, 2020.
4. Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016

Reference Books(s) / Web links:

1. Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur's Road Map, 2nd Edition, Routledge, 2017.
2. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016.

SUGGESTED ACTIVITIES

- Case study Discussion
- Flipped classroom –Capital Requirement.
- Activity Based Learning: -
Mind Mapping-Funding Start-up's,
Gallery Walk-Supporting Institutions,
Role Play-Key variables for an successful Start-up.

SUGGESTED EVALUATION METHODS

- Mini Projects
- Assignment problems
- Quizzes

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23C13.1	1	2	3	-	1	-	-	1	2	2	3	3	2	2	2
IT23C13.2	2	1	2	-	2	-	-	-	1	2	2	2	3	2	2
IT23C13.3	2	2	2	-	1	-	-	1	-	2	2	2	2	2	2
IT23C13.4	1	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C13.5	2	2	3	-	1	-	-	1	-	2	2	1	2	1	2
Average	1.7	1.8	2.6	-	1.4	-	-	1	1.3	2	2	1.8	2.4	1.7	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
IT23C14	Lateral Thinking Techniques	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To develop a basic nature of lateral thinking.
<ul style="list-style-type: none"> To analyze the factors that support thinking process.
<ul style="list-style-type: none"> To interpret feasibility Analysis towards making decisions.
<ul style="list-style-type: none"> To access growth stages in deliberate thinking.
<ul style="list-style-type: none"> To evaluate the lateral leadership course.

UNIT-I	Introduction	9
The Way the Mind Works- Difference between lateral and vertical thinking- Attitudes towards lateral thinking- Basic Nature of Lateral Thinking- The use of Lateral thinking- Techniques- The generation of Alternatives-type of problem.		
UNIT-II	Lateral Thinking	9
Pattern Changing- Humour- Hindsight and insight- Creativity and lateral thinking- Lateral thinking as a process- Judgement and provocation- The word 'po'- The stepping stone method- The escape method- The random stimulation method- General use of lateral thinking- The logic of lateral Thinking.		
UNIT-III	Making Decisions	9
Decision Pre-frame- Generation of alternatives- Values and Priorities- The dice method- The easy way out method- The spell out method- Buriden's ass method- The ideal solution method- The best home method- The what if? Method- The simple matrix method- The full matrix method- The laziness method- Decision post method- Emphasis on Fit-The Future.		
UNIT-IV	Deliberate Thinking	9
Deliberate- Focused- Confident- Enjoyable- Self Image- Time Discipline- Harvesting- Thinking about thinking- The TEC framework- The 5 minute think- symbolic TEC- PISCO- Symbolic PISCO- TEC-PISCO- Deliberate practice of Thinking- Thinking Clubs- General Thinking Skills- Formal and informal		
UNIT-V	The Lateral Leadership Course	9
Phase 1: Icebreakers And Energizers To Start- Phase 2: Brainstorming To Start The Flow- Phase 3: The Vision And Its Components- Phase 4: Creative Exercises- Phase 5: Strategy, Goals And Objectives- Phase 6: Questioning Exercises- Phase 7: Communications Plan- Phase 8: Staff Issues And Empowerment- Phase 9: Competitive And Product Workshop- Phase 10: Innovation Process And Gating Plan- Phase 11: Summary And Action List- Phase 12: Follow-Up Session.		
Total Contact Hours: 45		

Course Outcomes:

- Develop a basic nature of lateral thinking.
- Analyse the factors that support thinking process.
- Interpret feasibility Analysis towards making decisions.
- Access growth stages in deliberate thinking.
- Evaluate the lateral leadership course.

Text Book(s):

1. De Bono, Edward, Lateral Thinking PB: Creativity Step by Step, Harper Perennial , 24 February 2015.
2. Paul Sloane, The Leader's Guide to Lateral Thinking Skills: : Unlocking the Creativity and Innovation in You and Your Team, 2nd ed., Kogan Page India, New Delhi, 2008.

Reference Books(s) / Web links:

1. De Bone, Edward de bono "Thinking Course", https://ia800303.us.archive.org/19/items/pdfy-RP-OuErwuZWp4xkk/deBonos_thinking_course_text.pdf

SUGGESTED ACTIVITIES

- Case study Discussion
- Flipped classroom –Various methods of lateral thinking.
- Activity Based Learning: -
Mind Mapping-Making Decisions,
Gallery Walk-Deliberate Thinking,
Role Play-Lateral Leadership course.

SUGGESTED EVALUATION METHODS

- Mini Projects
- Assignment problems
- Quizzes

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23C14.1	1	2	3	-	1	-	-	2	2	2	3	3	2	2	2
IT23C14.2	2	1	2	-	2	-	-	-	1	2	2	2	3	2	2
IT23C14.3	2	2	2	-	1	-	-	2	-	2	2	2	2	2	2
IT23C14.4	1	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C14.5	2	2	3	-	1	-	-	2	-	2	2	1	2	1	2
Average	1.7	1.8	2.6	-	1.4	-	-	2	1.3	2	2	1.8	2.4	1.7	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
IT23C15	Software Quality Assurance	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> • Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
<ul style="list-style-type: none"> • Understand the integration of SQA components into the project life cycle.
<ul style="list-style-type: none"> • Be familiar with the software quality infrastructure.
<ul style="list-style-type: none"> • Be exposed to the management components of software quality.
<ul style="list-style-type: none"> • Be familiar with the Quality standards, certifications and assessments

UNIT-I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	9
Need for Software quality – Software quality assurance (SQA) – Software quality factors- McCall’s quality model – SQA system components – Pre project quality components – Development and quality plans.		
UNIT-II	SQA COMPONENTS AND PROJECT LIFE CYCLE	9
Integrating quality activities in the project life cycle – Reviews – Software Testing – Quality of software maintenance components – Quality assurance for external participants contribution – CASE tools for software quality Management.		
UNIT-III	SOFTWARE QUALITY INFRASTRUCTURE	9
Procedures and work instructions – Supporting quality devices - Staff training and certification - Corrective and preventive actions – Configuration management – Software change control – Configuration management audit - Documentation control.		
UNIT-IV	SOFTWARE QUALITY MANAGEMENT & METRICS	9
Project process control – Software quality metrics – Cost of software quality – Classical quality cost model – Extended model – Application and Problems in application of Cost model		
UNIT-V	STANDARDS, CERTIFICATIONS & ASSESSMENTS	9
Quality management standards – ISO 27001–ISO/IEC 27001- Capability Maturity Models – CMM and CMMI assessment methodologies – Bootstrap methodology – SPICE Project – SQA project process standards – Organization of Quality Assurance – Role of management in SQA – SQA units and other actors in SQA systems.		
		Total Contact Hours:45

Course Outcomes:
<ul style="list-style-type: none"> Utilize the concepts of SQA in software development life cycle
<ul style="list-style-type: none"> Demonstrate their capability to adopt quality standards.
<ul style="list-style-type: none"> Assess the quality of software products.
<ul style="list-style-type: none"> Apply the concepts in preparing the quality plan & documents.
<ul style="list-style-type: none"> Ensure whether the product meets company's quality standards and client's expectations demands.

Text Book(s):
1. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Addison Wesley, 2003.
2. Galin, Daniel, "Software Quality Assurance", India Pearson 2009
3. Software Quality Assurance By Claude Y. Laporte and Alain April Wiley-IEEE Computer Society Press January 2018
4. ISO 27001 Climate Change Amendment By Scott Dawson May 14, 2024

Reference Books(s) / Web links:
1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.
2. Kshirasagar Naim and Priyadarshi Tripathy, "Software Testing and Quality Assurance Theory and Practice", John Wiley & Sons Inc., 2008.
3. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 2014.

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23C15.1	2	2	3	-	1	-	-	2	2	2	3	3	2	2	2
IT23C15.2	2	1	2	-	2	-	-	-	1	2	2	2	3	2	2
IT23C15.3	2	2	2	-	1	-	-	2	-	2	2	2	2	2	2
IT23C15.4	2	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C15.5	2	2	3	-	1	-	-	2	-	2	2	1	2	1	2
Average	2	1.8	2.6	-	1.4	-	-	2	1.3	2	2	1.8	2.4	1.7	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
IT23C16	Green Computing	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To learn the fundamentals of Green Computing. To describe the Green computing assets and business management To analyze the Green computing Grid Framework. To understand the various information systems. To study and develop various case studies.

UNIT-I	FUNDAMENTALS	9
Green IT Fundamentals: Business, IT, and the Environment - Green IT Strategies: Range of Impact, Green Strategic Alignment, Proactive Green Strategies, Reactive Green Strategies- Green IT Drivers- Green IT Business Dimensions and Goal- Environmental : Policies, Practices, and Metrics		
UNIT-II	GREEN ASSETS AND BUSINESS PROCESS MANAGEMENT	9
Green Assets: Building and Facility Management ,Green IT Hardware-Green Data Centers, Networks, and Devices- Green Business Process Management: Modeling, Optimization, and Collaboration		
UNIT-III	GREEN ENTERPRISE ARCHITECTURE	9
Green Enterprise Architecture-Categoriess- Green IT and Organizational Systems-- Evolving Green Systems Architecture - Green Solutions Architecture - Green Supply Chain Management – Mobility - Green Portals in Green Enterprise Architecture- Business Intelligence and Green IT-The Environmental Intelligence Domain and Systems’ Evolving Complexity - Communication Channels, Web Services and Mobility.		
UNIT-IV	GREEN INFORMATION SYSTEMS	9
Green Information System (GIS): Phases, Features , Modeling and Architecture - GIS Requirements - Use Case Diagram for GOP- Class Diagram for GOP - Sequence Diagram for Emissions Check - Class Diagram for RSP - Sequence Diagram for Setting Standard Emissions Value.		
UNIT-V	CASE STUDIES	9
The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.		
Total Contact Hours: 45		

Course Outcomes:
<ul style="list-style-type: none"> Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment. Understand the ways to build various facilities and business models. Enhance the skill in energy saving practices in their use of hardware. Evaluate information systems that can reduce paper waste. Apply the green computing in various areas.

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

- Survey on green computing Problem.
- Building the business models
- Activity Based Learning
- Implementation of small module

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

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Bhuvan Unhelkar, “Green IT Strategies and Applications-Using Environmental Intelligence”, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, “Green Home computing for dummies”, August 2012.
3. John Lamb, “The Greening of IT”, Pearson Education, 2009

Reference Books(s) / Web links:

1. Alin Gales, Michael Schaefer, Mike Ebbers, “Green Data Center: steps for the Journey”, Shroff/IBM rebook, 2011.
2. Carl speshocky, “Empowering Green Initiatives with IT”, John Wiley & Sons, 2010.
3. Wu Chun Feng (editor), “Green computing: Large Scale energy efficiency”, CRC Press
4. Jason Harris, “Green Computing and Green IT- Best Practices on regulations & industry”, Lulu.com, 2008.

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23C16.1	3	–	2	–	–	–	–	–	–	2	–	–	–	–	2
IT23C16.2	3	2	3	–	3	2	–	–	–	–	–	3	–	2	2
IT23C16.3	3	3	3	–	3	2	–	–	–	1	–	3	–	3	1
IT23C16.4	3	2	3	3	3	2	–	1	2	2	2	3	1	2	3
IT23C16.5	3	3	3	3	3	2	2	1	2	2	3	3	3	3	3
Average	3	2.5	2.8	3	3	2	2	1	2	1.75	2.5	3	2	2.5	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 (Theory Course)	Category	L	T	P	C
IT23C17	Ubiquitous Computing (Common to IT, CSE, AIDS, AIDL)	PE	3	0	0	3

Objectives:
1. Understand the fundamental concepts and principles of ubiquitous computing.
2. Understand the architecture, lifecycle, and integration of smart devices and services in modern technological ecosystems.
3. Design and develop basic ubiquitous computing systems or applications.
4. Explore the principles and design of intelligent systems, focusing on interaction, autonomy, and artificial life.
5. Communicate effectively about ubiquitous computing concepts and applications.

UNIT-I	INTRODUCTION	9
Applications- Properties- Implicit Human Computer Interaction- Ubiquitous System Environment Interaction - Architectural Design for UbiCom Systems- Applications and Requirements: Example Early UbiCom Research Projects, Everyday Applications in the Virtual, Human and Physical World		
UNIT-II	SMART DEVICES	9
Smart Devices and Services - Service Architecture Models - Service Provision Life Cycle - Virtual Machines and Operating Systems- Smart Mobile Devices, Users, Resources and Code- Operating Systems for Mobile Computers and Communicator Devices - Smart Card Devices- Device Networks		
UNIT-III	HUMAN COMPUTER INTERACTION	9
Basic Concepts - User Interfaces and Interaction for Four Widely Used Devices - Hidden UI Via Basic Smart Devices - Hidden UI Via Wearable and Implanted Devices - Human Centred Design (HCD) - Tagging the Physical World - Sensors and Sensor Networks - Control Systems - Robots		
UNIT-IV	INTELLIGENT SYSTEMS	9
Basic Concepts , IS Architectures , IS System Operations - Interaction Multiplicity- Interaction Design -Generic Intelligent Interaction Applications- Autonomous Systems and Artificial Life		
UNIT-V	UBIQUITOUS COMMUNICATION	9
Audio Networks, Data Networks, Wireless Data Networks and Ubiquitous Networks- Managing Smart Devices in Virtual Environments and Human User Centered Environments		
Total Contact Hours: 45		

Course Outcomes:

1. Gain a comprehensive understanding of the principles and concepts underlying ubiquitous computing.
2. Design and implement service-oriented solutions leveraging smart devices and networks.
3. Understanding ubiquitous computing applications across various platforms, including mobile, wearable, and IoT devices.
4. Design intelligent systems with effective interaction and autonomous capabilities.
5. Apply ubiquitous computing principles to solve real-world problems and challenges such as healthcare, smart cities, and personalized services.

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

- Case study on ubiquitous computing
- Survey on various application
- Activity Based Learning
- Implementation of small module

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

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Stefan Poslad ,” Ubiquitous Computing Smart Devices, Environments and Interactions”, Wiley, First Edition, 2009.
2. Frank Adelstein, Sandeep K. S. Gupta, Golden G. Richard III, and Loren Schwiebert , “ Fundamentals of Mobile and Pervasive Computing” , McGraw-Hill, 2005.
3. John Krumm , “Ubiquitous Computing Fundamentals”, Chapman and Hall/CRC, 2009.

Reference Books(s) / Web links:

1. Hideyuki Nakashima, Hamid Aghajan, and Juan Carlos Augusto , “Handbook of Ambient Intelligence and Smart Environments”, *Springer-Verlag*, 2010.
2. Adam Greenfield , “ Everywhere: The Dawning Age of Ubiquitous Computing”, New Riders, First Edition, 2010.
3. Olivier Hersent, David Boswarthick, and Omar Elloumi , “The Internet of Things: Key Applications and Protocols” John Wiley & Sons Inc, Second Edition, 2012

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23C17.1	3	2	3	-	1	-	-	1	2	2	3	3	2	2	2
IT23C17.2	3	2	2	-	2	-	-	-	1	2	2	2	3	2	2
IT23C17.3	3	2	2	-	1	-	-	1	-	2	2	2	2	2	2
IT23C17.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C17.5	3	2	3	-	1	-	-	1	-	2	2	1	2	1	2
Average	3	2	2.6	-	1.4	-	-	1	1.3	2	2	1.8	2.4	1.7	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
IT23C18	Agile Methodologies	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
<ul style="list-style-type: none"> To provide a good understanding of software design and a set of software technologies and APIs.
<ul style="list-style-type: none"> To do a detailed examination and demonstration of Agile development and testing techniques.
<ul style="list-style-type: none"> To understand the benefits and pitfalls of working in an Agile team.
<ul style="list-style-type: none"> To understand Agile development and testing.

UNIT-I	AGILE METHODOLOGY	9
Theories for Agile Management - Management Accounting for Systems - TOC in Software Production- Dealing with Uncertainty - Software Production Metrics - Agile Project Management - Agile Project Planning- The Agile Manager's New Work.		
UNIT-II	DEVELOPMENT MANAGEMENT	9
Agile Development Management - Software Resource Planning - Governing Rules- Staffing Decisions- Management in the IT Department- Product Management- Financial Metrics for Software Services		
UNIT-III	AGILE METHODS	9
Production Metrics for Traditional Methods- Financial Metrics in Traditional Methods - Production Metrics in FDD - Project Management with FDD- FDD Process Elements- Financial Metrics in FDD		
UNIT-IV	PRODUCTION METRICS	9
Production Metrics in Extreme Programming - XP Process Elements- Financial Metrics in XP- Production Metrics in Scrum- Scrum Process Elements		
UNIT-V	COMPARISON OF METHODS	9
Devil's Advocacy- States of Control and Reducing Variation- Comparison of Production Metrics- Applicability of Agile Methods		
Total Contact Hours: 45		

Course Outcomes:

Realize the importance of interacting with business stakeholders in determining the requirements for a software system

Perform iterative software development processes: how to plan them, how to execute them.

