



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

REGULATION 2023

CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

**B.Tech Artificial Intelligence and
Data Science**



RAJALAKSHMI ENGINEERING COLLEGE
(An Autonomous Institution Affiliated to Anna University, Chennai)
Choice Based Credit System (CBCS)
CURRICULUM AND SYLLABUS
B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATIONS – 2023

Vision

To become a global leader in Artificial Intelligence and Data Science by achieving through excellence in teaching, training, and research, to serve the society.

Mission

- To develop students' skills in innovation, problem-solving, and professionalism through the guidance of well-trained faculty.
- To encourage research activities among students and faculty members to address the evolving challenges of industry and society.
- To impart qualities such as moral and ethical values, along with a commitment to lifelong learning

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1:Build a successful professional career across industry, government, and academia by leveraging technology to develop innovative solutions for real-world problems.

PEO 2:Maintain a learning mindset to continuously enhance knowledge through experience, formal education, and informal learning opportunities.

PEO 3:Demonstrate an ethical attitude while excelling in communication, management, teamwork, and leadership skills

PEO 4:Utilize engineering, problem-solving, and critical thinking skills to drive social, economic, and sustainable impact.

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

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.

PO4: 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.

PO5: 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.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

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

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering 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 lifelong learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Artificial Intelligence and Data Science Learning Program will demonstrate

PSO 1: Foundation Skills: Apply the principles of artificial intelligence and data science by leveraging problem-solving skills, inference, perception, knowledge representation, and learning techniques

PSO 2: Problem-Solving Skills: Apply engineering principles and AI models to solve real-world problems across domains, delivering cutting-edge solutions through innovative ideas and methodologies

PSO 3: Successful Progression: Utilize interdisciplinary knowledge to identify problems and develop solutions, a passion for advanced studies, innovative career pathways to evolve as an ethically responsible artificial intelligence and data science professional, with a commitment to society.

CURRICULUM
B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
Regulation 2023 | Total Credits: 160

SEMESTER I

S.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.	MA23116	Mathematical Foundations for AI	BS	4	3	1	0	4
3.	GE23117	தமிழர் மரபு /Heritage of Tamils	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
4.	PH23132	Physics for Information Science	BS	5	3	0	2	4
5.	GE23131	Programming using C	PC	7	1	0	6	4
6.	EE23133	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
LABORATORY COURSES								
7.	GE23122	Engineering Practices-Electrical and Electronics	ES	2	0	0	2	1
NON CREDIT COURSES								
8.	MC23111	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
TOTAL				29	16	1	12	20

SEMESTER II

S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA23214	Probability and Inferential Statistics	BS	4	3	1	0	4
2.	GE23217	தமிழரும் தொழில்நுட்பமும்/Tamils and Technology	HS	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
3.	GE23111	Engineering Graphics	ES	6	2	0	4	4
4.	IT23231	Digital Principles and Computer Architecture	PC	5	3	0	2	4
5.	AI23231	Principles of Artificial Intelligence	ES	5	3	0	2	4
6.	CS23231	Data Structures	PC	7	3	0	4	5
LABORATORY COURSES								
7.	HS23221/ HS23222	Technical Communication II / English for Professional Competence	HS	2	0	0	2	1
8.	GE23121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1
9.	CS23221	Python Programming Lab	PC	4	0	0	4	2
TOTAL				36	15	1	18	26

SEMESTER III								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA23313	Discrete Mathematics for AI	BS	4	3	1	0	4
LAB ORIENTED THEORY COURSES								
2.	AI23331	Fundamentals of Machine Learning	PC	5	3	0	2	4
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
NON CREDIT COURSES								
6.	MC23112	Environmental Science and Engineering	MC	3	3	0	0	0
TOTAL				31	16	1	14	21

SEMESTER IV								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Open Elective-I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
2.	MA23434	Optimization Techniques for AI	BS	5	3	0	2	4
3.	AI23431	Web Technology and Mobile Application	PC	5	1	0	4	3
4.	AD23431	Statistical Analysis and Computing	PC	4	2	0	2	3
5.	CS23431	Operating Systems	PC	7	3	0	4	5
6.	CS23432	Software Construction	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23421	Soft Skills I	EEC	2	0	0	2	1
8.	AD23421	Internship	EEC	0	0	0	2	1
TOTAL				31	15	0	18	24

SEMESTER V								
S.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.		Professional Elective – II	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	AD23531	Big Data Architecture	PC	5	3	0	2	4
4.	AD23532	Principles of Data Science	PC	6	2	0	4	4
5.	AI23531	Deep Learning	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				31	17	0	14	24

SEMESTER VI								
S.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.		Open Elective-II	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	AD23631	Data Privacy and Security	PC	5	3	0	2	4
4.	AD23632	Framework for Data and Visual Analytics	PC	5	3	0	2	4
5.	CS23634	Fundamentals of Generative AI and Prompt Engineering	PC	4	2	0	2	3
LABORATORY COURSES								
6.	GE23627	Design Thinking and Innovation	EEC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23621	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				26	14	0	12	20

SEMESTER VII								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective – IV	PE	3	3	0	0	3
2.		Professional Elective-V	PE	3	3	0	0	3
3.	AI23712	Reinforcement Learning	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS23633	Cloud Computing	PC	4	2	0	2	3
LABORATORY COURSES								
5.	AD23722	Project Phase I	EEC	8	0	0	8	4
TOTAL				21	11	0	10	16

SEMESTER VIII								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective- VI	PE	3	3	0	0	3
LABORATORY COURSES								
2.	AD23821	Project Phase II	EEC	12	0	0	12	6
TOTAL				15	3	0	12	9

- Should have focus on Artificial Intelligence and Data Science

TOTAL NO. OF CREDITS: 160

PROFESSIONAL ELECTIVES (PE)

DATA SCIENCE AND ANALYTICS								
S.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.	AD23A34	Predictive Analytics	PE	4	2	0	2	3
5.	AD23A35	Healthcare Analytics	PE	4	2	0	2	3
6.	AD23A36	Social Media Analytics	PE	4	2	0	2	3
7.	AD23A37	Image and Video Analytics	PE	4	2	0	2	3

DATA SCIENCE TECHNIQUES AND APPLICATIONS								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	AD23B31	Image Processing and Computer Vision	PE	4	2	0	2	3
2.	AD23B32	Natural Language Processing Analytics	PE	4	2	0	2	3
3.	AD23B33	Text and Speech Analysis	PE	4	2	0	2	3
4.	AI23B11	Information Visualization	PE	3	3	0	0	3
5.	AI23A33	AI for Game Programming	PE	4	2	0	2	3
6.	AI23B34	Human Computer Interaction	PE	4	2	0	2	3
7.	AI23B12	Cognitive Science	PE	3	3	0	0	3

FULL STACK DEVELOPMENT								
S.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.	IT23C17	Ubiquitous Computing	PE	3	3	0	0	3
3.	IT23C31	Software Testing	PE	4	2	0	2	3
4.	CS23A35	Web Application Security	PE	4	2	0	2	3
5.	IT23B33	DevOps	PE	4	2	0	2	3
6.	IT23C12	Software Project Management	PE	3	3	0	0	3

EMERGING TECHNOLOGIES								
S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT23A11	Internet of Things	PE	3	3	0	0	3
2.	CS23B32	Advanced Application Development with Oracle APEX	PE	6	0	0	6	3
3.	CS23A32	Robotic Process Automation	PE	4	1	0	4	3
4.	CB23G11	Quantum Computation and Quantum Information	PE	3	3	0	0	3
5.	CR23A33	Cryptocurrency and Blockchain Technologies	PE	4	2	0	2	3
6.	CS23A36	3D Printing and Design	PE	4	2	0	2	3
7.	CS23A33	Cyber Security and Forensics	PE	4	2	0	2	3

CYBER SECURITY								
S.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
9.	CR23A36	Information Security and Management	PE	4	2	0	2	3

VIRTUAL AND AUGMENTED REALITY								
S.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.	CS23A39	Game Development	PE	4	2	0	2	3
3.	CS23B31	Introduction to Metaverse	PE	4	2	0	2	3
4.	IT23E31	Graphics and Multimedia	PE	4	2	0	2	3
5.	CS23A38	Digital Marketing	PE	4	2	0	2	3
6.	CD23731	Film Making and Radio podcasting	PE	4	2	0	2	3

OPEN ELECTIVE COURSES OFFERED BY AIDS

S.NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	AD23O11	Introduction to Data Science	OE	3	3	0	0	3
2.	AD23O31	Data Visualization using Power BI	OE	4	2	0	2	3

SUMMARY OF ALL COURSES

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										
S.NO	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3	2							5
2	BS	8	4	4	4					20
3	ES	9	9							18
4	PC		11	17	15	17	11	6		77
5	PE					6	3	6	3	18
6	OE				3		3			6
7	EEC				2	1	3	4	6	16
8	MC	√		√						
	Total	20	26	21	24	24	20	16	9	160

AIDS Honors – Choose

1. Course from Programme Specific Elective 1 & 2 – 3 Subjects - 10 Credits
2. Courses from General Elective – 3 Subject – 9 Credits

Total Credits: 19

Guidelines for Special Projects / Activities for AIML, AIDS and CSD

S.no	Description	Credits	To be Completed	Compulsory	Optional	Professional or Open Elective can be dropped in
1	GE23527 Research Paper L T P C : 0 0 2 1	1	on or before VI Semester		AIML, AIDS & CSD	Additional credits or combine with other online courses eligible drop in VII or VIII Semester.
2	GE23427 Games/Short Film/ Animation Videos/ Animated Educational Content L T P C : 0 0 6 3	3	on or before VI Semester	CSD	AIML & AIDS	Not applicable for CSD, but for others in VII or VIII Sem (3 - credits Course only)
3	GE23428 Interdisciplinary Societal Project / Real World Web & Mobile Applications/ Innovative Product L T P C : 0 0 6 3	3	on or before VI Semester		AIML , AIDS & CSD	VII or VIII Sem (3 - credits Course only)
4	GE23429 Participation in National /International competitions L T P C : 0 0 6 3	3	on or before VI Semester		AIML , AIDS & CSD	VII or VIII Sem (3 - credits Course only)

GE23527 Research Paper writing (Eligible to drop 1 credit course Professional / Open elective course (if any) or combined with other online courses, eligible to drop one Professional/Open Elective (Max 3 credits) in VII or VIII semester)	L T P C : 0 0 2 1
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Research Paper –Guideline

Activities:

- Individual work
- Each student has to identify the domain area
- Select any 5 conferences/Journal papers to understand their work (published within 5 years)
- Write a research paper on comparative study on the following topics
 - Aim of the paper
 - Problem statement identified
 - Methodology to solve the problem
 - Tools used to solve the problem
 - Result of the problem
 - Identify the error or defect in the result
 - Identify the future work / enhancement of this result

Assessment:

- The **Research Paper writing** shall be evaluated for a maximum of 100 marks, as a Continuous Assessment
- A guide will be assigned to each student to monitor the progress and conduct the review meetings.
- Finally, student has to submit the research paper on comparative study
- The viva-voce examination will be conducted with external faculty member from other/same department(s)

Continuous Assessment 100 Marks		
Review I	Review II	Viva-Voce
Guide	Guide	External (from other department)
30	30	40

Evaluation - To be given as a Rubric – some components

- Introduction/Topic - introduction grabs interest of reader and states topic. Thesis/topic clear, well-developed, and a definitive statement.
- Topic Focus –The topic is focused narrowly enough for the scope of this assignment. A thesis statement provides direction for the paper, either by statement of a position or hypothesis.
- Content - Balanced presentation of relevant and legitimate information that clearly supports a central purpose or argument and shows a thoughtful, in-depth analysis of a significant topic. Concepts are integrated into the writer’s own insights.
- Depth of Discussion - In-depth discussion & elaboration in all sections of the paper. Sources support the thesis argument in a logical manner. References are correctly cited.

- Evaluation and Results – Appropriate evaluation Measure & Results Comparison with existing work
- Conclusion -Summary of thesis argument with concluding ideas that impact reader. Introduces no new information
- Review Presentations
- Writing - Writing is clear and relevant, with no grammatical and/or spelling errors – polished and professional. Reference, citations and images are properly formatted.
- Length - Paper is the not more than 10 pages specified in the assignment.
- References–(atleast 7) Quality -Sources include both general background sources and specialized sources. All web sites utilized are authoritative.

CATEGORY	Obtained	9-10 points	7-8 points	4-6 points	0-3 points
Introduction/Topic					
Topic Focus					
Content					
Depth of Discussion					
Evaluation and Results					
Conclusion					
Review Presentations					
Writing					
Length					
References					
Total:					

Passing Requirements:

- The student should secure 50% marks in Continuous Assessment to pass in the subject
- If a student fails in this course he/she has to redo this course in subsequent semesters.



GE23427 Games/Short Film/ Animation Videos / Animated Educational Content (Eligible to drop one Professional/Open Elective(Max 3-credits) in VII or VIII semester)	L T P C : 0 0 6 3
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Activities:

- Team Size : Maximum 2 students
- Team has to identify the problem statement of game/ Educational video content / short film/ Animated video
- Committee (consist of Project coordinator, Faculty member and guide) has to approve the team proposal to proceed further
- Team has to develop GAME/Video
- Team has to submit the report

Assessment:

- The **Game/Short Film/ Animation Videos /Animated Educational Content** shall be evaluated for a maximum of 100 marks, as a Continuous Assessment
- A guide will be assigned to each team to monitor the progress and conduct the review meetings.
- Finally, each student in the team has to submit the project report
- The viva-voce examination will be conducted with external faculty members from other/same department
- Based on the quality of the project, committee can approve to publish in YouTube.

Continuous Assessment 100 Marks		
Review I Guide	Review II Guide	Viva-Voce External (from other department)
30	30	40

Passing Requirements:

- The student should secure 50% marks in Continuous Assessment to pass in the subject
- For CSD students, this course is compulsory, in such a case , If a student fails in this course he/she has to redo this course in subsequent semesters
- For branch students, on successful completion of this project work, students are eligible to drop one Professional o/Open Elective (Max. 3 credits) in VII or VIII Semesters



GE23428 Interdisciplinary Societal Project / Real World Web or Mobile Applications / Innovative Product (Eligible to drop one Professional/Open Elective(Max 3-Credits) in VII or VIII semester)	L T P C : 0 0 6 3
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Activities:

- Team Size : Maximum 2 students
- Team has to identify the problem statement to solve
- Committee (consist of a Project coordinator, a Faculty member and a guide) has to approve the team proposal to proceed further
- Team has to develop a project
- Team has to submit the Project report

Assessment:

- The **Project work** shall be evaluated for a maximum of 100 marks, as a Continuous Assessment
- A guide will be assigned to each team to monitor the progress and conduct the review meetings.
- Finally, each student in the team has to submit the project report
- The viva-voce examination will be conducted with external faculty members from other/same department
- Based on the quality of the project, committee can approve to publish in YouTube.

Passing

Continuous Assessment 100 Marks		
Review I	Review II	Viva-Voce
Guide	Guide	External (from other department)
30	30	40

Requirements:

- The student should secure 50% marks in Continuous Assessment to pass in the subject
- on successful completion of the project work, students are eligible to drop one Professional or Open Electives (3 credits) in VII or VIII Semesters



GE23429 Participation in National /International competitions (Eligible to drop one Professional/Open Elective (Max 3-credits) in VII or VIII semester)	L T P C 0 0 6 3
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Activities:

- Team Size : Maximum 3 students
- Team has to identify National / International level competition
- Based on the problem statement GUIDE will be assigned
- Committee (consist of Project coordinator, Faculty member and guide) has to approve the proposal of the team to proceed further
- Team has to prepare and participate in the competition
- Team has to submit the final report

Assessment:

- Committee (consist of Project coordinator, Faculty member and guide) has to evaluate the report and should conduct viva-voce examination

Viva-Voce
50 Marks

Passing Requirements:

- The student should secure 50% marks in the Viva-voce examination
- Eligible students can drop one Professional or Open Elective (Max. 3 credits) in VII or VIII Semesters

SEMESTER I

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
HS 23111	TECHNICAL COMMUNICATION I Common to all branches of B.E/B. Tech programmes – First Semester	HS	2	0	0	2

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

UNIT-I	DEVELOPING COMPREHENSION SKILLS	6
Listening: Introduction to Informational listening – Listening to Podcasts, News Reading: Short Narratives and Skimming Passages. Speaking: Introducing Oneself, Narrating a Story / Incident. Writing: Sequential Writing (Jumbled Sentences), Process Description Grammar: Verbs – Main & Auxiliary: Simple Tenses – Form, Function and Meaning. Vocabulary: Word formation – Prefix, Suffix, Compound Words.		
UNIT-II	LISTENING AND EXTENDED READING	6
Listening: Deep Listening – Listening to Talk Shows and Debates Reading: In-depth Reading - Scanning Passages Speaking: Describing Current Issues, Happenings, etc., Writing: Note Making, Note Taking – Paragraph Writing Grammar: Continuous Tenses, Prepositions, Articles Vocabulary: One Word Substitutes, Phrasal Verbs.		
UNIT-III	FORMAL WRITING AND VERBAL ABILITY	6
Listening: Listening to Lectures and Taking Notes Reading: Interpretation of Tables, Charts and Graphs Speaking: SWOT Analysis on Oneself Writing: Formal Letter Writing and Email Writing Grammar: Perfect Tenses, Phrases and Clauses, Discourse Markers Vocabulary : Verbal Analogy / Cloze Exercise		
UNIT-IV	ENHANCING SPEAKING ABILITY	6
Listening: Listening to eminent voices of one's interest (Martin Luther King, APJ Abdul Kalam, etc..) Reading: Timed Reading, Filling KWL Chart. Speaking: Just a Minute, Impromptu Writing: Check-list, Instructions. Grammar: 'Wh' Questions / 'Yes' or 'No' Questions, Imperatives Vocabulary: Synonyms, Antonyms, Different forms of the same words.		
UNIT-V	LANGUAGE FOR WORKPLACE	6
Listening: Extensive Listening (Audio books, rendering of poems, etc.) Reading: Extensive reading (Jigsaw Reading, Short Stories, Novels) Speaking: Short Presentations on Technical Topics Writing: Recommendations, Essay Writing Grammar: Impersonal Passive, Reported Speech, Concord Vocabulary : Informal Vocabulary and Formal Substitutes		
Total Contact Hours		: 30

Course Outcomes:	
At the end of the course the student 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
•	Present, discuss and coordinate with their peers in workplace using their language skills

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	MeenakshiUpadhyay, 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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS 23111.1	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS 23111.2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS 23111.3	-	1	-	1	-	-	-	-	-	3	-	-	-	-	-
HS 23111.4	-	-	-	2	-	-	-	-	1	3	-	-	-	-	-
HS 23111.5	-	-	-	1	-	-	-	-	1	3	-	-	-	-	-
Average	-	1	-	1.2	-	-	-	-	1	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 Courses)	Category	L	T	P	C
MA23116	MATHEMATICAL FOUNDATIONS FOR AI I Sem- B.Tech AI&DS and AIML	BS	3	1	0	4

Objectives:	
•	To gain knowledge in using matrix techniques and the concepts of rank and nature of the matrix.
•	To gain knowledge in using matrix algebra techniques and the concepts of basis and dimension in vector spaces.
•	To understand normalization finding ortho-normal vectors.
•	To understand the concepts of source coding techniques
•	To understand the techniques of calculus which are applied in the Engineering problems..

UNIT-I	MATRICES AND QUADRATIC FORMS	12
Matrices : Types - Symmetric and Skew – symmetric matrices, Hermitian matrix, Unitary matrix and Orthogonal matrices – Rank, Inverse and Trace of a matrix - Eigen values and eigenvectors- Diagonalization of matrices using orthogonal transformation - Quadratic forms - Reduction to canonical form using orthogonal transformation.		
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 -Principal component analysis.		
UNIT-IV	INFORMATION THEORY	12
Measure of Information, Entropy, Source coding theorem - Shannon-Fano codes & Huffman codes, Discrete Memory less channel, Mutual information, Channel Capacity, Shannon-Hartley theorem.		
UNIT-V	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.		
Total Contact Hours		: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Apply the concept of Eigenvalues and eigenvectors, diagonalization of a matrix for solving problems.
•	Use concepts of basis and dimension in vector spaces in solving problems
•	Use concepts of normalization in inner products solving problems and to construct orthonormal basis using inner products.
•	Apply the various source coding techniques on communication systems
•	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.

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. http://library.lol/main/3FE18B4BC738F2D3130E2FD17B3CBB3A
3	T Veerarajan, Engineering Mathematics –I , Mc Graw Hill Education, 2018. http://library.lol/main/D84CE246DE69AD78EFC9998B4045EB65

4	Simon Haykin, "Communication Systems", 3rd Edition John Wiley & sons, 2001.
5	J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", 2nd Edition, Pearson Education, 2006.

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23116.1	3	2	1	-	-	-	-	-	-	-	1	-	1	1	-
MA23116.2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
MA23116.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA23116.4	2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23116.5	2	2	-	-	-	-	-	-	-	-	1	1	-	1	-
Average	2.4	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: “-”

அலகு I

மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயசார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழிக்காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II

மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள்வரை - சிற்பக்கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III

நாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள்.

அலகு IV

தமிழர்களின்திணைக்கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம்மற்றும் புறக்கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழத்தில் எழுத்தறிவும், கல்வியும் - சங்ககாலநகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்தநாடுகளில் சோழர்களின் வெற்றி.

அலகு V

இந்தியதேசியஇயக்கம்மற்றும்இந்தியபண்பாட்டிற்குத்தமிழர்களின்பங்களிப்பு:

3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப் பகுதிகளில் தமிழ்ப் பண்பாட்டின்தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சுவரலாறு.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகைநதிக் கரையில் சங்ககாலநகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறைவெளியீடு)
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 (Lab oriented Theory Courses)	Category	L	T	P	C
PH23132	PHYSICS FOR INFORMATION SCIENCE For Sem 1: Common to -B.E. CSD., B.Tech,- AIML, AI&DS	BS	3	0	2	4
	For Sem 2: Common to – B. E. CSE, B.Tech.- IT					

Objectives:	
•	To understand the principles of laser and fibre 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 FIBRE OPTICS	9
Lasers: Population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) –Nd-YAG Laser, Semiconductor lasers: Homojunction and Heterojunction- Applications of Lasers and Holography. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, mode) – losses associated with optical fibers -Fibre 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 –Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative), Type-I and Type II Superconductors -Magnetic Levitation-SQUIDS-Cryotrons.		
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 structures –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)- Formation of P-N junction-Forward bias- Reverse bias-Hall effect -Ohmic contact-Schottky diode- Tunnel diode.		
UNIT-V	OPTOELECTRONICS	9
Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) – Photo electric effect-Photo current in a P-N diode – Photo transistor-solar cell - LED – Organic LED- Non Linear Optical materials-properties and applications.		
Total Contact Hours		: 45

List of Experiments			
1	Determine the size of the microparticle using diode laser and wavelength of the laser using grating.		
2	Determine the angle of divergence of laser beam and numerical aperture and acceptance		
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:	
At the end of the course the student 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.

Text Book (s):	
1	Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2	Jaspri 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	-

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	3.00	3.00	2.00	2.00	2.80	1.00	1.00	0.00	0.00	0.00	0.00	2.00	1.80	1.00	1.00

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	PC	1	0	6	4

Objectives:	
•	To develop simple algorithms for arithmetic and logical problems.
•	To develop C Programs using basic programming constructs
•	To develop C programs using arrays and strings
•	To develop applications in C using functions , pointers and structures
•	To develop applications using structures and union

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 : 90	

Course Outcomes:	
At the end of the course the student will be able to	
•	To formulate simple algorithms for arithmetic and logical problems.
•	To implement conditional branching, iteration.
•	To decompose a problem into functions and synthesize a complete program.
•	To use arrays, pointers and structures to formulate algorithms and programs.
•	To apply programming to solve simple numerical method problems.

Text Book (s):	
1	Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Second Edition, PHI
2	Byron Gottfried, "Programming in C", Second Edition, Schaum Outline Series

Reference Books(s) / Web links:	
1	Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill.
2	Yashavant Kanetkar, “Let Us C”, BPB Publications
3	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4	NPTEL course , “Problem Solving Through Programming In C”, By Prof. Anupam Basu, IIT Kharagpur

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE19141.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE19141.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE19141.5	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 (Lab oriented Theory Courses)	Category	L	T	P	C
EE23133	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4

Objectives:	
•	To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
•	To impart 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, Kirchoff 's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.		
UNIT-II	AC CIRCUITS	9
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations series resonance. Three phase balanced circuits, voltage and current relations in star and delta connections		
UNIT-III	ELECTRICAL MACHINES	9
Construction, Principles of operation of DC machines, Single phase Transformers, Synchronous machines, Single phase induction motors.		
UNIT-IV	ELECTRONIC DEVICES & CIRCUITS	9
Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction diode–Forward and Reverse Bias – Bipolar Junction Transistor – Common Emitter characteristics –Introduction to operational Amplifier – Inverting Amplifier –Non Inverting Amplifier.		
UNIT-V	MEASUREMENTS & INSTRUMENTATION	9
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Piezoelectric, - Classification of instruments - PMMC and MI Ammeters and Voltmeters – Digital Storage Oscilloscope.		
Total Contact Hours		: 45

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

Course Outcomes:	
At the end of the course the student 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.

