RAJALAKSHMI ENGINEERING COLLEGE
CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

REGULATION 2023

Vision

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

Mission

- To produce globally competent cybersecurity experts, motivated to learn emerging technologies and innovate in solving real-world security challenges.
- To foster research activities among students and faculty that enhance societal security and resilience.
- To impart moral and ethical values in their profession, ensuring a strong commitment to cybersecurity ethics and responsible practices.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

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

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Computer Science and Engineering Program will demonstrate
PSO 1: Foundation Skills: Ability to understand, analyze, and develop computer programs in the areas related to algorithms, system software, web design, machine learning, data analytics, networking, and cybersecurity for efficient design of computer-based systems of varying complexity. Familiarity and practical competence with a broad range of programming languages, open-source platforms, and cybersecurity tools and practices.

PSO 2: Problem-Solving Skills: Ability to apply mathematical methodologies to solve computational tasks, model real-world problems using appropriate data structures and suitable algorithms, and address cybersecurity challenges. Understanding of standard practices and strategies in software project development, incorporating secure coding practices and using open-ended programming environments to deliver quality and secure products.

PSO 3: Successful Progression: Ability to apply knowledge in various domains to identify research gaps and provide solutions to new ideas, with a particular emphasis on cybersecurity challenges. Inculcating a passion for higher studies, creating innovative career paths to be an entrepreneur, and

evolving as an ethically and socially responsible computer science professional with strong cybersecurity expertise.

CURRICULUM

B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

Regulation 2023 | Total Credits: 160

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

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

SEMESTER III								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA23312	Fourier Series and Number Theory	BS	4	3	1	0	4
LAB ORIENTED THEORY COURSES								
2.	CS23332	Database Management Systems	PC	7	3	0	4	5
3.	CS23333	Object Oriented Programming Using Java	PC	7	1	0	6	4
4.	CS23532	Computer Networks	PC	7	3	0	4	5
5.	CR23331	Cryptography	PC	5	3	0	2	4
			TOTAL	**30**	**13**	**1**	**16**	**22**

SEMESTER IV								
SI. 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.	MA23435	Probability, Statistics and Simulation	BS	4	3	0	2	4
3.	CS23431	Operating Systems	PC	7	3	0	4	5
4.	CR23431	Network Security	PC	5	3	0	2	4
5.	CS23331	Design and Analysis of Algorithms	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
6.	GE23421	Soft Skills–I	EEC	2	0	0	2	1
7.	CS23421	Internship	EEC	0	0	0	2	1
			TOTAL	**26**	**15**	**0**	**12**	**22**

SEMESTER V								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective-I	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
2.	CS23531	Web Programming	PC	7	1	0	6	4
3.	CS23533	Foundations of Artificial Intelligence	PC	5	3	0	2	4
4.	CR23531	Ethical Hacking	PC	5	3	0	2	4
5.	CR23532	Cyber and Digital Forensics	PC	5	3	0	2	4
6.	CS23432	Software Construction	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE23521	Soft Skills-II	EEC	2	0	0	2	1
			TOTAL	**32**	**16**	**1**	**16**	**24**

SEMESTER VI								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	CR23611	Cyber Laws and Security Policies	PC	3	3	0	0	3
2.		Professional Elective-II	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	CR23631	Malware Analysis	PC	5	3	0	2	4
4.	CR23632	Blockchain Technologies	PC	5	3	0	2	4
5.	AI23331	Fundamentals of Machine Learning	PC	5	3	0	2	4
6.	GE23627	Design Thinking and Innovation	EEC	4	0	0	4	2
LABORATORY COURSES								
7.	CS23621	Mobile Application Development Laboratory	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	GE23621	Problem Solving Techniques	EEC	2	0	0	2	1
			TOTAL	**31**	**15**	**0**	**16**	**23**

SEMESTER VII								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective-III	PE	3	3	0	0	3
2.		Professional Elective-IV	PE	3	3	0	0	3
3.		Professional Elective-V	PE	3	3	0	0	3
4.		Open Elective – II	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
5.	CR23731	Blockchain Development in Hyperledger Fabric	PC	4	2	0	2	3
LABORATORY COURSES								
6.	CR23721	Project Phase I	EEC	6	0	0	6	3
			TOTAL	**22**	**14**	**0**	**8**	**18**

SEMESTER VIII								
SI. 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.	CR23821	Project Phase II	EEC	12	0	0	12	6
			TOTAL	**15**	**3**	**0**	**12**	**9**

TOTAL NO. OF CREDITS: 160

PROFESSIONAL ELECTIVES (PE)

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

Data Science								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AI23A31	Social Network Analysis	PE	4	2	0	2	3
2.	AD23A32	Explorative and Forecasting Analytics	PE	4	2	0	2	3
3.	AI23A35	Recommendation Systems	PE	4	2	0	2	3
4.	IT23D11	Deep Learning Concepts	PE	4	3	0	0	3
5.	AD23B33	Text and Speech Analysis	PE	4	2	0	2	3
6.	CS23A31	Business Analytics	PE	4	2	0	2	3
7.	AD23A37	Image and Video Analytics	PE	4	2	0	2	3
8.	AD23B31	Image Processing and Computer Vision	PE	4	2	0	2	3
9.	AI23A36	Big Data Analytics	PE	4	2	0	2	3
10.	AI23632	Natural Language Processing	PE	4	2	0	2	3