Develop techniques and tools for improving team collaboration and software quality.

Perform Software process improvement as an ongoing task for development teams.

Show how agile approaches can be scaled up to the enterprise level.

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

- Problem solving sessions
- Survey on various methods.
- Activity Based Learning
- Implementation of small module

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

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.

2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

Reference Books(s) / Web links:

1. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Addison-Wesley, 2004.

2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Butterworth-Heinemann, 2007.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23C18.1	3	2	3	-	1	-	-	1	2	2	3	3	2	2	2
IT23C18.2	3	2	2	-	2	-	-	-	1	2	2	2	3	2	2
IT23C18.3	3	2	2	-	1	-	-	1	-	2	2	2	2	2	2
IT23C18.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C18.5	3	2	3	-	1	-	-	1	-	2	2	1	2	1	2
Average	3	2	2.6	-	1.4	-	-	1	1.3	2	2	1.8	2.4	1.7	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
IT23C31	Software Testing (Common to IT, CSE, CSE CS, AIML, AIDS, CSBS, CSD)	PE	2	0	2	3

Objectives:						
<ul style="list-style-type: none"> To learn the criteria for test cases 						
<ul style="list-style-type: none"> To learn the design of test cases. 						
<ul style="list-style-type: none"> To understand test management and test automation techniques 						
<ul style="list-style-type: none"> To understand test management and test structure group 						
<ul style="list-style-type: none"> To apply test metrics and measurements 						
UNIT-I	INTRODUCTION					6
Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design						
UNIT-II	TEST CASE DESIGN STRATEGIES					6
Test case Design Strategies – Using Black Box Approach to Test Case Design – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Secured Code Writing – code complexity testing						
UNIT-III	LEVELS OF TESTING					6
The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests –Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing .						
UNIT-IV	TEST MANAGEMENT					6
People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group.						
UNIT-V	TEST AUTOMATION					6
Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics						
Total Contact Hours: 30						

Description of the Experiments	Total Contact Hours: 30
1. Demonstrate the working of the following a. constructs: i) do...while ii) while....do iii) if...else iv) switch v) for	
2. Take any system (e.g. ATM system) and study its system specifications and report the various bug	
3. Write the test cases for any known application (e.g. Banking application)	
4. Create a test plan document for any application (e.g. Library Management System)	
5. Study of any testing tool (e.g. Win runner)	
6. Study of any web testing tool (e.g. Selenium)	
7. Study of any bug tracking tool (e.g. Bugzilla, bugbit)	
8. Study of any test management tool (e.g. Test Director)	
9. Study of any open source-testing tool (e.g. Test Link)	

Course Outcomes:
At the end of the course the students will be able to
<ul style="list-style-type: none"> Design test cases suitable for a software development for different domains
<ul style="list-style-type: none"> Identify suitable tests to be carried out
<ul style="list-style-type: none"> Prepare test planning based on the document
<ul style="list-style-type: none"> Document test plans and test cases designed
<ul style="list-style-type: none"> Use automatic testing tools and Develop and validate a test plan

SUGGESTED ACTIVITIES (if any)
<ul style="list-style-type: none"> Survey on various Testing technologies Activity Based Learning

SUGGESTED EVALUATION METHODS (if Any)
<ul style="list-style-type: none"> Assignment problems Quizzes Class Presentation/Discussion

Text Book(s):
1. Andreas Spillner, Tilo Linz, "Software Testing Foundations", 5th Edition, O'Reilly Publisher, 2021.
2. Arnon Axelrod, "Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects ", Apress Publisher, 1st Edition, September 2018

Reference Books(s) / Web links:

1. Ilene Burnstein, "Practical Software Testing: A Process Oriented Approach", Springer International Edition, December 2010.
2. James Whittaker , Jason Arbon , Jeff Carollo , "How Google Tests Software", 1st Edition, Addison Wesley, 2012
3. Rex Black Erik van Veenendaal, Dorothy Graham , "Foundations of Software Testing ISTQB Certification" , 3rd Edition, Cengage Publications, 2015

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23C31.1	3	2	3	-	1	-	-	1	2	2	3	3	2	2	2
IT23C31.2	3	2	3	-	2	-	-	-	1	2	2	2	3	2	2
IT23C31.3	3	2	3	-	1	-	-	1	-	2	2	2	2	2	2
IT23C31.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23C31.5	3	2	3	-	1	-	-	1	-	2	2	1	2	1	2
Average	3	2	3	-	1.4	-	-	1	1.3	2	2	1.8	2.4	1.7	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 Courses)	Category	L	T	P	C
AD23A31	Customer Analytics and Opinion Mining	PE	2	0	2	3

Objectives:	
•	To Understand the fundamentals of customer analytics and its role in modern marketing.
•	To Learn sentiment analysis techniques to mine opinions, sentiments, and emotions from customer feedback.
•	To Explore digital analytics tools to measure customer behavior and marketing performance.
•	To Develop skills to segment customers and predict future trends using data.
•	To Understand key marketing metrics and how to evaluate the effectiveness of marketing campaigns.

UNIT-I	INTRODUCTION TO CUSTOMER ANALYTICS	6
Overview of customer analytics and its significance in modern marketing, Data sources for customer analytics: Social media, customer reviews, surveys, Introduction to opinion mining and its applications.		
UNIT-II	SENTIMENT ANALYSIS TECHNIQUES	6
Fundamentals of sentiment analysis, Supervised and unsupervised learning techniques, Opinion summarization and applications in business, Tools and platforms for sentiment analysis (e.g., Python, R, SaaS tools).		
UNIT-III	CUSTOMER SEGMENTATION AND BEHAVIOR ANALYSIS	6
Understanding customer segmentation using analytics, Predictive modeling for customer lifetime value (CLV), Analyzing customer journeys and touchpoints in the digital world.		
UNIT-IV	MARKETING METRICS AND PERFORMANCE ANALYSIS	6
Key marketing metrics (ROI, CLV, conversion rate, etc.), Measuring the effectiveness of digital marketing campaigns, Attribution models for marketing effectiveness, Metrics for customer satisfaction and brand loyalty.		
UNIT-V	ADVANCED OPINION MINING AND ETHICS IN ANALYTICS	6
Emotion detection in opinion mining, Challenges and limitations of sentiment analysis, Ethical considerations and privacy issues in customer data mining, Case studies of brands using sentiment analysis for decision-making.		
Contact Hours		: 30

List of Experiments	
1	Introduction to Sentiment Analysis Tools Explore and familiarize with sentiment analysis tools for customer feedback analysis.
2	Supervised vs. Unsupervised Sentiment Analysis Perform sentiment classification using supervised (logistic regression) and unsupervised (clustering) techniques.
3	Customer Segmentation Using K-Means Clustering Segment customers based on demographic or behavioral data using K-means clustering.
4	Predictive Modeling for Customer Lifetime Value (CLV) Build a predictive model to estimate Customer Lifetime Value (CLV) based on historical data.
5	Analyzing Customer Journeys Using Google Analytics Track customer journeys on a website, identify key touchpoints and analyze drop-off points.
6	Opinion Mining on Social Media Data Perform opinion mining on social media data (e.g., Twitter) to identify sentiments and trends.
7	Analyzing the Impact of Customer Satisfaction on Brand Loyalty Investigate the relationship between customer satisfaction and brand loyalty using survey data.
8	Customer Journey Analysis Using Touchpoint Data Analyze the digital customer journey across multiple touchpoints to understand user behavior and optimize

	marketing strategies.		
9	Marketing Campaign Performance Analysis Analyze the performance of a digital marketing campaign using key marketing metrics.		
10	Emotion Detection in Customer Feedback Detect emotions (e.g., happiness, anger, sadness) from customer feedback using sentiment analysis tools.		
11	Text Mining for Opinion Summarization Summarize customer opinions from a large dataset using text mining techniques.		
12	Ethical Issues in Customer Data Analytics Explore ethical concerns related to the use of customer data for analytics and opinion mining		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand the foundational concepts and importance of customer analytics.
•	Apply data preparation and preprocessing techniques to customer data.
•	Develop predictive models and implement customer segmentation.
•	Perform opinion mining and sentiment analysis using various techniques.
•	Analyze applications, address ethical issues, and explore future trends in customer analytics.

Text Book (s):	
1	Bing Liu, "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions", Cambridge University Press; 2nd edition., 2020
2	A. Karim Feroz, Gohar F. Khan and Marshall Sponder, "Digital Analytics for Marketing", Routledge, New York, 2nd edition, 2024

Reference Books(s) / Web links:	
1	Neil T. Bendle, Phillip E. Pfeifer "Marketing Metrics: The Manager's Guide to Measuring Marketing Performance", 4th edition, Pearson Publication, 2020

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
AD23A31.1	3	3	3	2	2	2	1	2	3	2	2	1	3	3	3
AD23A31.2	2	3	3	3	2	2	1	2	3	2	3	2	3	3	3
AD23A31.3	3	3	3	3	3	2	2	2	3	3	3	2	3	3	3
AD23A31.4	2	2	3	3	3	2	2	3	3	3	3	2	3	3	3
AD23A31.5	2	3	3	3	3	2	2	3	3	3	3	2	3	3	3
Average	2.4	2.8	3	2.8	2.6	2	1.6	2.4	3	2.6	2.8	1.8	3	3	3

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 oriented Laboratory Course)	Category	L	T	P	C
AD23A32	Explorative and Forecasting Analytics	PE	2	0	2	3

Objectives:	
•	To acquire proficiency in preparing datasets and applying Python-based techniques for exploratory data visualization.
•	To gain expertise in performing univariate, bivariate, and multivariate data analyses using advanced EDA techniques.
•	To develop a comprehensive understanding of time series data processing, analysis, and visualization.
•	To understand and apply statistical and machine learning models for time series forecasting.
•	To explore and implement cutting-edge forecasting models, leveraging tools like auto ARIMA, Facebook Prophet, and deep learning architectures.

UNIT-I	EXPLORATORY DATA ANALYSIS	6
Generating Summary Statistics- Preparing Data for EDA- Visualizing Data in Python- Preparing for visualization- Visualizing data in Matplotlib-Visualizing data in Seaborn-Visualizing data in GGLOT		
UNIT-II	ADVANCED EXPLORATORY DATA ANALYSIS TECHNIQUES	6
Performing Univariate Analysis in Python- Performing Bivariate Analysis in Python- Performing Multivariate Analysis in Python- Dealing with Outliers and Missing Values- Automated EDA using pandas profiling		
UNIT-III	TIME SERIES DATA ANALYSIS	6
Introducing time series-Acquiring and processing time series data-Analyzing and visualizing time series data-Generating strong baseline forecast-Accessing forecasting of a time series.		
UNIT-IV	FORECASTING MODELS	6
Forecasting as regression-Feature engineering for time series forecasting-Target Transformations-Forecasting time series with Machine Learning models-Time series models using statistical methods-Plotting ACF and PACF-Exponential Smoothing-ARIMA-SARIMA.		
UNIT-V	ADVANCED FORECASTING MODELS	6
Forecasting with auto ARIMA, Facebook Prophet-Forecasting multivariate time series using VAR models-Forecasting with RNN using Keras-Forecasting with LSTM using Keras.		
		Contact Hours : 30

List of Experiments	
1	Clean and analyze the Bitcoin Historical Data from Kaggle to calculate daily summary statistics and identify any missing values. Evaluation Parameters: Accuracy in handling time-specific missing values and the relevance of summary statistics generated.
2	Create line plots and decompose the Daily Temperature of Major Cities dataset from Kaggle to reveal trends, seasonality, and residuals. Evaluation Parameters: Effectiveness in revealing underlying patterns and anomalies in data.
3	Develop a series of box plots and violin plots for the Global Financial Indices dataset from the Data Market repository, focusing on capturing distribution variations over time. Evaluation Parameters: Ability to interpret and articulate findings from the distribution shapes and their changes over time.
4	Visualize the correlation matrix for multiple time series variables from the Multivariate Economic Statistics dataset using heat maps and network diagrams, emphasizing the strength and direction of relationships. Evaluation Parameters: Clarity in displaying correlations, effectiveness in using colors and layout to represent data complexities.
5	Perform data cleaning, transformation, and feature engineering on the Stock Market Data from Kaggle to prepare

	it for time series modeling. Evaluation Parameters: Creativity in feature engineering and thoroughness in preprocessing steps.
6	Apply Moving Average and Exponential Smoothing models to establish baseline forecasts using the Electricity Consumption Data from Kaggle. Evaluation Parameters: Accuracy of forecasts and suitability of the model chosen for the data's nature.
7	Construct and tune an ARIMA model using Daily Financial Market Data from Quandl, focusing on optimal parameter selection. Evaluation Parameters: Model's fit to the data and predictive accuracy.
8	Implement LSTM networks to forecast future patient admissions using the Hourly Patient Admission Data from the PhysioNet database. Evaluation Parameters: Effectiveness of the neural network architecture and its tuning.
9	Forecast a system of multiple interrelated economic indicators using Vector Autoregression (VAR) with the Multivariate Economic Statistics from the Data Market repository. Evaluation Parameters: Integration of multiple time series inputs and forecasting accuracy.
10	<p>Mini Project: Time Series Forecasting</p> <p>Objective: Develop predictive models to forecast future values in a time series dataset, utilizing historical data patterns and trends. The project aims to enhance understanding and predictive accuracy for various applications.</p> <p>Task: In this project, the student will gather historical time series data from a relevant domain, clean and preprocess the data to address issues like missing values and anomalies, conduct exploratory data analysis to uncover trends, seasonality, and cyclic behaviour, derive new features that may enhance predictive capabilities, construct various statistical and machine learning models for time series forecasting, and evaluate these models using appropriate metrics to determine their accuracy and reliability.</p> <p>Datasets:</p> <ol style="list-style-type: none"> 1. Global Development Data: Comprehensive datasets on development indicators like health, education, and economic metrics from countries worldwide, provided by the World Bank. 2. Climate Data: Detailed climatological datasets including temperature, precipitation, and more from the Global Historical Climatology Network. 3. International Economic Data: Extensive time series data covering global economic indicators like GDP, inflation rates, and employment figures from the International Monetary Fund (IMF). 4. Global Commodity Prices: Time series data on prices of various commodities such as food, metals, and agricultural products from the Food and Agriculture Organization (FAO). 5. Consumer Price Indexes (CPIs): Monthly time series data on consumer price indices, capturing inflation trends across various Indian cities and categories. Available on the Open Government Data (OGD) Platform India. 6. Tourism Statistics: "Monthly Foreign Tourist Arrivals" from the Ministry of Tourism, which provides data on the number of foreign tourists visiting India each month. 7. Agricultural Production Data: "Monthly Crop Production Statistics" from the Ministry of Agriculture and Farmers Welfare, detailing production volumes of major crops like wheat, rice, and sugarcane. 8. Water Reservoir Levels: "Weekly Reservoir Level Data" from the Central Water Commission, which monitors water levels in major reservoirs across India, crucial for managing irrigation and drinking water supply. 9. Air Quality Index (AQI) Data: "Daily Air Quality Index" from the Central Pollution Control Board (CPCB), which provides daily AQI readings from multiple cities across India. 10. Stock Market Data: "National Stock Exchange (NSE) Historical Data" from the NSE of India, including daily stock prices, trading volumes, and market indices.
	Contact Hours : 30
	Total Contact Hours : 60

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand the exploratory data analysis
•	Apply Univariate and multivariate analysis
•	Analyse and visualize time series data to derive insights and establish baseline forecasts.
•	Analyse the forecasting techniques to model and predict time series data
•	Design and implement robust forecasting solutions using statistical and deep learning methodologies.

Text Book (s):	
1	Ayodele Oluleye, Exploratory Data Analysis with Python Cookbook: Over 50 recipes to analyze, visualize, and extract insights from structured and unstructured data, Packt Publishing, 2023.
2	Manu Joseph, Modern Time Series Forecasting with Python-Explore Industry-ready Time Series Forecasting Using Modern Machine Learning and Deep Learning, Packt Publishing, 2022.
3	Suresh Kumar Mukhiya, Hands-On Exploratory Data Analysis with Python, Packt Publishing 2020.

Reference Books(s) / Web links:	
1	Chris Albon, Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning, 2nd Edition, O'Reilly Media, 2022.
2	Aileen Nielsen, Practical Time Series Analysis: Prediction with Statistics and Machine Learning, 1st Edition, O'Reilly Media, 2019.
3	Sam Green, Exploratory Data Analysis: Uncovering Patterns and Insights Through Data Exploration, Kindle Edition ,2024.
4	Joel Grus, Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media, 2019.