Text Book (s):	
1	J.B.Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K.Kataria& Sons Publications, 2002.
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, 2007
2	John Bird, “Electrical Circuit Theory and Technology”, Elsevier, First Indian Edition, 2006
3	Allan S Moris, “Measurement and Instrumentation Principles”, Elsevier, First Indian Edition, 2006
4	Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall of India, 2006
5	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, “Basic Electrical Engineering”, McGraw Hill Education(India) Private Limited, 2009
6	D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
7	https://nptel.ac.in/courses/108108076

Lab Equipment Required:

S.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(0-30V variable) 2. Bread Board 3. Resistors 4. Multimeter 5. Connecting wires	1 1 As per Circuit diagram As Required
2.	Loadtest on DC ShuntMotor. 1. Ammeter MC(0-20A) 2. Voltmeter MC(0-300)V 3. Tachometer 4. Field Rheostat 500Ω, 1.5A 5. Connecting wires	1 1 1 1 As Required
3.	LoadTest on Induction Motor 1. Ammeter MI(0-20A) 2. Voltmeter MI(0-300)V 3. Wattmeter–300V,30A 4. Tachometer–Digital 5. Connecting Wires 6. Single phase Induction motor	1 1 1 1 As Required 1

4.	Loadtest 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. PNDiode(IN4007), Zenerdiode(6.8V,1A) 2. Resistor1K Ω ,100 Ω 3. BreadBoard 4. DC Regulated Power supply(0-30Vvariable) 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. BreadBoard 4. DC Regulated Power supply(0-30Vvariable) 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

CO - PO – PSO matrices of course

PO/PSO CO	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	-	-	-
EE23133.2	3	3	3	3	-	3	1	1	2	1	1	1	-	-	-
EE23133.3	3	3	3	3	-	3	1	1	2	1	1	1	-	-	-
EE23133.4	3	3	3	3	-	3	1	1	2	1	1	1	-	-	-
EE23133.5	3	3	3	3	-	3	1	1	2	1	1	1	-	-	-
Average	3	3	3	3	-	3	1	1	2	1	1	1	-	-	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

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

Objectives:	
•	To provide hands-on experience on various basic engineering practices in Electrical Engineering.
•	To 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	Study of Multimeter 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:	
At the end of the course the student 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

Lab Equipment Required:

S. No.	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.

Reference Books(s) / Web links:	
1	Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
2	Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
3	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.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23122.1	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.2	3	3	2	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.3	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.4	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
GE23122.5	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
Average	3	3	2.67	2	-	-	2	-	3	2	-	3	-	-	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC23111	INDIAN CONSTITUTION AND FREEDOM MOVEMENT Common to all branches of B.E/B. Tech Programmes – First / Second/third Semester	MC	3	0	0	0

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

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

Course Outcomes:	
At the end of the course the student 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.

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, Prabhat Prakashan, 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.2nded, 2014.
5	Bipan Chandra, History of Modern India, Orient Black Swan, 2009.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MC23111.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.2	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
MC23111.3	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
MC23111.4	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
MC23111.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: "-"

SEMESTER II

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA23214	PROBABILITY AND INFERENTIAL STATISTICS II Sem B.E., CSD, B.Tech. AIDS and AIML	BS	3	1	0	4

Objectives:	
•	To provide the required mathematical support in real life problems.
•	To equip the students in using Statistical techniques to solve problems.
•	To use the concept of non parametric testing for Non-Normal population
•	To develop probabilistic models which can be used in several areas of Science and Engineering.
•	To understand the use of statistical modelling for forecasting

UNIT-I	PROBABILITY - BAYES THEOREM	12
Probability models and axioms- Conditioning and Bayes' rule – Discrete random variables: Binomial and Poisson distributions - Multiple discrete random variables: joint PMFs, expectations, conditioning - Continuous random variables: Uniform and Gaussian distributions - Multiple continuous random variables- Continuous Bayes rule.		
UNIT-II	STATISTICAL TESTING	12
Bayesian statistical inference- Maximal Likelihood estimation : Parameters of Binomial and Poisson distribution- Test of hypotheses: tests of significance – Z, Chi square, F test.		
UNIT-III	NON PARAMETRIC TESTS	12
Sign test -Wilcoxon signed rank test - Mann Whitney test - Run test - Kolmogorov Smirnov test - Spearmann and Kendall's test - Tolerance region.		
UNIT-IV	LINEAR STATISTICAL MODELS	12
Scatter diagram- Linear Regression and Correlation- Least squares method- Rank correlation- Multiple regression and multiple correlation- Analysis of variance (one way, two way).		
UNIT-V	BASICS OF TIME SERIES	12
Stationary Time Series - ARIMA models: Identification, Estimation and Forecasting		
Total Contact Hours: 60		

Course Outcomes:	
At the end of the course the student will be able to	
•	Apply the basic concepts of probability and random variables.
•	Obtain statistical data from experiments and to analyze the same using statistical test.
•	Use the concept of non parametric testing for Non-Normal population
•	Apply the concept of correlation, regression and analysis of variance in real life situation.
•	Apply the concept of Time series Analysis in real life situation

Text Book (s):	
1	T. Veerarajan, ‘Probability, Statistics and Random Processes with Queuing Theory and Queuing Networks’, McGraw Hill, 2016. https://dokumen.pub/qdownload/probability-statistics-and-random-processes-with-queueing-theory-and-queueing-networks-4nbsped-9339218558-9789339218553.html
2	Goon, M. Gupta and B. Dasgupta, ‘Fundamentals of Statistics’, Vol. I & II, A., World Press. http://125.22.75.155:8080/view/web/viewer.html?file=/bitstream/123456789/13979/3/Fundamentals%20of%20Statistics%20Vol%20one%20Sixth%20Revised%20Edition.pdf , https://ia804709.us.archive.org/32/items/in.ernet.dli.2015.462524/2015.462524.Fundamentals-Of-Statistics-Vol-2.pdf
3	B. S. Grewal, ‘Higher Engineering Mathematics’, Khanna Publication, Delhi. https://ia801706.us.archive.org/20/items/higher-engineering-mathematics-bs-grewal/Higher%20Engineering%20Mathematics%20BS%20Grewal.pdf
4	John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queuing Theory", Wiley series in Probability and Statistics, 5th edition, 2018. http://library.lol/main/CB08696D9B4FE8289B5BE19FD5783E1F
5	Chris Chatfield, ‘The analysis of Time series: An Introduction’ http://library.lol/main/251E2917F932D6CAE441AD5305971C11

Reference Books(s) / Web links:	
1	S.M. Ross, ‘A first course in Probability’, Prentice Hall, 8th edition, 2010. http://julio.staff.ipb.ac.id/files/2015/02/Ross_8th_ed_English.pdf
2	R. Johnson, ‘Miller & Freund’s Probability and Statistics for Engineers’, (9th Edition), PHI. http://library.lol/main/5B975EF87B5E4F3500CCB5A8621B76C3
3	Trivedi.K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", John Wiley and Sons, 2016. http://library.lol/main/FBCC848A75832ED38DA5736E798B87E8

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23214.1	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
MA23214.2	3	2	1	1	-	-	-	-	-	-	-	1	-	1	-
MA23214.3	3	2	2	2	-	-	-	-	-	-	-	1	-	1	-
MA23214.4	2	2	1	1	-	-	-	-	-	-	-	1	-	1	-
MA23214.5	3	2	2	1	-	-	-	-	-	-	-	1	-	1	-
Average	2.8	2	1.5	1.25	-	-	-	-	-	-	-	1	1	1	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

GE23217

தமிழரும் தொழில் நுட்பமும்

L T P C 1 0 0 1

அலகு I

நெசவுமற்றும் பானைத் தொழில்நுட்பம்:

3

சங்ககாலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.

அலகு II

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:

3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிறவழி பாட்டுத்தலங்கள் - நாயக்கர் காலக்கோயில்கள் - மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் - செட்டிநாடுவீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோ செனிக்கட்டிடக்கலை.

அலகு III

உற்பத்தித் தொழில்நுட்பம்:

3

கப்பல்கட்டும்கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடிமணிகள் - சுடுமண்மணிகள் - சங்குமணிகள் - எலும்புத்துண்டுகள் - தொல்லியல்சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV

வேளாண்மைமற்றும்நீர்ப்பாசனத்தொழில்நுட்பம்:

3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்குழுமித்தும் பின்முக்கியத்துவம் - கால்நடை பராமரிப்பு - கல்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல்குறித்த பண்டைய அறிவு - அறிவுசார்சமூகம்.

அலகு V

அறிவியல்தமிழ்மற்றும்கணித்தமிழ் :

3

அறிவியல் தமிழின்வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக்கல்விக்கழகம் - தமிழ் மின்நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்முகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருறை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
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 Course)	Category	L	T	P	C
GE23111	ENGINEERING GRAPHICS	ES	2	0	4	4

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

CONCEPTS AND CONVENTIONS (Not for Examination)		1
Importance of graphics in engineering applications–Use of drafting instruments– BIS conventions and specifications– Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.		
UNIT-I	PLANE CURVES AND PROJECTION OF POINTS	5+12
Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method – Cycloidal Curves–Construction of cycloid, epicycloid and hypocycloid – Construction of involutes of square and circle– Drawing of tangents and normal to the above curves. Principles of Projection and Projection of points.		
UNIT-II	PLANE CURVES AND PROJECTION OF POINTS	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:	
At the end of the course the student will be able to	
•	To construct different plane curves and to comprehend the theory of projection
•	To draw the basic views related to projection of lines and planes
•	To draw the projection of simple solids and to draw the projection of development of surfaces of Sectioned solids in simple vertical position
•	To draw the orthographic projection from pictorial objects and Isometric projections of simple solids
•	To visualize Perspective view of simple solids

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

Reference Books(s) / 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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 course)	Category	L	T	P	C
IT23231	DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE AIML, AIDS & CSD	ES	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.		
UNIT-II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9
Combinational Circuits : Adder - Subtractor –Multiplexer- De multiplexer – Decoder – Encoder. Sequential Circuits: Latches – Flip Flops – Shift Registers – Counters : Ripple – Synchronous Counter		
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. Case Study: RAID		
Total Contact Hours		: 45

List of Experiments	
•	Design and Implementation Basic Logic Gates – AND, OR and NOT
•	Design and Implementation Universal Gates – NAND and NOR
•	Design and Implementation of Half Adder using logic gates
•	Design and Implementation of Full Adder using logic gates
•	Design and Implementation of Half Subtractor using logic gates
•	Design and Implementation of Full Subtractor using logic gates
•	Design and Implementation of Multiplexer using logic gates.
•	Binary Multiplication using Booths Multiplication Algorithm
•	Binary Division using Restoring Algorithm
•	Binary Addition using floating point values
Total Contact Hours	
: 15	

Course Outcomes:	
At the end of the course the student will be able to	
•	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:	
•	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	M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008/ Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2	David A. Patterson and John L. Hennessey, "Computer organization and design", 5th 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", 10th Edition, Pearson Education Inc, 2011.
3	Charles H. Roth, "Fundamental of Logic Design", 6th Edition, Thomson Learning, 2013.
4	Donald D. Givone, "Digital Principles and Design", TMH, 2003.
5	Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", 2nd Edition, Pearson Education, 2005.
6	Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", 1st edition, Tata McGraw Hill, New Delhi, 2005.
7	John P Hayes, "Computer Architecture and Organization", 3rd edition, McGraw Hill, 2002.
8	V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organisation", 6th edition, Mc Graw-Hill Inc, 2012.
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23231.1	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
IT23231.2	3	2	3	-	-	-	-	-	-	-	-	-	2	1	2
IT23231.3	2	2	1	1	-	1	-	-	-	-	-	-	2	2	2
IT23231.4	3	3	1	2	-	-	-	-	2	-	1	-	2	2	2
IT23231.5	2	2	3	1	2	2	2	-	-	-	2	-	2	-	-
Average	2.6	2.4	2.2	1.33	2	1.5	2	-	2	-	1.5	-	2	1.75	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
AI23231	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	PC	3	0	2	4

Objectives:	
•	To Understand the various characteristics of a problem solving agent
•	To Learn about the different strategies involved in problem solving
•	To Learn about solving problems with various constraints.
•	To Learn about various knowledge representation
•	To Understand the different models of reasoning and decision making

UNIT-I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING AGENT	9
AI-Introduction. 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. 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 min max search procedure, alpha-beta pruning.		
UNIT-IV	KNOWLEDGE REPRESENTATION	9
AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.		
UNIT-V	REASONING & DECISION MAKING	9
Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. Decision networks, Markov Decision Process. Expert System		
Total 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
	Introduction to PROLOG
	Find minimum maximum of two numbers
	Here are some simple clauses.
	likes(mary,food).
	likes(mary,wine).
	likes(john,wine).
	likes(john,mary).
	The following queries yield the specified answers.
	?- likes(mary,food).
	yes.

	?- likes(john,wine). yes. ?- likes(john,food). no.			
	How do you add the following facts?			
	1. John likes anything that Mary likes 2. John likes anyone who likes wine 3. John likes anyone who likes themselves			
	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			
		Contact Hours	:	60
		Total Contact Hours	:	105

Lab Specifications:

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

Course Outcomes:

At the end of the course the student 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 the different models of reasoning and decision making for any given problem

Suggested Activities:

•	Case study Discussion
•	Flipped classroom – Comparing of Different Algorithms
•	Activity Based Learning

Suggested Evaluation Methods:

•	Mini Projects
•	Assignment problems
•	Quizzes

Text Book (s):	
1	S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Pearson, Fourth Edition, 2022.
2	Denis Rothman, Artificial Intelligence By Example: Acquire advanced AI, machine learning, and deep learning design skills, Packt Publishing; 2nd edition, 2020
3	Deepak Khemani, A First Course in Artificial Intelligence , McGraw Hill Education, 2017

Reference Books(s) / Web links:	
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

WEB LINKS FOR VIRTUAL LAB (if Any)	
1	https://sites.cs.ucsb.edu/~yuxiangw/classes/AICourse-2022Spring/
2	https://web.stanford.edu/class/archive/cs/cs221/cs221.1196/
3	https://redirect.cs.umbc.edu/~ypeng/AICourseOld/471-671.html
4	http://ai.berkeley.edu/lecture_slides.html
5	https://www.cs.utexas.edu/~mooney/cs343/
6	https://courses.cs.washington.edu/courses/csep573/22wi/
7	https://www.cse.iitd.ac.in/~rohanpaul/teaching/2022-col333.html
8	https://courses.grainger.illinois.edu/ece448/sp2022/

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23231.1	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI23231.2	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI23231.3	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI23231.4	2	2	2	2	3	-	1	2	-	-	2	2	2	2	2
AI23231.5	2	3	-	-	2	1	1	1	-	-	2	2	2	2	2
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	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: “-”

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 STRUCTURE –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 STRUCTURE –STACK AND QUEUE	8
Stack – Operations, Array and Linked list implementation, Applications – Evaluation of Arithmetic Expressions, Queues- Operations, Array and Linked list Implementation.		
UNIT-III	NONLINEAR DATA STRUCTURE -TREES	10
Tree Terminologies, Binary Tree Representation, Tree Traversals, Binary Search Trees, Binary Heap, Height Balance Trees – AVL Trees.		
UNIT-IV	NONLINEAR DATA STRUCTURE -GRAPH	9
Representation of Graphs, Topological Sort, Depth First Search and Breadth-First Search , Minimum Spanning Tree – Prim's Algorithm, Shortest path algorithm – Dijkstra's Algorithm.		
UNIT-V	SORTING AND HASHING	9
Sorting Techniques –Insertion Sort, Quick Sort, Merge Sort, Hashing- Hashing functions – Mid square, Division, Folding, Collision Resolution Techniques – Separate Chaining – Open Addressing – Rehashing.		
Total Contact Hours		: 45

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:	
	•	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
Total Contact Hours		: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Understand and apply the various concepts of Linear data Structures
•	Understand and apply the various concepts of Non Linear data Structures.
•	Understand and apply the various sorting and Hashing concepts.
•	Analyse and apply the suitable data structure for their research.
•	Choose efficient data structures and apply them to solve real world problems.

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

Suggested Evaluation Methods:	
•	Assignment problems - Linked List (Unit 1).
•	Tutorial problems - Applications – Evaluation of Arithmetic Expressions (Unit 2).
•	Quizzes - BST and Binary Heap (Unit 3).
•	Tutorial problems- Graph traversal (Unit 4).
•	Tutorial problems- Graph traversal (Unit 4).

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) / Web links:	
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.
3	Data Structures - GeeksforGeeks
4	Data Structures DS Tutorial - javatpoint
5	Data Structure and Types (programiz.com)

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23231.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS23231.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS23221	TECHNICAL COMMUNICATION II Common to all branches of B.E/B. Tech programmes –Second Semester	HS	0	0	2	1

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

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

Course Outcomes:	
At the end of the course the student will be able to	
•	communicate effectively using appropriate vocabulary
•	use the acquired language skills to comprehend various types of language contents
•	evaluate different texts and write effective technical content
•	use appropriate sentence structures to convey their thoughts in varied contexts
•	present their concepts and ideas in an effective manner

Suggested Activities:	
•	Story Lines
•	One truth and two lies
•	Hang Man
•	Pictionary
•	Word Scramble

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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS23221.1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
HS23221.2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.3	-	2	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.4	-	-	-	1	-	-	-	-	2	3	-	-	-	-	-
HS23221.5	-	-	-	1	-	-	-	-	2	2	-	-	-	-	-
Average	-	2	-	1	0	0	0	0	2	2.6	-	-	-	-	-

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
HS23222	ENGLISH FOR PROFESSIONAL COMPETENCE Common to all branches of B.E/B. Tech programmes –Second Semester	HS	0	0	2	1

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

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

Course Outcomes:	
At the end of the course the student will be able to	
•	interpret and respond appropriately in the listening and reading contexts.
•	express themselves effectively in spoken and written communication
•	apply their acquired language skills in writing the competitive examinations
•	exhibit their professional skills in their work place
•	identify the challenges in the work place and suggest strategies solutions

Suggested Activities:	
•	Online Quizzes on Vocabulary
•	Online Quizzes on grammar
•	Communication Gap Exercises
•	Presentations
•	Word Building Games

Suggested Evaluation Methods:	
•	Assignment topics
•	Quizzes
•	Class Presentation/Discussion
•	Continuous Assessment Tests

Reference Books(s) / Web links:	
1	How to Read Better & Faster, Norman Lewis, Goyal Publishers
2	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine ChuenMeng Goh, Cambridge University Press
3	The Official Cambridge Guide To IELTS by Pauline Cullen, Cambridge University Press
4	The 7 Habits of Highly Effective People by Stephen Covey, Simon and Schuster, UK
5	Board of Editors. Sure Outcomes. A Communication Skills Course for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad, 2013.
6	Hartley, Mary. "The Power of Listening," JaicoPublishing House; First Edition (2015).
7	Chambers, Harry. "Effective Communication Skills for Scientific and Technical Professionals," Persues Publishing, Cambridge, Massachusetts, 2000.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS23222.1	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.2	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.4	-	-	-	-	-	-	2	2	-	3	-	-	-	-	-
HS23222.5	-	-	1	-	-	-	2	-	-	3	-	-	-	-	-
Average	0	1	1	0	0	0	2	2	0	3	0	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 Courses)	Category	L	T	P	C
GE23121	ENGINEERING PRACTICES- CIVIL AND MECHANICAL	ES	0	0	2	1

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

List of Experiments	
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, planing and chiselling.
MECHANICAL ENGINEERING PRACTICE	
6	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
7	Gas welding practice.
Basic Machining:	
8	Simple Turning and Taper turning
9	Drilling Practice
Sheet Metal Work:	
10	Forming & Bending:
11	Model making – Trays and funnels
12	Different type of joints.
Machine Assembly Practice:	
13	Study of centrifugal pump
14	Study of air conditioner
Total Contact Hours	
: 30	

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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:	
•	Learn the basics of Python Programming and Control statements
•	Demonstrate various Python data structures like Lists, Tuples, Sets and dictionaries
•	Understand about Strings, Functions, Modules and Regular Expressions in Python Programming
•	Understand the concepts of file handling using Python
•	Understand the concepts of Numpy, Pandas, sciPy modules

List of 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:	
At the end of the course the student will be able to	
•	Use the basics of Python Programming in problem solving and conditionals and loops.
•	Use of Python Data structures such as List, Sets, Tuples, Dictionary for Compound Data
•	Use Strings, Functions, Modules and Regular Expressions in Python Programming
•	Implement the concepts of file handling and Exceptional handling.
•	Apply Numpy, Pandas and SciPy for numerical and statistical data

Reference Books(s) / Web links:	
1	https://www.python.org/shell/
2	https://python-iitk.vlabs.ac.in/
3	https://www.hackerrank.com/domains/python

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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: “-”

SEMESTER III

Course Code	Subject Name (Theory course)	Category	L	T	P	C
MA23313	DISCRETE MATHEMATICS FOR AI Common to Artificial Intelligence & Data Science and Artificial Intelligence & Machine Learning	BS	3	1	0	4

Objectives:	
•	To extend student's Logical and Mathematical maturity and ability to deal with abstraction.
•	To provide discrete structures of many levels and to know the principle of counting.
•	To provide the basic principles of sets and operations in sets and to Prove basic set equalities.
•	To introduce the concept of Number Theory using axioms, definitions, examples, theorems and their proofs.
•	To model problems in Computer Science and Engineering using graphs and trees.

UNIT-I	MATHEMATICAL LOGIC	12
Propositional calculus: Propositions and Connectives- Syntax: Semantics –truth tables – validity and satisfiability-Tautology–Connectives: Functionally complete set –Equivalence and normal forms –Formal reducibility–Predicates and quantifiers-Nested Quantifiers-Rules of inference – Temporal logic – Three valued logic.		
UNIT-II	COMBINATORICS	12
Basic counting sum and product- Balls and bins problems – Generating functions – Recurrence relations- Proof Techniques – Principle of Mathematical Induction - Pigeon hole principle.		
UNIT-III	STRUCTURED SETS	12
Set- Relation: Equivalence relations, Poset, Hasse diagram, Lattices –Boolean algebra–Algebraic System: Groups, Semi groups, monoid, homomorphism -Cosets and Lagrange's theorem-Rings and Fields (definition).		
UNIT-IV	NUMBER THEORY	12
Introduction - Divisibility - Primes - The binomial theorem-Congruences - Solutions of congruences - The Chinese - Remainder theorem - Techniques of numerical calculation.		
UNIT-V	GRAPHS AND TREES	12
Graph theory: Introduction to graphs- Graph isomorphism – Connectivity - Euler and Hamilton paths - Planar graphs - Trees –Properties- Distance and Centres – Types – Rooted Tree— Spanning Tree – Fundamental Circuits- Cut Sets – Properties –Connectivity - Separability -Graph coloring – Four color Theorem.		
Total Contact Hours		: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Demonstrate the ability to write and evaluate a proof or outline the basic structure and give examples of each proof technique described.
•	Apply counting principles to determine probabilities in engineering problems.
•	Analyse the concepts and properties of algebraic structures in the solving complex engineering problems.
•	Work effectively as part of a group to solve challenging problems in Number Theory.
•	Use different traversal methods for trees and graphs arising in the field of engineering and technology.

Suggested Activities:	
•	Problem solving sessions
•	Visio for drawing graphs
•	Online Calculators for PDNF and PCNF, recurrence relations and sets
•	Online calculators for Logic gates
•	GeoGebra for Hasse diagrams and graphs

Suggested Evaluation Methods:	
•	Problem solving in Tutorial sessions
•	Assignment problems
•	Quizzes and class test
•	Discussion in classroom

Text Book (s):	
1	Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw 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	Bressoud D., Wagon S., "A Course in Computational Number Theory", Key College Publishing, New York, 2000.