Virtual and Augmented Reality								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	CS23A37	Augmented Reality and Virtual Reality	PE	4	2	0	2	3
2.	CD23C22	Data Visualization	PE	6	0	0	6	3
3.	CS23A39	Game Development	PE	4	2	0	2	3
4.	CS23B31	Introduction to Metaverse	PE	4	2	0	2	3
5.	IT23E31	Graphics and Multimedia	PE	4	2	0	2	3
6.	CS23A38	Digital Marketing	PE	4	2	0	2	3
7.	CD23721	Visual Effects	PE	6	0	0	6	3
8.	CD23731	Film Making and Radio Podcasting	PE	4	2	0	2	3
9.	CS23A34	User Interface Design	PE	4	2	0	2	3

Emerging Technologies								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	CS23A31	Business Analytics	PE	4	2	0	2	3
2.	CS23A32	Robotic Process Automation	PE	5	1	0	4	3
3.	CS23A33	Cyber Security and Forensics	PE	4	2	0	2	3
4.	CS23A34	User Interface Design	PE	4	2	0	2	3
5.	CS23A35	Web Application Security	PE	4	2	0	2	3
6.	CS23A36	3D Printing and Design	PE	4	2	0	2	3
7.	CR23A33	Cryptocurrency and Blockchain Technologies	PE	4	2	0	2	3
8.	CB23G11	Quantum Computation and Quantum Information	PE	3	3	0	0	3
9.	IT23C31	Software Testing	PE	4	2	0	2	3
10.	IT23B33	DevOps	PE	4	2	0	2	3
11.	IT23B31	C# and .Net Programming	PE	4	2	0	2	3
12.	IT23A11	Internet of Things	PE	4	3	0	0	3
13.	CR23A37	Linux System Administration	PE	5	1	0	4	3

Credit Distribution

Category	R2023
Humanities and Social Sciences including Management courses HS	8
Basic Science courses BS	20
Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. ES	18
Professional core courses PC	72
Professional Elective courses PE	21
Open Electives from other technical and /or emerging Courses OE	6
Project work, seminar and internship in industry or elsewhere EEC	15
Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] MC	0
Total	160

SUMMARY OF ALL COURSES

B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)										
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		7	18	13	20	17	3		78
5	PE					3	3	9	3	18
6	OE				3			3		6
7	EEC				2	1	3	3	6	15
8	MC									
	Total	**20**	**22**	**22**	**22**	**24**	**23**	**18**	**9**	**160**

Semester - I

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS23111	Technical Communication I	HS	2	0	0	2
	Common to all branches of B.E/B. Tech programmes					

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

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

Course Outcomes:
On completion of the course students will be able to
• Apply their comprehension skills and interpret different contents effortlessly
• Read and comprehend various texts and audio visual contents
• Infer data from graphs and charts and communicate it efficiently in varied contexts
• Participate effectively in diverse speaking situations
• To present, discuss and coordinate with their peers in workplace using their language skills

SUGGESTED ACTIVITIES

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

SUGGESTED EVALUATION METHODS

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
HS23111. 1	-	-	-	1	-	-	-	-	-	3	-	-	-	2	-
HS23111. 2	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS23111. 3	-	1	-	1	-	-	-	-	-	3	-	-	2	-	-
HS23111. 4	-	-	-	2	-	-	-	-	1	3	-	-	3	-	1
HS23111. 5	-	-	-	1	-	-	-	-	1	3	-	-	1	-	-
Average	-	1.0	-	1.2	-	-	-	-	1	3	-	-	2.0	2	1.0

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

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA23111	Linear Algebra and Calculus	BS	3	1	0	4
Common to B.E. - CSE, CSE(CS), EEE, ECE, BME and B.Tech. IT.						

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

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

Course Outcomes: On completion of the course, students will be able to
● Demonstrate the matrix techniques in solving the related problems in engineering and technology.
● Apply the concepts of basis and dimension in vector spaces to the solution of related complex engineering problems.
● Construct orthonormal basis by the concepts of normalization in inner products and to analyse complex engineering problems.
● Interpret the problems in Engineering and Technology using the principles of mathematical calculus.
● Evaluate multiple integrals to conduct investigations of complex problems.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA23111.1	3	2	1	-	-	-	-	-	-	-	1	-	1	1	-
MA23111.2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
MA23111.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA23111.4	2	2	-	-	-	-	-	-	-	-	1	1	-	-	-
MA23111.5	2	2	-	-	-	-	-	-	-	-	-	1	1	-	-
Average	2.6	2.2	1	-	-	-	-	-	-	-	1	1	1	1	-

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

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

அலகு I	**மொழி மற்றும் இலக்கியம்:**	3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழிக் காப்பியங்கள், 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 ஓவியங்கள் வரை - சிற்பக் கலை:**	3
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.		
அலகு III	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:**	3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.		
அலகு IV	**தமிழர்களின் திணைக் கோட்பாடுகள்:**	3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.		
அலகு V	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**	3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
		Total Contact Hours: 15