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
AD23A32.1	3	2	3	2	-	1	-	-	2	-	-	-	3	2	-
AD23A32.2	2	3	-	3	2	-	-	-	2	-	-	-	2	3	-
AD23A32.3	3	2	2	3	2	-	-	-	3	-	-	2	3	3	-
AD23A32.4	2	3	-	2	-	3	-	2	3	-	2	3	-	2	3
AD23A32.5	-	-	3	-	2	3	3	2	-	3	2	-	3	-	3
Average	2.5	2.5	2	2.5	1.6	1.4	0.6	1	2	0.6	0.8	1	2.6	2	1.4

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 Courses)	Category	L	T	P	C
AD23A33	Bio Informatics Systems (Common to AIDS, IT)	PE	2	0	2	3

Objectives:	
•	To study the fundamental concepts of bioinformatics, including its applications, branches, and the basic biomolecular components essential for biological data analysis.
•	To Familiarize with major bioinformatics databases and tools, and understand their organization, content, and utility for biological research.
•	To Comprehend the various types of nucleic acid and protein sequence databases, their structures, and the different file formats used in bioinformatics.
•	To Grasp the basic concepts of sequence similarity, identity, and homology, including the use of scoring matrices in bioinformatics analysis
•	To Master the techniques of pairwise sequence alignment, including the application of algorithms such as Needleman-Wunsch and Smith-Waterman for analyzing nucleic acid and protein sequences.

UNIT-I	INTRODUCTION	6
Basic biomolecular concepts: Protein and amino acid, DNA & RNA, Sequence, structure and function - Types of Nucleotide Sequence - DNA sequencing methods: Basic and Automated DNA sequencing, DNA sequencing by capillary array and electrophoresis, Gene expression data.		
UNIT-II	BIOINFORMATICS RESOURCES	6
NCBI, EBI, ExPASy, RCSB, DDBJ: The knowledge of databases and bioinformatics tools available at these resources, organization of databases: data contents, purpose and utility - Open access bibliographic resources and literature databases: PubMed, BioMed Central, Public Library of Sciences (PloS), CiteXplore.		
UNIT-III	SEQUENCE DATABASES	6
Nucleic acid sequence databases - Protein sequence databases - Structure Databases - Sequence file formats - Protein and nucleic acid properties.		
UNIT-IV	SEQUENCE ANALYSIS	6
Basic concepts of sequence similarity - identity and homology, definitions of homologues, orthologues, paralogues and xenologues Scoring matrices.		
UNIT-V	SEQUENCE ALIGNMENT	6
Measurement of sequence similarity - Similarity and homology - Pairwise sequence alignment - Needleman and Wunsch, Smith and Waterman algorithms for pairwise alignments, gap penalties, use of pairwise alignments for analysis of Nucleic acid and protein sequences.		
		Contact Hours : 30

List of Experiments	
1	Introduction to Bioinformatics Tools: Explore and familiarize with basic bioinformatics software and online tools.
2	Sequence Alignment: Perform pairwise sequence alignment using the Needleman-Wunsch algorithm. Conduct multiple sequence alignment using ClustalW or MUSCLE.
3	Phylogenetic Analysis: Construct a phylogenetic tree using the Neighbor Joining method. Evaluate tree robustness using bootstrap analysis.
4	Genomic Data Analysis: Analyze RNA-Seq data for differential expression using TopHat and Cufflinks. Predict genes from genomic sequences using gene prediction tools.

5	Proteomic Data Analysis: Identify proteins from mass spectrometry data using MASCOT. Analyze protein-protein interactions using the STRING database.
6	Sequence Database Retrieval: Retrieve sequences from GenBank and analyze their properties. Convert sequence files between different formats (e.g., FASTA to GenBank).
7	Scoring Matrices : Use scoring matrices (PAM and BLOSUM) for sequence analysis. Compare the effectiveness of different matrices in alignment.
8	Machine Learning Applications: Implement a support vector machine (SVM) for classifying biological data. Cluster gene expression data using k-means algorithm in R.
9	Analysis of Gene Expression Data: Use tools like DESeq or edgeR for analyzing differential gene expression.
10	Structural Bioinformatics: Visualize and analyze protein structures using PyMOL or Chimera.
11	Mini Project Comparative Sequence Alignment and Phylogenetic Tree Construction Genomic Data Analysis for Differential Gene Expression Proteomic Data Analysis and Protein Interaction Mapping
Contact Hours : 30	
Total Contact Hours : 60	

Course Outcomes:	
At the end of the course the student will be able to:	
	<ul style="list-style-type: none"> • Understand the fundamental concepts and terminologies in bioinformatics and its applications • Apply knowledge of bioinformatics resources and databases to effectively retrieve biological data. • Analyze the nucleic acid and protein sequences using various sequence databases and bioinformatics tools. • Apply statistical and computational methods to assess sequence similarity, homology, and scoring matrices in bioinformatics applications. • Apply pairwise sequence alignment techniques and interpret alignment results to derive biological insights from data.

Text Book (s):	
1	Mount, D. W., Bioinformatics: Sequence and Genome Analysis, CSHL Press, 2nd Edition, 2004.
2	S. C. Rastogi, Namita Mendiratta, Parag Rastogi, "Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery", 5th Edition, Prentice Hall of India, 2022
3	Lesk, A. M., Introduction to Bioinformatics, Oxford University Press, 5th Edition, 2019.

Reference Books(s) / Web links:	
1	Baxevanis, A.D. and Francis Ouellette B.F., "Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins", 2nd edition, Wiley India Pvt Lt, 2004
2	Jean-michel Claverie and Cedric Notredame, "Bioinformatics for Dummies", Wiley India Pvt Lt, 2007.

CO - PO – PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
AD23A33.1	3	2	3	1	1	-	-	2	-	2	-	-	2	1	-
AD23A33.1	2	3	-	3	2	-	-	1	2	1	-	-	3	2	-
AD23A33.1	3	2	2	3	-	-	1	-	3	1	2	-	3	3	-
AD23A33.1	2	3	-	2	-	3	-	-	3	-	-	2	2	2	-
AD23A33.1	1	-	3	-	2	-	3	2	-	3	1	-	2	3	2
Average	2.2	2.5	2	1.8	1.4	0.6	0.8	1	1.6	1.4	0.6	0.4	2.4	2.2	0.4

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
IT23D11	Deep Learning Concepts (Common to IT, CSE, CSE(CS))	PE	3	0	0	3

Objectives:
<ul style="list-style-type: none"> To understand the fundamental principles, theory and approaches for learning with deep neural networks.
<ul style="list-style-type: none"> To learn the main variants of deep learning (such convolutional and recurrent architectures), and their typical applications \
<ul style="list-style-type: none"> To understand the key concepts, issues and practices when training and modelling with deep architectures
<ul style="list-style-type: none"> To understand how deep learning fits within the context of other ML approaches
<ul style="list-style-type: none"> To evaluate and optimize deep learning models

UNIT-I	Introduction to Neural Network	9
Introduction, Definition, Working of Neural Network. Gradient descent , Stochastic Gradient descent, Perceptron, Multilayer Perceptron, Back Propagation.		
UNIT-II	Introduction to Deep Learning	9
Deep Learning Definition, Deep learning algorithms, Deep learning architecture, Deep learning applications, Benefits and Challenges of Deep Learning, . Activation functions: Sigmoid function, Hyperbolic Tangent function, ReLu - Rectified Linear units, Softmax function.		
UNIT-III	CNN Model Architectures	9
Introduction to CNN : Train a simple convolutional neural net, Pooling layer in CNN, Building ,training and evaluating our first CNN, Model performance optimization. CNN Model Architectures: Introduction to Imagenet, LeNet architecture, AlexNet architecture, VGGNet architecture, ResNet architecture.		
UNIT-IV	Recurrent Neural Networks	9
Recurrent Neural Networks Definition, Understanding a Recurrent Neuron in Detail, Long Short-Term Memory(LSTM), Back propagation Through Time(BPTT), Implementation of RNN in Keras		
UNIT-V	Improving DL Networks	9
Bias & Variance – Regularization- Overfitting – Dropout regularization – data augmentation – Normalizing inputs – exploding gradients – derivative computation – gradient checking – gradient descent – exponentially weighted average– optimization algorithms – hyperparameter and its tuning – batch normalization- multiclass classification – DL framework.		
Total Contact Hours:45		

Course Outcomes:

- Understand the fundamental principles, theory and approaches of neural network
- Understand the basic concepts of deep learning and activation functions
- Understand the key concepts, issues and practices when training and modeling with CNN model architectures
- Explore Recurrent Neural Network model for real time applications.
- Ability to evaluate and optimize deep learning models

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

- Problem solving sessions
- Capstone Projects
- Activity Based Learning

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", The MIT Press, Nov 2016
2. Rajiv Chopra, "Deep Learning: A Practical Approach", Khanna Publication, 1st Edition, Jan 2018.
3. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing AG, 2023.
4. J Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley, 2021.

Reference Books(s) / Web links:

1. MOOC, Deep Learning By Google, <https://in.udacity.com/course/deep-learning--ud730>
2. MOOC, Deep Learning <https://www.coursera.org/specializations/deep-learning>

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23D11.1	3	2	3	-	1	-	-	1	2	2	3	3	3	2	2
IT23D11.2	3	2	3	-	2	-	-	-	1	2	2	2	3	2	2
IT23D11.3	3	2	3	-	1	-	-	1	-	2	2	2	3	2	2
IT23D11.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23D11.5	3	2	3	-	1	-	-	1	-	2	2	1	3	1	2
Average	3	2	3	-	1.4	-	-	1	1.3	2	2	1.8	3	1.7	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 Courses)	Category	L	T	P	C
AD23B32	Text and Speech Analysis	PE	2	0	2	3

Objectives:	
•	Gain foundational knowledge in natural language processing (NLP) and speech recognition.
•	Explore fundamental techniques used in speech processing.
•	Study various feature extraction methods, such as MFCC and LPC.
•	Evaluate techniques for speech recognition and synthesis, including algorithms and systems.
•	Acquire hands-on experience in implementing and applying text and speech analysis models and algorithms

UNIT I	INTRODUCTION TO TEXT AND SPEECH ANALYSIS	6
Overview of Text and Speech Analysis-Applications of NLP and Speech Processing-Basic Concepts in Text Analysis and Speech Recognition.		
UNIT II	INTRODUCTION TO STATISTICAL AND MACHINE	6
Introduction to Language Models (N-grams, Bag of Words, TF-IDF)-Topic Modeling: Latent Dirichlet Allocation (LDA).		
UNIT III	TEXT ANALYSIS	6
Text Classification: Naive Bayes, Support Vector Machines, and Neural Networks-Word Embeddings: Word2Vec, GloVe, BERT.		
UNIT IV	SPEECH SIGNAL PROCESSING	6
Basics of Digital Speech Processing-Feature Extraction: Mel-Frequency Cepstral Coefficients (MFCC), Linear Predictive Coding (LPC)-Speech Recognition: Hidden Markov Models (HMM), Dynamic Time Warping (DTW)-Introduction to Automatic Speech Recognition (ASR) Systems.		
UNIT V	ADVANCED TOPICS IN TEXT AND SPEECH ANALYSIS	6
Deep Learning for NLP: Recurrent Neural Networks (RNNs), Transformers-Speech Synthesis: Text-to-Speech (TTS) Systems-Cross-lingual Text and Speech Analysis-Ethical Considerations in Text and Speech Processing.		
		Contact Hours : 30

List of Experiments	
1	Text Preprocessing and Analysis a. Implementing tokenization, stemming, and lemmatization. b. Performing POS tagging and NER on text data. c. Building a sentiment analysis classifier using machine learning.
2	Language Models and Text Classification a. Creating and analyzing N-gram models b. Training and evaluating text classification models. c. Applying word embeddings for semantic similarity tasks.
3	Speech Processing a. Extracting MFCC features from speech signals. b. Implementing basic speech recognition using HMM or DTW. c. Developing a simple ASR system using open-source tools.
4	Advanced Projects a. Building a text-to-speech synthesis system. b. Implementing a neural network model for text classification. c. Developing a cross-lingual NLP application.
5	Mini Project: 1. Automated Customer Feedback Analyzer

<p>A retail company wants to automatically analyze feedback from customers, which may come as text (emails or chat messages) or speech (voice calls). The goal is to classify feedback into actionable categories (e.g., "Product Complaint," "Service Feedback," "General Inquiry") and identify the sentiment (positive/negative/neutral) expressed.</p> <p>Datasets:</p> <ol style="list-style-type: none"> Kaggle Sentiment Analysis Dataset. LibriSpeech Dataset for speech data. Custom recordings of feedback using PyAudio or mobile apps. <p>2. News Article Classification and Topic Analysis</p> <p>A news agency wants to automatically classify articles based on their content (e.g., Politics, Sports, Technology) and understand the underlying topics discussed in a collection of news articles.</p> <p>Datasets:</p> <ol style="list-style-type: none"> BBC News Classification Dataset (pre-classified news articles). Newsgroups Dataset (multi-category news data). <p>3. Spam Email Detection Using Machine Learning and Word Embeddings"</p> <p>An email service provider wants to automatically detect spam emails to prevent them from reaching users' inboxes. This system will classify emails as "Spam" or "Not Spam" using traditional and deep learning models, while experimenting with different word embedding techniques.</p> <p>Datasets:</p> <ol style="list-style-type: none"> SpamAssassin Public Dataset. Kaggle SMS Spam Collection Dataset. 			
	Contact Hours	:	30
	Total Contact Hours	:	60

Course Outcomes:
● Demonstrate an understanding of the basic principles of text and speech analysis, including NLP applications and speech recognition fundamentals.
● Utilize statistical models such as N-grams, Bag of Words, and TF-IDF to analyze textual data and perform topic modeling using Latent Dirichlet Allocation (LDA).
● Implement and evaluate machine learning methods like Naive Bayes, Support Vector Machines (SVM), and neural networks for text classification.
● Implement speech recognition models using Hidden Markov Models (HMM) and Dynamic Time Warping (DTW).
● Apply deep learning methods like RNNs and Transformers for advanced NLP tasks.

Text Book (s):
1. T V Geetha, Understanding Natural Language Processing (Machine Learning and Deep Learning Perspectives), Pearson Paperback, June 2024.
2. Daniel Jurafsky and James H. Martin, Speech and Language Processing, 3rd Edition, Pearson, 2020.

Reference Books(s) / Web links:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2
2. L. Ashok Kumar, D. Karthika Renuka, Deep Learning Approach for Natural Language Processing, Speech, and Computer Vision, 1st Edition, CRC Press, 2023.
3 Christopher D. Manning, Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

CO-PO-PSO Mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
AD23B32.1	3	3	2	2	2	1	1	1	2	2	1	2	3	2	1
AD23B32.2	3	3	2	2	3	1	1	1	2	2	1	3	3	2	2
AD23B32.3	2	3	3	3	3	2	1	1	2	2	2	2	3	2	3
AD23B32.4	3	2	3	3	3	2	2	2	2	2	2	3	3	2	2
AD23B32.5	3	3	3	3	3	3	2	2	3	2	3	3	3	3	3
Average	2.8	2.8	2.6	2.6	2.8	1.8	1.4	1.4	2.2	2	1.8	2.6	3	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: “-”

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CS23A31	BUSINESS ANALYTICS	PE	2	0	2	3
For B.E Programme CSE ,CSECS and B.Tech Programme in IT,AI ML						

Objectives:
<ul style="list-style-type: none"> Understand the Fundamentals of Business Analytics. Develop Spreadsheet Proficiency for Analytics. Master Data Visualization Techniques. Learn Descriptive Statistical Analysis. Explore Probability Distributions and Data Modeling.