Reference Books(s) / Web links:	
1	Introduction to linear algebra. 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	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
6	Mathematical Logic for Computer Science,L. Zhongwan, World Scientific, Singapore.
7	Topics in Algebra, I. N. Herstein, John Wiley and Sons.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23313.1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-
MA23313.2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23313.3	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
MA23313.4	3	3	3	3	2	-	-	-	-	-	-	2	1	-	1
MA23313.5	3	3	3	3	2	-	-	-	-	-	-	2	1	2	2
Average	2	1	2	3	2	-	-	-	-	-	-	2	1	1.5	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 Courses)	Category	L	T	P	C
AI23331	FUNDAMENTALS OF MACHINE LEARNING Common to Artificial Intelligence & Data Science and Artificial Intelligence & Machine Learning	PC	3	0	2	4

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.		
Total 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:	
At the end of the course the student 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 Book (s):	
1	Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. September 2019, 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(s) / Web links:	
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, 2016.

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/

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 (Lab Oriented Theory course)	Category	L	T	P	C
CS23331	Design and Analysis of Algorithms Common to CSE, AIML, & AIDS	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:	
At the end of the course the student 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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23331.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
CS23331.2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS23331.5	1	2	2	2	-	-	-	-	-	-	-	1	3	3	1
Average	2.0	2.8	2.0	2.0	-	-	-	-	-	-	-	1.0	3.0	2.8	1.2

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

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23332	Database Management Systems Common to CSE, AIML, & AIDS	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 – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.		
UNIT-V	NOSQL DATABASE	9
NoSQL Database vs.SQL Databases – CAP Theorem –Migrating from RDBMS to NoSQL – MongoDB – CRUD Operations– MongoDB Sharding – MongoDB Replication – Web Application Development using MongoDB with Python and Java.		
		Total Contact Hours : 45

List of Experiments		
1	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 Invisible Secrets in the initial screen using Steganography	
		Contact Hours : 30
		Total Contact Hours : 75

Course Outcomes:	
At the end of the course the student 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

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

Reference Books(s) / Web links:	
1	Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2016.
2	C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
3	Atul Kahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl, “Oracle PL/SQL Programming”, sixth edition, Publisher: O’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.Williams, Web Database Applications with PHP and MySQL, O’Reilly Media; 2nd edition, 2004

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23332.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS23332.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS23332.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS23332.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS23332.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	1.3	1.4	1.8	1.7

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
CS23333	OBJECT ORIENTED PROGRAMMING USING JAVA Common to AIML & AIDS	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		Contact Hours	:	60
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:	
At the end of the course the student will be able to	
•	Develop Java programs using OOP principles and Strings.
•	Develop Java programs with the concepts inheritance.
•	Build Java applications using exceptions and interfaces.
•	Develop Java applications using I/O and collections.
•	Develop interactive Java applications using Streams and JDBC.

Suggested Activities:	
•	Quizzes – basic concepts of JAVA & language basics (Unit 1).
•	Tutorial – Class & Inheritance (Unit 2).
•	Flipped Classroom – Packages & Interface (Unit 3).
•	Mind Map, Poster Design – IO & Collections (Unit4).
•	Implementation of small Systems- JDBC (Unit5).

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23333.1	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23333.2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CS23333.3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CS23333.4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CS23333.5	3	3	3	3	3	-	2	-	2	2	3	3	3	3	3
Average	3	3	3	2.6	3	-	2	-	2	2	3	3	3	3	2.6

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
MC23112	ENVIRONMENTAL SCIENCE AND ENGINEERING Common to AIML & AIDS	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 nurture skills to solve environmental degradation issues
•	To develop the knowledge about the environmental laws

UNIT-I	AIR AND NOISE POLLUTION	9
Definition –sources of air pollution –chemical and photochemical reactions in the atmosphere –formation of smog, PAN, acidrain, 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),electro static 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 waste water-marine pollution – thermal pollution – Control of water pollution by physical, chemical and biological methods – waste water 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- steps involved - 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 - carboncredits,carbontrading,carbonsequestration,ecolabeling-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:	
At the end of the course the student will be able to	
•	Associate air and noise quality standards with environment and human health.
•	Illustrate the significance of water and devise control measures for water pollution.
•	Analyze solid wastes and hazardous wastes.
•	Outline the goals of sustainable development in an integrated perspective.
•	Comprehend the significance of environmental laws.

SUGGESTED EVALUATION METHODS	
•	Continuous assessment tests
•	Assignments
•	Case studies, class room presentations (or) site visit

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

Reference Books(s) / Web links:	
1	R.K.Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol.I and II, EnviroMedia.38. Edition 2010.
2	Cunningham, W.P.Cooper, T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3	Fowler B, Electronic Waste–1st Edition (Toxicology and Public Health Issues), 2017 Elsevier
4	NPTEL course url https://onlinecourses.nptel.ac.in/noc19_ge22/ https://news.mit.edu/2013/ewaste-mit
5	For downloading text/reference books the weblink is given below can be used http://libgen.rs/

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MC23112.1	1	2	3	1	-	2	2	2	1	1	1	2	-	1	2
MC23112.2	1	2	3	1	-	2	2	2	1	1	1	2	-	1	2
MC23112.3	-	-	3	1	-	2	3	2	1	-	1	2	-	1	3
MC23112.4	-	1	2	1	1	3	3	2	1	1	1	2	-	-	3
MC23112.5	-	1	2	-	-	2	2	2	1	2	2	2	-	-	3
Average	0.4	1.2	2.6	0.8	0.2	2.2	2.4	2	1	1	1.2	2	-	0.6	2.6

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: "-"

SEMESTER IV

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
MA23434	OPTIMIZATION TECHNIQUES FOR AI	BS	3	0	2	4

Objectives:	
•	To enumerate the fundamental knowledge of Linear Programming problems.
•	To develop formulation skills in transportation and assignment models and finding solutions.
•	To formulate and solve the pure integer, mixed integer or 0-1 integer linear programming models.
•	To analyse the problems of unconstrained nonlinear programming and to know the necessary and sufficient conditions for the solution of unconstrained problems.
•	To find the best ways to crash project schedule, shortening total project duration and the ways to save money by adjusting activity durations and optimizing resource requirements.

UNIT-I	INTRODUCTION TO OPTIMIZATION	9
Convex sets, Convex function-Linear Optimization: formulation, solution by graphical and simplex methods - Primal-Penalty- Two Phase –Principles of Duality.		
UNIT-II	TRANSPORTATION AND ASSIGNMENT MODELS	9
Transportation Models (Minimizing and Maximizing Problems) – Initial Basic feasible solution by Vogel’s approximation methods- Check for optimality: Solution by MODI algorithm – Case of Degeneracy- Assignment Models -Solution by Hungarian method-Introduction to Bandit algorithm.		
UNIT-III	INTEGER PROGRAMMING	9
Cutting plane algorithm –Branch and bound methods -Multistage(Dynamic) programming.		
UNIT-IV	NON –LINEAR OPTIMIZATION	9
Unconstrained external problems -Newton–Raphson method–Equality constraints– Gradient Descent Method – Jacobian methods–Lagrangian method–Kuhn–Tucker conditions–Simple problems.		
UNIT-V	PROJECT SCHEDULING	9
Network diagram representation– Critical path method–Timecharts and resource leveling–PERT.		
Total Contact Hours		: 45

List of Experiments		
1	Linear programming Problem-Constraint Optimization	
2	Transportation Problem	
3	Assignment Problem	
4	Integer Programming Problem- Branch and bound method	
5	Dynamic programming – Knapsack problem, Subset sum problem, longest common subsequence problem	
6	Gradient Descent Method- Stochastic Gradient Descent Algorithm	
7	Unconstrained Optimization- Nonlinear Least squares	
8	Kuhn-Tucker conditions -Lagrangian Multiplier method	
9	CPM -Analysis	
10	PERT -Analysis	
Contact Hours		: 30
Total Contact Hours		: 75

Course Outcomes:	
At the end of the course the student will be able to	
•	Solve Linear Programming problems using different methods.
•	Formulate and solve transportation and assignment models arising in the field of engineering and technology.
•	Set up and solve the pure integer, mixed integer or 0-1 integer linear programming problems in engineering and technology.
•	Analyze the problems of unconstrained nonlinear programming and to know the necessary and sufficient conditions for the solution of unconstrained problems.
•	Find the best ways to crash project schedule, shortening total project duration and the ways to save money by adjusting activity durations and optimizing resource requirements in real life problems.

SUGGESTED ACTIVITIES:	
•	Usage of MP Solver wrapper to solve LPP.
•	Problem solving sessions
•	Smart Class room sessions

SUGGESTED EVALUATION METHODS:	
•	Problem solving in Tutorial sessions
•	Assignment problems
•	Quizzes and class test
•	Discussion in classroom

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	S.Boyd and L.Vandenberghe, Convex optimization, Cambridge University press,2004.
4	John Myles White , Bandit algorithm for website Optimization, O' Riley Media, 2012.

Reference Books(s) / Web links:	
1	Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print,2008.
2	G. Srinivasan, Operations Research – Principles and Applications, 2nd edition, PHI, 2011.
3	F.S. Hiller and G.J. Lieberman, Introduction to Operations Research, McGraw-Hill, Year: 2001
4	Katta G. Murty Linear Programming, John Wiley & Sons, 1983.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23434.1	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA23434.2	2	2	-	-	-	-	-	-	-	-	1	-	-	-	-
MA23434.3	2	1	2	-	1	-	-	-	-	-	-	-	-	-	-
MA23434.4	2	2	-	-	-	-	-	-	-	-	2	-	-	-	-
MA23434.5	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-
Average	2	1.6	2	-	1	-	-	-	-	-	1.3	-	-	-	-

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
AI23431	WEB TECHNOLOGY AND MOBILE APPLICATION	PC	1	0	4	3
Common to AIDS & AIML						

Objectives:	
•	To provide foundational knowledge and practical skills in creating and structuring web pages using HTML, enabling students to build accessible and well-organized websites.
•	To understand and practice Embedded Dynamic Scripting on Client-side Internet Programming.
•	To implement Server Side Scripting.
•	To facilitate students to understand android Application Design
•	To help students to gain a basic understanding of Android application development

UNIT-I	WEB SITE BASIC, HTML 5.2, CSS 3.0	3
Internet Protocols – HTTP -Understand Internet-Difference between web site and application server-Internet technology overview-Understanding the difference between internet and intranet. HTML5.2 and CSS 3.0		
UNIT-2	JAVASCRIPT	3
Introduction to Scripting - Core features - Data types and Variables -Operators, Expressions and Statements - Functions - Arrays - Objects - Document Object Model -Event Handling- JSON – Introduction to AJAX.		
UNIT-3	SERVER SIDE PROGRAMMING	3
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session HandlingUnderstanding Cookies-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP:Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-CreatingHTML forms by embedding JSP code.		
UNIT-4	MOBILE APPLICATION DEVELOPMENT	3
Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.		
UNIT-5	ANDROID USER INTERFACE DESIGN	3
User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Testing Android applications, Publishing Android application.		
Total Contact Hours		: 15

List of Experiments	
1	HTML & CSS Create a web page to embed a map along with hot spot, frames & links. Create a web page using an embedded, external and inline CSS file.
2	Write JavaScript to validate the following fields of the Registration page. a) First Name (Name should contains alphabets and the length Should not be less than 6 characters). b) Password (Password should not be less than 6 characters length). c) E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) d) Mobile Number (Phone number should contain 10 digits only). e) Last Name and Address (should not be Empty).
3	Write a Servlet program that prints "Hello, World!" when accessed through a browser.
4	Create a web form that accepts a user's name and age. Write a Servlet to process the form data and display it back on the browser.
5	Write a Servlet to demonstrate the difference between HTTP GET and POST methods by creating a form and

	handling requests accordingly.			
6	Write a Servlet to demonstrate session tracking using HttpSession. Implement a simple login system where the user's session is tracked.			
7	Write a Servlet program to store a user's preferences (like theme or language) using cookies. Retrieve and display these preferences on subsequent visits.			
8	Consider a Library Management System. Develop a JavaScript program that will validate the controls in the forms you have created for the application. State the assumptions you make (business logic you are taking into consideration). Note: Your application must access a database using Servlet/JSP.			
9	Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality like Addition, Subtraction, multiplication, and Division.			
10	Develop an application to change the font and color of the text and display toast message when the user presses the button.			
11	Implement an application that writes data to the SD card.			
12	Develop a mobile application to send an email.			
		Contact Hours	:	60
		Total Contact Hours	:	75

Course Outcomes:

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

•	Upon completing the course, students will be able to design and develop basic web pages with proper structure and semantic elements, ensuring accessibility and functionality.
•	Design and implement dynamic web page with validation using javascript objects and by applying different event handling mechanism.
•	Design and implement simple webpage to learn JSP and Servlet.
•	Design and implement simple Application Design.
•	Identify various concepts of mobile programming that make it unique from programming for other platforms

Text Book (s):

1	Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, Fifth Edition, Pearson Education, 2011.
2	Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.
3	T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)

Reference Books(s) / Web links:

1	Web Development with MongoDB and Node.js, Jason Krol, Packt Publishing, 2015.
2	Java Server Pages – Hans Bergsten, SPD O’Reilly.2011.
3	Beginning Web Programming-Jon Duckett WROX,2019
4	Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson,2016
5	R1. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd,2010
6	R2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd,2012

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23431.1	3	3	3	3	3	3	2	2	3	2	1	3	3	3	2
AI23431.2	3	3	3	3	3	3	2	2	3	2	1	1	3	3	2
AI23431.3	3	3	3	3	3	3	2	2	3	2	2	2	3	3	3
AI23431.4	3	3	3	3	3	3	2	2	3	2	2	3	3	3	3
AI23431.5	3	3	3	3	3	3	2	2	3	2	3	3	3	3	3
Average	3	3	3	3	3	3	2	2	3	2	1.8	2.1	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 Courses)	Category	L	T	P	C
AD23431	STATISTICAL ANALYSIS AND COMPUTING	PE	2	0	2	3

Objectives:						
•	To impart knowledge about the basics of R programming					
•	To analyze the data using R programming					
•	To learn the appropriate statistical test and analyses.					
•	To implement data classification models and learns about different classification algorithms.					
•	To learn the different regression and clustering algorithms..					

UNIT-I	Introduction to R Programming Structures and Functions	9	
Overview of R programming – Basic objects: Vectors– Matrix–Array–Lists–Factors– Data frames. Basic expressions: Arithmetic expressions – Control Statements: if and if-else statements — switch statement – Loops: for loop – while loop – Functions– Strings			
UNIT-II	Introduction to Data Science	9	
Introduction – Roles of Data Science Projects – Data Collection and Management – Modeling – Model Evaluation and Critique – Determining lower and upper bounds – Loading Data into R – Working with data from files and relational database - Exploring data – Managing data: Missing values – cleaning data			
UNIT-III	Statistical Analysis	9	
Frequency distribution - Measures of central tendency and dispersion – Hypothesis Testing: Test Statistics – ANOVA – F-Test – TTest – U-Test – Fisher’s Exact Test – Kruskal- Wallis Test – Bartlett’s Test – Statistical Distribution: Binomial – Poisson – Normal – Chi-squared distribution			
UNIT-IV	Classification	9	
Tests and Training splits- Building Single Variable Model: Categorical Features- Numerical Features – Cross Validation - Building Multi Variable Model: Variable Selection – Decision Trees – Nearest Neighbor Methods – Naïve Baye			
UNIT-V	Regression and Clustering	9	
Linear and Logistic Regression: Introduction – Building Model – Making Predictions – Characterizing Co-efficient quality – Unsupervised Methods: Cluster Analysis – Distance – Hierarchical Clustering – The K-means Algorithm			
		Total Contact Hours	: 45

List of Experiments			
1	Implement simple programs in R 3. 4. 5. 6 7. 8.		
2	Perform data preprocessing in R		
3	Perform statistical analysis for a given dataset		
4	Implement decision tree algorithm in R		
5	Implement K-Nearest Neighbor algorithm in R		
6	Implement Naive Bayesian classifier in R		
7	Implement linear regression in R		
8	Implement K-means clustering algorithm in R		
9	Implementation of Searching and Sorting algorithms		
10	Hashing –Linear probing		
		Contact Hours	: 30
		Total Contact Hours	: 75

Course Outcomes:	
At the end of the course the student will be able to	
•	solve problems using the fundamentals of R
•	explore and manage data using R
•	perform statistical analysis using R
•	demonstrate Decision Tree, Nearest Neighbor, Naïve bayes classification algorithms
•	apply regression and clustering algorithms for the sample dataset using R

Text Book (s):	
1	SandipRakshit, “R for Beginners”, McGraw Hill Education, 2017 for Units I and III.
2	Nina Zumel, John Mount, “Practical Data Science with R”,2nd Edition, Manning Publications, 2019 for Units II,IV and V

Reference Books(s) / Web links:	
1	Software:R

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23431.1	3	2	2	2	2	-	-	-	-	-	-	2	3	2	-
AD23431.2	3	2	2	2	2	-	-	-	-	-	-	2	3	2	-
AD23431.3	2	2	1	2	2	-	-	-	-	-	-	2	2	2	-
AD23431.4	3	2	2	2	2	-	-	-	-	-	-	2	3	2	-
AD23431.5	2	2	2	2	1	-	-	-	-	-	-	2	3	3	-
Average	3	2	2	2	2	-	-	-	-	-	-	2	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 (Lab Oriented Theory course)	Category	L	T	P	C
CS23431	Operating Systems Common to CSE, AIML, & AIDS	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:	
At the end of the course the student will be able to	
•	Interpret the evaluation OS functionality, structure and layers.
•	Analyze the various Scheduling algorithms and design a model scheduling algorithm.
•	Apply and analyze Intercrosses communications, synchronization and Deadlock
•	Compare and contrast various memory management schemes.
•	Mount file systems and evaluate various disk scheduling techniques.

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

Text Book (s):	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10 th Edition, John Wiley and Sons Inc., 2018.

Reference Books(s) / Web links:	
1	William Stallings, “Operating Systems – Internals and Design Principles”, 9 th Edition, Pearson, 2018.
2	Andrew S. Tanenbaum and Herbert Bos, “Modern Operating Systems”, 4 th Edition, Pearson, 2016.
3	Achyut Godbole and Atul Kahate, “Operating System”, 3 rd 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”, 7 th Edition, Microsoft Press, 2017.

CO - PO – PSO matrices of course

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

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: “-”

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23432	Software Construction Common to CSE, AIML, & AIDS	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	SOFTWARE CONFIGURATION MANAGEMENT	9
System Modeling-Context Model-Interaction Model-Interaction Model-Structural Model-Behavioral Model-Architectural patterns-Architectural patterns-continuation-Data Flow Diagrams-ER Diagram-Tools Practice (Azure) – Prototypes / MVP		
UNIT-IV	TESTING	9
Testing Using AZURE-AZURE Test Plan Preparation-Manual and Exploratory Testing-Automated Testing Traceability-Reporting and Analysis.		
UNIT-V	SOFTWARE CONFIGURATION MANAGEMENT	9
Software Configuration Management-Introduction-Tools for SCM and Version Control-Visual Source Safe (VSS) – Introduction-Advanced Software Engineering Models-Case Study		
		Total Contact Hours : 45

List of Experiments	
1	Develop User Stories for the respective projects that has been assigned (both FR and NFR) in Azure Board
2	Develop the Business Architecture, Conceptual and Logical Model for the entities defined in the project
3	Develop the Class Diagram for these defined entities with all attributes and the associated methods
4	Develop the Sequence diagram for atleast 2 use stories for the respective project
5	Develop the Architecture diagram (using MVC) for the respective project (picking a template for Azure Architecture Center)
6	Identify which SOLID design principles would be applicable and write the design document for the same
7	Develop a view of the github repository in terms of code, design, test plans, test cases etc and showcase the same in Azure Repos

8	Develop Test Plans, test cases for the user stories			
9	Develop a CI/CD pipeline using Azure DevOps to test the Architecture and Design			
10	Showcase the CI/CD pipeline using Azure DevOps for a single user story			
		Contact Hours	:	30
		Total Contact Hours	:	75

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

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

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

Reference Books(s) / Web links:	
1	Code Complete A Practical Handbook of Software Construction by Steve McConnell
2	The Pragmatic Programmer Your Journey to Mastery by David Thomas, Andrew Hunt

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23432.1	2	2	3	2	2	2	2	2	2	2	3	2	1	3	-
CS23432.2	2	3	1	2	2	1	-	1	1	1	2	-	1	2	-
CS23432.3	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1
CS23432.4	2	2	3	2	2	2	1	0	2	2	2	1	1	2	1
CS23432.5	2	2	2	1	1	1	1	0	2	1	1	1	2	1	-
Average	2.0	2.2	2.0	1.6	1.6	1.4	1.3	1.3	1.6	1.4	1.8	1.3	1.4	2.0	1.0

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	EMPLOYABILITY ENHANCEMENT COURSE	Category	L	T	P	C
GE23421	Soft Skills - I	EEC	0	0	2	1

Objectives:	
•	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 process?	The aim of this activity is to develop 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	The activity aims at breaking the students' shyness and encouraging them to standup in front of the class

		points but can't read them out they can only use it as a reference.	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.
13.	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 Outcomes:	
At the end of the course the student will be able to	
●	Students should be able to be more confident
●	Students should be able to speak in front of a large audience.
●	Students should be able to be better creative thinkers.
●	Students should be able to be spontaneous.
●	Students should be able to know the importance of communicating in English

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
CO2	1	-	-	-	-	-	1	-	1	3	1	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
Average	0.2	0	0	0	0	0	0.2	0	0.4	3	0.2	0.4	0	0	0

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

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

SEMESTER V

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AD23531	Big Data Architecture	PC	3	0	2	4

Objectives:	
•	To learn the fundamentals of data science and big data.
•	To gain in-depth knowledge on descriptive data analytical techniques.
•	To gain knowledge to implement simple to complex analytical. Algorithms in big data frameworks.
•	To develop programming skills using suitable libraries and packages to perform data analysis in Python.
•	To understand and perform data visualization, web scraping, machine learning and natural language processing using various Data Science tools.

UNIT-I	UNDERSTANDING BIG DATA	9
Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Non-Definitional traits of Big Data – Business Intelligence vs. Big Data – Data warehouse and Hadoop environment – Coexistence. Big Data Analytics: Classification of analytics – Data Science – Terminologies in Big Data – CAP Theorem – BASE Concept.		
UNIT-II	HADOOP	9
Introduction to Hadoop: Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.		
UNIT-III	NoSQL DATABASES	9
No SQL databases: Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables		
UNIT-IV	HADOOP ECOSYSTEM	9
Hadoop Eco systems: Hive – Architecture – data type – File format – HQL – SerDe – User defined functions – Pig: Features – Anatomy – Pig on Hadoop – Pig Philosophy – Pig Latin overview – Data types – Running pig – Execution modes of Pig – HDFS commands		
UNIT-V	OVERVIEW OF BIG DATA AND SPARK	9
Gentle Overview of Big Data and Spark: What is Apache Spark-History of Spark-The Present and Future of Spark-Downloading Spark Locally-A Gentle Introduction to Spark: Spark's Basic Architecture - Spark Applications-Spark API's-The SparkSession- Partitions-Lazy Evaluation-DataFrames and SQL.		
Total Contact Hours		: 45

List of Experiments	
1	Develop a Hadoop Ecosystem Lab and setup a Hadoop cluster
2	Design and implement NoSQL database schema
3	Develop a word count program using map reduce.
4	Design map reduce program that mines weather data.
5	Create a HIVE table: Create a HIVE table named "orders" with the at least 5 parameters like order_id (int), customer_id (int), order_date (string), product_id (int), order_total (double) Load data into HIVE: Load the "orders" dataset into the HIVE table. Write HIVE queries: Find the total number of orders. Find the total revenue (sum of order_total).