Text Book(s):
1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu)(Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi – 'Sangam City 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 Course)	Category	L	T	P	C
GE23131	**Programming Using C**	ES	1	0	6	4

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

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

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

Course Outcomes: On completion of the course, the students will be able to	
●	Formulate simple algorithms for arithmetic and logical problems.
●	Implement conditional branching, iteration and recursion.
●	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
●	Use arrays, pointers and structures to formulate algorithms and programs.
●	Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE23131.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE23131.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE23131.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE23131.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE23131.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	2
Average	1.4	1.6	2.2	1.6	1.0	-	-	-	1.0	2.0	1.4	1.0	2.0	2.2	2.0

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
EE23133	Basic Electrical and Electronics Engineering	ES	3	0	2	4

Objectives:
● To provide knowledge on the analysis of DC circuits.
● To provide knowledge on the analysis of AC circuits
● To expose the principles of electrical machines and electronic devices.
● To teach the concepts of different types of electrical measuring instruments and transducers.
● To experimentally analyze the electrical circuits and machines, electronic devices and transducers.

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

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

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

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

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

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

Lab Equipment Required:

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EE23133.1	3	3	3	3	-	3	1	1	2	1	1	1	2	2	2
EE23133.2	3	3	3	3	-	3	1	1	2	1	1	1	1	-	1
EE23133.3	3	3	3	3	-	3	1	1	2	1	1	1	2	2	2
EE23133.4	3	3	3	3	-	3	1	1	2	1	1	1	2	1	2
EE23133.5	3	3	3	3	-	3	1	1	2	1	1	1	2	3	2
Average	3	3	3	3	-	3	1	1	2	1	1	1	1.8	2.0	1.8

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
PH23132	**Physics for Information Science** Common to -B.E.-CSE, CSD, Cyber Security & B. Tech.- IT, AIML, AI&DS.	BS	3	0	2	4

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

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

List of Experiments		
1	Determine the wavelength of the laser using grating and size of the particle using diode laser.	
2	Determine the numerical aperture and acceptance angle of optical fiber.	
3	Study the permeability of the free space using Helmoltz coil.	
4	Determine the hysteresis loss in the transformer core using B-H curve unit.	
5	Determine the band gap of given semiconductor.	
6	Determine the Hall coefficient of semiconducting material.	
7	Determine specific resistance of the material of given wires using metre bridge.	
8	Study the resonance frequency in series connected LCR circuits.	
9	Determine the V-I characteristics of the solar cell.	
10	Determine the thickness of the given specimen by using air wedge method.	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

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

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

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

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
PH23132.1	3	3	2	2	2	1	-	-	-	-	-	2	1	1	1
PH23132.2	3	3	2	2	3	1	1	-	-	-	-	2	1	1	1
PH23132.3	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
PH23132.4	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
PH23132.5	3	3	2	2	3	1	1	-	-	-	-	2	2	1	1
Average	3	3	2	2	2.80	1	1	0	0	0	0	2	1.80	1	1

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

Subject Code	Subject Name (Laboratory course)	Category	L	T	P	C
GE23121	Engineering Practices – Civil and Mechanical	ES	0	0	2	1

Objectives:

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE23121.1	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.2	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.3	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.4	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.5	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
Average	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1

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

Subject Code	Subject Name (Non-credit course)	Category	L	T	P	C
MC23111	Indian Constitution and Freedom Movement	MC	3	0	0	0
	Common to all branches of B.E/B. Tech Programme					

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

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

Course Outcomes: Upon completion of the course, students will be able to:
● Appreciate the sacrifices made by freedom fighters during freedom movement.
● Be responsible citizens and abide by the rules of the Indian constitution.
● Be aware of the functions of the Indian government.
● Be knowledgeable about the functions of the state Government and the Local bodies.
● Apply the knowledge on constitutional functions and role of constitutional bodies and non-constitutional bodies.

SUGGESTED ACTIVITIES

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

SUGGESTED EVALUATION METHODS

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

Text Book(s):

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

Reference Books(s):

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC23111.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.2	-	-	-	-	-	-	-	-		-	-	-	-	-	-
MC23111.3	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
MC23111.4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
MC23111.5	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-

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

Semester - II

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA23213	Discrete Mathematical Structures	BS	3	1	0	4
Common to B.E. - CSE and B. Tech. IT						

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

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

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

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

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA23213.1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23213.2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23213.3	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-
MA23213.4	3	2	3	-	-	-	-	-	-	-	-	-	-	1	-
MA23213.5	3	2	3	-	-	-	-	-	-	-	-	1	1	-	-
Average	3	2.2	2.2	1	-	-	-	-	-	-	-	1	1	1	-

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

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE23217	**தமிழரும் தொழில்நுட்பமும்**	**HS**	**1**	**0**	**0**	**1**
	Common to all branches of B.E/B. Tech programmes					