UNIT-I	Introduction to Business Analytics	6
What Is Business Analytics?, Evolution of Business Analytics, Scope of Business Analytics, Data for Business Analytics, Models in Business Analytics, Problem Solving with Analytics.		
UNIT-II	Analytics on Spreadsheets	6
Basic Excel Skills, Excel Functions, Using Excel Lookup Functions for Database Queries, Spreadsheet Add-Ins for Business Analytics.		
UNIT-III	Visualizing and Exploring Data	6
Data Visualization, Creating Charts in Microsoft Excel, Other Excel Data Visualization Tools, Data Queries: Tables, Sorting, and Filtering, Statistical Methods for Summarizing Data, Exploring Data Using PivotTables.		
UNIT-IV	Descriptive Statistical Measures	6
Populations and Samples, Measures of Location, Measures of Dispersion, Measures of Shape, Excel Descriptive Statistics Tools, Descriptive Statistics for Grouped Data, Descriptive Statistics for Categorical Data: The Proportion, Statistics in PivotTables. Measures of Association, Outliers, Statistical Thinking in Business Decisions		
UNIT-V	Probability Distributions and Data Modeling	6
Basic Concepts of Probability, Random Variables and Probability Distributions, Continuous Probability Distributions, Random Sampling from Probability Distributions, Data Modeling and Distribution Fitting.		
	Contact Hours:	30

List of Experiments

1.	Excel essentials: Introduction to the Interface an Source Data Formatting Navigation Shortcuts Format Painter Insert Delete Rows and Columns Autofill Data Sorting Filtering Custom Lists
2	Excel Formulas Logical Formulas IF & IFS Formulas Statistical Formulas Lookup Formulas Index and Match Switch Text Formulas Date and Time Formulas
3	Excel Data Visualization Inserting a Chart in Excel Changing Elements in a Chart Select Data Method Format Chart Elements Line Chart, Area Chart, Pie Chart, Donut Chart, Histogram & Pareto Chart, Waterfall Chart, Heat Maps, Combo Chart, Sparkline Dynamic Charts Funnel Chart, Slope Chart, Dumbbell Chart Highlight Points in Time

	<p>Highlight Min and Max</p> <p>Actual vs Target</p>
4	<p>Excel Pivot Table</p> <p>Introduction to the Source Data</p> <p>Inserting a Pivot Table</p> <p>Understanding the Field List</p> <p>Clear, Select and Move Functions</p> <p>Refreshing Pivot Table</p> <p>Number Formatting in Pivot Table</p> <p>Conditional Formatting in Pivot Table</p> <p>Sorting in Pivot Table</p> <p>Filtering in Pivot Table</p> <p>Grouping in Pivot Table</p> <p>Pivot Table Layouts</p> <p>Table Styles and Other Important Options</p> <p>Summarize Values By</p> <p>Calculated Fields</p> <p>Pivot Charts</p> <p>Slicers</p>
5	Mini Project
	Contact Hours: 30
	Total Contact Hours: 60

Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> ● Apply Business Analytics Techniques. ● Utilize Advanced Excel Functions. ● Create and Interpret Data Visualizations. ● Perform Descriptive Statistical Analysis. ● Model Business Scenarios Using Probability.

Text Book(s):	
1	R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017.
2	R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2 nd Edition, Wiley, 2016.

Reference Book(s) / Web link(s):	
1	Philip Kotler and Kevin Keller, Marketing Management, 15 th edition, PHI, 2016.
2	VSP Rao, Human Resource Management, 3 rd Edition, Excel Books, 2010.
3	Mahadevan B, "Operations Management -Theory and Practice", 3 rd Edition, Pearson Education, 2018.

CO-PO-PSO Mapping

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
CS23A31.1	2	2	3	1	1	-	-	-	1	2	1	1	3	2	1
CS23A31.2	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CS23A31.3	2	2	3	3	2	-	-	-	3	1	1	3	3	1	2
CS23A31.4	2	1	1	2	2	-	-	-	3	3	2	1	1	3	1
CS23A31.5	2	3	2	3	2	-	-	-	3	3	1	3	3	1	1
Average	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2	2.8	1.6	1.4

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
AI23B34	HUMAN COMPUTER INTERACTION	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To learn the foundations of Human Computer Interaction.
<ul style="list-style-type: none"> To be familiar with the software design process.
<ul style="list-style-type: none"> To acquire knowledge about human interaction models and theories.
<ul style="list-style-type: none"> To explore various mobile applications development platforms
<ul style="list-style-type: none"> To learn the guidelines of design thinking and apply it.

UNIT-I	FOUNDATIONS OF HCI AND HUMAN FACTORS AS HCI THEORIES	6
What HCI Is and Why It Is Important- Principles of HCI- Specific HCI Guidelines- Human Information Processing- Sensation and Perception of Information- Human Body Ergonomics (Motor Capabilities)		
UNIT-II	HCI DESIGN	6
The Overall Design Process-Interface Selection Options-Wire-Framing-“Naïve” Design Example: No Sheets 1.0: Requirements Analysis, User Analysis, Making a Scenario and Task Modeling, Interface Selection and Consolidation		
UNIT-III	USER INTERFACE LAYER	6
Understanding the UI Layer and Its Execution Framework-Input and Output at the Low Level-Processing the Input and Generating Output: Events, UI Objects, and Event Handlers, Event-Driven Program Structure, Output		
UNIT-IV	UI DEVELOPMENT TOOLKIT & INTERACTIVE SYSTEM DEVELOPMENT FRAMEWORK	6
Model, View, and Controller (MVC), MVC Implementation: Simple Bank Application, No Sheets User Interface Toolkit, Java AWT UI Toolkit, Android UI Execution Framework and Toolkit, Examples: iOS UIKit Framework and Toolkit, Case study experiencing the use of Flutter / React Native / Figma		
UNIT-V	USER INTERFACE EVALUATION AND FUTURE OF HCI	6
User Interface Evaluation: Evaluation Criteria, Evaluation Methods, Future of HCI: Non-WIMP/Natural/Multimodal Interfaces-Mobile and Handheld Interaction-High-End Cloud Service and Multimodal Client Interaction-Natural/Immersive/Experiential Interaction-Mixed and Augmented Reality.		
		Contact Hours: 30

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> Describe the foundations of Human Computer Interaction.
<ul style="list-style-type: none"> Demonstrate the software design process
<ul style="list-style-type: none"> Apply the concepts of human interaction models and theories .
<ul style="list-style-type: none"> Design effective Mobile Applications
<ul style="list-style-type: none"> Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.

Text Book(s):

1. Gerard Jounghyun Kim ,”Human-Computer Interaction: Fundamentals and Practice”Apple Academic Press Inc.; 1st edition (20 March 2015)

Reference Book(s)/Web link(s)

1. Alan Dix, Janet Finckay, Greg Goryd, Abowd, Russell Bealg, ”Human – Computer Interaction”, Pearson Education

2. Shneiderman, Plaisant, Cohen ,Jacobs, Elmqvist”Designing the User Interface Strategies for Effective Human-Computer Interaction” Sixth Edition

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23B34.01	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
AI23B34.02	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
AI23B34.03	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
AI23B34.04	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
AI23B34.05	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3.0	3.0	2.75	2.6	2.25	2.8	2.75	3.0	3.0	2.67	3.0	2.67	3.0	3.0

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 (Theory Course)	Category	L	T	P	C
AI23B12	Cognitive Science (Common to AIDS, AIML, IT)	PE	3	0	0	3

Objectives: This course will enable students
<ul style="list-style-type: none"> To learn the basics of cognitive science To understand the integration of psychological and neuroscientific explanations in cognitive science through key frameworks and models. To explore symbolic and neural network models of cognitive processes in information processing. To explore the mind's organization through modularity theories, hybrid architectures, and brain mapping techniques. To examine dynamical systems, situated cognition, and brain connectivity in understanding consciousness and building artificial brain systems

UNIT-I	Introduction to Cognitive Science	9
The prehistory of cognitive science- The discipline matures: Three milestones-The turn to the brain-Cognitive systems as functional systems anatomy of the brain and the primary visual pathway-Extending computational modeling to the brain-Mapping the stages of lexical processing		
UNIT-II	Cognitive science and the integration challenge	9
Levels of explanation: The contrast between psychology and neuroscience-The integration challenge-Local integration I: Evolutionary psychology and the psychology of reasoning-Local integration II: Neural activity and the BOLD signal-Marr's tri-level hypothesis and the integration challenge-Models of mental architecture		
UNIT-III	Information-Processing Models of the Mind	9
The physical symbol system hypothesis- From physical symbol systems to the language of thought -Applying the symbolic paradigm- Neural networks and distributed information processing -Neural network models of cognitive processes: Language learning in neural networks- Neural network models of children's physical reasoning.		
UNIT-IV	The Organization of the Mind	9
Architectures for intelligent agents-Fodor on the modularity of mind massive modularity hypothesis-Hybrid Strategies for brain mapping: Structure and function in the brain-Studying cognitive functioning: Techniques from neuroscience		
UNIT-V	New horizons: Dynamical systems and situated cognition	9
Cognitive science and dynamical systems-Applying dynamical systems-Situated cognition and biorobotics-Information processing without conscious awareness-The global workspace theory of consciousness-Exploring the connectivity of the brain-Building artificial brain systems		
Total Contact Hours:45		

Text Book(s):

1. Bermúdez, José Luis. Cognitive science: An introduction to the science of the mind. Cambridge University Press, 2017.

Reference Books:

1. The Encyclopedia of Cognitive Science
2. Andy Clark: Mindware: An Introduction to the philosophy of cognitive science
3. Andy Clark: Natural born cyborgs: Minds, Technologies, and the Future of Human Intelligence
4. Bradley Voytek & Timothy Verstynen: Do Zombies Dream of Undead Sheep? A Neuroscientific View of the Zombie Brain
5. Fromkin, Rodman, and Hyams. An Introduction to Language, Boston, MA: Thomson Wadsworth, 9th edition, 2011, chapters 1-2.

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

- Understand the foundations of cognitive science, including computational modeling, brain anatomy, and lexical processing stages.
- Analyze interdisciplinary integration challenges and frameworks like Marr's tri-level hypothesis to connect psychology and neuroscience.
- Explore symbolic and neural network models of cognitive processes such as language learning and reasoning.
- Evaluate modularity theories, hybrid architectures, and neuroscience techniques for studying brain structure and function.
- Apply dynamical systems, situated cognition, and brain connectivity in understanding consciousness and artificial brain systems.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O 3
AI23B12.1	3	3	2	2	3	-	-	-	-	1	1	2	3	2	1
AI23B12.2	3	3	2	2	3	3	-	-	-	1	2	2	2	3	-
AI23B12.3	3	3	3	3	2	-	-	-	-	1	2	2	3	3	-
AI23B12.4	2	3	3	3	3	3	3	1	1	2	2	2	1	3	3
AI23B12.5	2	2	3	3	3	2	-	2	2	2	2	3	1	3	3
Average	2.8	2.8	2.6	2.6	2.8	1.6	0.6	0.6	0.6	1.4	1.8	2.5	2	2.8	1.6

CO-PO-PSO Mapping

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
AI23B31	Knowledge Representation and Reasoning	PE	2	0	2	3

OBJECTIVES:	
•	To learn the concepts of First Order Logics.
•	To understand the concepts of Knowledge Engineering and Resolution.
•	To acquire the knowledge of Rules, Frames and Structured Description.
•	To familiarize the fundamentals of uncertainty and degrees of belief.
•	To understand the fundamental concepts of Planning

UNIT I	INTRODUCTION	6
Introduction: The Key Concepts, Need for Knowledge Representation and Reasoning - The Role of Logic. Language of First-Order Logic: Introduction-The Syntax- The Semantics-The Semantics-Explicit and Implicit Belief.		
UNIT II	EXPRESSING KNOWLEDGE AND RESOLUTION	6
Expressing Knowledge: Knowledge Engineering – Vocabulary - Basic Facts -Complex Facts - Terminological Facts Entailments. Resolution : The Propositional Case- Handling Variables and Quantifiers - Dealing with Computational Intractability - Backward Chaining - Forward Chaining.		
UNIT III	RULES, FRAMES AND STRUCTURED DESCRIPTION	6
Rules in Production System: Basic Operation, Working Memory, Production Rules and examples- Conflict Resolution- Applications and Advantages. Frames: objects and frames - Basic frame formalism- Frame examples.		
UNIT IV	UNCERTAINTY AND DEGREES OF BELIEF	6
Non-categorical Reasoning- Objective Probability- Subjective Probability- Vagueness. Explanation and Diagnosis: Diagnosis- Explanation- A Circuit Example.		
UNIT V	PLANNING	6
Planning in the Situation Calculus - The STRIPS Representation- Planning as a Reasoning Task. Hierarchical Planning - Conditional Planning.		
		Contact Hours : 30

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
•	Apply the concept of First Order Logic for knowledge representation.
•	Apply the concepts of unification and resolution to solve real time facts.
•	Integrate the concepts of rules and frames for real world phenomena
•	Analyze the concept of uncertainty and degrees of belief to find the varying levels of knowledge and confidence level of real time facts.
•	Explain the concepts of planning to find the difference between plan space and state space.

List of Experiments					
1	Build a rule-based system to recommend activities based on weather conditions				
2	Create a knowledge base using dictionaries and query it. Example: Store animal facts and allow the user to query for characteristics.				
3	Represent family relationships and query for relations (e.g., parent, sibling). Example: Use nested dictionaries to represent relations.				
4	perform data preprocessing, annotation, and dataset creation for a machine learning project				
5	Implementation of searching techniques in AI.				
6	Creating and Querying a Simple Semantic Network.				
7	Create and visualize a knowledge graph				
8	Implement a backward chaining algorithm to reason backward from a goal..				
9	Develop a forward chaining inference system where new facts are derived from existing facts.				
10	Mini Project. <ul style="list-style-type: none"> • Simple Chabot for FAQ • Basic Spam Email Filter • Rule-based Weather Prediction System • Basic Production System for Traffic Light Control • Simple Knowledge Base for Book Recommendations • Basic Recipe Recommendation System 				
			Contact Hours	:	30
			Total Contact Hours	:	60

TEXT BOOKS:	
1	Gerardus Blokdyk, "Knowledge Representation And Reasoning A Complete Guide", 2020.
2	Gerardus Blokdyk, "Knowledge representation and reasoning ", Third Edition, ,October 2018.

REFERENCES:	
1	Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.
2	Michael Gelfond and Yulia Kahl, "Knowledge Representation, Reasoning, and the Design of Intelligent Agents: The Answer-Set Programming Approach", 2014.

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O 3
AI23B31.1	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AI23B31.2	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
AI23B31.3	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AI23B31.4	3	2	1	1	1	-	-	-	-	-	1	1	2	1	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: “-”

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23A37	AUGMENTED REALITY AND VIRTUAL REALITY	PE	2	0	2	3
For B.E Programme CSE ,CSECS and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> To gain the knowledge of historical and modern overviews and perspectives on virtual reality. To learn the fundamentals of sensation, perception, and perceptual training. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems. To learn the Haptics and modelling from the lens of design. To learn the technology of augmented reality and implement it various applications to have practical knowledge.

UNIT-I	INTRODUCTION TO AUGMENTED REALITY AND VIRTUAL REALITY	6
Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays.		
UNIT-II	SENSATION AND PERCEPTION	6
Physiology of Perception, Cutaneous Senses, Pain, Olfaction, Gustation, Auditory System, Auditory Localization, Speech, Visual System, Object Perception, Motion Detection, Depth and Size Perception, psychophysical methods for computing perceptual thresholds.		
UNIT-III	MOBILE VR AND AR	6
VR UX with the Unity API, Interaction and Locomotion, Working with Mobile VR in Unity, Travel and Wayfinding in Virtual Environments, Strategies for Designing and Developing 3D UIs, Evaluation of 3D User Interfaces, Traditional and Emerging VR/AR applications.		
UNIT-IV	INTRODUCTION TO HAPTICS and MODELLING	6
Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.		
UNIT-V	APPLICATIONS	6
Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education. Open-source toolkits/ libraries such as OpenScene Graph, Vega, VRML etc., Future AR/VR applications (holo teleportation, telepresence).		
Contact Hours:		30

List of Experiments	
1.	Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender
2	Use the primitive objects and apply various projection types by handling camera. 3. Download objects from asset store and apply various lighting and shading effects
3	Model three dimensional objects using various modelling techniques and apply textures over them.
4	Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
5	Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
6	Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
7	Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
8	Develop simple MR enabled gaming applications.
	Contact Hours:
	30
	Total Contact Hours:
	60

Course Outcomes: On completion of the course, the students will be able to	
	<ul style="list-style-type: none"> ● Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences. ● The strength of how VR and AR systems work. ● Choose, develop, explain, and defend the use of particular designs for AR and VR experiences. ● Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body. ● Identify and examine state-of-the-art AR and VR design problems and solutions from the industry and academia.

Text Book(s):	
1	Ralf Doerner - “ Virtual and Augmented Reality (VR/AR) Foundations and Methods of Extended Realities (XR) ”, Springer Cham, March 2022.
2	Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018.
3	Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016

Reference Book(s) / Web link(s):	
1	Paul Mealy – “Virtual & Augmented Reality for Dummies”, For Dummies, July 2018.
2	M. Claudia tom Dieck – “Augmented Reality and Virtual Reality”, Springer International Publishing, May 2021.
3	Jay David – “ Reality Media Augmented and Virtual Reality”, MIT Press, November 2021.
4	Amber Dailey – “ Current and Prospective Applications of Virtual Reality in Higher Education”, IGI Global, 2020.