	Find the top 5 products by total revenue. Find the number of orders by customer ID		
6	Load data into PIG: Load the "orders" dataset into PIG. Write PIG scripts: Find the total number of orders. Find the total revenue (sum of order_total). Find the top 5 products by total revenue. Find the number of orders by customer ID. Use PIG's GROUP and JOIN operators: Group orders by customer ID and calculate the total revenue for each customer.		
7	Create DDL & DML comments using Cassandra.		
8	Mini Project (Any one of the following title but not limited) <ul style="list-style-type: none"> • Recommender System for E-Commerce • Big Data for Healthcare Analysis • Stock Market Analysis and Prediction • Real-Time Traffic Management System 		
		Contact Hours	: 30
		Total Contact Hours	: 75

Course Outcomes:	
At the end of the course the student will be able to	
•	Understand the necessary tools to apply big data analytics in real-world scenarios.
•	Apply Hadoop for managing and processing big data efficiently.
•	Analyze the data management, querying, and performance optimization in distributed database systems
•	Apply Hive and Pig function within the Hadoop to process and manage large datasets
•	Analyze the data DataFrames and SQL using modern tools

Text Book (s):	
1	Balamurugan Balusamy, Nandhini Abirami. R, Seifedine Kadry, and Amir H. Gandomi, "Big Data Concepts, Technology, and Architecture", Wiley Publication, 2021
2	Raj Kamal, Preeti Saxena, Big Data Analytics: Introduction to Hadoop, Spark, and Machine, McGraw Hill Education (India) Pvt. Ltd. 2019

Reference Books(s) / Web links:	
1	Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2015.
2	Kyle Banker, "Mongo DB in Action", III edition, Manning Publications Company, 2024.
3	Russell Bradberry, Eric Blow, "Practical Cassandra A Developers Approach", Pearson Education, 2014,

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23531.1	3	2	-	-	3	-	-	-	-	-	-	2	3	2	2
AD23531.2	2	3	3	-	3	-	-	-	-	-	-	2	2	3	3
AD23531.3	3	2	3	2	3	-	-	-	-	-	-	2	2	3	3
AD23531.4	2	2	2	3	3	-	-	-	-	-	-	2	2	3	3
AD23531.5	2	2	2	3	3	-	-	-	-	-	-	2	2	3	3
Average	2.4	2.2	2.5	2	3	-	-	-	-	-	-	2	2.2	2.8	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 Courses)	Category	L	T	P	C
AD23532	Principles of Data Science	PC	2	0	4	4

Objectives:	
•	To Understand Data Science Fundamentals
•	To Master the Data Science Methodology
•	To Analyze and Process Text Data
•	To Leverage Python for Data Science Applications
•	To practice the concept of data ethics

UNIT-I	DATA SCIENCE CONTEXT AND DATA BASE	6
Data Science importance - Data Science Process – SQL – Tool for Data Science - No-SQL: Document Databases, Wide-column Databases and Graphical Databases		
UNIT-II	DATA SCIENCE METHODOLOGY	6
Analytics for Data Science – Examples of Data Analytics – Data Analytics Lifecycle: Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Ethical Use of Predictive Analytics, Ethical Data Collection and Use, Ethics of AI and Autonomous Systems, Ethical Guidelines and Frameworks.		
UNIT-III	DATA ANALYTICS AND TEXT ANALYSIS	6
Text Mining – Information Retrieval – Data Mining – Natural Language Processing – Text analysis tasks - Text Analysis steps - NLP: Major components of NLP, stages of NLP, and NLP applications.		
UNIT-IV	PLATFORM FOR DATA SCIENCE	6
Python for Data Science –Python Libraries – Data Frame Manipulation with Numpy and Pandas – Exploration Data Analysis – Time Series Data – Clustering with Python – Dimensionality Reduction. Python integrated Development Environments (IDE) for Data science.		
UNIT-V	DATASCIENCE ETHICS	6
Ethical Principles in Data Science, Ethical Use of Predictive Analytics, Data Privacy and Security, Bias in Data and Algorithms, Transparency and Accountability, Ethical Guidelines and Frameworks, Ethics of Artificial Intelligence and Autonomous Systems, Informed Consent in Data Collection, Impact of Data Science on Society.		
		Contact Hours : 30

List of Experiments	
1	Data Preprocessing and Cleaning <ul style="list-style-type: none"> Importing libraries: Import popular data science libraries like Pandas, NumPy, and Matplotlib. Loading datasets: Load sample datasets (e.g., CSV, Excel) into Pandas DataFrames. Data cleaning: Handle missing values, remove duplicates, and perform data normalization. Data transformation: Apply data transformations like encoding categorical variables and scaling numerical variables.
2	Data Analytics Lifecycle: Data Discovery and Preparation <ul style="list-style-type: none"> Perform data discovery and exploratory analysis on a real-world dataset (e.g., Titanic or Iris dataset) Clean and preprocess the data (handle missing values, outliers, and normalization).
3	Model Planning and Building <ul style="list-style-type: none"> Implement and compare simple machine learning models (e.g., linear regression or k-means clustering). Visualize and communicate the results using descriptive statistics and plots.
4	Text Preprocessing and Analytics Pipeline <ul style="list-style-type: none"> Perform text cleaning (remove stop words, special characters) and tokenization on a text dataset (e.g., product reviews).

5	NLP Task: Part-of-Speech Tagging and Information Retrieval <ul style="list-style-type: none"> Use NLP libraries (e.g., NLTK or spaCy) to perform part-of-speech tagging. Develop an information retrieval system to search and rank documents based on relevance 			
6	Exploratory Data Analysis with Python <ul style="list-style-type: none"> Use Python libraries (NumPy, Pandas) to analyze a dataset. Perform descriptive statistics, group-wise aggregations, and time-series analysis. Visualize the data using Matplotlib or Seaborn 			
7	Clustering <ul style="list-style-type: none"> K-Means on Customer Segmentation Dataset: Apply K-Means clustering on a customer segmentation dataset to identify distinct customer groups Clustering Ensemble Methods: Implement clustering ensemble methods (e.g., cluster-based similarity partitioning algorithm (CSPA)) on a datasetWine Quality - UCI Machine Learning Repository 			
8	Interactive Dashboards with Tableau <ul style="list-style-type: none"> Create a Tableau dashboard that integrates Google Sheets data. Develop interactive visualizations, such as bar charts, line plots, and scatter plots, to display sales or demographic data. 			
9	Mini Project <ul style="list-style-type: none"> Customer Segmentation Analysis using K-Means Clustering Predictive Analytics on Titanic Dataset Text Analytics for Sentiment Analysis on Product Reviews Interactive Sales Dashboard with Tableau 			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand the fundamental knowledge on data science.
•	Apply the data analytics techniques
•	Apply advanced tools to work on dimensionality reduction and mathematical operations
•	Understand various types of data and visualize them using through programming for knowledge representation.
•	Understand and practice the ethical principles in data science

Text Book (s):	
1	Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, 'Fundamentals of Data Science, CRC Press, 1st Edition, 2022.
2	Avrim Blum, John Hopcroft, Ravindran Kannan, "Foundations of Data Science", Cambridge University Press, First Edition, 2020.

Reference Books(s) / Web links:	
1	Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 1 st Edition, 2015
2	Ani Adhikari and John DeNero, ‘Computational and Inferential Thinking: The Foundations of Data Science’, GitBook, 2019.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23532.1	3	2	-	-	3	-	-	-	-	-	-	2	3	2	2
AD23532.2	3	3	2	-	3	-	-	-	-	-	-	2	3	3	3
AD23532.3	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
AD23532.4	3	2	2	3	3	-	-	-	-	-	-	2	3	3	3
AD23532.5	2	2	2	3	3	-	-	-	-	-	-	2	3	3	3
Average	2.8	2.4	2.2	2	3	-	-	-	-	-	-	2	3	2.8	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 Courses)	Category	L	T	P	C
AI23531	Deep Learning	PC	3	0	2	4

Objectives:	
•	To introduce the foundational concepts of neural networks and enable students to implement a basic three-layer neural network for handwritten digit recognition.
•	To impart knowledge on various training techniques including optimization algorithms and hyperparameter tuning.
•	To familiarize students with convolutional neural networks (CNNs) and guide them through building and experimenting with CNN architectures.
•	To explore recurrent neural networks (RNNs) and their applications in natural language processing, image generation, and autoencoders.
•	To understand generative models, including variational autoencoders (VAE) and generative adversarial networks (GANs), and to discuss best practices for model optimization and scaling.

UNIT-I	INTRODUCTION TO DEEP LEARNING	9
Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – BackPropagation -Activation and Loss Functions – Implementing three layer Neural Network - Handwritten Digit Recognition		
UNIT-II	TRAINING TECHNIQUES	9
Numerical Differentiation – Gradient – Implementing a Training Algorithm - Stochastic Gradient Descent – Momentum – AdaGrad – Adam – Initial Weight Values – Regularization – Hyperparameter optimization - Validating Hyper parameters- - Model ensembling - Scaling up model training.		
UNIT-III	CONVOLUTIONAL NEURAL NETWORKS	9
Overall Architecture – The convolution layer – The pooling layer – Implementing a CNN- LeNet - ImageNet – AlexNet - VGG – GoogLeNet – ResNet		
UNIT-IV	RECURRENT NEURAL NETWORKS	9
Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Auto encoder -Complete Auto encoder, Regularized Autoencoder- LSTM		
UNIT-V	GENERATIVE DEEP LEARNING	9
Generative deep learning: Text generation – Deep dream – Neural style transfer – Generating images with variational autoencoders – Introduction to Generative Adversarial Networks.		
		Total Contact Hours : 45

List of Experiments	
1	Design and implement a three-layer neural network from scratch using Python. Train the network using the backpropagation algorithm with appropriate activation and loss functions. Apply the model to recognize handwritten digits. Suggested Dataset: MNIST Dataset
2	Develop a multi-layer perceptron (MLP) for a simple classification task. Experiment with different numbers of hidden layers and activation functions, and evaluate the model's performance using accuracy and loss. Suggested Dataset: Iris Dataset
3	Implement a training algorithm using stochastic gradient descent (SGD) with momentum and compare it with the Adam optimizer. Train both models on a dataset and compare their convergence rates and performance. Suggested Dataset: CIFAR-10 Dataset
4	Implement a Convolutional Neural Network (CNN) from scratch to classify images. Train the network using a dataset of labeled images and evaluate its performance. Visualize the learned filters in the convolution layers. Suggested Dataset: CIFAR-10 Dataset

5	Implement and compare the performance of three popular CNN architectures: VGG, ResNet, and GoogLeNet for classification using Dogs vs. Cats dataset. Suggested Dataset: Dogs vs. Cats dataset.			
6	Implement a bidirectional recurrent neural network (RNN) to predict sequences in time-series data. Train the RNN and compare its performance with a traditional feed-forward neural network for sequence-based tasks. Suggested Dataset: Airline Passenger Dataset			
7	Build a deep recurrent neural network (RNN) to generate image captions. Combine CNN for image feature extraction with RNN for sequence generation. Suggested Dataset: MS COCO Dataset			
8	Implement a variational autoencoder (VAE) to generate new images from a given dataset. Train the VAE to learn the latent representation of images and generate new samples from the learned distribution. Suggested Dataset: CelebA Dataset			
9	Build a text generation model using Long Short-Term Memory (LSTM) networks. Train the model on a text corpus to generate coherent sequences of text and evaluate the generated text for fluency and coherence. Suggested Dataset: Shakespeare Corpus			
10	Train a Generative Adversarial Network (GAN) to generate new images from a dataset. Evaluate the quality of the images generated using visual inspection and a quantitative metric like the Inception Score (IS) or Fréchet Inception Distance (FID). Suggested Dataset: LSUN Dataset			
11	<p>Mini Project</p> <ul style="list-style-type: none"> • Choose a Topic: Identify a deep learning problem of interest, such as image classification, text generation, or anomaly detection. Research related work using platforms like Google Scholar. • Dataset Selection: Find or collect a suitable dataset from sources like Kaggle or UCI. Ensure it is relevant, well-sized, and consider preprocessing requirements. • Develop Methodology: Start with baseline models, then experiment with advanced architectures (e.g., CNNs, Transformers). Use frameworks like TensorFlow or PyTorch. • Implementation & Evaluation: Train models and evaluate performance using appropriate metrics (e.g., accuracy, F1-score). Document findings systematically. • Discuss & Present: Analyze results, highlight challenges, and present your work with clear insights and future directions. 			
		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:	
At the end of the course the student will be able to	
•	Define the architecture of a neural network and implement a three-layer neural network
•	Analyze and apply various training techniques to optimize neural network performance
•	Design and evaluate convolutional neural networks (CNNs) by building models for image classification tasks
•	Illustrate the working of recurrent neural networks (RNNs) and apply autoencoders for various applications
•	Construct deep generative model for various applications.

Text Book (s):	
1	Koki Saitoh, “Deep Learning from the Basics - Python and Deep Learning: Theory and Implementation”, 1 st edition, Packt Publishing,2021.
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville,” Deep Learning “,1 st edition ,MIT Press,2016.

Reference Books(s)	
1	Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2 nd edition ,2007.
2	François Chollet, “Deep Learning with Python”, Second Edition, Manning, 2021.
3	Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, First Edition, Springer International Publishing AG ,2018.

Web links:	
1	https://www.manning.com/books/deep-learning-with-python-second-edition

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23531.1	3	3	2	2	1	-	-	1	-	-	-	1	3	3	1
AI23531.2	3	3	2	2	2	-	-	2	-	-	-	1	3	3	2
AI23531.3	3	3	3	2	2	-	-	2	-	-	-	1	3	3	1
AI23531.4	3	3	3	2	3	1	1	2	1	1	-	1	3	3	3
AI23531.5	3	3	3	2	3	1	1	2	1	1	-	1	3	3	3
Average	3	3	2.6	2	2.2	1	1	1.8	1	1	-	1	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 (Lab oriented Theory Courses)	Category	L	T	P	C
CS23532	Computer Networks	PC	3	0	4	5

Objectives:	
•	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:	
At the end of the course the student 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 schemes and various routing protocols in data communication to select the 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 Book (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 Edition, 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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CS23532.1		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: "-"

Course Code	:	GE23521
Course Title	:	Soft Skills-II
Teaching Period	:	5 th Semester
Credit Points	:	L T P C – 0 0 2 1
Course Category	:	EEC

Course Objectives:

The major course objectives are:

- a. To help students break out of shyness.
- b. To build confidence
- c. To enhance English communication skills.
- d. 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

SEMESTER VI

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AD23631	Data Privacy and Security	PC	3	0	2	4

Objectives:	
•	To understand the fundamental principles of data privacy and security, including key concepts like the CIA Triad (Confidentiality, Integrity, Availability).
•	To gain knowledge of cryptographic techniques, encryption algorithms, and their applications in safeguarding sensitive data.
•	To identify and analyze data threats, privacy attacks, and the strategies to mitigate risks.
•	To study emerging trends and innovative approaches in data security and privacy, such as ID4D initiatives, continuous authentication, and cancellable authentication methods
•	To understand the fundamental principles of data privacy and security, including key concepts like the CIA Triad (Confidentiality, Integrity, Availability).

UNIT-I	INTRODUCTION TO DATA PRIVACY AND SECURITY	9
Data Governance and simple Privacy Approaches. – Documenting Data For use-Defining Differential Privacy-Real World Differential Privacy – Key concepts: Confidentiality, Integrity, Availability (CIA Triad).		
UNIT-II	ENCRYPTION TECHNIQUES	9
Concepts of Cryptography – Symmetric and Asymmetric Encryption - Cryptographic algorithms: AES, RSA, DES - Encryption standards and applications.		
UNIT-III	ACCESS CONTROL AND AUTHENTICATION	9
Hashing techniques and digital signatures - Methods and threats of Authentication – Password - BioMetric Authentication—MultiFactor Authentication-CIA model-RPC protocol		
UNIT-IV	DATA ATTACKS AND THREATS	9
Privacy Attacks-Different Methods Of Privacy Attacks – Data Security – Access Control-Data Loss Prevention-Extra Security Control-An Average Attacker Measuring Risk Accessing Threats.		
UNIT-V	EMERGING TRENDS IN DATA SECURITY AND PRIVACY	9
ID4D initiative – identity Life Cycle – Assurance Levels Of Authentication – Continuous Authentication – Cancellable Authentication		
		Contact Hours : 45

List of Experiments	
1	Implement secure data communication using encryption techniques, including symmetric (AES) and asymmetric (RSA) encryption.
2	Configure and implement access control policies in a database environment to restrict unauthorized data access.
3	Implement MFA using OTP (One-Time Password) and email/SMS-based verification.
4	Perform a case study on data breaches, analyze causes, and design effective response strategies.
5	Implement Identity and Access Management (IAM) features in cloud environments using tools like AWS IAM or Azure AD.
6	Design and implement differential privacy techniques for secure and anonymized data sharing.
7	Configure firewalls and intrusion detection/prevention systems to safeguard data and monitor unauthorized access attempts.
8	MINI PROJECT Develop an authentication system using appropriate datasets <ol style="list-style-type: none"> 1. Biometric Authentication System – finger print 2. Biometric Authentication System – face recognition 3. Two way Authentication System – Password with capciha 4. Two way Authentication System – password with OTP 5. Secure Communication using modern encryption techniques Key generation and authentication system

<p>DATASETS:</p> <p>FVC (Fingerprint Verification Competition) Datasets: A set of fingerprint databases for evaluating recognition systems. Includes real and synthetic fingerprint images.</p> <p>SOCOFing Dataset: Contains fingerprint images for identity verification research.</p> <p>CASIA-FingerprintV5: A public dataset from the Chinese Academy of Sciences.</p> <p>Labeled Faces in the Wild (LFW): Contains 13,000 facial images for facial recognition and verification tasks.</p> <p>CelebA Dataset: Over 200,000 celebrity images with annotations for facial attribute recognition.</p> <p>CASIA-WebFace: A large-scale dataset for face recognition tasks.</p>					
			Contact Hours	:	30
			Total Contact Hours	:	75

Course Outcomes:	
At the end of the course the student will be able to :	
•	Understand the of data privacy and security, including the CIA triad
•	Design and implement cryptographic solutions to ensure data security
•	Analyze the access control and authentication mechanisms to enhance system security
•	Analyze the threats, vulnerabilities, and risks in data systems
•	Apply the contemporary standards for data protection in real-world scenarios

Text Book (s):	
1	Kathrine Jarmull, Foreword by Dr, Nagima Damalli Stefflbauer, “Practical Data Privacy: Enhancing Privacy and Security in Data”, O’REILLY Publication April 2023.
2	William Stallings, “Cryptography and Network Security”, Seventh Edition Pearson India Education, 2017
Reference Books(s) / Web links:	
1	"Data Privacy: Principles and Practice" by Annie C. Antón, S. B. He, Lee A. Bygrave, O’Reilly Media,2013
2	"Cryptography and Network Security: Principles and Practice" by William Stallings, Pearson,2016
3	Sirapet Boon Krong, “Authentication and Access Control: Practical Cryptography Methods and Tools”, 1st ed. Edition, Apress,2020

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23631.1	3	3	2	-	3	2	2	3	2	-	-	2	3	2	3
AD23631.2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
AD23631.3	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
AD23631.4	3	3	2	3	3	3	-	-	-	-	-	2	3	3	3
AD23631.5	3	3	3	3	3	3	2	2	-	-	-	2	3	3	3
Average	3	3	2.6	2.2	3	2.5	1	1	0.4	-	-	2	3	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 Courses)	Category	L	T	P	C
AD23632	Framework for Data and Visual Analytics Common to AIML and AIDS	PC	3	0	2	4

Objectives:	
•	To analyze the various data analysis frameworks (CRISP-DM, SEMMA, KDD) to determine their applications and effectiveness in different scenarios.
•	To evaluate the effectiveness of different exploratory data analysis (EDA) techniques in Python for handling and cleaning diverse datasets.
•	To Analyze the relationships and correlations within datasets by creating advanced visualizations using Python libraries like Matplotlib
•	To evaluate the functionalities and features of Power BI in designing and developing comprehensive data visualizations and interactive reports.
•	To analyze and compare various advanced visualization techniques in Tableau to create insightful dashboards and stories that effectively communicate data-driven insights.

UNIT-I	INTRODUCTION TO DATA ANALYTICS AND FRAMEWORK	9
Overview of Data Analytics-Importance and Applications-Data Types and Sources- Overview of Data Analysis Frameworks-CRISP-DM (Cross-Industry Standard Process for Data Mining)-SEMMA (Sample, Explore, Modify, Model, Assess)-KDD (Knowledge Discovery in Databases)		
UNIT-II	EXPLORATORY DATA ANALYSIS USING PYTHON	9
Introduction to Exploratory Data Analysis - 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	VISUALIZATION IN PYTHON	9
Importance of data visualization in EDA- Types of data visualizations- Python Libraries for Data Visualization- Basic Plotting with Matplotlib - Visualization for Descriptive Statistics-Visualizing central tendency and dispersion-Box plots and whisker plots-Correlation and Relationship Analysis-Scatter plot matrix-Correlation heatmaps.		
UNIT-IV	VISUALIZATION USING POWER BI	9
What is Power BI? - Features of Power BI -Getting Started with Data Importing-Data Modelling- Report Design : Adding Visualization to the Report, Style Manipulations on a Report, Setting Colours and Background-,Exploring charts - Introduction to DAX Measures and Columns -Editing Interactions-Filters: Types of Filters- Visual Level, Page and Report Level, Include and Exclude,Using Slicer as a Filter-Adding Reports and Data Sets in Workspace -Converting Published Reports into Dashboards		
UNIT-V	VISUALIZATION USING TABLEAU TOOL	9
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 : 45

List of Experiments				
1	Setting up the Python environment and libraries-Jupyter Notebook	<ul style="list-style-type: none"> • Create a new notebook for Python • Write and execute Python code • Create new cells for code and Markdown • Demonstrate the application of Jupyter Widgets, Jupyter AI 		
2	EDA-Data Import and Export	<ul style="list-style-type: none"> • Importing data from CSV, Excel, SQL databases, and web scraping • Handling different data formats • Export a DataFrame to an Excel file. 		
3	EDA-Data Cleaning	<ul style="list-style-type: none"> • Handling missing values: detection, filling, and dropping • Removing duplicates and unnecessary data • Data type conversion and ensuring consistency • Normalize data (e.g., standardization, min-max scaling). 		
4	EDA-Data Inspection and Analysis	<ul style="list-style-type: none"> • 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) 		
5	EDA-Data Visualization with Matplotlib	<ul style="list-style-type: none"> • Basic plotting: line charts, bar charts, histograms 		
6	Data Visualization Using PowerBi	<ul style="list-style-type: none"> • Learning the Power BI Interface • Connecting to various data sources (Excel, CSV, SQL databases) • Creating basic visualizations: bar charts, line charts, pie charts • Creating Calculated Columns and Measures • Building Dashboards 		
7	Data Visualization Using Tableau	<ul style="list-style-type: none"> • Introduction to Tableau and its interface • Connecting to various data sources (Excel, CSV, SQL databases) • Creating basic visualizations: bar charts, line charts, pie charts • Creating calculated fields • Building dashboards and stories in Tableau 		
8	Mini Project	<ul style="list-style-type: none"> • Healthcare Data Analytics • Financial Data Analytics • Social Media Data Analytics • Sports analytics • Tourism Analytics 		
		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:	
At the end of the course the student will be able to:	
•	Critically analyze different data analysis frameworks (CRISP-DM, SEMMA, KDD) and determine their suitability for various data analytics projects and real-world applications.
•	Evaluate and apply appropriate exploratory data analysis (EDA) techniques in Python to clean, transform, and prepare datasets for further analysis, ensuring data quality and integrity.
•	Analyze complex datasets by creating advanced visualizations using Python libraries (Matplotlib) and interpret the visual representations to extract meaningful insights and identify patterns.
•	Evaluate the capabilities of Power BI and develop interactive and dynamic data visualizations and reports, effectively communicating data insights to stakeholders.
•	Analyze and compare advanced visualization techniques in Tableau, creating comprehensive dashboards and stories that effectively present data insights and support data-driven decision-making.