அலகு I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்:**	3
சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.		
அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:**	3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.		
அலகு III	**உற்பத்தித் தொழில் நுட்பம்:**	3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:**	3
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கல்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.		
அலகு V	**அறிவியல் தமிழ் மற்றும் கணித்தமிழ் :**	3
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.		
		Total Contact Hours: 15

Text Book(s):
1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu)(Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi – 'Sangam City 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 course)	Category	L	T	P	C
EC23232	Digital Logic and Microprocessor	ES	3	0	4	5

Objectives:
● To learn basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions.
● To illustrate the formal procedures for the analysis and design of Combinational and Sequential circuits.
● To understand the basic functionalities of 8085 and programming logic.
● To understand the concepts and basic functionalities of 8051 architecture and its functionalities.
● To peruse the knowledge of programming, peripherals and interface various devices.

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

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

Course Outcomes: On completion of the course students will be able to:
● Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization
● Apply the procedure to design and implement combinational and sequential circuits.
● Interpret the concepts of 8085 and develop programs using 8085.
● Analyze the concepts of 8051 and to infer the basic functionalities.
● Explore the knowledge of interfacing and use it for different applications.

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

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

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

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

Text Book(s):

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

Reference Books(s) / Web links:

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

Lab equipment required:

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC23232.1	3	3	3	3	3	2	2	2	3	2	3	3	3	3	2
EC23232.2	3	3	3	3	3	2	1	1	3	2	2	3	3	3	2
EC23232.3	3	3	2	3	3	2	2	2	2	1	2	2	3	3	1
EC23232.4	3	3	3	3	3	2	1	1	3	2	3	3	3	3	1
EC23232.5	3	3	3	3	3	2	2	1	3	2	3	3	3	3	1
Average	3.0	3.0	2.8	3.0	3.0	2.0	1.6	1.4	2.8	1.8	2.6	2.8	3.0	3.0	1.4

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

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	**PROJECTION OF LINES AND PLANE SURFACES**	**6+12**
Projection of straight lines (First angle projection) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		
UNIT-III	**PROJECTION OF SOLIDS AND PROJECTION OF SECTIONED SOLIDS**	**12**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method. Sectioning of solids in simple vertical position when the cutting plane is inclined to HP and perpendicular to VP – obtaining true shape of the section. Practicing three-dimensional modeling of simple objects by CAD software (Not for examination)		
UNIT-IV	**DEVELOPMENT OF SURFACE AND ISOMETRIC PROJECTIONS**	**12**
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones Model making of isometric projection of combination of solids as assignment (Not for End semester)		
UNIT-V	**FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS**	**12**
Free Hand sketching: Freehand sketching of multiple views from pictorial views of objects - Freehand sketching of pictorial views of object from multiple views Perspective projection of simple solids-Prisms, pyramids, cylinder and cone by visual ray method.		
Total Contact Hours: (L=30; P=60) 90 Periods		

Course Outcomes: After learning the course, the students should be able
● To construct different plane curves and to comprehend the theory of projection
● To draw the basic views related to projection of lines and planes
● To draw the projection of simple solids and to draw the projection of development of surfaces of Sectioned solids in simple vertical position
● To draw the orthographic projection from pictorial objects and Isometric projections of simple solids
● To visualize Perspective view of simple solids

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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
CS23231	Data Structures	PC	3	0	4	5

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

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

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

SUGGESTED ACTIVITIES

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

SUGGESTED EVALUATION METHODS

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

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

Reference Books(s) :	
1	"Data Structures Using C and C++", Langsam, Augenstein and Tanenbaum, 2nd Edition, Pearson Education, 2015.
2	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.

List of Experiments		
1	Implementation of Single Linked List (Insertion, Deletion and Display).	
2	Implementation of Doubly Linked List (Insertion, Deletion and Display).	
3	Implementation of Stack using Array and Linked List implementation.	
4	Implementation of Queue using Array and Linked List implementation.	
5	Implementation of Binary Search Tree and perform Tree Traversal Techniques.	
6	Program to perform Quick Sort	
7	Program to perform Merge Sort	
8	Program to perform Linear Probing.	
9	Program to perform Rehashing.	
10	Mini Project: ● Contact book application using Linked List. ● Dictionary using Binary search trees. ● Snake Game. ● Chess Game. ● Travel Planner (Shortest Path Algorithm). ● Tic-Tac-Toe Game. ● Library Management System. ● Project Management System. ● other projects .	
	Contact Hours :	**60**
	Total Contact Hours :	**105**
Platform Needed: GCC Compiler for Windows/Linux		

Course Outcomes: On completion of the course, the students will be able to	
●	Analyze the various data structure concepts.
●	Implement Stacks and Queue concepts for solving real-world problems.
●	Analyze and structure the linear data structure using tree concepts.
●	Critically Analyse various non-linear data structures algorithms.
●	Apply different Sorting, Searching and Hashing algorithms.
Web links for Theory & Lab(if any)	
1	Data Structures - GeeksforGeeks
2	Data Structures | DS Tutorial - javatpoint
3	Data Structure and Types (programiz.com)

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23231.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS23231.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS23231.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