Courses :	
1	Introduction to Augmented Reality and ARCore, Coursera
2	Intro to AR/VR/MR/XR: Technologies, Applications & Issues, Coursera

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A37.1	3	2	2	-	3	-	-	-	2	2	1	2	2	1	2
CS23A37.2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
CS23A37.3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
CS23A37.4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
CS23A37.5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3
Average	3	2.6	2.4	2	3	-	-	-	2.8	2.2	1.8	2.6	2.8	1.8	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 (Laboratory Course)	Category	L	T	P	C
CD23C22	DATA VISUALIZATION (Common to AIML, CSE, CSE(CS), IT, MCT)	PE	0	0	6	

Course Objectives:
<ul style="list-style-type: none"> To introduce students to Excel's basic and advanced data visualization techniques.
<ul style="list-style-type: none"> To familiarize students with Tableau.
<ul style="list-style-type: none"> To develop skills in using Power BI.
<ul style="list-style-type: none"> To enable students to design comprehensive visual dashboards.
<ul style="list-style-type: none"> To apply knowledge through a capstone project.

List of Experiments	
Excel for Data Visualization	
1	Data Manipulation and Cleaning <ul style="list-style-type: none"> Using Functions and formulae for Data Cleaning. Sorting, Filtering and Data Validation techniques.
2	Excel Charts and Tools <ul style="list-style-type: none"> Getting started with charts (Bar, Line, Pie). Advanced charts (Histograms, Box plots, Area Chart, Bubble chart).
3	Excel Advanced Features <ul style="list-style-type: none"> Using PivotTables for data analysis. Dynamic Dashboards with Slicers and Timeline.
Data Visualization with Tableau	
4	Getting Started with Tableau <ul style="list-style-type: none"> Connecting to data and basic visualizations. Interactive Dashboards and Storytelling. Filters, Pages, Hierarchies, Sorting and Dates.
5	Advanced Data Manipulation Techniques <ul style="list-style-type: none"> Calculated fields and parameters. Calculations and Expressions -Total and Aggregations, Automatic and Custom split. Organizing Data and Visual Analytics – Reference lines and bands, Clusters, Forecasting, Trend lines, Summary Card.
6	Introduction to Power BI <ul style="list-style-type: none"> Getting started with Data importing and transforming with Power Query. Report designing with basic visualizations and using the visualization pane. Measures, Filters. Features of Power BI- Drill through, Hierarchies.

Data Visualization with Power BI	
7. Introduction to Power BI	
<ul style="list-style-type: none"> • Getting started with Data importing and transforming with Power Query. • Report designing with basic visualizations and using the visualization pane. • Measures, Filters. • Features of Power BI- Drill through, Hierarchies. 	
8. Advanced Power BI	
<ul style="list-style-type: none"> • DAX. • Creating complex reports and dashboards. 	
Capstone Project - Students will select a real-world dataset and use any tools (Excel, Tableau, and Power BI) to create comprehensive dashboards.	
	Total Contact Hours : 90

Course Outcomes:
On completion of course you will be able to
<ul style="list-style-type: none"> • Create basic and advanced visualizations in Excel for data analysis.
<ul style="list-style-type: none"> • Develop interactive dashboards and perform data manipulations in Tableau.
<ul style="list-style-type: none"> • Design reports and apply DAX for advanced reporting in Power BI.
<ul style="list-style-type: none"> • Integrate and organize data to create comprehensive dashboards using various visualization tools.
<ul style="list-style-type: none"> • Apply their learning to solve real-world data visualization problems using Excel, Tableau, and Power BI.

Textbooks:	
1	Kieran Healy, “Data Visualization: A Practical Introduction”, Princeton University Press, 1 st Edition, 2022.
2	Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, O’Reilly Media, 2 nd Edition, 2023.
3	Jon Schwabish, Better Data Visualizations: A Guide for Scholars, Researchers, and Wonks”, Columbia University Press, 1 st Edition, 2023.
4	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”, CRC Press, 2 nd ,2022.

Reference Books (s):
<u>Excel Visualizations</u> <u>Power BI Documentation</u>
https://learn.microsoft.com/en-us/training/browse/?products=power-bi https://www.tableau.com/learn/training
<u>Online Course: Coursera — Data Visualization with Tableau</u> <u>Excel Visualizations</u> <u>Power BI Documentation</u>

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CD23C22.1	3	2	2	1	2	-	-	-	-	-	-	-	3	2	1
CD23C22.2	3	3	2	2	3	1	-	-	-	-	-	-	3	3	2
CD23C22.3	3	2	3	2	3	-	1	-	-	-	-	-	3	3	2
CD23C22.4	3	3	3	2	3	-	1	1	-	-	-	-	3	3	3
CD23C22.5	3	3	3	3	3	2	2	1	1	1	2	1	3	3	3
Average	3	2.5	2.5	2	2.8	1.5	1.3	1	1	1	2	1	3	2.8	2.5

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 Courses)	Category	L	T	P	C
AI23B11	Information Visualization	PE	3	0	0	3
Common to AIML & AIDS						

Objectives: On completion of this course, the student will be able to
● Identify and recognize visual perception and representation of data.
● Illustrate about projections of different views of objects.
● Apply various Interaction and visualization techniques.
● Analyze various groups for visualization.
● Evaluate visualizations

UNIT-I	INTRODUCTION AND DATA FOUNDATION	9
Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets.		
UNIT-II	FOUNDATIONS FOR VISUALIZATION	9
Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables – Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson’s Affordance theory – A Model of Perceptual Processing.		
UNIT-III	VISUALIZATION TECHNIQUES	9
Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data – Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.		
UNIT-IV	INTERACTION CONCEPTS AND TECHNIQUES	9
Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations – Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space –Data Space - Attribute Space- Data Structure Space - Visualization Structure – Animating Transformations - Interaction Control.		
UNIT-V	Designing of Visualization	9
Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications		
		Contact Hours : 45

Course Outcomes:
On completion of the course, the students will be able to
● Visualize the objects in different dimensions
● Design and process the data for Visualization
● Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences
● Apply the virtualization techniques for projects
● Identify appropriate data visualization techniques given particular requirements imposed by the data.

Reference Books:	
1	Colin Ware, "Information Visualization Perception for Design", 4th edition, Morgan Kaufmann Publishers, 2021.
2	Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
3	Ward, Grinstein, Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick, 2nd edition, A K Peters, Ltd 2015.
4	Scott Murray, Interactive Data Visualization for the Web ,2nd Edition, 2017

CO-PO-PSO Mapping

CO \ PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI23B11.1	3	3	2	-	-	-	-	-	1	-	-	-	3	1	-
AI23B11.2	3	3	3	2	-	2	-	-	-	-	-	2	2	3	-
AI23B11.3	3	3	3	2	3	-	-	2	2	-	-	-	-	3	-
AI23B11.4	3	3	3	-	3	1	-	-	-	-	1	2	2	-	-
AI23B11.5	3	3	2	3	2	-	-	1	3	-	3	3	3	3	1
Average	3	3	2.6	1.4	1.4	0.6	-	0.6	0.8	-	0.6	1.4	2	2	0.2

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
CS23A38	Digital Marketing	PE	2	0	2	3
For B.E Programme CSE ,CSECS and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment. It also focusses on how digital marketing can be utilised by organisations and how its effectiveness can be measured.

UNIT-I	INTRODUCTION TO ONLINE MARKET	6
Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand Website - Planning and Creation- Content Marketing.		
UNIT-II	SEARCH ENGINE OPTIMIZATION	6
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement		
UNIT-III	E - MAIL MARKETING	6
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximising email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.		
UNIT-IV	SOCIAL MEDIA MARKETING	6
Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.		
UNIT-V	DIGITAL TRANSFORMATION	6
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.		
Contact Hours:		30

List of Experiments	
1	Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aid with the branding of the company and how it aids its potential customer segments.
2	Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool. 3. Demonstrate how to use the Google Web Masters Indexing API
3	Discuss an interesting case study regarding how an insurance company manages leads.
4	Discuss negative and positive impacts and ethical implications of using social media for political advertising.
5	Discuss how Predictive analytics is impacting marketing automation.
	Contact Hours: 30
	Total Contact Hours: 60

Course Outcomes: On completion of the course, the students will be able to
<ul style="list-style-type: none"> ● To examine and explore the role and importance of digital marketing in today's rapidly changing business environment. ● To focusses on how digital marketing can be utilised by organisations and how its effectiveness can measured. ● To know the key elements of a digital marketing strategy ● To study how the effectiveness of a digital marketing campaign can be measured . ● To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

Text Book(s):	
1	Fundamentals of Digital Marketing by Puneet Singh Bhatia; Pearson Education; First edition (July 2017).
2	Digital Marketing by Vandana Ahuja ;Oxford University Press (April 2015) .
3	Marketing 4.0: Moving from Traditional to Digital by Philip Kotler; Wiley; 1st edition (April 2017).

Reference Book(s):	
1	Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited
2	Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education.
3	Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western , Cengage Learning.

CO-PO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A38.1	3	3	2	1	3	-	-	-	1	2	3	3	3	3	3
CS23A38.2	2	2	2	1	3	-	-	-	1	2	3	3	3	3	3
CS23A38.3	1	1	1	2	2	-	-	-	1	2	1	1	3	2	1
CS23A38.4	3	2	2	3	1	-	-	-	1	3	2	3	2	3	2
CS23A38.5	2	3	1	3	3	-	-	-	2	3	1	2	1	2	1
Average	2.2	2.2	1.6	2	2.4	-	-	-	1.2	2.4	2	2.4	2.4	2.6	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 Laboratory course	Category	L	T	P	C
CD23721	Visual Effects	PC	0	0	6	3

LIST OF EXPERIMENTS	
GREEN SCREEN COMPOSITING	
1	<p>Green Screen Compositing</p> <p>Tools: Adobe After Effects, Nuke, or DaVinci Resolve.</p> <p>Experiment Variants: Experiment with different lighting setups on the green screen to minimize spill and maximize keying quality.</p>
2	<p>Rot scoping Techniques</p> <p>Tools: After Effects, Nuke, Mocha.</p> <p>Focus Areas: Vary the complexity by tracking subjects with different motions and adding elements behind or in front of the rotoscope layer.</p>
ROTOSCOPING TECHNIQUES	
3	<p>Motion Tracking and Match Moving</p> <p>Tools: After Effects, Blender, Cinema 4D.</p> <p>Variants: Try planar tracking for surfaces and 3D tracking to simulate the camera movement for more immersive VFX scenes.</p>
4	<p>Particle Simulation for Environmental Effects</p> <p>Tools: Blender, Houdini, Maya.</p> <p>Experiment Variants: Adjust particle behaviour to control effects like the density of snow or smoke spread based on environmental conditions.</p>
MOTION TRACKING AND MATCH MOVING	
5	<p>Dynamic Lighting and Shadow Matching</p> <p>Tools: Maya, Blender, or Nuke.</p> <p>Experiment Variants: Test different lighting angles, intensities, and shadow softness to match the original footage's conditions.</p>
6	<p>Physics-Based Animation</p> <p>Tools: Blender, Houdini, Cinema 4D.</p> <p>Focus: Experiment with gravity, elasticity, and friction settings to see how they impact object interactions.</p>
7	<p>Time Manipulation Effects</p> <p>Tools: After Effects, Premiere Pro.</p> <p>Variants: Test speed-ramping (changing speeds mid-shot) and frame blending to make fast actions smoother or simulate slow-motion effects.</p>
Total Contact Hours	
:90	

Course Outcomes:

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

- Identify user interface for compositing, Views and Previews, Layers and Properties & Animation, Colours, Masks, Transparency and Keying, Text, Drawing and Painting, Motion Tracking, Effects and Animation, Presents, Rendering and Exporting.
- Differentiate Image Based Motion Graphics & Video Based Motion Graphics
- Create Effects & Title effects.
- Do colour correction & Keying after effects tools.
- Use Match mover, Motion tracking Overview, Motion Tracking, Workflow and Controls, Rotoscoping, Wire Removal.

Textbooks

1. Visual Effects Society (VES), "The VES Handbook of Visual Effects", Routledge, Edition: 2nd, 2024.
6. Steve Wright Year, "Compositing Visual Effects: Essentials for the Aspiring Artist", Focal Press, Edition: 3rd, 2022.
7. Adobe Creative Team, "Adobe After Effects Classroom in a Book", Adobe Press, Edition: 1st, 2023.

Reference Book(s) / Web link(s):

1. William C. Smith, "**The Complete Guide to Digital Effects for the Screen**", Focal Press, 1st Edition, 2019.
2. **Barnes & Noble**
large bookstore with a variety of titles: www.barnesandnoble.com
3. **Book Depository**
Offers free shipping worldwide: www.bookdepository.com

CO-PO-PSO Mapping

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
CD23721.1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CD23721.2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CD23721.3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CD23721.4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CD23721.5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-
Average	2	2.5	2	1.8	2	-	1	2	3	2	2	2.3	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 “-”

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CD23731	FILM MAKING AND RADIO PRODUCTION	PC	2	0	2	3

UNIT-I	Introduction to Media Production	6
Radio as a means of Mass Communication - Brief history of Radio from early years to the present stage - Print vs Electronic Media - Studio set-ups and productions - Field reporting		
UNIT-II	Radio Broadcasting Technologies	6
Public vs Private broadcasting systems in India - Radio Broadcasting Systems--MW, SW, FM - Internet Radio, Space Radio, Community Radio.		
UNIT-III	A Guide to Radio Scriptwriting and Management	6
Scriptwriting for different formats of Radio - Elements of Radio scripts - Listing, scheduling and traffic management - Importance of Audience Surveys.		
UNIT-IV	Functions of Radio in Public and Private Broadcasting Systems	6
Functions of Radio in the context of Public and Private Broadcasting systems - Types and formats of Radio programmes - News, Music, Interviews, Talks, Dramas – Discussions.		
UNIT-V	Art and Craft of Radio News Reporting	6
Art and Craft of Radio News Reporting - Locating radio news stories - Structure a radio news report - Tools and techniques of radio news reporting - Radio news interviews and vox pops		
Contact Hours		30

List of Experiments		Contact Hours:30
1	Create a short video focusing on different shot types (close-up, medium, wide), camera angles, and movement techniques (panning, tilting, tracking).	
2	Set up different lighting setups (3-point lighting, high key, low key) and capture a scene to understand their impact on mood and aesthetics.	
3	Record audio separately from video and then synchronize it in post-production, focusing on lip-sync and ambient sound.	
4	Shoot footage with a green screen, remove the background in post-production, and place the subject into a virtual environment.	
5	Write a short script and direct a scene with actors, focusing on dialogue delivery, blocking, and character motivation.	
6	Design and mix sound effects, music, and dialogue for a short film clip.	
	Mini project: Produce a short documentary (5-7 minutes) on a subject of choice, utilizing interviews, voice-over narration, and B-roll footage and create a 2-3 minute stop-motion animation using physical objects or clay figures.	

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Students understand the conceptual process of Radio Production.
<ul style="list-style-type: none"> • Students evaluate the complexities of Radio Production as a means of mass communication.
<ul style="list-style-type: none"> • Students create the Radio scripts and other practical implications of the radio production.
<ul style="list-style-type: none"> • Students evaluate the complexities of the Radio Broadcasting in detail.
<ul style="list-style-type: none"> • Students create Radio News Report and also the Radio feature reporting.

Textbooks
1. John J. Lee, "The Roadmap for the Balanced Film Producer", Routledge, edition:1 st , 2024.
2. Steven D. Katz, "Film Directing Shot by Shot: Visualizing from Concept to Screen", Routledge, edition: 1 st , 2024.
3. David F. O'Connell, "Radio Production", Oxford University, Edition:2 nd ,2022.
4. Andrew Thom's, "The Radio Producer's Handbook", Sage Publications,dition:1 st , 2023.

Reference Book(s) / Web link(s):
1. John O. M. McCarthy, "The Encyclopaedia of Film Making Techniques", Focal Press, 1 st Edition, 2020.
2. https://www.amazon.com/Filmmakers-Handbook-Comprehensive-Digital-ebook/dp/B00E19FWG0
3. https://www.amazon.com/Film-Directing-Shot-Techniques-Aesthetics/dp/0941188268
4. https://www.amazon.com/Directing-Techniques-Aesthetics-Michael-Rabiger/dp/1285428982

CO-PO-PSO Mapping

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
CD23731.1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CD23731.2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CD23731.3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CD23731.4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CD23731.5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-
Average	2	2.5	2	1.8	2	-	1	2	3	2	2	2.25	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 “-“

Subject Code	Subject Name (Theory oriented Laboratory Course)	Category	L	T	P	C
CS23A34	User Interface Design	PE	2	0	2	3
For B.E Programme CSE ,CSECS and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> ● Analyze application structures to organize content clearly. ● Construct Navigation that enables users to easily accomplish tasks. ● Design page layouts that support findability of hierarchical content and task completion. ● Determine how to display data to meet user needs. ● Construct effective forms with focused input controls.