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
5	"Microsoft Power BI - The Complete Masterclass [2023 EDITION]", Nokolai Schuler, 2023, Packt Publishing

Reference Books(s) / Web links:	
1	https://www.datacamp.com/courses/statistical-thinking-in-python-part-1

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23632.1	3	3	2	2	2	1	1	2	3	2	2	1	3	3	2
AD23632.2	2	3	3	3	2	2	1	2	3	2	3	2	3	3	3
AD23632.3	3	3	3	3	3	2	2	2	3	3	3	2	3	3	3
AD23632.4	2	2	3	3	3	2	2	3	3	3	3	2	3	3	3
AD23632.5	2	3	3	3	3	2	2	3	3	3	3	2	3	3	3
Average	2.4	2.8	2.8	2.8	2.6	1.8	1.6	2.4	3	2.6	2.8	1.8	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 Courses)	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:	
At the end of the course the student will be able to	
●	Construct design challenge and reframe the design challenge into design opportunity.
●	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.
●	Develop ideas and prototypes by brainstorming.
●	Organize the user walkthrough experience to test prototype
●	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(s)	
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

Weblinks	
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
GE23627.1	3	2	3	3	3	2	2	3	3	3	3	3
GE23627.2	3	2	3	3	3	2	2	3	3	3	3	3
GE23627.3	3	2	3	3	3	2	2	3	3	3	3	3
GE23627.4	3	2	3	3	3	2	2	3	3	3	3	3
GE23627.5	3	2	3	3	3	2	2	3	3	3	3	3
Average	3	2	3	3	3	2	2	3	3	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 (Lab oriented Theory Courses)	Category	L	T	P	C
CS23634	Fundamentals of Generative AI and Prompt Engineering	PC	2	0	2	3

Objectives:	
•	Gain a solid understanding of Generative AI, its applications, and ethical considerations.
•	Learn the foundations of NLP and how transformer models work
•	Develop the skills to design, refine and optimize prompts for various tasks
•	Create practical AI powered tools like chatbots and content generators
•	Analyze and mitigate ethical and technical challenges in Generate AI

UNIT-I	INTRODUCTION TO GENERATIVE AI	6
What is Generative AI – Definition and key concepts, difference between Gen and Discriminative AI, Popular models (GPT, DALL-E etc), Applications of Gen AI – Text, Image, Code Generation, Audio/Video synthesis. Ethics and Challenges of Gen AI – Bias in AI models, Misinformation and deepfakes and Intellectual Property and Copyright issues		
UNIT-II	FOUNDATIONS OF NATURAL LANGUAGE PROCESSING (NLP)	6
What is NLP, Key NLP tasks (text classification, sentiment analysis, summarization), Tokenization and Text Representation – Word embeddings, Transformers and attention mechanisms. Introduction to Transformer Models – Architecture of Transformers, Overview of BERT, GPT and other transformer-based models		
UNIT-III	PROMPT ENGINEERING BASICS	6
Prompt Engineering – Definition and Importance, Role of prompts in guiding AI behaviour. Types of Prompts – Zero- shot, few-shot and chain of thought programming, Instruction-based prompts Vs open-ended prompts. Best practices of Prompt Design – clarity, specificity and context, iterative refinements of prompts, Handling ambiguous or complex queries		
UNIT-IV	ADVANCED PROMPT ENGINEERING TECHNIQUES	6
Prompt Engineering for Specific Domains. Customizing prompts for technical, creative or business use cases, Domain-specific fine tuning. Handling Edge Cases – Dealing with ambiguous or incomplete inputs, Avoiding biased or harmful outputs. Prompt Chaining and Multi Step Reasoning – Breaking down complex tasks into smaller prompts, Using chain of thought prompt for logical reasoning		
UNIT-V	BUILDING REAL WORLD APPLICATIONS WITH GENERATIVE AI	6
Integrating Gen AI into workflows – API's for Gen AI models (OpenAI API, Hugging Face), Automating tasks using AI. Building Custom Apps – Chatbots and Virtual Assistants, Content generation tools (blog writing, marketing copy), Code generation and debugging tools. Evaluating and Optimizing AI outputs – Metrics for evaluating AI performance, Iterative improvement of prompts and models		
Contact Hours		: 30

List of Experiments	
1	Generative AI Explore Pre-Trained Gen AI Tools <ul style="list-style-type: none"> • Use ChatGPT to generate text and DALL-E to create images • Analyze the outputs and discuss their quality and limitations Ethical Implications Exercise <ul style="list-style-type: none"> • Identify potential ethical issues in AI-generated content • Write a short report on how to mitigate these issues
2	Foundations of NLP Text processing with Python Use libraries like spaCy or NLTK to tokenize and preprocess text data

	Fine Tune a Pre-Trained Model			
	<ul style="list-style-type: none"> Use Hugging Face to fine-tune a transformer model to simple NLP task(eg sentimental analysis) 			
3	Prompt Engineering Basics Experiment with Different Prompts <ul style="list-style-type: none"> Use ChatGPT to test zero-shot, few-shot and chain-of-thought prompts Compare outputs and analyze their effectiveness Create prompts for tasks like summarization, code generation and creating writing 			
4	Advanced Prompt Engineering Techniques Multi-Step Prompt workflow – Design a workflow for a complex task (eg. Writing a research paper or debugging code) Evaluate and Refine Prompts – Test prompts on ChatGPT and refine them based on the outputs			
5	Building Real-World applications with Gen AI Build a Chatbot – Use Open API or Hugging Face to create a simple chatbot Develop a Content Generation Tool – Build a tool that generates social media posts or blog articles Building Dashboards			
		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand Generative AI Fundamentals: Gain a solid understanding of Generative AI, its applications, and ethical considerations.
•	Master NLP Basics: Learn the foundations of NLP and how transformer models work.
•	Become Proficient in Prompt Engineering: Develop the skills to design, refine, and optimize prompts for various tasks.
•	Build Real-World Applications: Create practical AI-powered tools like chatbots and content generators.
•	Develop Critical Thinking: Analyze and mitigate ethical and technical challenges in Generative AI.

Text Book (s):	
1	Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016, 1st Edition.
2	Lane, Howard, and Hapke, Natural Language Processing in Action, Manning Publications, 2019, 1st Edition.
3	Ben, The Art of Prompt Engineering, Self-Published, 2023, 1st Edition.

Reference Book(s) / Web link(s):	
1	Cathy O’Neil, Weapons of Math Destruction, Crown Publishing Group, 2016, 1st Edition.
2	Vincent C. Müller, Ethics of Artificial Intelligence and Robotics, Springer, 2020, 1st Edition.
3	Daniel Jurafsky and James H. Martin, Speech and Language Processing, Pearson, 2021, 3rd Edition.
4	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O’Reilly Media, 2019, 2 nd Edition.
5	Denis Rothman, Transformers for Natural Language Processing, Packt Publishing, 2021, 2nd Edition.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23633.1	3	2	2	2	3	2	2	3	-	2	-	3	3	3	3
CS23633.2	3	3	2	2	3	-	-	-	-	2	-	3	3	3	2
CS23633.3	3	3	2	2	3	-	-	2	-	3	-	3	3	3	3
CS23633.4	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CS23633.5	3	3	2	3	2	3	3	3	2	2	2	3	3	3	3
Average	3	2.8	2.2	2.4	2.8	2.33	2.33	2.5	2.5	2.4	2.5	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: “-”

Course Code	:	GE23621
Course Title	:	Problem-Solving Techniques
Teaching Period	:	6 th Semester
Credit Points	:	L T P C – 0 0 2 1
Course Category	:	EEC

Course Objectives:

- To improve the numerical ability
- To improve problem-solving skills.

Course topics:

S.No.	Topics
1	Numbers system
2	Reading comprehension
3	Data arrangements and Blood relations
4	Time and Work
5	Sentence correction
6	Coding & Decoding, Series, Analogy, Odd man out and Visual reasoning
7	Percentages, Simple interest and Compound interest
8	Sentence completion and Para-jumbles
9	Profit and Loss, Partnerships and Averages
10	Permutation, Combination and Probability
11	Data interpretation and Data sufficiency
12	Logarithms, Progressions, Geometry and Quadratic equations.
13	Time, Speed and Distance

Course Outcome:

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

1. Have mental alertness
2. Have numerical ability
3. Solve quantitative aptitude problems with more confident

SEMESTER VII

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
AI23712	Reinforcement Learning	PC	3	0	0	3

Objectives:						
•	Demonstrate various Components of Reinforcement Learning.					
•	Make use of various exploration and exploitation strategies.					
•	Apply Model based and Model Free Prediction techniques.					
•	Make use of different value based Reinforcement Learning Algorithms.					
•	Demonstrate various Policy based Reinforcement Learning Algorithms.					

UNIT-I	Introduction	9
Deep Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning -Agent, Environment, Observations, Actions, Example-The Bandit Walk Environment, Agent-Environment interaction cycle, MDP (Markov Decision Process): The engine of the Environment-States, Actions, Transition Function, Reward Signal.		
UNIT-II	Planning, Exploitation and Exploration of Reinforcement Learning	9
Planning: Objective of a decision making agent-environment, Plan, Optimal policy, Comparison of Policies, Bellman Equation/State-Value Function, Action-Value Function, Action-Advantage Function, Optimality. Exploitation and Exploration of Reinforcement Learning: Bandits- Single-state decision problem(Multi-Armed Bandit(MAB) problem), The cost of exploration, Approaches to solve MAB environments, Greedy Strategy, Random Strategy, Epsilon-Greedy Strategy, Decaying Epsilon-Greedy Strategy, Optimistic Initialization strategy, Strategic exploration, Softmax exploration strategy, Upper confidence bound (UCB) equation strategy, Thompson sampling strategy.		
UNIT-III	Model Free Reinforcement Learning	9
Model Free Reinforcement Learning: Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD), Learning to estimate from multiple steps, N-step TD learning, Forward-view TD(λ), Backward-view TD(λ), Generalized policy iteration(GPI), Monte Carlo control, SARSA: On-Policy TD control, Q-learning: Off-Policy TD control, Double Q-learning, SARSA(λ), Watkins's Q(λ)		
UNIT-IV	Value Based Reinforcement Learning	9
Deep reinforcement learning agents with sequential feedback, evaluative feedback, sampled feedback, Function Approximation for Reinforcement Learning- high-dimensional state and action spaces, continuous state and action spaces, state-value function and action-value function with and without function approximation, Neural Fitted Q (NFQ), Deep Q-Network (DQN), Double Deep-Q Networks(DDQN), Dueling DDQN, Prioritized Experience Replay (PER).		
UNIT-V	Policy Based Reinforcement Learning	9
Policy Gradient and Actor-Critic Methods—REINFORCE Algorithm and Stochastic Policy Search, Vanilla Policy Gradient(VPG), Asynchronous Advantage Actor-Critic (A3C), Generalized Advantage Estimation (GAE), Advantage Actor-Critic(A2C), Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3), Soft Actor-Critic (SAC), proximal policy optimization (PPO).		
		Total Contact Hours : 45

Course Outcomes:	
At the end of the course the student will be able to	
•	List various applications of Reinforcement Learning.
•	Apply Random and Optimistic Exploration Strategies to make correct decision making.
•	Apply different Prediction techniques.
•	Demonstrate deep reinforcement learning agents with feedback.
•	Demonstrate various policy based Reinforcement Learning Algorithms.

Text Book (s):	
1	Laura Graesser, Wah Loon Keng, ‘‘Foundations of Deep Reinforcement Learning: Theory and Practice in Python’’ Addison-Wesley Data & Analytics Series, 1st Edition, 2022.
2	Miguel Morales, Grokking Deep Reinforcement Learning, Manning Publications, 2020.
3	Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An Introduction, Second Edition, MIT Press, 2019.

Reference Books(s) / Web links:	
1	Marco Wiering, Martijn van Otterlo(Ed),Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
2	Keng, Wah Loon, Graesser, Laura, Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Addison Wesley Data & Analytics Series, 2020.
3	Francois Chollet, Deep Learning with Python, Manning Publications, 2018.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23712.1	-	1	-	2	2	-	-	-	-	-	-	1	3	3	3
AI23712.2	-	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI23712.3	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI23712.4	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI23712.5	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
Average	1	1.8	1	2	2	-	-	-	1	2	-	1	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 (Lab oriented Theory Courses)	Category	L	T	P	C
CS23633	CLOUD COMPUTING	PC	2	0	2	3

Objectives:	
•	To learn the fundamentals of Cloud Computing and designing Private Cloud and Public Cloud Environment
•	Understand Virtual Machines and workload, Cloud Infrastructure.
•	To learn the cloud management and cloud native.
•	To gain knowledge on various cloud computing architecture.
•	To learn the cloud security.

UNIT-I	INTRODUCTION	6
Basic concepts and terminology-roles and boundaries-cloud characteristics-cloud delivery model and deployment Model (Public, Private and Hybrid models). Understand Cloud computing models IaaS, SaaS and PaaS and its differences and when to use what model.		
UNIT-II	VIRTUAL MACHINES AND WORKLOADS, UNDERSTAND CLOUD INFRASTRUCTURE	6
Virtual Private Server (VPS), difference between dedicated and VPS server. Cloud Migration: Backup, Restore of the same and its associated costing. Cloud Infrastructure Resources: File, Block, Object Storage and CDN (Content Delivery Networks)		
UNIT-III	CLOUD MANAGEMENT AND CLOUD NATIVE	6
Understand how to maintain control and oversight of cloud computing infrastructure, resources, and services in public, private, or hybrid cloud environments – Interoperability, Cloud Sprawl, Automation, Cloud Governance, Monitoring and Logging, Performance and Cost Reporting		
UNIT-IV	CLOUD COMPUTING ARCHITECTURE	6
Understand the services like storage, databases, software, analytics, and other platforms that are accessible via the internet. Understand how to build, design, and manage applications on the cloud platform.		
UNIT-V	CLOUD SECURITY	6
AWS and the shared responsibility model, Azure and the shared responsibility model, GCP and the shared responsibility model. Command-Line tools: AWS CLI, Azure CLI, Google Cloud SDK.		
Total Contact Hours		: 30

List of Experiments	
1	Private Cloud Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation
2	Public Cloud Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.
3	Hybrid Cloud Setting Up Hybrid Connectivity Experiment with setting up a secure VPN connection between an on-premises data center and a public cloud provider such as AWS or Azure. Configure a hybrid network topology using virtual private clouds (VPCs), subnets, and route tables.
4	Basic VPS Server Setup Provision a VPS instance from a cloud provider or set up a virtual machine on your local system using software like VirtualBox or VMware. Install a Linux distribution such as Ubuntu, CentOS, or Debian as the operating system. Configure network settings, including IP address, subnet mask, gateway, and DNS.
5	Cloud Migration-Backup Setup

	Choose a cloud storage service provider such as Amazon S3, Google Cloud Storage, or Azure Blob Storage for storing backups. Set up a backup schedule to regularly back up critical data and configurations from your on-premises or existing cloud environment. Utilize backup tools or scripts to automate the backup process and ensure consistency.
6	CDN Service Selection, CDN Configuration Research and select a CDN provider such as Cloudflare, Akamai, or Amazon CloudFront. Sign up for a CDN account or utilize free trial options if available. Configure your CDN account settings, including domain setup and DNS configuration. Create CDN distributions or zones to specify which content will be cached and delivered through the CDN network.
	Contact Hours : 30
	Total Contact Hours : 60

Course Outcomes: On completion of the course, the students will be able to	
•	Demonstrate the cloud, its characteristics, various delivery and deployment models and designing Private Cloud and Public Cloud Environment.
•	The strength of virtualization, workload its role in enabling the cloud infrastructure.
•	Recognize the scope cloud management and cloud native.
•	The fundamental cloud components mechanism with cloud computing architecture.
•	Analyze the core issue of cloud such as security. Provide an insight into future prospects of computing in the cloud

Text Book (s):	
1	Eyal Estrin- “Cloud Security Handbook”, Packt Publishing Ltd, First published : March 2022
2	Thomas Erl, Zaigham Mahood, Ricardo Puttini- “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, First Edition, 2013.

Reference Books(s) / Web links:	
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 Guide”. 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	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.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23633.1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS23633.2	2	3	3	3	3	2	2	2	3	2	3	2	2	3	3
CS23633.3	3	3	3	3	3	2	3	2	2	2	3	2	2	3	3
CS23633.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS23633.5	3	3	3	2	2	2	2	2	2	2	3	2	2	2	3
Average	3	2.8	2.8	2.6	2.6	2	2	1.8	2.4	1.8	3	2	2.2	2.4	2.8

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

PROFESSIONAL ELECTIVES (PE)

DATA SCIENCE AND ANALYTICS

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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	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 (Lab Oriented Theory course)	Category	L	T	P	C
AD23A32	Explorative and Forecasting Analytics Common to CSE,IT,CSE(CS),AIDS	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	<p>Perform data cleaning, transformation, and feature engineering on the Stock Market Data from Kaggle to prepare it for time series modeling.</p> <p>Evaluation Parameters: Creativity in feature engineering and thoroughness in preprocessing steps.</p>			
6	<p>Apply Moving Average and Exponential Smoothing models to establish baseline forecasts using the Electricity Consumption Data from Kaggle.</p> <p>Evaluation Parameters: Accuracy of forecasts and suitability of the model chosen for the data's nature.</p>			
7	<p>Construct and tune an ARIMA model using Daily Financial Market Data from Quandl, focusing on optimal parameter selection.</p> <p>Evaluation Parameters: Model's fit to the data and predictive accuracy.</p>			
8	<p>Implement LSTM networks to forecast future patient admissions using the Hourly Patient Admission Data from the PhysioNet database.</p> <p>Evaluation Parameters: Effectiveness of the neural network architecture and its tuning.</p>			
9	<p>Forecast a system of multiple interrelated economic indicators using Vector Autoregression (VAR) with the Multivariate Economic Statistics from the Data Market repository.</p> <p>Evaluation Parameters: Integration of multiple time series inputs and forecasting accuracy.</p>			
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	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	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:	
CO1	Understand the fundamental concepts and terminologies in bioinformatics and its applications
CO2	Apply knowledge of bioinformatics resources and databases to effectively retrieve biological data.
CO3	Analyze the nucleic acid and protein sequences using various sequence databases and bioinformatics tools.
CO4	Apply statistical and computational methods to assess sequence similarity, homology, and scoring matrices in bioinformatics applications.
CO5	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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	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 (Lab oriented Theory Courses)	Category	L	T	P	C
AD23A34	PREDICTIVE ANALYTICS	PE	2	0	2	3

Objectives:							
•	To introduce Predictive Modeling.						
•	To familiarize students with Regression and Classification Techniques.						
•	To impart knowledge on the concepts of Support Vector Machines and Neural Networks.						
•	To explore tree-based classifiers and ensemble methods.						
•	To introduce Topic Modeling.						
UNIT-I	INTRODUCTION TO PREDICTIVE ANALYTICS					6	
Evolution of Data Analytics, Types of Predictive Analytic, Role of Predictive Analytics, Tools, Frameworks, Platforms, Languages, Libraries, Services, Challenges, Vertical Industry Use cases for Predictive Analytics.							
UNIT-II	DATA MODELING IN PREDICTIVE ANALYTICS					6	
Understanding Advanced Data, Data Preprocessing and Feature Engineering, Predictive Analytics Pipeline, Selecting Right Model, Python and Scikit learn for predictive analytics.							
UNIT-III	MATHEMATICS AND ALGORITHMS IN PREDICTIVE ANALYTICS					6	
Statistics and Linear Algebra, Regression, Decision Trees, Random Forests, Neural Networks, Support Vector Machines, Naïve bayes classifiers,							
UNIT-IV	MACHINE LEARNING IN PREDICTIVE MODELING					6	
Predict future events with Big Data, Predict future events with Data mining, Predict future events with Predictive Modelling, Statistics to predict future events, Data analysis for prediction, Using Machine Learning to make predictions, Prediction traps, Bias, Estimating the best prediction, Implementing Predictive Analysis.							
UNIT-V	APPLICATIONS OF PREDICTIVE MODELING					6	
Prediction based Optimal Retail Price recommendations, Recommender Systems, Credit Card Fraud Classification, Navigation and Traffic Management, Social Impact of Predictions.							
					Contact Hours	:	30
List of Experiments							
1	Build a linear regression model to predict housing prices based on features like area, number of rooms, and location. Evaluate the performance using R-squared and Mean Absolute Error (MAE).						
2	Develop a logistic regression model to predict customer churn in a telecom dataset. Analyze performance using confusion matrix, precision, and recall metrics.						
3	Construct a decision tree classifier to classify iris flower species based on petal and sepal measurements. Visualize the tree and prune it to improve performance.						
4	Build a random forest model to predict loan approval status based on customer data. Compare accuracy, precision, and recall with a decision tree.						
5	Implement an SVM model to classify handwritten digits using the MNIST dataset. Experiment with different kernel functions (linear, polynomial, RBF) and analyze performance.						
6	Train a simple feedforward neural network on the CIFAR-10 image dataset. Use backpropagation and monitor accuracy and loss over epochs.						
7	Perform topic modeling on a collection of news articles using LDA. Analyze the top words in each topic and interpret the results.						
8	Implement a GBM model to predict customer satisfaction based on survey data. Compare performance with other classification models like SVM and logistic regression.						
9	Use the k-NN algorithm to classify the wine quality dataset. Experiment with different values of 'k' and evaluate the results using F1-score and confusion matrix.						
10	Perform data cleaning, normalization, and feature engineering on a dataset related to predictive analytics (e.g., weather data). Apply techniques such as handling missing data, scaling features, and encoding categorical variables.						
Software Tools: Scikit Learn, TensorFlow							
					Contact Hours	:	30
					Total Contact Hours	:	60

Course Outcomes:	
At the end of the course the student will be able to:	
•	Develop a foundational understanding of predictive modeling and its applications.
•	Apply regression and classification techniques to real-world problems
•	Analyze the system using Support Vector Machines and Neural Networks for predictive analytics.
•	Understand and implement tree-based classifiers and ensemble methods.
•	Apply topic modeling techniques to various datasets

Text Book (s):	
1	Nooruddin Abbas Ali, “Predictive Analytics for the Modern Enterprise: A Practitioner's Guide to Designing and Implementing Solutions”, O’Reilly Media Publications, first Edition, May 2024.
2	Richard Hurley, “Predictive Analytics: The Secret to Predicting Future Events Using Big Data and Data Science Techniques Such as Data Mining, Predictive Modelling, Statistics, Data Analysis, and Machine Learning”, Atona publications, February 2020.

Reference Books(s) / Web links:	
1	Daniel Vaughan, Analytical Skills for AI and Data Science: Building Skills for an AI-Driven Enterprise, O’Reilly Media, 1st Edition, April 2021.
2	Eric Siegel, The AI-Powered Enterprise: Harnessing the Power of Machine Learning to Lead with Confidence and Transform Your Business, McGraw-Hill Education, 1st Edition, February 2022.
3	John D Kelleher, Brian Mac Namee, Aoife D’Arcy, “Fundamentals of Machine Learning for Predictive Data Analytics, second edition: Algorithms, Worked Examples, and Case Studies”, The MIT press, October 2020.
4	Alvaro Fuentes, “Hands-On Predictive Analytics with Python”, Packt Publications, December 2018.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23A34.1	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
AD23A34.2	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
AD23A34.3	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
AD23A34.4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2
AD23A34.5	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2
Average	3	3	3	3	3	2	2	2	2	2	2	2	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 (Lab oriented Theory Courses)	Category	L	T	P	C
AD23A35	Healthcare Analytics	PE	2	0	2	3

Objectives:	
•	To Introduce Predictive Modeling
•	To familiarize Regression and Classification Techniques.
•	To impart knowledge on the concepts of Support vector machines and Neural Networks.
•	To explore tree-based classifiers and ensemble methods
•	To introduce Topic modeling

UNIT-I	INTRODUCTION TO HEALTHCARE DATA ANALYTICS	6
Introduction, Healthcare Data Sources and Basic Analytics, Advanced Data Analytics for Healthcare, Applications and Practical Systems for Healthcare, Resources for Healthcare Data Analytics.		
UNIT-II	HEALTH CARE DATA SOURCES AND BASIC ANALYTICS	6
Health Law, Big Data Analytics & AI in healthcare, History of EHR, Components of EHR, Coding Systems, Benefits of EHR, Barriers to Adopting EHR, Challenges of Using EHR Data, Phenotyping Algorithms.		
UNIT-III	ARTIFICIAL INTELLIGENCE IN HEALTH CARE	6
Big Data Analytics and Artificial Intelligence in Health care, Biomedical Imaging Modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction,		
UNIT-IV	HEALTH INFORMATICS & MINING OF SENSOR DATA IN HEALTHCARE	6
Digitizing Medical Records, Health Record Content and Documentation, Clinical Terminologies, Classifications and Code Systems, Mining Sensor Data in Medical Informatics: Scope and Challenges, Challenges in Healthcare Data Analysis, Nonclinical Healthcare Applications.		
UNIT-V	ADVANCED DATA ANALYTICS IN HEALTHCARE	6
Public Health Informatics, Security and Privacy Issues, Healthcare Statistics, Statistical Prediction Models, Survival Models, Evaluation and Validation.		
		Contact Hours : 30

List of Experiments	
1	Perform EDA on a publicly available healthcare dataset to identify trends, patterns, and outliers. Dataset: Kaggle Health Data.
2	Analyze a dataset containing EHRs to understand components, coding systems, and barriers to adoption. Dataset: MIMIC-III Clinical Database
3	Implement a classification algorithm to predict diseases using patient demographics and clinical data. Dataset: UCI Machine Learning Repository - Heart Disease
4	Apply image processing techniques for object detection and segmentation in biomedical images. Dataset: The Cancer Imaging Archive (TCIA)
5	Extract features from medical images and build a predictive model for diagnosis. Dataset: Chest X-ray Images (Pneumonia)
6	Design a basic application using health informatics principles to analyze patient data and visualize results. Dataset: Health and Nutrition Examination Survey (NHANES)
7	Develop statistical models to predict health outcomes based on historical data. Dataset: World Health Organization (WHO) Data
8	Analyze a dataset for privacy concerns and develop recommendations for securing health data. Dataset: Healthcare Cost and Utilization Project (HCUP).
9	Mini Project a. Predictive Analytics for Diabetes Management: A Machine Learning Approach Objective: Utilize machine learning algorithms to predict the likelihood of diabetes in patients based on clinical and demographic data. Analyze the factors influencing diabetes risk and visualize the results for healthcare professionals. b. Development of an EHR Dashboard: Insights from Electronic Health Records