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

Subject Code	Subject Name (Laboratory course)	Category	L	T	P	C
HS23222	**Technical Communication II**	HS	0	0	2	1
	Common to all branches of B.E/B. Tech programme					

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

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

Course Outcomes:
On completion of the course students will be able to
● Communicate effectively using appropriate vocabulary
● Use the acquired language skills to comprehend various types of language contents
● Evaluate different texts and write effective technical content
● Use appropriate sentence structures to convey their thoughts in varied contexts
● Present their concepts and ideas in an effective manner

SUGGESTED ACTIVITIES

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

SUGGESTED EVALUATION METHODS

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

Text Book(s):

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

Reference 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
HS23221. 1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
HS23221. 2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221. 3	-	2	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221. 4	-	-	-	1	-	-	-	-	2	3	-	-	-	-	-
HS23221. 5	-	-	-	1	-	-	-	-	2	2	-	-	-	-	-
Average	-	2	-	1	0	0	0	0	2	2.6	-	-	-	-	-

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

Course Code	Subject Name (Theory course)	Category	L	T	P	C
HS23223	**English for Professional Competence**	HS	0	0	2	1
	Common to all branches of B.E/B. Tech programme					

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 – Courseive 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:

On completion of the course students 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
- Case study

SUGGESTED EVALUATION METHODS

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
HS23222. 1	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 2	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222. 4	-	-	-	-	-	-	2	2	-	3	-	-	-	-	-
HS23222. 5	-	-	1	-	-	-	2	-	-	3	-	-	-	-	-
Average	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 (Laboratory course)	Category	L	T	P	C
GE23122	Engineering Practices – Electrical and Electronics	ES	0	0	2	1

Objectives:

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

List of Experiments

A. ELECTRICAL ENGINEERING PRACTICE

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

B. ELECTRONICS ENGINEERING PRACTICE

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

Total Contact Hours	**:**	**30**

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

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

Reference Books(s) / Web links:

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

Lab Equipment Required:

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE23122.1	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.2	3	3	2	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.3	3	3	3	2	-	-	2	-	3	2	-	3	-	-	-
GE23122.4	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
GE23122.5	3	3	3	2	-	-	-	-	3	2	-	3	-	-	-
Average	3	3	2.67	2	-	-	2	-	3	2	-	3	-	-	-

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

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

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

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

Web links for virtual lab (if any)
• https://www.python.org/shell/
• https://python-iitk.vlabs.ac.in/
• https://www.hackerrank.com/domains/python

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23221.1	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.2	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.3	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.4	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
CS23221.5	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-
Average	3	2	2	1	-	1	-	2	2	2	-	2	-	-	-

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

Subject Code	Subject Name (Non-credit course)	Category	L	T	P	C
MC23112	**Environmental Science and Engineering**	**MC**	**3**	**0**	**0**	**0**

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

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

UNIT-V	ENVIRONMENTAL MANAGEMENT AND LEGISLATION		9
Environmental Management systems - ISO 14000 series- Environmental audit-Environmental Impact Assessment- life cycle assessment- human health risk assessment - Environmental Laws and Policy- Objectives - Polluter pays principle, Precautionary principle - The Environment (Protection) Act 1986 - Role of Information technology in environment and human health.			
	Total Contact Hours	**:**	**45**

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

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

Text Book(s):

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

Reference Books(s) :

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

Web links for virtual lab (if any)

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC23112. 1	-	-	-	1	-	-	-	-	-	3	-	-	-	2	-
MC23112. 2	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 3	-	1	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 4	-	-	-	2	-	-	-	-	1	3	-	-	3	-	1
MC23112. 5	-	-	-	1	-	-	-	-	1	3	-	-	1	-	-
Average	-	1.0	-	1.2	-	-	-	-	1	3	-	-	2.0	2	1.0

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

Semester III

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA23312	Fourier Series and Number Theory	BS	3	1	0	4
Common to III Sem. B.E. – EEE, ECE, Bio Medical, CSE, CSE(CS), AIML, CSD and B.Tech. IT						

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

UNIT-I	**FOURIER SERIES**	12
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic analysis.		
UNIT-II	**FOURIER TRANSFORMS**	12
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application to boundary value problems.		
UNIT-III	**NUMERICAL SOLUTIONS OF BOUNDARY VALUE PROBLEMS**	12
Finite difference method for solving second order differential equations - Finite difference techniques for the solution of two-dimensional Laplace and Poisson equations on rectangular domain – One dimensional heat flow equation by implicit and explicit methods – One Dimensional Wave Equation by Explicit method		
UNIT-IV	**CONGRUENCES**	12
Finite Fields -Linear Diophantine equations – Congruence's – Linear Congruence's – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.		
UNIT-V	**CLASSICAL THEOREMS IN NUMBER THEORY**	12
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions.		
Total Contact Hours:60		