UNIT I	INTRODUCTION	9
<p>An overview of the user interface. Human factors in interface design: memory, chunking, recognition vs. recall. User interface design principles: user familiarity, consistency, minimal surprise, recoverability, user guidance, user diversity. Characteristics of Graphical User Interface: command line, menu selection, form fill-in, direct manipulation, anthropomorphic. Models of user interface - Generation of user interfaces-Graphical User Interface (GUI), Web User Interface (WUI), Voice User Interfaces (VUI), Tangible User Interfaces (TUI), Ubiquitous User Interfaces(UUI. Next generation of user interfaces.</p>		
UNIT II	INTERFACE DESIGN METHODS	9
<p>Interface Design Methods: Characteristics of a GUI. Information presentation. Interaction styles. Direct manipulation. Direct Manipulation advantages. Indirect manipulation. Command interfaces. Problems with command interfaces. Command languages. Natural language interfaces. User interface design process. Lifecycle models. A simple interaction design model. Traditional ‘waterfall’ life cycle. A life cycle for RAD (Rapid Applications Development). The Star lifecycle model. Usability engineering lifecycle model: features. Menu systems. Problems with menu systems. Multiple user interfaces. Help and message system. Guidelines for error messages. Task analysis and modeling. Content analysis. Work environment analysis.</p>		
UNIT-III	IMPLEMENTATION OF GRAPHICAL USER INTERFACES	9
<p>Correctly designed software- Software layers. Widgets, buttons, callbacks. Working principles of widgets. Project plan. UI design. Low-level prototypes. Evaluation: user-centered. Users’ steps.Evolving user understanding. Result. Colors. Layout.</p>		
UNIT IV	DIALOG AND STORYBOARDS	9
<p>Alignment on grids. I/O. Dialogs. Dialogs and storyboards. Input prototyping and design. Checks for inputs. Output. Data visualization. Examples. Challenges of visualization. Error messages.</p>		
UNIT-V	TESTING AND USABILITY ASSESSMENT	9
<p>Testing and Usability Assessment: User interface evaluation. Guiding principles for evaluation. Simple evaluation techniques. Process of evaluation. Approaches to evaluation. User observation. Preparing for user observation. Advantages of observation. Disadvantages of observation. Observation research tips. Importance of usability. Usability testing. Usability testing methods. Qualitative vs. Quantitative observation. Usability attributes. Testing. Formal vs. informal testing. Testing basics process.</p>		

		Total Contact Hours	:	45
Experiment No:	Title	Tools		
1	Design a UI where users recall visual elements (e.g., icons or text chunks). Evaluate the effect of chunking on user memory.	Pencil Project, Figma.		
2.	Develop and compare CLI, GUI, and Voice User Interfaces (VUI) for the same task and assess user satisfaction.	Python (Tkinter for GUI, Speech Recognition for VUI), Terminal		
3.	Create a prototype with familiar and unfamiliar navigation elements. Evaluate ease of use with different user groups.	Proto.io, Wireflow		
4	Design two interfaces: one with direct manipulation (drag-and-drop) and another with indirect commands. Compare usability.	JavaScript (with libraries like D3.js), HTML/CSS.)		
5.	Conduct task analysis for an app (e.g., online shopping) and document user flows. Create corresponding wireframes.	Lucid chart (free tier), Dia (open source).		
6.	Simulate the lifecycle stages for UI design using the RAD model and develop a small interactive interface.	Axure RP, OpenProj.		
7.	Implement a form-based GUI using widgets (e.g., radio buttons, text inputs). Add event handling for user interactions.	PyQt, Tkinter.		
8.	Experiment with different layouts and color schemes for an app. Collect user feedback on aesthetics and usability.	Figma (free version), GIMP (open source for graphics).		
9.	Develop low-fidelity paper prototypes for a banking app and convert them into digital wireframes.	Pencil Project, Inkscape.		
10.	Create storyboards to represent the user flow for a mobile app (e.g., food delivery app).	Balsamiq, OpenBoard		
11.	Design input forms that validate data (e.g., email, phone number) and display error messages.	HTML/CSS, JavaScript (with Validator.js).		
12.	Create a data visualization (e.g., pie charts, bar graphs) for an inventory management system.	Java Script		
13.	Conduct a heuristic evaluation of a simple website based on Jakob Nielsen's usability principles.	UsabilityHub, Google Sheets for evaluation recording.		
	Perform usability testing on a small application, observing user	OBS Studio for recording, Excel for		

14.	interactions and documenting issues	data analysis.
15.	Execute both formal (structured) and informal (ad hoc) testing on a web application. Compare results.	Selenium, Jupyter Notebook

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

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

- Understand the importance of user interface and benefits of good design.
- Understand the user interface design process and business function
- Understand the types of system menus and navigation schemes.
- Understand the characteristics of windows and device based controls.
- Understand the screen based controls and kinds of tests.

Textbooks:

1. Wilbert O. Galitz The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, 3rd Edition
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction" Pearson, 5th Edition, 2015

Reference Books (s)/Web links:

1. SendPoints, GUI: Graphical User Interface Design, 2015
8. Jeff Johnson, Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines, Morgan Kaufmann

CO-PO-PSO Mapping

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
CS23A34.1	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS23A34.2	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS23A34.3	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS23A34.4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS23A34.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3	3	2.8	2.6	2.3	2.8	2.8	3	3	2.7	3	2.67	3	3

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
IT23E31	Graphics and Multimedia (Common to IT, CSE, CSE CS, CSD)	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To gain knowledge about graphics hardware devices and software used.
<ul style="list-style-type: none"> To understand the two-dimensional graphics and their transformations.
<ul style="list-style-type: none"> To understand the three-dimensional graphics and their transformations.
<ul style="list-style-type: none"> To appreciate illumination and color models
<ul style="list-style-type: none"> To become familiar with hypermedia models

UNIT-I	INTRODUCTION	6
An Introduction Graphics System : Computer Graphics and Its Types, Application of computer graphics - Graphics Systems : Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations, Input Devices, Hard Copy Devices, Graphics Software - Scan Conversion Basics, Line, Circle and Ellipse drawing algorithms – Parallel Curve Algorithm – Filled Area Primitives.		
UNIT-II	2D PRIMITIVES	6
Two-dimensional Geometric Transformations: Basic Transformations, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing. Two-Dimension Viewing : The viewing Pipeline, Window to view port coordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping, Text Clipping, Exterior Clipping.		
UNIT-III	3D CONCEPTS	6
Three-Dimensional Concepts : Three Dimensional Display Methods, 3D Transformations, Parallel Projection and Perspective Projection Parallel and Perspective projections - 3D Concepts – 3D Object Representation, Polygons, Curved Lines, Splines, Quadratic Surfaces, Splines, B-Splines, Bezier Curves, Beta Splines, 3D Transformations, 3D Viewing – Visible surface identification, Elements of Color, Color Perception, Color Matching, Color Models – XYZ, RGB, YIQ, CMY, HSV -		
UNIT-IV	MULTIMEDIA SYSTEM DESIGN	6
Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.		
UNIT-V	HYPERMEDIA	6
Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures		
Total Contact Hours:30		

Description of the Experiments	Total Contact Hours: 30
1. Implement Bresenham's line algorithm, Midpoint Circle Algorithm, and Midpoint Ellipse Algorithm. Draw different geometric objects on the screen.	
2. Implement the scan conversion of a polygon and use flood-fill algorithms to fill areas in a graphics window.	
3. Write a program that performs translation, scaling, and rotation on basic 2D shapes (e.g., triangle, rectangle) using matrices.	
4. Write a program that clips polygons to a specified window and displays the clipped polygon.	
5. Write a program that allows the user to perform 3D transformations on basic 3D objects (cube, pyramid) and view the results.	
6. Create and render 3D objects (like cubes, spheres) using polygons and apply basic color and shading techniques.	
7. Create a multimedia application that integrates images, sound, and video in a simple user interface.	
8. Create a program that captures video/audio from a webcam or microphone and displays it on a multimedia interface.	
9. Create an application that allows users to send and receive multimedia messages including text, image, and audio.	
10. Create a simple 3D model using Blender (e.g., a house or object) and apply basic shading and textures to the model.	

Course Outcomes:
<ul style="list-style-type: none"> To gain knowledge about graphics hardware devices and software used.
<ul style="list-style-type: none"> To understand the two-dimensional graphics and their transformations.
<ul style="list-style-type: none"> To understand the three-dimensional graphics and their transformations.
<ul style="list-style-type: none"> To appreciate illumination and color models
<ul style="list-style-type: none"> To become familiar with multimedia and hypermedia

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic
<ul style="list-style-type: none"> Problem solving sessions Flipped classroom - Comparing SOA with Client-Server and Distributed architectures Survey on various storage technologies Activity Based Learning Implementation of small module

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Donald Hearn and Pauline Baker M, "Computer Graphics", 2nd Edition, Prentice Hall, 2014.

4. Richard E. Mayer, "Multimedia Learning", 3rd Edition, Cambridge University Press, 2020

Reference Books(s) / Web links:

1. Judith Jeffcoate, "Multimedia in Practice: Technology and Applications", Pearson Publisher, Edition 2009.

2. John F. Hughes, Andries Van Dam, Morgan Mcuire, David F. Sklar, James D Foley Steven K Feiner, Kurt Akeley, "Computer Graphics: Principles and Practice", 3rd Edition, Addison Wesley Professional, 2013.

5. Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, 4th Edition, CRC Press, December 2015

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
IT23E31.1	3	2	3	-	1	-	-	1	2	2	3	3	3	2	2
IT23E31.2	3	2	3	-	2	-	-	-	1	2	2	2	3	2	2
IT23E31.3	3	2	3	-	1	-	-	1	-	2	2	2	3	2	2
IT23E31.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23E31.5	3	2	3	-	1	-	-	1	-	2	2	1	3	1	2
Average	3	2	3	-	1.4	-	-	1	1.3	2	2	1.8	3	1.7	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
CR23A11	Security Assessment and Risk Analysis	PE	3	0	0	3

Objectives:	
	Understand the fundamental principles of information security and the threat landscape.
	Understand various security assessment methodologies.
	Develop the ability to identify, assess, and manage information security risks through risk profiling and risk management concepts.
	Learn risk evaluation and mitigation strategies.
	Gain an introduction to common security frameworks and standards (NIST CSF and ISO 27001).

UNIT I	INTRODUCTION	9
Fundamentals of information security- CIA triad: Confidentiality, Integrity, Availability. Threat landscape overview: Common security threats, actors, and motivations. Introduction to vulnerability management.		
UNIT II	SECURITY ASSESSMENT METHODOLOGIES	9
Security assessment methodologies: Penetration testing - Vulnerability scanning - Security audits. Penetration testing types: White-box, black-box, grey-box testing. Vulnerability scanning tools and their functionalities.		
UNIT-III	RISK ANALYSIS AND RISK MANAGEMENT	9
Risk Profiling - Formulating the Risk - Risk Exposure Factors. Risk management concepts: Risk identification-assessment - mitigation and acceptance. Case Study - Work in groups to develop a risk register for a fictional company, identifying potential security risks, their likelihood, and impact.		
UNIT IV	RISK ASSESSMENT AND ANALYSIS	9
Risk Evaluation and mitigation strategies - Reports and Consulting - Risk Assessment Techniques. Project: Conduct a risk assessment for a specific department within your organization (if applicable) or a chosen cloud service platform.		
UNIT-V	SECURITY FRAMEWORKS AND STANDARDS	9
Introduction to security frameworks and standards (NIST CSF, ISO 27001) -Aligning security assessments and risk analysis with frameworks - Implementing security controls based on identified risks.		
		Total Contact Hours : 45

Course Outcomes:
On completion of course you will be able to
<ul style="list-style-type: none"> • Understand the CIA triad and identify common security threats, actors, and their motivations. • Distinguish between penetration testing, vulnerability scanning, and security audits. • Describe the four main risk management concepts: identification, assessment, mitigation, and acceptance • Explain risk profiling and risk evaluation techniques. • Summarize the purpose and benefits of security frameworks like NIST CSF and ISO 27001

Suggested Activities:
<ul style="list-style-type: none"> • Quizzes
<ul style="list-style-type: none"> • Class presentation/Discussion
<ul style="list-style-type: none"> • Group Presentation

Reference Books (s)/Web links:
1. William Stallings, "Cryptography and Network Security", Seventh Edition, Pearson, 2017
2. Mark Talabis and Jason Martin, "Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis", Syngress, 2012
3. Thomas R Peltier, "Information Security Risk Analysis", First Edition, Auerbach Publications, 2001
4. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First Edition, Syngress, 2011
5. Jon Erickson, "Hacking: The Art of Exploitation", Second Edition, No Starch Press, 2008

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CR23A11.1	3	3	-	2	2	2	1	2	-	1	-	2	3	3	2
CR23A11.2	2	3	-	3	3	-	-	-	-	1	-	1	3	3	2
CR23A11.3	3	3	3	3	3	2	1	2	-	-	-	2	3	3	2
CR23A11.4	3	2	3	3	3	-	2	2	-	-	-	1	3	3	2
CR23A11.5	3	3	2	3	3	2	2	3	-	-	-	2	3	3	2
Average	2.8	2.8	2.6	2.8	2.8	2	1.5	2.25	-	1	-	1.6	3	3	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
CS23A11	Malware Detection and Analysis	PE	3	0	0	3
For B.E Programme CSE ,CSECS,CSD and B.Tech Programme in IT						

Objectives:
<ul style="list-style-type: none"> To introduce the malware components and behaviour To detect and analyze malware affected documents. To introduce malware fundamentals and basic analysis. To enable to identify and analyze various malware types by static analysis. To enable to identify and analyze various malware types by dynamic analysis.

UNIT I	MALWARE COMPONENTS AND FUNCTIONALITY	9
Malware Components-Payload, Packers, Persistence, Communication, Propagation, Armoring ,Stealth, Distribution Mechanisms, Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection		
UNIT II	MALWARE DETECTION AND REVERSE ENGINEERING	9
Antivirus Engines-Main Components, Signatures and Signature Modules, File Scanner, Unpacker Module, Memory Scanner, Hook and Rootkit detection Modules, Next Generation Antiviruses, Malware Sandbox Internals, Reverse engineering malicious code - Identifying malware passwords - Bypassing authentication -Advanced malware analysis: Virus, Trojan and APK Analysis - Reverse Engineering Tools: IDA Pro and OLLYDBG		
UNIT-III	BASIC MALWARE ANALYSIS	9
Objective of Malware Analysis, Malware Analysis techniques, Types of Malware, General Rules for Malware Analysis, Antivirus scanning, Hashing, Finding Strings, Packed and Obfuscated Malware , Portable Executable File Format, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots.		
UNIT IV	MODERN MALWARE STATIC ANALYSIS	9
Levels of Abstraction, Reverse-Engineering, The x86 Architecture, Simple Instructions, The Stacks, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.		

UNIT-V	MODERN MALWARE DYNAMIC ANALYSIS	9
<p>Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wire shark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching.</p>		
		Contact Hours:45

Course Outcomes: On completion of course you will be able to
<ul style="list-style-type: none"> • Understand the various components of malware analysis and their functionalities. • Understand the malware detecting methods and reverse engineering. • Understand the various concepts of malware analysis and their technologies used. • Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques • To be able to safely analyze, debug, and disassemble any malicious software by malware analysis

Textbooks:
1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012.
2. Abhijit Mohanta, Anoop Saldanha, Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware, 2020, 1st edition, Apress .
3. M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software. 2012, 1st edition, No Starch Press.

Reference Books (s)/Web links:
1. Monnappa K A, Learning Malware Analysis- Explore the concepts, tools, and techniques to analyze and investigate Windows malware, 2018, 1st edition, Packt Publishing.
2. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O’Reilly, 2015.

CO-PO-PSO Mapping

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
CS23511.1	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.2	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.3	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.4	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
CS23511.5	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
Average	2	1.8	2.5	1.6	2	1	-	1	-	-	1	-	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 Oriented Theory course)	Category	L	T	P	C
CR23A31	Ethical Hacking and Security	PE	2	0	2	3

Objectives:	
•	To understand the ethical hacker's role, the hacking methodology, and the legal boundaries distinguishing ethical from malicious hacking.
•	To identify system weaknesses, network vulnerabilities, and use scanning tools to find security gaps.
•	To understand using ethical hacking tools and techniques to simulate real-world attacks for defensive purposes.
•	To learn how to prioritize risks, recommend security measures and report vulnerabilities.
•	To understand social engineering tactics, zero-day vulnerabilities.