	<p>Objective: Create a dashboard that aggregates and visualizes key metrics from electronic health records (EHRs) to help healthcare providers monitor patient outcomes, identify trends, and improve decision-making.</p> <p>c. Image Segmentation for Tumor Detection in Medical Imaging Objective: Implement image segmentation techniques using deep learning to identify and delineate tumors in MRI or CT scan images. Evaluate the effectiveness of various segmentation algorithms and their potential in clinical settings.</p> <p>d. Mining Sensor Data for Predictive Health Monitoring in Wearable Devices Objective: Analyze data collected from wearable health devices (e.g., heart rate monitors) to predict potential health issues. Develop a model to classify activity levels and assess how these correlate with user health metrics.</p> <p>e. Evaluating Public Health Trends Using Statistical Models and Health Informatics Objective: Utilize statistical models to analyze public health data and identify trends in health outcomes related to specific demographics. Provide recommendations for interventions based on the findings.</p> <p>Considerations for Implementation</p> <p>Data Sources: For each project, identify appropriate datasets (as suggested in the previous message) to support your analysis.</p> <p>Tools and Technologies: Use relevant programming languages and libraries (e.g., Python, R, TensorFlow, Pandas) based on the project requirements.</p> <p>Documentation: Ensure thorough documentation of project objectives, methodologies, results, and conclusions to facilitate understanding and potential future work in the field.</p>						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">Contact Hours</td> <td style="width: 5%; text-align: center;">:</td> <td style="width: 25%; text-align: right;">30</td> </tr> <tr> <td>Total Contact Hours</td> <td style="text-align: center;">:</td> <td style="text-align: right;">60</td> </tr> </table>	Contact Hours	:	30	Total Contact Hours	:	60
Contact Hours	:	30					
Total Contact Hours	:	60					

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand and apply basic and advanced data analytics techniques to healthcare datasets, enabling data-driven decision-making in healthcare environments.
•	Develop predictive models using regression, classification techniques, and support vector machines to analyze and interpret healthcare data effectively.
•	Implement and evaluate various machine learning algorithms, including tree-based classifiers and ensemble methods, to address complex healthcare problems.
•	Analyze biomedical images and signals using techniques such as segmentation, registration, and feature extraction to enhance diagnostic accuracy.
•	Explore and apply sensor data mining techniques in healthcare to develop non-clinical applications and address challenges in medical informatics.
Text Book (s):	
1	Leming Zhou, "Introduction to Healthcare Informatics", American Health Information Management Association Publication, Third Edition, March 2023.
2	Phillip Olla, Joseph Tan, "Digital Health Care: Perspectives, Applications, and Cases: Perspectives, Applications, and Cases", Jones & Bartlett Learning, May 2022.
3	Chandan K. Reddy, Charu C. Aggarwal, "Healthcare Data Analytics", Chapman and Hall/CRC, First Edition, June 2020.
4	Susan White, "A Practical Approach to Analyzing Healthcare Data", Ahima Publications, Fourth Edition, March 2021.
Reference Books(s) / Web links:	
1	Oachs, Watters, "Health Information Management: Concepts, Principles, and Practice", AHIMA Press Publications, Sixth Edition, February 2020.
2	Nalin Johri PhD MPH, "Health Services Research and Analytics Using Excel", Springer Publishing Company, First Edition, February 2020.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23A35.1	3	3	2	2	2	1	1	1	1	2	1	2	3	2	2
AD23A35.2	3	3	2	3	3	1	1	1	1	2	2	2	3	2	2
AD23A35.3	3	3	2	3	3	1	1	1	2	2	2	2	3	3	2
AD23A35.4	3	3	2	3	3	1	2	1	2	2	2	2	3	3	2
AD23A35.5	3	3	2	3	3	1	2	1	2	2	2	2	3	3	2
Average	3	3	2	2.5	2.5	1	1.5	1	1.5	2	2	2	3	2.5	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
AD23A36	Social Media Analytics	PE	2	0	2	3

Objectives:	
•	To introduce the fundamentals of social media analytics and its importance in today's digital landscape.
•	To understand essential network concepts and analytical techniques used in social media analysis.
•	To apply techniques such as text and link analytics on social media data.
•	To analyze the influence of social media actions on user engagement.
•	To explore the use of web analytics tools for campaign evaluation and performance measurement.

UNIT-I	INTRODUCTION TO SOCIAL MEDIA ANALYTICS	6
Introduction: Social media landscape, Need for SMA; Types of SMA; SMA Cycle, Tools, Application of SMA in different areas like marketing, health, and politics, Challenges to Social Media Analytics		
UNIT-II	SOCIAL MEDIA NETWORK ANALYTICS	6
Basic Concept : Network definitions, centrality measures : Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality, Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence		
Applications: Types of Network, Network Terminologies, Tools for Network Analytic, Detection communities, identification of key influencers, and their roles in network dynamics.		
UNIT-III	SOCIAL MEDIA LINK AND TEXT ANALYTICS	6
Link analysis: Random graphs and network evolution, Link Prediction, Collective Classification, Collecting and analyzing social media data, and clustering techniques		
Text Analytics: Types Of Social Media Text, Purpose Of Text Analytics, Steps In Text Analytics, Social Media Text Analysis Tools.		
UNIT-IV	SOCIAL MEDIA ACTIONS AND HYPERLINK ANALYTICS	6
Actions Analytics: Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group		
Hyperlink Analytics: Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Hyperlink Analytics		
UNIT-V	WEB ANALYTICS TOOLS	6
Web 2.0 Analytics: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis		
Visualization Techniques: Visualization techniques for social media data, Dashboards, heatmaps, word clouds, network graphs, time-series visualizations, and storytelling with data.		
Contact Hours		: 30

List of Experiments	
1	Analyze the case study "The Underground Campaign That Scored Big" by simulating hypothetical campaign data, applying analytical methods to identify patterns, and evaluating strategies based on key performance metrics.
2	Analyze Twitter networks using Python to identify influencers, calculate centrality measures, and detect community structures. (Dataset: Sample Twitter data (tweets, followers, retweets)).
3	Apply network metrics on a LinkedIn dataset using Python or UCINET to analyze structure, equivalence, and user roles.(Dataset: LinkedIn dataset)
4	Analyze social media reviews using Python and machine learning libraries or NLTK to perform sentiment analysis, extract key phrases, and apply clustering techniques for actionable insights.(Dataset: Amazon product reviews, hotel reviews, or Twitter comments.)
5	Predict future connections in a social media network using algorithms like Adamic-Adar or Jaccard similarity and validate predictions with network evolution data.(Dataset: Synthetic or real-world network data)
6	Analyze Instagram engagement data using Python and Tableau to identify patterns in likes, comments, and shares, and visualize user engagement trends.(Dataset: Instagram engagement dataset.)

7	Analyze YouTube video hyperlinks and metadata using Python and the YouTube API to identify factors influencing video virality.(Dataset: YouTube video metadata and hyperlink data.)
8	Collect and analyze Twitter data using Python and Tableau to evaluate campaign performance through clickstream and sentiment analysis, and visualize insights in dashboards.(Dataset: Real-time Twitter data or pre-downloaded datasets)
9	Analyze Facebook page performance using Python and Power BI by examining reach, engagement, and demographics, and visualize results with time-series and network graphs.
10	Mini Project Analyze social media data and uncover fact or trend in any one of the following domain <ul style="list-style-type: none"> • Health, • Marketing • Financial
Software Tools: Power BI, Python, Tableau, Scikit Learn, TensorFlow	
Contact Hours : 30	
Total Contact Hours : 60	

Course Outcomes:	
At the end of the course the student will be able to:	
•	Understand the significance and applications of social media analytics.
•	Apply network concepts and analytical tools to analyze social media networks
•	Perform link prediction and text analysis to derive insights from social media data
•	Assess the role of social media actions and hyperlinks in enhancing content engagement.
•	Apply the web analytics to evaluate the effectiveness of campaigns and present insights using advanced visualization techniques.

Text Book (s):	
1	Dr. Gohar F. Khan, “Creating Value with Social Media Analytics”, Third Edition, May 2024
2	Charu C. Aggarwal, “Social Network Data Analytics”, Springer-Verlag New York Inc., 2011th edition, 2011.

Reference Books(s) / Web links:	
1	https://theintactone.com/2023/06/02/natural-language-processing-techniques-for-micro-text-analysis/
2	https://theintactone.com/2023/06/02/facebook-analytics-introduction-parameters-demographics-analyzing-page-audience-reach-and-engagement-analysis-post-performance-on-fb/
3	Matthew Ganis, Avinash Kohirkar Social Media Analytics: Techniques and Insights for Extracting Business Value Out Of Social Media, IBM Press, 1st edition,14 December 2015.
4	Marshall Sponder, “Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics”, McGraw Hill, 1st edition, 2 September 2011.
5	Subhasinin Chellappan, “Big Data and Analytics”, Seema Acharya, Wiley Publications, January 2019
6	Melissa S. Barker, Donald I. Barker, Nicholas F. Bormann, Krista E. Neher, Social Media Marketing: A Strategic Approach, Cengage, 1st edition, January 2013.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23A36.1	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1
AD23A36.2	2	3	3	2	1	3	2	3	2	1	3	2	2	3	2
AD23A36.3	3	2	2	1	2	2	3	2	3	2	1	3	3	2	1
AD23A36.4	1	3	1	2	3	2	2	3	1	3	2	1	2	3	3
AD23A36.5	2	2	3	3	2	1	2	3	2	1	3	2	3	2	1
Average	2.2	2.4	2	2.2	2	1.8	2.4	2.6	1.8	2	2.2	1.8	2.6	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 (Lab oriented Theory Courses)	Category	L	T	P	C
AD23A37	Image and Video Analytics Common to CSE,IT,CSE(CS),AIDS	PE	2	0	2	3

Objectives:	
•	To Understand the basics of image processing techniques for computer vision and video analysis.
•	To Explain the techniques used for image pre-processing.
•	To Develop various object detection techniques.
•	To Understand the various face recognition mechanisms.
•	To Understand deep learning-based video analytics.

UNIT I	INTRODUCTION	6
Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation		
UNIT II	IMAGE PRE-PROCESSING	6
Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multispectral images - Local pre-processing in the frequency domain - Line detection by local preprocessing operators - Image restoration.		
UNIT III	OBJECT DETECTION USING MACHINE LEARNING	6
Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures - R-CNN-Faster R-CNN		
UNIT IV	FACE RECOGNITION AND GESTURE RECOGNITION	6
Face Recognition - Introduction - Applications of Face Recognition - Process of Face Recognition - DeepFace solution by Facebook - FaceNet for Face Recognition- Implementation using FaceNetGesture Recognition.		
UNIT V	VIDEO ANALYTICS	6
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem - RestNet architecture-RestNet and skip connections-Inception Network		
		Contact Hours : 30

List of Experiments		
1	Write a program that computes the T-pyramid of an image.	
2	Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity	
3	Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.	
4	Develop a program to implement Object Detection and Recognition	
5	Develop a program for motion analysis using moving edges and apply it to your image sequences.	
6	Develop a program for Facial Detection and Recognition	
7	Write a program for event detection in video surveillance system	
		Contact Hours : 30
		Total Contact Hours : 60

Course Outcomes:	
•	To understand the basics of image processing techniques for computer vision.
•	To apply the techniques used for image pre-processing.
•	To analyze the various object detection techniques.
•	To apply the various Object recognition mechanisms.
•	To examine on the video analytics techniques.

Text Book (s):	
1	Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013
2	Vaibhav Verdhan, 2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021
3	Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, 4/e, Pearson Education 2019.

Reference Books(s) / Web links:	
1	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011.
2	Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3	D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education,
4	E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23A37.1	3	2	3	2	2	1	2	1	1	1	1	2	3	2	1
AD23A37.2	3	3	3	3	2	2	2	2	1	1	2	3	3	3	2
AD23A37.3	2	3	3	3	2	2	3	2	2	1	2	3	3	3	2
AD23A37.4	3	3	2	3	3	2	3	3	2	1	3	3	3	3	3
AD23A37.5	3	3	3	3	3	2	3	3	3	2	3	3	3	3	3
Average	2.8	2.8	2.8	2.8	2.4	1.8	2.6	2.2	1.8	1.2	2.2	2.8	3	2.8	2.2

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

DATA SCIENCE TECHNIQUES AND APPLICATIONS

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AD23B31	Image Processing and Computer Vision Common to CSE,CSE(CS),AIDS	PE	2	0	2	3

Objectives:						
•	To Learn the basic concepts of image processing and computer vision.					
•	To explore the use of computer vision for object detection and image segmentation problems.					
•	To understand the ideas about image Recognition and Restoration					
•	Explore the ideas of object detection and Segmentation using Vision Datasets.					
•	To demonstrate the model prediction and to solve a variety of problems					

UNIT I	INTRODUCTION	6
Introduction to Image Processing and Computer Vision-Features-Applications- Image formation -Geometric primitives and Photometric image formation - The digital camera and Image processing - Point operators - Linear filtering ,Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization - Feature detection and matching Points and patches - Edges – Lines		
UNIT II	Image Segmentation and Alignment	6
Segmentation: Active contours - Split and merge - Mean shift and mode finding - Normalized cuts -Graph cuts-Feature-based alignment - 2D and 3D feature-based alignment - -Geometric intrinsic calibration.		
UNIT III	Object Detection, Recognition, and 3D Reconstruction	6
Object detection -Face recognition -Instance recognition - Category recognition -Context and scene understanding - Recognition databases and test set, 3D reconstruction: Shape from X - Active range finding - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction -Recovering texture maps and albedos		
UNIT IV	Vision Datasets and Model Predictions	6
Object Detection – Segmentation. Creating Vision Datasets: Collecting Images – Data types – Manual Labeling – Labeling at Scale – Automated Labeling – Bias – Creating a Dataset -Model Predictions: Making Predictions		
UNIT V	Object Measurement, Pose Estimation, and Image Understanding	6
Object Measurement – Counting – No-Code Computer Vision - Pose estimation- Image Search, Image and Text Generations: Image Understanding – Image Generation –Image Captioning .		
Contact Hours		: 30

List of Experiments						
1	Installation of Open CV & To perform the basic image handling processing operation on the image					
2	Implement Edge Detection, Line Detection and Corner Detection					
3	Demonstrate Camera Calibration using python					
4	Implement Image Histogram and Histogram Equalization					
5	Develop a python program for Skin color Detection					
6	Create a python program for Warping and Estimation					
7	Develop a python program for Motion Tracking					
8	Design a program for Object Detection using YOLO					
9	Develop a python program for Stereo Vision and Depth Estimation					
10	Demonstrate Augmented reality using feature matching					
11	Mini Project: Real-Time Object Detection with YOLO (You Only Look Once) Camera Calibration and Stereo Vision for Depth Estimation Skin Color Detection and Tracking in Real-Time Augmented Reality using Feature Matching and Homography Motion Tracking System for Object Detection					
Contact Hours		:	30			
Total Contact Hours		:	60			

Course Outcomes:	
•	Understand the basic concepts and techniques of digital image processing.
•	Apply various image transformation and restoration techniques.
•	Extract features from images and perform image segmentation.
•	Gain familiarity with computer vision concepts like depth perception, motion estimation, and 3D vision.
•	Apply deep learning techniques for image classification and object detection.

Text Book (s):	
1	Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 4th Edition, Pearson Education, 2018.
2	Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer, 2020.
3	Adrian Kaehler and Gary Bradski, "Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library", 2nd Edition, O'Reilly Media, 2016.

Reference Books(s) / Web links:	
1	Rajalingappaa Shanmugamani, "Deep Learning for Computer Vision", Packt Publishing, 2018.
2	Himanshu Singh, "Practical Machine Learning and Image Processing", Apress, 2019.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23B31.1	3	3	2	2	3	2	2	1	1	1	1	2	3	3	2
AD23B31.2	3	3	3	3	3	2	2	2	1	1	2	3	3	3	2
AD23B31.3	3	3	3	3	2	2	3	2	2	1	2	3	3	3	2
AD23B31.4	3	3	3	3	3	2	3	3	2	2	2	3	3	3	3
AD23B31.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3	3	2.8	2.8	2.8	2.2	2.6	2.2	1.8	1.6	2	2.8	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 Courses)	Category	L	T	P	C
AD23B32	Natural Language Processing Analytics	PE	2	0	2	3

Objectives:	
•	To introduce the fundamentals of Natural Language Processing (NLP) and its applications in analytics.
•	To explore different text representation and feature extraction techniques.
•	To understand semantic analysis and modeling techniques in NLP.
•	To study advanced deep learning models for NLP applications.
•	To apply predictive analytics and deploy NLP models for real-world use cases.

UNIT-I	INTRODUCTION TO NLP ANALYTICS	6
Overview of NLP Analytics: Introduction to Natural Language Processing and its applications in analytics.NLP Pipeline: Stages of NLP analytics – text preprocessing, tokenization, and vectorization. Basic Analytics Techniques: Statistical measures (entropy, cross-entropy), text encoding (character encoding, word embeddings).Tools and Frameworks: Introduction to popular NLP tools (NLTK, spaCy, TextBlob).		
UNIT-II	TEXT REPRESENTATION AND FEATURE EXTRACTION	6
Text Representation: Bag of Words, TF-IDF, Word2Vec for text vectorization.Feature Extraction: N-grams, part-of-speech tagging, named entity recognition (NER), and semantic features.Dimensionality Reduction: Techniques like PCA and LDA for reducing feature space in text analytics.Sentiment Analysis: Extracting sentiment from text data and its applications in social media and reviews.		
UNIT-III	SEMANTIC ANALYSIS AND MODELING	6
Lexical Semantics: Word similarity, WordNet, and context-based word meaning.Semantic Models: TF-IDF, Pointwise Mutual Information (PMI), and co-occurrence models.Word Embeddings: Word2Vec, GloVe, and their application in capturing semantic meaning in large text corpora.Text Classification: Applying semantic models for text classification tasks like spam detection or topic modeling.		
UNIT-IV	ADVANCED NLP MODELS AND DEEP LEARNING	6
Deep Learning for NLP: Introduction to RNNs, LSTMs, GRUs, and Transformers (BERT, GPT).Transfer Learning: Using pre-trained models for NLP tasks (BERT, GPT, etc.).Named Entity Recognition (NER) and Dependency Parsing: Advanced syntactic and semantic analysis using deep learning.Sequence Labeling: Tasks such as part-of-speech tagging, chunking, and syntactic parsing.		
UNIT-V	PREDICTIVE ANALYTICS AND MODEL DEPLOYMENT	6
Predictive Analytics in NLP: Text classification, sentiment analysis, and predictive modeling.Text Generation and Summarization: Building models for text generation (e.g., chatbots) and text summarization.Model Evaluation: Metrics like accuracy, precision, recall, F1-score, and BLEU for text-based models.Model Deployment: Techniques for deploying NLP models (via APIs, cloud services) for real-time text analytics applications.		
		Total Contact Hours : 30

List of Experiments	
1	Implement text preprocessing techniques, including tokenization, removing stop words, and punctuation, and applying stemming/lemmatization.Tools: NLTK, spaCy. Dataset: 20 Newsgroups Dataset.
2	Implement Bag of Words and TF-IDF for text vectorization and compare the effectiveness of both methods. Tools: NLTK, scikit-learn Dataset: SMS Spam Collection Dataset
3	Perform NER and POS tagging on text data to identify entities and their syntactic roles. Tools: spaCy, NLTK Dataset: CoNLL-03 Dataset
4	Perform sentiment analysis on social media text (e.g., tweets) to classify the sentiment as positive, negative, or neutral. Tools: TextBlob, NLTK

	Dataset: Sentiment140 Dataset		
5	Build a text classification model using Word2Vec or GloVe embeddings to classify text data (e.g., spam detection). Tools: Gensim, scikit-learn Dataset: SMS Spam Collection Dataset		
6	Deploy a text classification model as a REST API that can be used for real-time predictions. Tools: Flask/Django, scikit-learn, or HuggingFace Transformers Dataset: IMDb Movie Reviews Dataset		
7	Mini Project <ul style="list-style-type: none"> • Sentiment Analysis and Classification of Social Media Posts • Spam Detection in SMS Messages Using Word Embeddings • Named Entity Recognition (NER) for Extracting Key Information from News Articles • Real-time Sentiment Analysis API for News Headlines 		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Understand the NLP pipeline, including text preprocessing, tokenization, and vectorization techniques.
•	Apply various text representation methods such as Bag of Words, TF-IDF, and Word2Vec for feature extraction.
•	Analyze semantic relationships in text using lexical semantics, word embeddings, and co-occurrence models.
•	Implement deep learning techniques like RNNs, LSTMs, and Transformers for advanced NLP applications.
•	Evaluate NLP models based on metrics such as accuracy, precision, recall, and deploy them for real-world applications.

Text Book (s):	
1	Daniel Jurafsky and James H. Martin “Speech and Language Processing”, 3rd edition, Prentice Hall, 2024
2	T V Geetha ,”Understanding Natural Language Processing”, (Machine Learning and Deep Learning Perspectives),1 st edition, Pearson,2024

Reference Books(s) / Web links:	
1	Bird, S., Klein, E., & Loper, E. (2009). <i>Natural Language Processing with Python</i> . O’Reilly Media.
2	Vaswani, A., et al. (2017). <i>Attention Is All You Need</i> . NeurIPS.
3	Manning, C. D., & Schütze, H. (1999). <i>Foundations of Statistical Natural Language Processing</i> . MIT Press.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23B32.1	3	3	2	2	3	2	1	2	2	2	2	3	3	2	2
AD23B32.2	3	3	2	2	3	2	1	1	2	2	2	3	3	2	3
AD23B32.3	3	3	3	2	3	2	1	2	2	2	2	3	3	3	3
AD23B32.4	3	3	3	2	3	2	1	2	2	2	2	3	3	3	2
AD23B32.5	3	3	3	3	3	2	1	2	3	3	3	3	3	3	3
Average	3	3	2.6	2.2	3	2	1	1.8	2.2	2.2	2.2	3	3	2.6	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 Courses)	Category	L	T	P	C
AD23B33	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 A retail company wants to automatically analyze feedback from customers, which may come as text (emails or

<p>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 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	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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	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 (Theory Courses)	Category	L	T	P	C
AI23B11	Information Visualization	PE	3	0	0	3
Common to AIML & AIDS						

Objectives:	
•	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		
Total Contact Hours		: 45

Course Outcomes:	
At the end of the course the student will be able to	
•	Visualize the objects in different dimensions
•	Design and process 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 requirements imposed by the data.

Reference Books(s) / Web links:	
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 Courses)	Category	L	T	P	C
AI23A33	AI for Game Programming	PE	2	0	2	3

Objectives:	
•	To understand the role of AI in game design and the complexity of AI behaviors
•	To investigate Artificial Intelligence techniques used in traditional and modern computer games.
•	To select appropriate artificial intelligence techniques to address specific game design challenges.
•	To evaluate the runtime performance of artificial intelligence techniques used in computer games.
•	To explore cutting-edge artificial intelligence methods to solve computer game design problems.

UNIT I	INTRODUCTION	6
Introduction to Game AI-Roles of AI in Game design, Game AI Interfaces (Movement, Path finding, Decision Making, Strategy), Complexity (Artificial Stupidity, Intelligent Mistakes)-Game AI Inputs, Outputs, and Behaviors The 2D Rigidbody Agent, Steering Output, Variable Matching		
UNIT II	CLASSICAL TECHNIQUES	6
Movement Algorithms-Position Matching: Kinematic and Dynamic Seek, Flee, Arrive-Orientation Matching: Kinematic and Dynamic Align, Wander-Advanced Movement: Delegation and Combination Interfaces, Blending, Arbitration-Advanced Position and Orientation Matching Pursue, Evade, Face, Look Where You Are Going		
UNIT III	MODERN TECHNIQUES	6
Structure of Procedural Content Generators Content Selection v. Generation, Expressive Range-Pseudorandom Number Generation Halton Sequence, Poisson Disk, Kaleidoscope Effect-Content Selection L-systems, Grammars, Randomness-Content Generation Parametric Systems, Search-based Methods		
UNIT IV	STRATEGY ALGORITHMS	6
Structure of Strategy Algorithms Blackboard, Utility Theory-Game Playing Minimax, Alpha-beta Pruning-Monte-Carlo Tree Search Algorithm, Improving Performance-Coordinated Action Multi-tier AI, Influence Maps		
UNIT V	LEARNING	6
Decision Tree Learning ID3 Algorithm-Artificial Neural Networks Credit Assignment, Feedforward and Back propagation, Error Term-Overview, Architectures		
		Total Contact Hours : 30

List of Experiments			
1	Implementation of Texture the Triangle using Direct 3D 11.		
2	Implementation of Diffuse Lightning using Direct3D 11.		
3	Implementation of Bouncing Ball Game.		
4	Creation of Virtual Pet Game.		
5	Simulation of Treasure Hunt Game.		
6	Simulation of Shooting Game.		
7	Develop an interactive game using Tynker.		
8	Study of PyGame program and Unity software for multimedia applications..		
9	Develop a 2D Game with Unity.		
10	Mini Project -Design video games such as The Last of Us,FIFA 22,Red Dead Redemption 2,Tom Tom Clancy's Splinter Cell: Blacklist,XCOM: Enemy Unknown using gaming tools.		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Develop software code for a range of artificial intelligence techniques used in traditional and modern computer games
•	Describe the performance of artificial intelligence techniques used in traditional and modern computer games.
•	Choose, develop, explain, and defend the use of particular artificial intelligence techniques for solving particular game design problems.
•	Evaluate the relative benefits and drawbacks of different artificial intelligence techniques that can be used to solve computer game design problems.
•	Identify and examine state-of-the-art artificial intelligence techniques from the industry and academia to solve computer game design problems.