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

SUGGESTED ACTIVITIES

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

SUGGESTED EVALUATION METHODS

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
MC23112. 1	-	-	-	1	-	-	-	-	-	3	-	-	-	2	-
MC23112. 2	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 3	-	1	-	1	-	-	-	-	-	3	-	-	2	-	-
MC23112. 4	-	-	-	2	-	-	-	-	1	3	-	-	3	-	1
MC23112. 5	-	-	-	1	-	-	-	-	1	3	-	-	1	-	-
Average	-	1.0	-	1.2	-	-	-	-	1	3	-	-	2.0	2	1.0

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23332	**Database Management Systems** Common to III Sem. B.E. CSE, CSE(CS), AIML, CSD and B.Tech IT	PC	3	0	4	7

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

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

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

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CS23332.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS23332.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS23332.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS23332.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS23332.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	1.3	1.4	1.8	1.7

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23333	**Object Oriented Programming Using Java** Common to III Sem. B.E. CSE, CSE(CS), AIML, CSD and B.Tech. IT	PC	1	0	6	4

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

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

List of Experiments	
1	Programs using control structures.
2	Programs using arrays.
3	Programs using strings and string buffer.
4	Programs using classes and objects.
5	Programs using inheritance.
6	Programs using default & static methods in interfaces.
7	Programs using functional interface.
8	Programs to create user defined exceptions.
9	Programs to implement Object Serialization.
10	Programs using collections-LIST.
11	Programs using collections-SET.
12	Programs using collections-MAP.
13	Programs using STREAMS.
14	Programs using LAMBDA.
15	Simple applications using JDBC.
Contact Hours :	60
Total Contact Hours :	75

Course Outcomes:	
On completion of the course, the students will be able to	
●	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).**

Textbooks:	
●	Herbert Schildt, "Java The Complete Reference", 9th Edition, McGraw Hill Education, 2014
●	Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

Reference Books (s)/Web links:	
1.	Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2.	Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3.	Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
4.	SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

5.	https://www.javatpoint.com/java-tutorial
6.	https://java-iitd.vlabs.ac.in/
7.	https://www.hackerrank.com/domains/java

CO - PO – PSO matrices of course

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

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
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:	
On completion of course you will be able to	
•	Choose the required functionality at each layer for given application
•	Trace the flow of information from one node to another node in the network
•	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
•	Monitor the traffic within the network and analyze the transfer of packets.
•	Develop real time applications of networks using different tools

Suggested Activities:	
•	Assignment problems based on GATE, Quiz
•	Class presentation/Discussion

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

Reference Books (s)/Web links:	
1.	William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson 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

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO3
CS23532.1	3	2	1	-	3	1	1	1	1	-	1	1	2	1	1
CS23532.2	2	2	1	-	2	1	1	-	-	-	2	2	1	1	1
CS23532.3	3	3	1	-	3	-	1	-	-	-	2	1	2	3	2
CS23532.4	2	3	-	-	3	1	1	1	-	-	2	2	1	2	3
CS23532.5	3	2	2	2	3	-	1	1	-	-	3	3	3	3	3
Average	2.6	2.4	1.3	2.0	2.8	0.6	1	0.6	0.2	0	2	1.8	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
CR23331	**Cryptography**	**PC**	**3**	**0**	**2**	**4**

Objectives:	
•	To become proficient in the classical ciphers and number theory.
•	To learn the principles and practices of symmetric and asymmetric ciphers.
•	To gain understanding of hash functions and message authentication
•	To acquire knowledge about key establishment and user authentication
•	To acquire knowledge of advanced cryptographic concepts

UNIT I	**CLASSICAL CIPHERS AND NUMBER THEORY**	**9**
Introduction to Classical Ciphers – Substitution Techniques-Transposition Techniques–Steganography–Number Theory-Prime Numbers-Euclidean Algorithm- Fermat's and Euler's Theorem-Testing for Primality-The Chinese Remainder Theorem.		
UNIT II	**SYMMETRIC CIPHERS AND ASYMMETRIC CIPHERS**	**9**
Block Cipher principles – Feistel Cipher Structure – DES- AES-Multiple Encryption-Triple DES-Asymmetric Ciphers- RSA-Elliptic Curve Arithmetic-Elliptic Curve Cryptography–Side Channel Attacks		
UNIT-III	**HASH FUNCTIONS AND MESSAGE AUTHENTICATION**	**9**
Applications of Cryptographic Hash Functions – Requirements and Security-Birthday Paradox – MD5 – Secure Hash Algorithm (SHA512) – Message Authentication Requirements-Message Authentication Function-Message Authentication Code–Security of MACs – HMAC – Digital Signature Standards-DSA – Case Study: SHA-3 (Keccak), ECDSA		
UNIT IV	**KEY ESTABLISHMENT AND USER AUTHENTICATION**	**9**
Key Establishment Introduction-Key Freshness and Key Derivations- The n^2 Key Distribution Problem–Key Establishment using Symmetric key Techniques - KDC–Key Establishment using Asymmetric key techniques-Remote User Authentication Principles-Federated Authentication-Protocols-SAML-OAuth-OpenID		
UNIT-V	**ADVANCED CRYPTOGRAPHIC CONCEPTS**	**9**
Introduction to Quantum Cryptography - QKD-Quantum resistant algorithms–Post-Quantum Cryptography Algorithms-Fully Homomorphic Encryption (FHE) – Privacy-preserving Computing - Technologies-Computing Platforms and Cases-Challenges and Opportunities		
	Total Contact Hours :	**45**