UNIT I	INTRODUCTION	6
Overview of Ethical Hacking- Importance of ethical hacking for Businesses-Key concepts of Ethical Hacking- Difference between Ethical Hacking and Malicious Hacking-Most used tools in Ethical Hacking Incidents(NMAP, Metasploit)-Ethical hacking challenges and their solutions.		
UNIT II	NETWORK VULNERABILITIES AND VARIOUS SCANNING TOOLS	6
Overview of Network vulnerability scanning- Types of network vulnerability scanning-Key features of network vulnerability scanner-Network vulnerability scanning vs network scanning- Network scanning tools(Burp Suite)		
UNIT-III	ETHICAL HACKING TOOLS AND TECHNIQUES	6
Overview, Tools and Techniques in Ethical Hacking (Metasploit Framework, Nessus, Wireshark, Burp Suite, Nmap, John-the-Ripper, OWASP Zap.		
UNIT IV	RISK ASSESSMENT AND TYPES OF SYSTEM HARDENING	6
Overview, Types of system hardening (Network hardening, Server hardening, Application hardening, Database hardening, Operating system hardening), Types of Security Risk assessments (Physical security assessment, IT security assessment, Data security assessment, Application security assessment, Insider Threat assessment)		
UNIT-V	SOCIAL ENGINEERING AND ZERO DAY ATTACKS	6
Overview of Social Engineering and zero day attacks, Impact of social Engineering and zero day attacks, Prevention and mitigation techniques, Best practices for protecting against social engineering and zero day attacks.		
		Total Contact Hours : 30

List of Experiments		
1	Conduct a basic penetration test using Metasploit to exploit a known vulnerability in a controlled environment.	
2	Use NMAP to scan a network and identify open ports and services.	
3	Perform a web vulnerability scan using Burp Suite and document the identified vulnerabilities and their potential impacts.	
4	Perform a vulnerability scan using Nessus and generate a detailed report on the findings, including recommended remediation steps.	
5	Conduct a web application security test using OWASP ZAP. Document vulnerabilities and provide remediation recommendations.	
6	Assess the security of a sample application and provide a detailed report on vulnerabilities and recommended hardening measures.	
7	Perform a risk assessment on a sample IT system and present a risk management plan.	
8	Perform Social Engineering attack	
9	View and capture network traffic using Wireshark	
10	Explore dig tool for vulnerabilities	
Contact Hours :		30
Total Contact Hours :		60

Course Outcomes: On completion of course you will be able to
<ul style="list-style-type: none"> • Grasp Core Ethical Hacking Concepts includes exploring the ethical hacker's role, the hacking methodology and the legal boundaries of ethical hacking.
<ul style="list-style-type: none"> • Learn in detail about common system weaknesses, network vulnerabilities, and various scanning tools to pinpoint security gaps
<ul style="list-style-type: none"> • Able to Understand ethical hacking tools and techniques
<ul style="list-style-type: none"> • Gain knowledge in risk assessment and types of system hardening
<ul style="list-style-type: none"> • Understand topics like social engineering tactics, zero-day vulnerabilities, and keeping abreast • of industry best practices.

Suggested Activities:

<ul style="list-style-type: none"> Code implementing sessions in NMAP, Metasploit, Burp Suite
<ul style="list-style-type: none"> Mini projects

Course Outcomes:
On completion of course you will be able to
<ul style="list-style-type: none"> Tutorial problems.
<ul style="list-style-type: none"> Assignment problems.
<ul style="list-style-type: none"> Quizzes
<ul style="list-style-type: none"> Class presentation/Discussion

Textbooks (s)/Web links:	
1.	Jon Erickson,"The Art of Exploitation", 2nd Edition, No Starch Press, 2017
2.	Dafydd Stuttard ,"Web Application Hacker's Handbook: Finding and Exploiting Security Flaws",2 nd edition, John Wiley, 2011
3	J. Thomas," Mastering Ethical Hacking",1 st Edition, TheHackStore, 2023

CO-PO-PSO Mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CR23A31.1	3	2	1	2	2	2	-	3	1	2	-	2	3	2	1
CR23A31.2	3	3	2	3	3	1	1	2	2	2	-	3	3	3	2
CR23A31.3	2	3	3	3	3	2	-	2	2	3	-	3	3	3	3
CR23A31.4	2	3	2	3	2	2	-	3	2	2	-	3	3	3	2
CR23A31.5	3	3	2	3	2	2	2	3	2	2	1	3	3	2	3
Average	2.6	2.8	2	2.8	2.4	1.8	1.5	2	2.6	2.2	1	2.8	3	13	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 oriented Theory course)	Category	L	T	P	C
CR23A32	Digital and Mobile Forensics	PE	2	0	2	3

Objectives:	
	To understand basic digital forensics and techniques.
	To understand digital crime and investigation.
	To understand how to be prepared for digital forensic readiness.
	To understand and use forensics tools for Android devices.
	To understand and use Anti Forensics.

UNIT I	INTRODUCTION	6
Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process: Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.		
UNIT II	DIGITAL CRIME AND INVESTIGATION	6
The International Legal Framework of Cybercrime Law - Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence		
UNIT-III	DIGITAL FORENSIC READINESS	6
Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics		
UNIT IV	ANDROID FORENSICS	6
Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling		
UNIT-V	SQLITE DATABASE FORENSICS AND ANTI FORENSICS	6
Sqlite Database Forensics: Relational Databases - Other Viewers - Anti Forensics: Introduction - Steganography – Cryptography - Password Cracking.		
		Total Contact Hours : 30

List of Experiments	
1	Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2	Data extraction from call logs using Sleuth Kit.
3	Data extraction from SMS and contacts using Sleuth Kit.
4	Extract installed applications from Android devices.

5	Extract diagnostic information from Android devices through the adb protocol.	
6	Generate a unified chronological timeline of extracted records,	
7	Implement the sql query database and to handle sqlite in browser	
8	Hide InvisibleSecrets in the initial screen using Steganography	
Contact Hours :		30
Total Contact Hours :		60

Course Outcomes:
On completion of course you will be able to
<ul style="list-style-type: none"> • Have knowledge on digital forensics. • Know about digital crime and investigations. • Be forensic ready • Investigate, identify and extract digital evidence from Android devices. • Know about Anti Forensics.

Suggested Activities:
<ul style="list-style-type: none"> • Assignment problems, Quiz. • Class presentation/Discussion

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

Reference Books (s)/Web links:
1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
2. Dejay, Murugan, "Cyber Forensics", 1 st Edition, Oxford, 2018
3. Rohit, Oleg, Mahalik, Satish, "Practical Mobile Forensics", 4 th Edition, Packt, 2020

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CR23A32.1	3	2	2	3	3	-	2	3	-	-	2	3	3	2	2
CR23A32.2	2	3	3	2	3	2	2	3	2	2	-	3	3	3	2
CR23A32.3	3	3	2	3	3	-	-	3	2	-	3	3	3	2	3
CR23A32.4	3	3	3	3	3	2	-	3	-	2	-	3	3	3	3
CR23A32.5	2	2	3	2	3	-	2	3	-	-	-	3	2	3	2
Average	2.6	2.6	2.6	2.6	3	2	2	3	2	2	2.5	3	2.8	2.6	2.4

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
CR23A33	Cryptocurrency and BlockChain Technologies	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To understand how blockchain operates and its potential applications beyond cryptocurrency
<ul style="list-style-type: none"> To understand various types of cryptocurrencies, mining processes, wallets, and their economic principles
<ul style="list-style-type: none"> To understand how smart contracts and decentralized applications transform the Ethereum
<ul style="list-style-type: none"> To understand common security challenges in cryptocurrencies and blockchain
<ul style="list-style-type: none"> Explore in setting up a cryptocurrency wallet, interacting with blockchain platforms, and exploring dApps for diverse applications.

UNIT I	INTRODUCTION	6
Overview, distributed ledger, how it works, and its key components like blocks, hashing functions, and consensus mechanisms (Proof of Work, Proof of Stake). Blockchain operation and its potential to revolutionize various industries beyond just cryptocurrency.		
UNIT II	CRYPTOCURRENCIES	6
Overview of history and evolution of leading cryptocurrencies like Bitcoin and Ethereum, different types of cryptocurrencies available, the mining process that creates new coins, how to securely store them in wallets, and the economic principles that govern their value.		
UNIT-III	SMART CONTRACTS AND DAPPS	6
Overview of smart contracts and decentralized applications (dApps), Smart contracts functionalities, limitations, and real-world applications, dApp platforms like Ethereum and how these applications are transforming industries such as finance, supply chain management, and even voting systems.		
UNIT IV	BLOCKCHAIN SECURITY, REGULATION, AND FUTURE APPLICATIONS	6
Overview on common security challenges associated with cryptocurrencies and blockchain platforms, like hacking attempts and fraudulent activities, explore the current regulations and potential future frameworks being developed globally, Future applications of blockchain technology across different sectors like healthcare, data management, and the Internet of Things (IoT).		
UNIT-V	BLOCKCHAIN IN PRACTICE	6
Provide practical experience with blockchain and cryptocurrency tools, Set up a cryptocurrency wallet, interact with a blockchain platform like Ethereum or another chosen platform, or explore dApps for different purposes (e.g., decentralized finance applications or NFT marketplaces).		
Total Contact Hours		: 30

List of Experiments		
1	Simulate a Simple Blockchain creation	
2	Simple implementation of Proof of Work	
3	Simulate Bitcoin Mining	
4	Creating a Crypto-currency Wallet	
5	Creating and Deploying a Simple Smart Contract on Ethereum (Remix)	
6	Developing a Simple dApp with Web3 and Python	
7	Writing a Simple Smart Contract with Python or Solidity	
8	Public and Private key generation and basic encryption for Wallet security	
9	Creating a cryptocurrency wallet on a platform like MetaMask or Trust Wallet, and perform transactions on a testnet	
10	Exploring and Interacting with a Decentralized Finance (DeFi) Application or NFT Marketplace	
Contact Hours :		30
Total Contact Hours :		60

Course Outcomes:
On completion of course you will be able to
<ul style="list-style-type: none"> • Develop knowledge in the core concepts of blockchain technology, including distributed ledgers, hashing functions, and consensus mechanism
<ul style="list-style-type: none"> • Focus on understanding history and evolution of cryptocurrencies, such as Bitcoin and Ethereum
<ul style="list-style-type: none"> • Understand the concept of smart contracts and their functionalities on a blockchain platform
<ul style="list-style-type: none"> • Understand the potential future applications of blockchain technology across various industries
<ul style="list-style-type: none"> • Demonstrate practical skills through hands-on activities, such as setting up a cryptocurrency wallet or interacting with a blockchain platform

Suggested Activities:
<ul style="list-style-type: none"> • Problem solving sessions
<ul style="list-style-type: none"> • Mini projects

Course Outcomes: On completion of course you will be able to	
•	Tutorial problems.
•	Assignment problems.
•	Quizzes
•	Class presentation/Discussion

Reference Books (s)/Web links:
1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
2. Don and Tapscott, Alex, “Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World”, 2018, Penguin
3. Andreas M. Antonopoulos, “Internet of Money”, 2018
6. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017
7. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing, 2018

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CR23A33.1	3	2	3	-	1	-	-	-	1	-	1	2	2	1	2
CR23A33.2	2	2	2	-	1	-	-	-	1	-	1	2	2	1	2
CR23A33.3	2	2	3	-	2	-	-	-	1	-	1	2	2	1	2
CR23A33.4	2	2	2	-	2	-	-	-	1	-	1	2	2	1	2
CR23A33.5	2	2	2	-	2	-	-	-	1	-	1	2	2	1	2
Average	2.2	2	2.6	-	1.6	-	-	-	1	-	1	2	2	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
CR23A34	Security and Privacy in Cloud	PC	2	0	2	3

Objectives:
<input type="checkbox"/> To learn the fundamentals of Cloud Computing.
<input type="checkbox"/> To learn the infrastructure security in cloud environment.
<input type="checkbox"/> To learn the cloud application.
<input type="checkbox"/> To learn the data life cycle and privacy in cloud.
<input type="checkbox"/> To learn the cloud privacy and risk management.

UNIT-I	FUNDAMENTALS OF CLOUD CONCEPTS	6
Cloud Computing-Cloud computing technology components, Cloud services delivery, Cloud Deployment Model, Key drivers for adopting the cloud.		
UNIT-II	INFRASTRUCTURE SECURITY	6
Infrastructure Security: The Host Level-The Network Level, Ensuring Data Confidentiality and Integrity, Ensuring Proper Access Control, SaaS and PaaS Host Security, IaaS Host Security, Virtualization Software Security, Threats to the hypervisor, Virtual Server Security, Securing virtual servers.		
UNIT-III	CLOUD APPLICATION	6
Application-Level Security Threats, DoS and EDoS, End User Security, End User Security, PaaS Application Security, Customer-Deployed Application Security, IaaS Application Security, Public Cloud Security Limitations.		
UNIT-IV	CLOUD PRIVACY	6
Privacy: Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy.		
UNIT-V	CLOUD PRIVACY RISK MANAGEMENT	6
Privacy Risk Management:Collection Limitation Principle, Use Limitation Principle, Security Principle, Transfer Principle, Accountability Principle, Legal and Regulatory Implications.		
Contact Hours		: 30

List of Experiments	
1.	Private Cloud
a	Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.
b	Perform Creation, Management and Termination of a CirrOS instance in OPENSTACK.
c	Show the virtual machine migration based on certain conditions from one node to the other.
2	Public Cloud
a	Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.
b	Test how a SaaS applications scales in response to demand.
c	Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.
3	Data Encryption

a	Encrypt data both in transit and at rest using robust encryption algorithms.			
b	Implement Transport Layer Security (TLS) for securing communication channels.			
c	Use disk encryption to protect data stored on physical or virtual disks.			
4	Access Control Policies			
a	Develop access control policies defining who can access what resources.			
b	Implement role-based access control (RBAC) to assign permissions based on roles.			
5	Identity Access Management			
a	Capture all the flags in AWS bigiam challenges that consists of common misconfigurations in IAM.			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Understand the cloud concepts and fundamentals.
<input type="checkbox"/>	Explain the infrastructure security in cloud
<input type="checkbox"/>	Define cloud application.
<input type="checkbox"/>	Understand various privacy in the cloud.
<input type="checkbox"/>	Define the various privacy risk management.

Text Book(s):	
1. Tim Mather, Subra Kumaraswamy, and Shahed Latif” Cloud Security and Privacy”, O’Reilly, First Edition 2009.	
2. Eyal Estrin, “Cloud Security Handbook”, Packt, 2022.	

Reference Book(s) / Web link(s):	
1. Michael J. Kavis “Architecting the Cloud: Design Decisions for Cloud Computing Service Models(SaaS, PaaS, and IaaS)”, First Edition, Wiley,2014.	
2. Tom White, “Hadoop: The Definitive Guid”. Yahoo Press, 2014.	
3.Rajkumar Buyya, Christain Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.	
4. John W. Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.	
5.Thomas Erl, Zaigham Mahood, Ricardo Puttini- “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, First Edition, 2013.	
8. Kai Hwang, Geoffery C, Fox and Jack J, Dongarra,” Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet”, First Edition, Morgan Kaufman Publisher, an Inprint of Elsevier, 2012.	
9. https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000160001PDFE.pdf	

10. <https://www.youtube.com/watch?v=dmEe6dHBKYc>

11. <https://www.youtube.com/watch?v=zd4LWt5Phac>

12. <https://www.youtube.com/watch?v=qTRmgP3oaqk>

CO-PO-PSO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CR23A34.1	3	2	1	-	2	-	-	-	-	1	-	2	2	1	-
CR23A34.2	2	3	2	2	3	1	-	2	-	-	1	2	3	2	-
CR23A34.3	2	2	3	-	3	-	-	1	1	-	-	1	2	2	-
CR23A34.4	2	2	1	-	2	2	1	3	-	1	-	1	2	1	1
CR23A34.5	2	3	2	1	2	2	1	3	-	1	2	1	2	1	2
Average	2.2	2.4	1.8	1.5	2.4	1.6	1	2.25	1	1	1.5	1.4	2.2	1.4	1.5

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
CR23A35	Social Network Security	PE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> To understand and develop semantic web related applications
<ul style="list-style-type: none"> To understand privacy and security issues in Social Networking
<ul style="list-style-type: none"> To learn about the data extraction and mining of social networks
<ul style="list-style-type: none"> To discuss the prediction of human behaviour in social communities
<ul style="list-style-type: none"> To learn about the Access Control and identity management

UNIT I	FUNDAMENTALS OF SOCIAL NETWORKING	6
Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.		
UNIT II	PRIVACY AND SECURITY ISSUES	6
The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviours, Anonymity in a networked world.		
UNIT-III	EXTRACTION AND MINING IN SOCIAL NETWORKING DATA	6
Extracting evolution of Web Community from a Series of Web Archive, detecting communities in social networks, Definition of community, evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.		
UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	6
Understanding and predicting human behaviour for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.		
UNIT-V	ACCESS CONTROL AND IDENTITY MANAGEMENT	6
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.		
Total Contact Hours		30

List of Experiments		
1	Developing a social media application.	
2	Create a Network model using Neo4j.	
3	Read and write Data from Graph Database.	
4	Find “Friend of Friends” using Neo4j.	
5	Implement secure search in social media.	
6	Create a simple Security & Privacy detector.	
Contact Hours :		30
Total Contact Hours :		60

Course Outcomes:	
On completion of course you will be able to	
•	Develop a semantic web related application
•	Address Privacy and Security issues in Social Networking
•	Extract and mine the social networks data
•	To predict human behaviour in social communities
•	To enforce access control mechanism and do identity management

Suggested Activities:	
•	Assignment problems.
•	Class presentation/Discussion

Textbooks:	
1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.	
2. Borko Furht, “Handbook of Social Network Technologies and Application”, First Edition, Springer, 2010.	
3. Jerome Baton and Rik Van Bruggen, "Learning Neo4j 3.x", Second Edition, Packt publishing, 2017	
4. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World", First Edition, Cambridge University Press, 2010.	