Suggested activities:	
•	Role play- The 2D RigidBody Agent (Unit 1).
•	Mind Map, Poster Design - Kinematic and Dynamic Align (Unit 2).
•	Flipped Classroom – Kaleidoscope Effect (Unit 3).
•	Poster Design – Carlo Tree Search Algorithm (Unit4).
•	Implementation of small module- ID3 Algorithm (Unit5).

Text Book (s):	
1	Paul Roberts, “Game AI uncovered”, 1 st Edition, , CRC press,2024
2	Millington, Ian. “Artificial Intelligence for Games”, 3rd Edition, CRC Press, 2021.
3	Steve Rabin, “Game AI Pro 3: Collected Wisdom of Game AI professional “ , 1 st Edition, CRC press,2021

Reference Books(s) / Web links:	
1	Fouad Sabry, “Artificial Intelligence Video Games: Fundamentals and Applications”, One billion Knowledgeable community press,2023
2	Paul Roberts, “Artificial Intelligence in Games” , CRC press, 2022

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23A33.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
AI23A33.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
AI23A33.3	3	3	3	3	3	-	-	2	2	-	2	2	3	2	3
AI23A33.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
AI23A33.5	2	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average	2.8	3	3	3	3	3.0	2.0	2.0	2.3	2.0	1.8	2.4	3	2.8	2.6

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AI23B34	Human Computer Interaction	PE	2	0	2	3

Objectives:	
•	To learn the foundations of Human Computer Interaction.
•	To be familiar with the software design process.
•	To acquire knowledge about human interaction models and theories.
•	To explore various mobile applications development platforms
•	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.		
		Total Contact Hours : 30

Course Outcomes:	
At the end of the course the student will be able to	
•	Describe the foundations of Human Computer Interaction.
•	Demonstrate the software design process
•	Apply the concepts of human interaction models and theories .
•	Design effective Mobile Applications
•	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 Books(s) / Web links:	
1	Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, “Human – Computer Interaction”, Pearson Education
2	Shneiderman, Plaisan Cohen, Jacobs, Elmqvist, “Designing the User Interface Strategies for Effective Human-Computer Interaction”, Sixth Edition

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23B34.1	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
AI23B34.2	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
AI23B34.3	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
AI23B34.4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
AI23B34.5	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 Courses)	Category	L	T	P	C
AI23B12	Cognitive Science	PE	3	0	0	3

Objectives:	
•	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

Course Outcomes:	
At the end of the course the student will 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

Text Book (s):	
1	Bermúdez, José Luis. Cognitive science: An introduction to the science of the mind. Cambridge University Press, 2017.

Reference Books(s) / Web links:	
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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”

FULL STACK DEVELOPMENT

Subject Code	Subject Name (Lab oriented Theory Courses)	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:	
•	To learn basic programming in C# and the object oriented programming concepts.
•	To study the advance programming concepts in C#.
•	To understand the working of base class libraries, their operations and manipulation of data using XML.
•	To update and enhance skills in writing Windows application, WPF, WCF and WWF with C# and .NET.
•	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 .		
Total 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(){

	<pre> 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"); } </pre> <p>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.</p>
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 to 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:	
At the end of the course the student will be able to	
•	Write various applications using C# Language.
•	Write various applications using advanced C# concepts.
•	Create window services, libraries and manipulating data using XML.
•	Develop distributed applications using .NET Framework.
•	Create mobile applications using .NET compact Framework.

Text Book (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(s) / Web links:	
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	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 course)	Category	L	T	P	C
IT23C17	Ubiquitous Computing (Common to IT, CSE)	PE	3	0	0	3

Objectives:	
•	Understand the fundamental concepts and principles of ubiquitous computing.
•	Understand the architecture, lifecycle, and integration of smart devices and services in modern technological ecosystems.
•	Design and develop basic ubiquitous computing systems or applications.
•	Explore the principles and design of intelligent systems, focusing on interaction, autonomy, and artificial life.
•	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:	
On completion of the course, the students will be able to	
CO1	Gain a comprehensive understanding of the principles and concepts underlying ubiquitous computing.
CO2	Design and implement service-oriented solutions leveraging smart devices and networks.
CO3	Understanding ubiquitous computing applications across various platforms, including mobile, wearable, and IoT devices.
CO4	Design intelligent systems with effective interaction and autonomous capabilities.
CO5	Apply ubiquitous computing principles to solve real-world problems and challenges such as healthcare, smart cities, and personalized services.

Suggested Activities (if any)	
•	Case study on ubiquitous computing
•	Survey on various application
•	Activity Based Learning
•	Implementation of small module

Suggested Evaluation Methods (if any)	
•	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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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(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:	
•	To learn the criteria for test cases
•	To learn the design of test cases.
•	To understand test management and test automation techniques
•	To understand test management and test structure group
•	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

List of Experiments			
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)		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Design test cases suitable for a software development for different domains
•	Identify suitable tests to be carried out
•	Prepare test planning based on the document
•	Document test plans and test cases designed
•	Use automatic testing tools and Develop and validate a test plan

Suggested Activities (if any)	
•	Survey on various Testing technologies
•	Activity Based Learning

Suggested Evaluation Methods (if any)	
•	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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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
CS23A35	Web Application Security	PE	2	0	2	3

Objectives:						
•	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:	
At the end of the course the student 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

Text Book (s):	
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/hackactivities/search
6	https://portswigger.net/web-security/learning-paths

CO - PO – PSO matrices of course

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 (Lab oriented Theory Courses)	Category	L	T	P	C
IT23B33	DevOps (Common to IT, CSE, CSE CS, AIML, AIDS, CSBS, CSD)	PE	2	0	2	3

Objectives:	
•	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 Devop- 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-V	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		
		Total 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 Downtown using Blue-Green Deployment	
11	Testing Project with ZAP and Postmen	
		Contact Hours : 30
		Total Contact Hours : 60

Course Outcomes:	
At the end of the course the student 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.
•	<ul style="list-style-type: none"> 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 matrices of course

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

Objectives:	
•	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:	
At the end of the course the student will be able to	
•	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”, 9 th 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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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: “-”

EMERGING TECHNOLOGIES

Subject Code	Subject Name (Theory Courses)	Category	L	T	P	C
IT23A11	Internet of Things (Common to IT, AITL, AIDS, CSE, CSE CS)	PE	3	0	0	3

Objectives:	
•	To understand the basics of Internet of Things and communication protocols.
•	To understand the basic principles, architecture, and components, Methods of IoT systems.
•	To explore the hardware aspects, including microcontrollers (e.g., Arduino, Raspberry Pi) and sensors commonly used in IoT projects.
•	To gain hands-on experience with popular IoT platforms, Physical servers and cloud.
•	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	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-V	TOOLS AND APPLICATIONS	9
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home		
Total Contact Hours		: 45

Course Outcomes:	
At the end of the course the student will be able to	
•	Know about IoT and its functionalities.
•	Interpret IoT Architecture.
•	Implement the various IoT elements and design the system.
•	Understand the IoT physical servers and cloud integration.
•	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
•	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 Arshdeep Bahga, —Internet of Things (A Hands-on-Approach),1st Edition, Orient Blackswan Private Limited, 2015.
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 matrices of course

PO/PSO CO	PO1	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 Course)	Category	L	T	P	C
CS23B32	Advanced Application Development with Oracle APEX	PE	0	0	6	3

Objectives:	
•	To provide students with an understanding of Oracle APEX as a platform for rapid application development using Oracle Autonomous Database.
•	To enable students to create, design, and manage database-driven applications with interactive features.
•	To introduce advanced techniques for managing interactive reports, grids, and dynamic data visualization tools like cards and smart filters.
•	To teach students how to enhance applications using dynamic actions, computations, processes, validations, and implement robust security features.
•	To prepare students to handle application lifecycle tasks such as migrating development between environments and managing application data effectively.

List of Experiments	
1	Setting up the environment and getting started with Oracle APEX.
2	Exploring SQL Workshop, creating tables, and executing SQL queries.
3	Creating database application and deploying it on APEX.
4	Adding and customizing pages and regions in an application.
5	Creating and formatting reports to visualize data.
6	Modifying interactive reports to enhance user interaction.
7	Managing and personalizing interactive grids in an application.
8	Adding page controls like buttons, list items, and selectors.
9	Integrating computations, processes, and validations for application logic.
10	Implementing dynamic actions to enhance user interactivity.
11	Designing and implementing advanced search and filter options.
12	Creating interactive forms and connecting them with database tables.
13	Designing and implementing navigation menus and breadcrumbs.
14	Customizing application look and feel using themes and styles.
15	Adding plugins and JavaScript to extend functionality.
16	Importing, exporting, and managing data within an application.
17	Implementing security measures like authentication and authorization.
18	Integrating new pages into the existing application structure.
19	Deploying and migrating applications across different environments.
Contact Hours	
: 90	

Course Outcomes:	
At the end of the course the student will be able to	
•	Demonstrate the ability to use Oracle APEX to create and deploy scalable database applications.
•	Develop and customize pages, regions, forms, and navigation components for a seamless user experience.
•	Integrate interactive reports, grids, dynamic actions, and search functionalities to enhance application interactivity and usability.
•	Apply best practices for securing applications and managing data, including implementing authentication and authorization techniques.
•	Exhibit proficiency in migrating applications between environments and extending their capabilities using themes, plugins, and advanced customization techniques.

Software Requirements:	
1	Oracle APEX Installation Requirements URL: https://docs.oracle.com/en/database/oracle/apex/24.1/htmig/apex-installation-requirements.html#GUID-02BE4A34-B631-412C-8A82-EB92DABBACE0
2	Oracle Database Requirements Oracle APEX release 24.1 requires an Oracle Database release 19c or later. APEX runs on all database editions, including Enterprise Edition (EE), Standard Edition (SE), and Oracle Database Free. APEX can be installed in single-instance database and in Oracle Real Application Clusters (Oracle RAC) database.
3	Browser Requirements Oracle APEX requires a JavaScript-enabled browser and supports the current and prior major release of Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Edge.
4	Web Server Requirements Oracle APEX requires Oracle REST Data Services (ORDS) 20.x or later. The use of Quick SQL requires Oracle REST Data Services (ORDS) 23.3 or later.
5	Disk Space Requirement Free space for APEX software files on the file system: 599 MB if using English only download (apex_24.1_en.zip) and 983 MB if using full download (apex_24.1.zip). Free space in APEX tablespace: 190 MB Free space in SYSTEM tablespace: 125 MB Free space in APEX tablespace for each additional language (other than English) installed: 60 MB
6	Oracle XML DB Requirement Oracle XML DB must be installed in the Oracle database that you want to use if you are installing a full development environment. If you are using a preconfigured database created either during an installation or by Database Configuration Assistant (DBCA), Oracle XML DB is already installed and configured.
7	Free APEX Workspace URL: https://apex.oracle.com/pls/apex/r/apex/quick-sign-up/request-workspace
8	Run APEX in a Virtual Machine URL: https://www.oracle.com/database/technologies/databaseappdev-vm.html

Text Book (s):	
1	Oracle APEX: The Essentials, Patrick Cimolini, Packt Publishing, 1st Edition, 2020.
2	Pro Oracle Application Express, John Scott and Scott Spendolini, Apress, 2nd Edition, 2021
3	Oracle APEX Cookbook, Marcel van der Plas, Packt Publishing, 3rd Edition, 2019.

Reference Books(s) / Web links:	
1	Beginning Oracle Application Express, Rick Greenwald, Apress, 1st Edition, 2022.
2	Oracle APEX Best Practices, Alex Nuijten, Iloon Ellen-Wolff, Learco Brizzi, Packt Publishing, 1st Edition, 2016.
3	Oracle Database 19c and 21c New Features, Bert Scalzo, Mukesh Sharma, Oracle Press (McGraw Hill), 1st Edition, 2021.
4	Oracle Application Express for Beginners: A Hands-on Approach, Riaz Ahmed, Independently Published, 1st Edition, 2020.
5	Advanced Oracle PL/SQL Developer's Guide, Saurabh K. Gupta, Packt Publishing, 3rd Edition, 2019.
6	Oracle APEX Official Documentation URL: https://docs.oracle.com/en/database/oracle/application-express/index.html

7	Oracle APEX Community URL: https://apex.oracle.com/community/
8	Oracle APEX Tutorials on Oracle Learning Library URL: https://apex.oracle.com/en/learn/

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23B32.1	3	2	2	1	3	-	2	-	1	2	1	3	3	2	2
CS23B32.2	3	3	3	2	3	1	2	1	2	3	2	3	3	3	3
CS23B32.3	2	3	3	2	3	1	1	1	2	3	2	3	3	3	2
CS23B32.4	3	2	2	3	2	3	3	3	2	2	3	3	2	2	3
CS23B32.5	3	2	3	3	3	1	2	2	2	3	3	3	3	3	3
Average	2.8	2.4	2.6	2.2	2.8	1.5	2	1.8	1.8	2.6	2.2	3	2.8	2.6	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
CS23A32	Robotic Process Automation	PE	1	0	4	3

Objectives:	
•	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:	
At the end of the course the student 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 Book (s):	
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(s) / Web links:	
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 Taulli, 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 matrices of course

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 Courses)	Category	L	T	P	C
CB23G11	Quantum Computation and Quantum Information	PE	3	0	0	3

Objectives:	
•	To learn about Quantum information.
•	To gain knowledge about Quantum algorithms.
•	To understand and learn about Quantum random number generators.
•	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:	
At the end of the course the student will be able to	
•	Apply quantum gates and circuits using quantum information.
•	Apply quantum algorithms in cryptosystems.
•	Understand the importance of Quantum random number generator.
•	Understand the importance of Quantum key distribution.
•	Apply the concept of post-quantum cryptography.

Text Book (s):	
1	Chris Bernhardt, "Quantum Computing for Everyone", The MIT Press, 2019.
2	M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Edition, 2010.
3	Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/
Reference Books(s) / Web links:	
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 Tharmashastha, 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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	3	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 Courses)	Category	L	T	P	C
CR23A33	Cryptocurrency and Blockchain Technologies	PE	2	0	2	3

Objectives:	
•	To understand how blockchain operates and its potential applications beyond cryptocurrency
•	To understand various types of cryptocurrencies, mining processes, wallets, and their economic principles
•	To understand how smart contracts and decentralized applications transform the Ethereum
•	To understand common security challenges in cryptocurrencies and blockchain
•	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:	
At the end of the course the student will be able to	
•	Develop knowledge in the core concepts of blockchain technology, including distributed ledgers, hashing functions, and consensus mechanism
•	Focus on understanding history and evolution of cryptocurrencies, such as Bitcoin and Ethereum
•	Understand the concept of smart contracts and their functionalities on a blockchain platform
•	Understand the potential future applications of blockchain technology across various industries
•	Demonstrate practical skills through hands-on activities, such as setting up a cryptocurrency wallet or interacting with a blockchain platform

Suggested Activities	
•	Problem solving sessions
•	Mini Projects

Course Outcomes:	
At the end of the course the student 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
4	Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017
5	Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing, 2018

CO - PO – PSO matrices of course

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 Courses)	Category	L	T	P	C
CS23A36	3D PRINTING AND DESIGN	PE	2	0	2	3

Objectives:	
•	To discuss on basis of 3D Printing
•	To explain the file format of 3D Printing techniques
•	To explain the processes of 3D Printing
•	To explain and demonstrate INKJET technology
•	To explain and demonstrate laser technology

UNIT I	INTRODUCTION TO CAD	6
<p>Coordinate systems: Geometric co-ordinate systems - Cartesian, Cylindrical and Spherical coordinate systems. Display co-ordinate systems - Global, Local, View and Screen coordinate systems.</p> <p>Curves: Definition - Parametric and non- parametric forms of analytical and synthetic curves. Analytical Curve modeling - Line Segment, Circle, Ellipse. Synthetic Curve modeling - Hermite Cubic Spline, Bezier, B-spline .Surfaces and types. Mathematical modeling of Solids: Properties of solid model, Solid modeling Techniques - Boundary representation, Constructive Solid Geometry, Analytical Solid Modeling, Sweep representation schemes. Solid Manipulation Techniques.</p>		
UNIT II	STL FILE FORMAT AND MANIPULATION	6
<p>Introduction, Preparation of CAD Models – The STL File Format, Binary/ASCII ,Creating STL Files from a CAD System, Calculation of Each Slice Profile, Technology Specific Elements, Problems with STL Files, STL File Manipulation- Viewers, STL Manipulation on the AM Machine,Beyond the STL File- Direct Slicing of the CAD Model, Color Models, Multiple Materials, Use of STL for Machining.</p>		
UNIT-III	3D PRINTING PROCESSES	6
<p>Vat photo polymerization, Material jetting, Binder jetting, Powder bed fusion, Material extrusion, Directed energy deposition, Sheet lamination, 3D printing Processes limitations and Industrial applications.</p>		
UNIT IV	INKJET TECHNOLOGY	6
<p>Printer- Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-on-Demand; Material Formulation for jetting; Liquid based fabrication – Continuous jet, Multijet; power based fabrication- Colourjet.</p>		
UNIT-V	LASER TECHNOLOGY	6
<p>Light Sources – Types ,Characteristics ; Optics – Deflection, Modulation; Material feeding and flow- Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.</p>		
		Total Contact Hours : 30

List of Experiments	
1	Analyze the CAD software's interface and fundamental tools
2	Study 3D printers including print head, build envelope , materials used and related support removal systems
3	Review the Commands for moving from 2D to 3D
4	Adept CAD commands for exploring 3D objects
5	Design every Day Object Using Thingiverse, Shapeways, and GitFab <ul style="list-style-type: none"> • Mobile Stand

	<ul style="list-style-type: none"> • Football • Tooth Brush 			
6	Use the CAM Software to prepare files for 3D Printing			
7	Manipulate machine movement and material layering			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:	
At the end of the course the student will be able to	
•	Outline and examine the basic concepts of 3D Printing technology using CAD software
•	Outline of File Format and manipulation
•	Students can able to understand the basic concepts of printing processes
•	Students can able to explain and categories the working principles of Inkjet technology
•	Students can able to explain and categories the working principles of laser technology

Text Book (s):	
1	Christopher Barnatt, 3D Printing : The Next Industrial Revolution ,CreateSpace Independent Publishing platform,2013
2	Ibrahim Zeid , Mastering CAD CAM Tata Mc Graw- Hill Publishing Co.,2007

Reference Books(s) / Web links:	
1	C. K. Chua, K. F. Leong, C. S. Lim: Rapid Prototyping: Principles and Applications, Second Edition, World Scientific publishers ,2010
2	Ian M. Hutchings , Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons,2013
3	Joan Horvath , Mastering 3D Printing , APress , 2014

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A36.1	1	1	2	2	3	1	-	-	2	-	2	2	3	2	1
CS23A36.2	3	2	3	3	3	2	-	-	3	-	3	2	3	2	3
CS23A36.3	2	2	2	2	2	2	-	-	2	-	2	2	3	2	2
CS23A36.4	2	2	2	2	3	2	-	-	2	-	2	2	3	3	2
CS23A36.5	1	3	3	3	3	3	-	-	3	-	3	3	3	3	1
Average	1.8	2	2.4	2.4	2.8	2	-	-	2.4	-	2.4	2.2	3	2.4	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 course)	Category	L	T	P	C
CS23A33	Cyber Security and Forensics	PE	2	0	2	3

Objectives:	
•	To learn about Cyber Crime and Cyber Laws
•	To understand Cyber attacks and tools to mitigate it.
•	To learn about Computer Forensics and understanding computer Investigation
•	To become familiar with evidence collection and forensics tools
•	To learn to analyze and validate forensic data

UNIT I	INTRODUCTION	6
Cyber Security- History of Internet - Impact of Internet - Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime–Cybercriminals – Classification of Cybercrimes– A Global Perspective on Cyber Crimes – Cyber Laws-The Indian IT Act		
UNIT II	ATTACKS AND COUNTERMEASURES	6
Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures		
UNIT-III	INTRODUCTION TO COMPUTER FORENSICS	6
Introduction to Traditional Computer Crime and its problems – Introduction to Identity Theft & Identity Fraud – Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation – Preparation for IR: Creating response tool kit and IR team – Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.		
UNIT IV	EVIDENCE COLLECTION AND FORENSICS TOOLS	6
Processing Crime and Incident Scenes – Working with Windows and DOS Systems –Current Computer Forensics Tools- Software/ Hardware Tools		
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		
		Contact Hours : 30

List of Experiments	
1	Linux auditing using Lynis and increase the hardening index using security tools
2	Hardening Linux OS using various configuration to reduce the attack surface
3	Analyze Web Application Security using N-Stalker tool
4	Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
5	Live Data Acquisition of a folder and take its image using FTKImager

6	Recover deleted file using FTKImager		
7	Analyze RAM dump using Volatility tool		
8	Collect Email Evidence in Victim PC and Extract Browser Artifacts (ChromeHistory view for Google Chrome)		
9	Perform Live Forensics Case Investigation using Autopsy		
10	Study Email Tracking and Email Tracing and write a report on them.		
		Contact Hours :	30
		Total Contact Hours :	60

Course Outcomes:	
At the end of the course the student will be able to	
•	Explain the basics of Cybercrime and Cyber Laws
•	Identify various types of cyber-attacks and take appropriate countermeasures
•	Apply computer forensics investigation and to do data acquisition
•	Apply various forensics tools for evidence collection
•	Analyze and Validate the evidence collected

Text Book (s):	
1	Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021
2	Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.

Reference Books(s) / Web links:	
1	MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.
2	Dejey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018
3	CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
4	John R.Vacca, "Computer Forensics", Cengage Learning, 2005
5	Xiaodong Lin, "Introductory Computer Forensics: A Hands-on Practical Approach", Springer, 2018

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A33.1	1	1	1	1	-	1	-	-	-	-	1	-	2	2	2
CS23A33.2	1	3	1	3	2	1	-	-	-	-		-	2	2	1
CS23A33.3	2	1	1	1	-	1	-	-	-	-	1	-	2	2	2
CS23A33.4	3	3	2	2	2	1	-	-	-	-		-	2	2	2
CS23A33.5	3	2	1	1	1	1	-	1	-	-	1	-	2	2	2
Average	2	2	1.2	1.6	1.6	1	-	1	-	-	1	-	2	2	1.8

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

1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High)

No correlation: “-“

CYBER SECURITY

Subject Code	Subject Name (Theory Courses)	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:	
At the end of the course the student will be able to	
•	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:	
•	Quizzes
•	Class presentation/Discussion
•	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 matrices of course

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 (Lab oriented Theory Courses)	Category	L	T	P	C
CS23A11	MALWARE DETECTION AND ANALYSIS	PE	3	0	0	3

Objectives:	
•	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
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		
		Total Contact Hours : 45

Course Outcomes:	
At the end of the course the student will be able to	
•	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

Text Book (s):	
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A11.1	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23A11.2	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23A11.3	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23A11.4	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
CS23A11.5	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
Average	2	1.8	1.4	1.4	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 Courses)	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:	
At the end of the course the student will be able to	
•	Grasp Core Ethical Hacking Concepts includes exploring the ethical hacker's role, the hacking methodology and the legal boundaries of ethical hacking.
•	Learn in detail about common system weaknesses, network vulnerabilities, and various scanning tools to pinpoint security gaps
•	Able to Understand ethical hacking tools and techniques
•	Gain knowledge in risk assessment and types of system hardening
•	Understand topics like social engineering tactics, zero-day vulnerabilities, and keeping abreast of industry best practices.