List of Experiments	
1	Capture all flags in Encryption Crypto 101 in TryHackMe Platform
2	Cracking the hashes using John-the-Ripper tool
3	Passive and Active Reconnaissance in TryHackMe Platform
4	Perform SQL Injection Lab in TryHackMe Platform
5	Perform Linux Code injection on a live process with ptrace.
6	Perform wireless audit on an access point or a router and decrypt WPA keys (aircrack-ng)
7	Demonstrate Intrusion Detection System using any tool (snort or any other equivalent s/w)
8	Demonstrate various exploits of Windows OS using Metasploit framework.
9	Install and Configure Firewalls for a variety of options using iptables
10	Demonstrate a simple MITM attack (ettercap)
Contact Hours :	**30**
Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Apply knowledge of number theory in cryptographic algorithms
•	Understand thoroughly symmetric and asymmetric ciphers to apply in real world scenarios
•	Analyze different cryptographic hash functions and message authentication codes
•	Understand the concepts of key establishment and user authentication
•	Understand thoroughly the modern cryptographic concepts to apply in real world scenarios

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

Text Books:	
1.	William Stallings, "Cryptography and Network Security Principles and Practice", 8th Edition Pearson, 2023.
2.	Christof Paar and Jan Pelzi, "Understanding Cryptography: A Textbook for Students and Practitioners", Springer 2014

Reference Books (s)/Web links:	
1.	Douglas R. Stinson, "Cryptography: Theory and Practice", Third Edition, CRC Press, 2006
2.	Gilles van Assche, "Quantum Cryptography and Secret-Key Distillation", Cambridge University Press, First Edition, 2012
3.	Ayantika Chatterjee and Khin Mi Mi Aung,"Fully Homomorphic Encryption in Real World Applications (Computer Architecture and Design Methodologies)", Springer 2020
4.	Kai Chen and Qiang Yang, "Privacy-preserving Computing", Cambridge University Press, 2023
5.	https://www.cdot.in/cdotweb/assets/docs/products/optical/qkd.pdf
6.	https://www.cisa.gov/quantum

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23331. 1	3	3	-	-	2	-	-	-	-	-	-	3	3	2	-
CR23331. 2	3	2	-	-	2	-	-	-	-	-	2	-	2	-	2
CR23331. 3	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CR23331. 4	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CR23331. 5	3	3	-	2	-	-	-	-	-	2	2	3	2	2	2
Average	3	2	-	2	2	-	-	-	-	2	2	3	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 IV

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
MA23435	Probability, Statistics and Simulation	BS	3	0	2	4
Common to IV Sem. B.E. – CSE, CSE(CS) and B.Tech IT						

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

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

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

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

SUGGESTED ACTIVITIES
● Problem solving sessions ● Smart Class room sessions

SUGGESTED EVALUATION METHODS
● Assignment problems ● Quizzes ● Class Presentation ● Discussion

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

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

CO - PO – PSO matrices of course

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO3
MA23435.1	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA23435.2	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA23435.3	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
MA23435.4	3	3	3	3	3	-	-	-	-	-	1	2	3	1	2
MA23435.5	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
Average	3.0	3.0	2.6	2.6	1.8	-	-	-	-	-	1.7	2.0	2.6	1.0	2.0

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23431	**Operating Systems** Common to III Sem. B.E. CSE, CSE(CS), AIML, CSD and B.Tech IT	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**	**9**
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		
	Contact Hours :	**45**

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

Course Outcomes: On completion of the course, the students will be able to	
●	Interpret the evaluation OS functionality, structure and layers.
●	Analyze the various Scheduling algorithms and design a model scheduling algorithm.
●	Apply and analyze Intercrosses communications, synchronization and Deadlock
●	Compare and contrast various memory management schemes.
●	Mount file systems and evaluate various disk scheduling techniques.

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

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

Web links:	
1	https://www.octawian.ro/fisiere/cursuri/asor/build/html/_downloads/Russinovich_M_WinInternals_part1_7th_ed. pdf
2	https://swayam.gov.in/
3	https://www.youtube.com/watch?time_continue=98&v=xwxgpCKo7c4
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Linux&search_language=English
5	https://www.redhat.com/sysadmin/create-rpm-package

CO - PO – PSO matrices of course

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

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23431	Network Security	PC	3	0	2	4

Objectives:	
•	To understand the basic concepts of security and zero trust architecture.
•	To understand the concept of authentication protocols and digital signatures.
•	To understand various security applications.
•	To learn Transport, Email and IP security
•	To understand the Malicious software, Intruders and Firewalls.