Reference Books (s)/Web links:
1. Easley D and Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly Connected World”, Cambridge University Press, 2010.
2. Jackson and Matthew O, “Social and Economic Networks”, Princeton University Press, 2008.
3. GuandongXu , Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling”, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

CO-PO-PSO Mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CR23A35.1	2	3	3	2	3	-	-	-	1	2	-	2	3	2	1
CR23A35.2	3	3	2	-	3	3	-	3	-	1	-	2	3	2	2
CR23A35.3	2	3	2	3	3	-	-	2	-	1	-	2	3	3	1
CR23A35.4	1	3	2	-	2	-	-	2	-	1	-	1	2	2	1
CR23A35.5	2	3	3	2	3	2	-	3	-	1	2	2	3	2	2
Average	2	3	2.4	2.3	2.8	2.5	-	2.5	1	1.2	2	1.8	2.8	2.2	1.4

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
CS23A35	Web Application Security	PE	2	0	2	3
For B.E Programme CSE ,CSECS,CSD and B.Tech Programme in IT,AIML & AIDS						

Objectives:
<ul style="list-style-type: none"> ● To understand the fundamentals of Web Application Security ● To know about web application authentication and authorization mechanism ● To identify common web application vulnerabilities ● To focus on wide aspects of secure development and deployment of web applications ● To get insight about mitigations and countermeasures against web application attacks

UNIT I	INTRODUCTION	6
History of Software Security – OWASP Top Ten List 2021 – Input Validation – Attack Surface Reduction – Classifying and Prioritizing Threats		
UNIT II	WEB APPLICATION SECURITY PRINCIPLES	6
Authentication - Access Control Overview - Two Factor and Three Factor Authentication - Web Application Authentication – Authorization - Session Management Fundamentals - Securing Web Application Session Management		
UNIT-III	COMMON WEB APPLICATION VULNERABILITIES	6
Cross Site Scripting- Reflected XSS- Stored XSS- DOM based XSS- Mutation based XSS – Cross Site Request Forgery - SQL Injection – Code Injection – Insecure Direct Object References (IDOR)		
UNIT IV	SECURE DEVELOPMENT AND DEPLOYMENT	6
Application Security- Training- Threat Modelling- Secure Coding Libraries- Code Review- Security Testing- Security Incident Response Planning – Microsoft Security Development Lifecycle (SDL) – OWASP Comprehensive Lightweight Application Security Process (CLASP) – Software Assurance Maturity Model (SAMM)		
UNIT-V	MITIGATIONS AND COUNTERMEASURES	6
Anti XSS Coding Best Practices- Sanitizing User Input – Anti CSRF Coding Best Practices – Mitigating Against SQL Injection – Generic Injection Defenses – Defending Against IDOR – Architecture Level Mitigations		
Total Contact Hours		: 30

List of Experiments		
1	Identify security issues in web application – Walking An Application in TryHackMe Platform	
2	Burp Suite Basics in TryHackMe Platform	
3	OWASP ZAP to scan authenticated web application in TryHackMe Platform	
4	SQL Injection Lab in TryHackMe Platform	
5	Explore OWASP Top Ten -2021 Vulnerabilities in TryHackMe Platform	
6	SQLmap to exploit web application in TryHackMe Platform	
7	Exploit File Inclusion and Path Traversal Vulnerabilities in TryHackMe Platform	
8	Server Side Template Injection in TryHackMe Platform	
9	DejaVu Code Injection Vulnerability in TryHackMe Platform	
10	NoSQL Injection on MongoDB in TryHackMe Platform	
Contact Hours :		30
Total Contact Hours :		60

Course Outcomes: On completion of course you will be able to
<ul style="list-style-type: none"> ● Understand the fundamentals of web application security ● Apply security principles in developing a secure web application ● Identify common web vulnerabilities that are exploited by hackers ● Identify the secure model for web application development and deployment ● Apply best practices for mitigations of vulnerabilities

Suggested Activities:
<ul style="list-style-type: none"> ● Assignment problems, Quiz. ● Class presentation/Discussion

Textbooks:
1. Andrew Hoffman, “Web Application Security: Exploitations and Countermeasures for Modern Web Applications”, 2 nd Edition, O’Reilly, 2024
2. Brian Sullivan and Vincent Liu, “Web Application Security: A Beginners Guide”, 1 st Edition, McGrawHill, 2012

Reference Books (s)/Web links:
1. Ron Lepofsky, "The Manager's Guide to Web Application Security: A Concise Guide to the Weaker Side of the Web", Apress, 2015
2. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, Wiley, 2011
3. Joseph Marshall, "Hands-On Bug Hunting for Penetration Testers: A practical guide to help ethical hackers discover web application security flaws", Packt, 2018
4. https://owasp.org/www-project-top-ten/
5. https://tryhackme.com/r/hacktivities/search
6. https://portswigger.net/web-security/learning-paths

CO-PO-PSO Mapping

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
CS23A35.1	1	2	2	1	3	-	-	-	-	-	-	1	-	-	-
CS23A35.2	2	1	2	1	3	-	-	-	-	-	-	-	-	-	-
CS23A35.3	1	1	1	2	3	-	-	-	-	-	-	1	-	-	-
CS23A35.4	1	2	1	1	2	-	-	-	-	-	-	-	-	-	-
CS23A35.5	1	2	2	2	2	-	-	-	-	-	-	1	-	-	-
Average	1.2	1.6	1.6	1.4	2.6	-	-	-	-	-	-	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
CR23A36	Information Security and Management	PE	2	0	2	3

Objectives:	
▪	To understand the basics of Information Security and legal and ethical issues in Information Security.
▪	To understand the information security policy and concepts of access control.
▪	To learn about intrusion detection and prevention techniques and tools.
▪	To learn about auditing techniques and tools.
▪	To Learn to analyze and validate forensics data

UNIT-I	INTRODUCTION	6
Security Trends, OSI security architecture, Security attacks, security services, security mechanisms, Security System Development Life cycle – Legal, Ethical and Professional issues.		
UNIT-II	SECURITY ANALYSIS	6
Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk. Blueprint for Information Security - Information Security Policy. Case Study: Healthcare Data Security		
UNIT-III	SECURITY TECHNOLOGY	6
Intrusion Detection and Prevention Systems (IDPS)-Terminology-Types-Detection methods. Honeypots, Honeynets and padded cell systems. Scanning and Analysis Tools-Port scanners-Firewall analysis tools, Operating system detection tools-Vulnerability scanners-Packet sniffers-Wireless security Tools		
UNIT-IV	AUDITING	6
Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment- Case Study: Web Application Security Assessment for Online Retailer		
UNIT-V	ANALYSIS AND VALIDATION	6
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics. -Case Study: WannaCry Ransomware Attack		
Contact Hours		30

List of Experiments			
1	Implementation to gather information from any PC's connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.		
2	Implementation of Steganography		
3	Implementation of Mobile Audit and generate the report of the existing Artifacts.		
4	Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.		
5	Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.		
6	Perform mobile analysis in the form of retrieving call logs, SMS log ,all contacts list using the forensics tool like SAFT		
7	Implementation to identify web vulnerabilities, using OWASP project.		
Contact Hours			30
Total Contact Hours			60

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Discuss the basics of information security and legal and ethical issues in Information Security.
<input type="checkbox"/>	Analyze the risk management and information security policy.
<input type="checkbox"/>	Implement intrusion detection and prevention techniques using different tools.
<input type="checkbox"/>	Perform auditing of logs.
<input type="checkbox"/>	Analyze and validate forensics data

Text Book(s):
1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security with Mindtap”, Cengage Learning, Seventh Edition 2023.
2. Nelson, Phillips, Enfinger, Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2008.

Reference Book(s)/Web link(s):
1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, CRC Press; 6 th Edition, 2007.
2. John R. Vacca, “Computer Forensics”, Cengage Learning, 2005
3. Marjie T. Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3 rd Edition, Prentice Hall, 2013.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CR23A36.1	3	2	1	-	-	2	2	3	1	-	-	2	3	1	1
CR23A36.2	2	3	2	2	-	-	2	3	-	2	2	2	2	2	1
CR23A36.3	2	3	3	3	3	-	-	2	-	1	-	2	3	2	1
CR23A36.4	2	2	3	3	3	-	-	-	-	-	-	1	3	3	1
CR23A36.5	3	2	2	3	-	-	2	3	-	-	1	2	3	3	2
Average	2.4	2.4	2.2	2.2	3	2	2	2.75	1	1.5	1.5	1.8	2.8	2.2	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
IT23O31	Data Science using Python	OE	2	0	2	3

Objectives:
<ul style="list-style-type: none"> Develop a broad understanding of the scope, key skills, tools, and applications of data science across various industries.
<ul style="list-style-type: none"> Gain the ability to perform thorough EDA using Python, focusing on data cleaning, transformation, and visualization techniques.
<ul style="list-style-type: none"> Learn to apply descriptive statistics to analyze data distributions, central tendencies, and measures of dispersion using real-world datasets.
<ul style="list-style-type: none"> Acquire skills to create a wide range of data visualizations, both basic and advanced, using Python libraries and Tableau for effective data communication.
<ul style="list-style-type: none"> Understand and implement the CRISP-DM framework to structure and manage data science projects effectively, from data collection to visualization.

UNIT-I	INTRODUCTION TO DATA SCIENCE	6
Definition and Scope of Data Science- Role of a Data Scientist-Key Skills and Tools Used in Data Science- Applications of Data Science in Various Industries (e.g., healthcare, finance, retail, etc.)- Overview of the Data Science Process: Data Collection, Data Preparation, Data Analysis, and Data Visualization- CRISP-DM (Cross-Industry Standard Process for Data Mining) Framework- Descriptive Statistics-Measures of Central Tendency (Mean, Median, Mode)-Measures of Dispersion (Range, Variance, Standard Deviation)-Data Distribution: Normal Distribution, Skewness, and Kurtosis		
UNIT-II	EDA using Python-Data Cleaning	6
Introduction to EDA -Types of EDA-EDA Tools-EDA using Python : Data Frame Operations- Key Data Structures: Series and Data Frame-Creating and Loading Data Frames from Various Sources (e.g., CSV, Excel, SQL)- Viewing and Inspecting Data Frames-Filtering and Subsetting Data using Conditions-Data Cleaning with Pandas- Handling Missing Data-Detection, Filling, and Dropping-Removing Duplicates and Unnecessary Data-Data Type Conversion and Ensuring Consistency		
UNIT-III	EDA using Python-Data Transformation	6
Data Transformation and Feature Engineering - Applying Functions across DataFrames: Apply, Map, and Lambda Functions-Creating New Columns and Modifying Existing Ones-Aggregation and Grouping Operations: GroupBy - Summarizing and Visualizing Data using Pandas Built-in Plotting-Correlation and Covariance Analysis-Data Scaling and Normalization.		
UNIT-IV	Visualization in EDA	6
Importance of data visualization in EDA- Types of data visualizations- Python Libraries for Data Visualization- Basic Plotting with Matplotlib - Advanced Plotting with Seaborn- Interactive Visualization with Plotly- Visualization for Descriptive Statistics-Visualizing central tendency and dispersion-Box plots and whisker plots-Correlation and Relationship Analysis-Scatter plot matrix-Correlation heatmaps.		
UNIT-V	Visualization using Tableau tool	6
Introduction to Tableau-Overview of Tableau-Tableau Interface-Connecting to Data-Connecting to various data sources (Excel, CSV, SQL databases-Data Preparation-Data cleaning and transformation within Tableau-Basic Visualizations in Tableau -Bar charts, line charts, and pie charts-Tables and cross-tabs-Formatting and styling visualizations- Filters and Parameters-Adding filters to visualization-Calculated Fields and Analytics-Advanced Visualizations in Tableau-Heatmaps, tree maps, and bubble charts-Creating maps- Dashboards and Stories .		

Contact Hours:	30
-----------------------	-----------

Description of the Experiments	Contact Hours:	30
---------------------------------------	-----------------------	-----------

Setting up the Python environment and libraries-Jupyter Notebook

Data Collection from Various Sources

- Importing data from CSV, Excel, SQL databases, and web scraping
- Handling different data formats
- Loading data into Pandas Data Frames

Data Cleaning Techniques

- Handling missing values: detection, filling, and dropping
- Removing duplicates and unnecessary data
- Data type conversion and ensuring consistency

Exploratory Data Analysis (EDA) Using Pandas

- Viewing and inspecting DataFrames
- Filtering and subsetting data using conditions
- Descriptive statistics: measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation)

Data Transformation and Feature Engineering

- Applying functions across DataFrames: apply, map, and lambda functions
- Creating new columns and modifying existing ones
- Aggregation and grouping operations: GroupBy
- Data scaling and normalization.

Data Visualization with Matplotlib

Basic plotting: line charts, bar charts, histograms.

Advanced Data Visualization with Seaborn

- Creating advanced plots: box plots, violin plots, scatter plots, and pair plots
- Customizing Seaborn plots: themes and color palettes
- Visualizing data distributions and relationships

Interactive Visualization with Plotly

- Introduction to Plotly for interactive visualizations
- Creating interactive plots: line charts, scatter plots, bar charts
- Building interactive dashboards with Plotly

Data Visualization Using Tableau

- Introduction to Tableau and its interface
- Connecting to various data sources (Excel, CSV, SQL databases)
- Creating basic visualizations: bar charts, line charts, pie charts
- Building dashboards and stories in Tableau

Course Outcomes:

- Students will be able to define the scope of data science and identify its key applications in various industries, demonstrating a clear understanding of the role and skills of a data scientist.
- Students will gain practical experience in performing EDA using Python, including data cleaning, transformation, and visualization, enabling them to handle real-world data efficiently.
- Students will be able to apply descriptive statistics techniques to analyze and interpret data distributions, central tendencies, and measures of dispersion, providing meaningful insights from data.
- Students will develop proficiency in creating various types of data visualizations using Matplotlib, Seaborn, and Plotly, and will be able to create interactive visualizations and dashboards using Tableau.
- Students will be able to implement the CRISP-DM framework in data science projects, effectively managing the data collection, preparation, analysis, and visualization stages to derive actionable insights.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Flipped classroom - Comparing SOA with Client-Server and Distributed architectures
- Activity Based Learning

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Wes McKinney, "Python for Data Analysis", O'Reilly Media.2012
2. Wes McKinney, Python for Data Analysis - Data wrangling with pandas, Numpy, and ipython, Second edition, O'ReillyMedia Inc, 2017.
3. "Hands-On Data Analysis with Pandas: Efficiently perform data collection, wrangling, analysis, and visualization using Python" by Stefanie Molin
4. "Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization" by Joshua N. Milligan

Reference Books(s) / Web links:1. <https://www.datacamp.com/courses/statistical-thinking-in-python-part-1>**CO - PO – PSO MAPPING**

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
IT23O31.1	3	2	2	–	3	–	–	2	3	2	–	–	2	2	–
IT23O31.2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
IT23O31.3	3	3	3	3	3	2	3	3	3	3	2	3	3	3	3
IT23O31.4	3	3	3	3	3	2	2	3	3	3	3	2	2	3	3
IT23O31.5	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
Average	3	2.8	2.8	3	3	2	3	2.8	3	2.8	2.75	2.75	2.6	2.8	3

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

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

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