Suggested Activities:	
•	Code implementing sessions in NMAP, Metasploit, Burp Suite.
•	Mini projects

Course Outcomes:	
At the end of the course the student will be able to	
•	Tutorial problems.
•	Assignment problems.
•	Quizzes
•	Class presentation/Discussion

Text Book (s):	
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",2nd edition, John Wiley, 2011
3	J. Thomas," Mastering Ethical Hacking",1st Edition, TheHackStore, 2023

CO - PO – PSO matrices of course

PO/PSO CO	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 Courses)	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:	
At the end of the course the student will be able to	
•	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:	
•	Assignment problems, Quiz
•	Class presentation/Discussion

Text Book (s):	
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”, 1st Edition, Oxford, 2018
3	Rohit, Oleg, Mahalik, Satish, “Practical Mobile Forensics”, 4th Edition, Packt, 2020

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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 (Theory Courses)	Category	L	T	P	C
CR23A33	Cryptocurrency and Blockchain Technologies	PE	2	0	2	3

Objectives:	
•	To understand how blockchain operates and its potential applications beyond cryptocurrency
•	To understand various types of cryptocurrencies, mining processes, wallets, and their economic principles
•	To understand how smart contracts and decentralized applications transform the Ethereum
•	To understand common security challenges in cryptocurrencies and blockchain
•	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:	
At the end of the course the student will be able to	
•	Develop knowledge in the core concepts of blockchain technology, including distributed ledgers, hashing functions, and consensus mechanism
•	Focus on understanding history and evolution of cryptocurrencies, such as Bitcoin and Ethereum
•	Understand the concept of smart contracts and their functionalities on a blockchain platform
•	Understand the potential future applications of blockchain technology across various industries
•	Demonstrate practical skills through hands-on activities, such as setting up a cryptocurrency wallet or interacting with a blockchain platform

Suggested Activities:	
•	Problem solving sessions
•	Mini projects

Course Outcomes:	
At the end of the course the student 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
4	Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017
5	Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing, 2018

CO - PO – PSO matrices of course

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 Courses)	Category	L	T	P	C
CR23A34	Security and Privacy in Cloud	PE	2	0	2	3

Objectives:	
•	To learn the fundamentals of Cloud Computing.
•	To learn the infrastructure security in cloud environment.
•	To learn the cloud application.
•	To learn the data life cycle and privacy in cloud.
•	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.		
		Total 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 bigiamchallenges that consists of common misconfigurations in IAM.	
		Contact Hours : 30
		Total Contact Hours : 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Understand the cloud concepts and fundamentals.
•	Explain the infrastructure security in cloud
•	Define cloud application.
•	Understand various privacy in the cloud.
•	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 Books(s) / Web links:	
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.
6	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.
7	https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000160001PDFE.pdf
8	https://www.youtube.com/watch?v=dmEe6dHBKYc
9	https://www.youtube.com/watch?v=zd4LWt5Phac
10	https://www.youtube.com/watch?v=qTRmgP3oaqk

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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 Courses)	Category	L	T	P	C
CR23A35	Social Network Security	PE	2	0	2	3

Objectives:	
•	To understand and develop semantic web related applications
•	To understand privacy and security issues in Social Networking
•	To learn about the data extraction and mining of social networks
•	To discuss the prediction of human behaviour in social communities
•	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:	
At the end of the course the student 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

Text Book (s):	
1	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2	BorkoFurht, "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 matrices of course

PO/PSO CO	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 Courses)	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		
Total 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:	
At the end of the course the student will be able to	
•	Discuss the basics of information security and legal and ethical issues in Information Security.
•	Analyze the risk management and information security policy.
•	Implement intrusion detection and prevention techniques using different tools.
•	Perform auditing of logs.
•	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 Books(s) / Web links:	
1	Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, CRC Press; 6th Edition, 2007.
2	John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
3	MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3 rd Edition, Prentice Hall, 2013.

CO - PO – PSO matrices of course

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: “-”

VIRTUAL AND AUGMENTED REALITY

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23A37	AUGMENTED REALITY AND VIRTUAL REALITY	PE	2	0	2	3

Objectives:						
•	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).		
Total 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:	
At the end of the course the student will be able to	
•	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 Books(s) / Web links:	
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 matrices of course

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 (Lab Oriented Theory Course)	Category	L	T	P	C
CS23A39	GAME DEVELOPMENT	PE	2	0	2	3

Objectives:	
o	To understand the history and overview of game design
o	To develop the Game design document
o	To apply the concepts of game loop, collision detection and Cameras
o	To understand the concepts of graphics in game design
o	To be able to incorporate various Mechanics in Developing game

UNIT-I	Introduction to Game Development	6
Games Overview; History of Games.Lecture: History and Generations of Video Games-Overview of Game Platforms-the Elements of Gameplay-Maths behind Game Development-Generic Programming		
UNIT-II	Game Design Document	6
Platforms-Input Devices-Game Genres-Game Design-Characters-Storyline-Levels and Environments-Game Play-Graphic Style and Art-Sound and Music-Game Controls-Accessibility-Marketing.		
UNIT-III	Concepts of Game Design	6
Game Loop-Collision Detection and Reaction-Common Issues with Collision Detection-Cameras-Screen Space Vs Game Space-Hybrid Approaches-Game Design-Game Mechanics-Rewarding the Player-Tips and Tricks-Virtual Resolution-Layering the Graphics-Palette Swapping		
UNIT-IV	Graphic Design for Game Development	6
Sound and Music-Digital Sound Processing-Fonts-Shaders-Patterns, containers and Classes-Design Pattern-Resource Manager-Ai in Video Games-Useful Algorithms		
UNIT-V	Mechanics in Developing in Game Design	6
Game Mechanics-I Frames-2D mechanics-RPG Like Games-Rhythm Games-Matchx Games-Cut Scenes-Testing your Game-Balancing your Game-No BS Principle-Managing Hype-Digital Rights Management-Game Jams		
		Total Contact Hours : 30

List of Experiments		
1	Create a simple sprite animation using an open source tool.	
2	Narrate a simple game using scratch 2.0 (Character narration).	
3	Implement a scoring mechanism, such as collecting items or reaching certain milestones.	
4	Enhance the visual appeal of the game by adding animated sprites for player movement and other game elements.	
5	Implement basic AI behaviors, such as following the player when in range or patrolling between predefined points.	
6	Implement level transitions and progression.	
7	Incorporate sound effects for player movement, jumping, and interactions.	
8	Create menu screens for starting the game, pausing/resuming, and displaying game over information	
9	Optimize game performance, fix bugs, and polish game elements to improve the overall quality.	
		Contact Hours : 30
		Total Contact Hours : 60

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Understand the history and overview of game design
CO2	Understand and develop the game design document
CO3	Understand the collision mechanism, cameras and game loops
CO4	Analyse and apply graphic design approaches for designing an game
CO5	Choose efficient mechanic in developing and rolling out a game

Text Book (s):	
1	“2D Game Development: From Zero to Hero”, Daniele Penazzo, Python Edition, 2020
2	“Game Development Patterns and Best Practices”, John P. Doran, Matt Casanova, Packt Publishing, 2017.

Reference Books(s) / Web links:	
1	“Game Development with Unity”, Michelle Minard Course Technology, 2012.
2	Game Development using Python”, James R Parker, Mercury Learning and Information, 2021.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23A39.1	3	2	2	1	2	-	-	-	-	-	-	-	2	2	2
CS23A39.2	1	2	2	1	2	-	-	-	-	-	-	-	2	2	1
CS23A39.3	1	1	1	2	1	-	-	-	-	-	-	-	2	2	2
CS23A39.4	3	3	1	3	3	-	-	-	-	-	-	-	2	2	3
CS23A39.5	3	3	2	1	3	-	-	-	-	-	-	-	2	2	3
Average	2.2	2.2	1.6	1.6	2.2	-	-	-	-	-	-	-	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
CS23B31	Introduction to METAVERSE	PE	2	0	2	3

Objectives:	
•	To learn the basics of Metaverse characteristics, concepts and layers.
•	To understand and analyze Metaverse technologies, tools and platforms.
•	To discuss design theories and practices relevant to the Metaverse.
•	To explore cybersecurity and cybercrime in the Metaverse.
•	To explore metaverse applications and examine open challenges in the Metaverse.

UNIT-I	Metaverse fundamentals	6
Metaverse evolution-Metaverse importance and characteristics-The interdisciplinary nature of the Metaverse- Metaverse opportunities and risks- Computer-mediated communication -Avatar-mediated communication-layers of Metaverse: Experience-Discovery-Creator economy- Spatial computing- Decentralization - Human interface- Infrastructure		
UNIT-II	Metaverse technologies, tools and platforms	6
Metaverse Technologies: AR/VR/MR/XR - 3D reconstruction - Game engines - Smart glasses- wearables, haptic devices, headsets and headwear -Blockchain, smart contracts, tokens, NFTs - Cryptography - Artificial Intelligence (AI) - Internet of Things (IoT) - Edge computing and 5G, 6G Tools and technologies for Metaverse UX and UI: Tools and services for avatar systems - Spatial user interface design - Cross-platform user experience design - Multimodal user interface- Technologies and devices for human computer interaction in Metaverse Metaverse Platforms: Decentraland, SANDBOX - Roblox, Axie Infinity- uHive, Hyper Nation - Nakamoto (NAKA), Metahero (HERO), Star Atlas (ATLAS)- Bloktopia (BLOK), Stageverse - Spatial, PalkaCity, Viverse -Sorare, Illuvium, Upland - Second Life, Sansar, Sensorium Galaxy		
UNIT-III	Design theories and practices	6
Social presence and co-presence - Motion sickness and cybersickness- Uncanny valley - Sense of self-location, sense of agency and sense of body ownership-Universal simulation principle- Prototyping- Evaluation techniques		
UNIT-IV	Cybersecurity and Cybercrime in the Metaverse	6
Metaverse and cybersecurity: Cybersecurity concerns in Metaverse: social engineering attacks, Data theft, Decentralization vs vulnerabilities - Cybersecurity risks in Metaverse: process, people, technology - Best practices for preventing cyberattacks in Metaverse: Risk assessment and mitigation, Physical security, Data encryption, Controlled access, Protect outbound data - Implementing cybersecurity in the Metaverse: Platform owners, Property owners/renters, Consumers/users Metaverse and cybercrime: Scam and theft- Rug pull- Money manipulation and wash trading- Money laundering		
UNIT-V	Metaverse applications, challenges and open issues	6
Metaverse applications: Gaming and entertainment- Travel and tourism - Education and learning- Real estate -Banking and Finance- Healthcare- Social media- Fashion Metaverse challenges and open issues: Persistency - Interoperability and scalability- Maturity- Regulation- Usefulness and ease-of-use - Privacy and data security- Content creation- NFTs and creator economy - Social, legal and ethical issues in the Metaverse		
Total Contact Hours		: 30

List of Experiments			
1	Create and customize an avatar in a Metaverse platform (Decentraland, Second Life, or Roblox).		
2	Analyze different layers of the Metaverse (Experience, Discovery, Creator Economy, etc.).		
3	Build a simple AR application using WebAR or Unity.		
4	Create a simple NFT and understand its role in the Metaverse.		
5	Measure motion sickness symptoms when using VR applications.		
6	Design a simple 3D virtual space.		
7	Identify phishing and scam techniques used in the Metaverse.		
8	Create a virtual classroom using a Metaverse platform.		
	Tools: Mozilla Hubs, Spatial.io, Gather.town. Unity, Unreal Engine, culus Quest 2, VRChat, Unity VR.		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes:	
At the end of the course the student will be able to	
•	Understand the characteristics, and interdisciplinary nature of the Metaverse, the opportunities and risks it presents.
•	Analyze Metaverse layers, the technologies used in creating them, as well as design theories and practices for Metaverse.
•	Examine and discuss Metaverse platforms, applications and the latest technological developments in this area
•	Identify cybersecurity issues, understand cybercrime in the Metaverse
•	Discuss various applications and the open challenges in Metaverse

Text Book (s):	
1	Terry Winters ,”The Metaverse : Prepare Now For the Next Big Thing! ”, Independently published, 2021 (ISBN: 979-8450959283)

Reference Books(s) / Web links:	
1	Ball, M., 2022, “The Metaverse and How It Will Revolutionize Everything “, Liveright, ISBN: 978-1324092032
2	Christodoulou, K. Katelaris, L., Themistocleous, M, Christoudoulou P. and Iosif E, 2022, “NFTs and the Metaverse Revolution: Research Perspectives and Open Challenges”, Blockchains and the Token Economy: Theory and Practice, Eds: Lacity M., Treiblmaier H., (2022), Palgrave Macmillan, Cham, pp. 139-178
3	Damar, M. (2021). Metaverse shape of your life for future: A bibliometric snapshot. Journal of Metaverse, 1(1), 1–8.
4	Day, J. (2022) Metaverse will see cyberwarfare attacks unlike anything before: 'Massively elevated', February 28, https://www.express.co.uk/news/science/1570844/metaverse-news-cyberwarfare-attacks-virtual-worlds-russia-china-spt .
5	Davis, A., Khazanichi, D., Murphy, J., Zigurs Ilze, & Owens, D. (2009). Avatars, people, and virtual worlds: Foundations for research in metaverses. Journal of the Association for Information Systems, 10(2), 90–117. https://doi.org/10.17705/1jais.00183

Learning Activities and Teaching Methods:	
•	Faculty Lectures
•	Guest-Lectures Seminars
•	Directed and Background Reading
•	Case Study Analysis
•	Academic Paper Discussion
•	Simulations
•	Student-led Presentations
•	In-Class Exercises

Assessment Methods:	
•	Interactive Activities
•	Assignments / Project
•	Quiz
•	CAT & Final Exams

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23B31.1	3	2	2	2	3	3	2	3	-	2	-	3	3	2	3
CS23B31.2	3	3	3	3	3	2	2	2	-	2	-	3	3	3	3
CS23B31.3	3	3	3	3	3	2	2	2	-	2	-	3	3	3	3
CS23B31.4	3	3	3	3	3	3	2	3	-	3	-	3	3	3	3
CS23B31.5	3	3	3	3	3	2	2	2	3	3	2	3	3	3	3
Average	3	2.8	2.8	2.8	3	2.4	2	2.4	3	2.4	3	3	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 (Lab oriented Theory course)	Category	L	T	P	C
IT23E31	Graphics and Multimedia	PE	2	0	2	3

Objectives:	
•	To gain knowledge about graphics hardware devices and software used.
•	To understand the two-dimensional graphics and their transformations.
•	To understand the three-dimensional graphics and their transformations.
•	To appreciate illumination and color models
•	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

List of Experiments	
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.
Contact Hours : 30	

Course Outcomes:	
At the end of the course the student will be able to	
•	To gain knowledge about graphics hardware devices and software used.
•	To understand the two-dimensional graphics and their transformations.
•	To understand the three-dimensional graphics and their transformations.
•	To appreciate illumination and color models
•	To become familiar with multimedia and hypermedia

Suggested Activities (if any)	
•	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 (if any)	
•	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.
2	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.
3	Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, 4th Edition, CRC Press, December 2015

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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 (Laboratory Oriented Theory Courses)	Category	L	T	P	C
CS23A38	DIGITAL MARKETING	PE	2	0	2	3

Objectives:	
•	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 measure.

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 - OffPage 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	
CO1	To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
CO2	To focusses on how digital marketing can be utilised by organisations and how its effectiveness can measure.
CO3	To know the key elements of a digital marketing strategy
CO4	To study how the effectiveness of a digital marketing campaign can be measured.
CO5	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 Books(s) / Web links:	
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 matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 (Lab oriented Theory Courses)	Category	L	T	P	C
CD23731	Film Making and Radio podcasting	PE	2	0	2	3

Objectives:	
o	To understand the fundamentals of visual storytelling, including scriptwriting and storyboarding.
o	To learn the technical aspects of camera operations, lighting, and shot composition.
o	To learn technical aspects of audio recording, mixing, and editing.
o	To design and produce a variety of radio content such as interviews, advertisements, and podcasts.
o	To create complete radio programs incorporating jingles, sound effects, and music.

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		
		Total Contact Hours : 30
List of Experiments		
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.	
7	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.	
		Contact Hours : 30
		Total Contact Hours : 60

Course Outcomes: On completion of the course, the students will be able to	
CO1	Students understand the conceptual process of Radio Production.
CO2	Students evaluate the complexities of Radio Production as a means of mass communication.
CO3	Students create the Radio scripts and other practical implications of the radio production.
CO4	Students evaluate the complexities of the Radio Broadcasting in detail.
CO5	Students create Radio News Report and also the Radio feature reporting.

Text Book (s):	
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’s Handbook”, Oxford University Edition 2 2022
4	Andrew Thorn’s, “The Radio Producer’s Handbook” Sage Publication Edition 1 2023

Reference Books(s) / Web links:	
1	John O. M. McCarthy, “The Encyclopaedia of Film Making Techniques”, Focal Press, 1st 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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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: “-”

OPEN ELECTIVE COURSES OFFERED BY AIDS

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
AD23O11	Introduction to Data Science	OE	3	0	0	3
Objectives:						
•	To Understand the Fundamentals of Data Science					
•	To Perform Exploratory Data Analysis (EDA)					
•	To Develop Skills in Data Collection and Pre-Processing					
•	To Build Predictive Models					
•	To Evaluate Model Performance					

UNIT-I	INTRODUCTION	9
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.		
UNIT-II	DATA COLLECTION AND DATA PRE-PROCESSING	9
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.		
UNIT-III	EXPLORATORY DATA ANALYTICS	9
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots –Pivot Table – Heat Map – Correlation Statistics – ANOVA		
UNIT-IV	MODEL DEVELOPMENT	9
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.		
UNIT-V	MODEL EVALUATION	9
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting –Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.		
Contact Hours		: 45

Course Outcomes:	
•	Explain foundational concepts in data science, including the data science lifecycle, key roles, and application
•	Demonstrate proficiency in employing various data collection methods and effectively preprocessing data
•	Apply descriptive statistics and create visualizations (such as box plots and heat maps) to explore and summarize data, identifying patterns and trends.
•	Construct and evaluate regression models, utilizing appropriate techniques for model fitting
•	Analyze model performance through evaluation metrics, applying techniques such as cross-validation

Text Book (s):	
1	Kevin Clark, "Python For Data Science", Kevin Clark publisher, 2020
2	Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.

Reference Books(s) / Web links:	
1	David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
2	Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3	Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AD23O11.1	3	3	2	2	2	1	1	1	2	2	1	2	3	2	1
AD23O11.2	3	3	3	2	3	1	1	1	2	2	1	3	3	3	2
AD23O11.3	3	3	2	3	3	2	1	1	3	2	1	3	3	2	2
AD23O11.4	3	3	3	3	3	2	1	1	2	2	2	3	3	3	2
AD23O11.5	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
Average	3	3	2.6	2.6	2.8	1.8	1.2	1.2	2.2	2	1.6	2.8	3	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 (Lab oriented Theory course)	Category	L	T	P	C
AD23O31	Data Visualization using Power BI	OE	2	0	2	3
Objectives:						
•	To introduce Power BI and teach data import, transformation, and preparation techniques.					
•	To develop skills in building data models, creating relationships, and using DAX for calculated fields.					
•	To learn techniques for creating and customizing visualizations to represent different types of data effectively.					
•	To create, format, and publish interactive reports and dashboards for effective data storytelling.					
•	To explore advanced features like custom visuals, animations, and analytics for enhancing Power BI reports.					

UNIT-I	INTRODUCTION TO POWER BI	6
Introduction to PowerBI-Importing Data into PowerBI Desktop- Data Transformation strategies- The Power Query Editor-Transform Basics-Advanced data transformation options.		
UNIT-II	DATA MODELING AND DAX	6
Building the Data Model-Building Relationships-Working with complex relationships -Leveraging DAX-Building calculated columns-Calculated measures.		
UNIT-III	DATA VISUALIZATION WITH POWER BI	6
Data visualization basics-Visuals for filtering-Visualizing tabular data-Visualizing categorical data-Visualizing trend data-Visualizing KPI data-Visualizing geographical data-Leveraging Power BI custom visuals-Data visualization tips and tricks.		
UNIT-IV	POWER BI REPORTS AND DASHBOARDS	6
Creating Reports with Power BI Desktop- Publishing Reports and Creating Dashboards in the Power BI Portal-Visualization best practices- Choosing the visual-Visual interactions-Slicers-Visualization Formatting-Map visuals		
UNIT-V	CUSTOM VISUALS ANIMATION AND ANALYTICS	6
Drillthrough report pages-Bookmarks-ArcGIS Map visual for Power BI -Waterfall chart breakdown-Analytics pane-Quick Insights -Custom visuals-Animation and data storytelling		
		Contact Hours
		: 30

List of Experiments	
1	Import a CSV dataset into Power BI and perform basic data exploration. Dataset: "Sales_Data.csv" (containing columns like Date, Product, Region, Sales, and Quantity). Evaluation Parameters: Successful data import. Identification of basic dataset attributes (e.g., column types, null values).
2	Perform data cleaning (remove duplicates, handle missing values, and rename columns) and transformations (split and merge columns, filter rows). Dataset: "Customer_Data.csv" (containing inconsistent customer details). Evaluation Parameters: Application of data transformation techniques. Proper handling of missing or duplicate data.
3	Create a star schema by linking multiple datasets (Sales, Products, and Regions). Dataset: "Sales_Data.csv" "Products.csv" "Regions.csv" Evaluation Parameters: Correct creation of relationships between datasets. Proper configuration of primary and foreign keys.
4	Use DAX to create calculated columns (e.g., Profit = Sales - Cost) and measures (e.g., Total Sales, Average Sales). Dataset: "Retail Sales.csv" (containing columns: Sales, Cost, Region, Product).

	<p>Evaluation Parameters: Accuracy of DAX formulas. Proper usage of calculated columns and measures.</p>			
5	<p>Create visuals for sales trends (line chart), product performance (bar chart), and regional distribution (pie chart). Dataset: "Sales_Performance.csv" (containing columns like Product, Region, Sales, Quantity). Evaluation Parameters: Clarity and formatting of charts.</p>			
6	<p>Create a combination chart (e.g., line and clustered column chart) to display sales trends alongside profit margins for different products over time. Dataset: "Sales_Profit_Data.csv" (containing columns: Date, Product, Sales, Profit, Category). Evaluation Parameters: Proper selection and configuration of a combination chart. Clarity in displaying dual data series (e.g., Sales and Profit). Effective use of legends, labels, and axes formatting.</p>			
7	<p>Use a treemap to show sales distribution across product categories and subcategories. Create a funnel chart to display the sales process stages (e.g., leads, qualified leads, deals closed). Dataset: "Category_Sales_Data.csv" (columns: Category, Subcategory, Sales). "Sales_Stages.csv" (columns: Stage, Count). Evaluation Parameters: Correct use of treemaps for hierarchical data representation. Effective display of stages in the funnel chart. Proper formatting and labeling of visuals.</p>			
8	<p>Publish a Power BI report to the Power BI Service and create a dashboard by pinning visuals. Dataset: Any dataset used in earlier labs. Evaluation Parameters: Successful publication of the report. Correct creation and formatting of the dashboard.</p>			
9	<p>Visualize sales data on a map, showing sales by country or region using Power BI's map visuals. Dataset: "Global_Sales.csv" (containing columns: Country, Region, Sales, Quantity). Evaluation Parameters: Accurate use of location data for map visuals. Presentation quality of the geographical visualization.</p>			
10	<p>Install a custom visual (e.g., Word Cloud) from the Power BI marketplace and demonstrate its use. Add advanced interactions using bookmarks and drill through. Dataset: "Feedback_Data.csv" (text data for Word Cloud). Evaluation Parameters: Installation and correct use of custom visuals. Proper setup of bookmarks and drill through functionality.</p>			
		Contact Hours	:	60
		Total Contact Hours	:	60

Course Outcomes:	
•	Apply data import and transformation techniques to prepare data for analysis using Power BI.
•	Build effective data models and leverage DAX to create calculated fields and measures.
•	Design and customize visualizations to communicate insights from various types of data.
•	Develop interactive reports and dashboards using Power BI's reporting and visualization tools.
•	Utilize advanced Power BI features like custom visuals, animations, and analytics for enhanced storytelling and decision-making.

Text Book (s):	
1	Devin Knight , Erin Ostrowsky , Mitchell Pearson ,Microsoft Power BI Quick Start Guide - Third Edition: The ultimate beginner's guide to data modeling, visualization, digital storytelling, and more, packt publishing,2022.
2	Dan Clark, Beginning Microsoft Power BI-A Practical Guide to Self-Service Data Analytics, Apress Publishers,2020.

Reference Books(s) / Web links:	
1	Brian Larson, Data Analysis with Microsoft Power BI, McGraw Hill Professional, 2020
2	Greg Deckler, Learn Power BI-A Comprehensive, Step-by-step Guide for Beginners to Learn Real-world Business Intelligence, Packt Publishing 2022.
3	Brett Powell, Microsoft Power BI Cookbook-Creating Business Intelligence Solutions of Analytical Data Models, Reports, and Dashboards, Packt Publishing 2017.

Web links for virtual lab (if any)	
1	https://www.linkedin.com/learning/learning-power-bi-desktop/
2	https://www.linkedin.com/learning/complete-guide-to-power-bi-for-data-analysts-by-microsoft-press/

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AD23O31.4	3	3	3	3	3	2	2	2	3	2	2	3	3	3	3
AD23O31.5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
Average	3	3	2.8	2.8	3	2	1.4	1.4	2.8	2.2	1.8	2.8	3	2.8	2.4

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