UNIT I	INTRODUCTION	9
Basics Concepts of Computer Security – OSI Security Architecture - Security Services - Security Mechanisms - Security Attacks – Model of Network Security – Standards – Fundamental Security Design Principles – Attack Surfaces–Attack Trees–Zero Trust Architecture–Case Study: SolarWinds Attack		
UNIT II	**FOUNDATIONS OF CRYPTOGRAPHY**	**9**
Symmetric and Asymmetric– Principles- Algorithms– Random and Pseudorandom Numbers – Stream Ciphers- RC5-ChaCha20– Authenticated Encryption with Associated Data– CMAC– Digital Signatures- ElGamal-Schnorr-Case Study: Lightweight Cryptography for IoT		
UNIT-III	**NETWORK SECURITY APPLICATIONS**	**9**
Key Distribution–Remote User Authentication Principles- Kerberos- X.509 Certificates– Federated Identity Management– Cloud Security- Cloud Computing- Risks and Countermeasures- Data Protection- SaaS		
UNIT IV	**SECURITY: TRANSPORT, EMAIL AND IP**	**9**
Transport– Transport Layer Security- HTTPS- Secure Shell (SSH) –E-mail- Formats- Threats- S/MIME – Pretty Good Privacy –IP- Encapsulating Security Payload- Internet Key Exchange		
UNIT-V	**SYSTEM SECURITY**	**9**
Malicious Software– Types- Infected Content- Attack Agent- Distributed Denial of Service–Intruders- Intrusion Detection–Password Management– Firewalls- Need- Types- Basing- Location and Configurations		
	Total Contact Hours :	**45**

List of Experiments		
1	Analyze malicious network traffic using wireshark in TryHackMe platform	
2	Perform Stack-based buffer overflow attacks in TryHackMe platform	
3	Demonstrate Linux privilege escalation in TryHackMe platform	
4	Rootkit detection and removal using rkhunter in TryHackMe platform	
5	Demonstrate cyber evasion techniques in TryHackMe platform	
6	Secure Network Architecture implementation in TryHackMe platform	
7	Perform log analysis for detection and response in TryHackMe platform	
8	Deployment of Honeypots and analysis of botnet activities in TryHackMe platform	
9	Explore Tor network for anonymous communication in TryHackMe platform	
10	Detection of real-time threats, analyze recorded traffic files and identify anomalies using snort	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Describe computer and network security fundamental concepts and principles
•	Acquire the knowledge of various symmetric keys, authentication protocols and digital signature.
•	To get a better knowledge of key distribution and cloud security.
•	To get a knowledge of security transport, Email, IP.
•	Identify and assess different types of threats and attacks such as social engineering, rootkit, firewalls.

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

Textbooks:	
1.	William Stallings, “Network Security Essentials”, Sixth Edition, Pearson Education, 2018
2.	Charlie Kaufman, Radia Perlman, Mike Speciner and Ray Perlner, "Network Security: Private Communications in a Public World", Third Edition, Pearson, 2024

Reference Books (s)/Web links:	
1.	Behrouz A. Forouzan and Debdeep Mukhopadhyay, “Cryptography and Network Security”, Third Edition, McGraw Hill Education, 2015
2.	Chris Sanders and Jason Smith, "Applied Network Security Monitoring: Collection, Detection, and Analysis", Syngress, 2014
3.	Christof Paar and Jan Pelzi, "Understanding Cryptography: A Textbook for Students and Practitioners", Springer 2014

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23431.1	3	3	2	3	3	-	-	2	2	1	-	2	3	3	2
CR23431.2	3	3	-	3	2	-	-	2	-	1	-	1	3	3	2
CR23431.3	3	2	3	3	3	2	1	2	-	1	-	1	3	3	2
CR23431.4	3	3	-	3	2	-	-	2	-	-	-	2	3	3	3
CR23431.5	3	3	2	3	3	1	-	2	-	-	-	2	3	3	3
Average	3	2.8	2.3	3	2.6	1.5	1	2	-	1	-	1.6	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 (Theory course)	Category	L	T	P	C
CS23331	**Design and Analysis of Algorithms** Common to III Sem. B.E CSE, CSE(CS), AIML, CSD and B.Tech. – Information Technology	**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		

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

SUGGESTED ACTIVITIES

- Complexity Analysis Exercises: Assign exercises where students practice calculating the space and time complexity of given algorithms using the counter method and mathematical analysis.
- Asymptotic Notations Quiz: Organize quizzes focusing on understanding and applying asymptotic notations to compare algorithm efficiency.
- Greedy technique and Divide and Conquer Technique-Problem-Solving Contests-Host contests where students solve problems like the activity selection problem using greedy techniques, encouraging competitive learning.

- Dynamic Programming-Case Studies on Optimization Problems-Discuss in-depth various optimization problems solved using dynamic programming, highlighting the strategy and solution steps.
- Approximation Algorithm Projects: Assign projects where students explore and implement approximation algorithms for problems

SUGGESTED EVALUATION METHODS

- Practical Programming Assignments
- Case Study Analysis
- Quizzes on Specific Topics
- Theoretical Examinations
- Project Work

	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

Description of the Experiments	**Total Contact Hours: 30**
1. Finding Time Complexity of algorithms	
2. Design and implement algorithms using Divide and Conquer Technique	
3. Design and implement algorithms using **G**reedy Technique	
4. Design and implement algorithms using Dynamic Programming	
5. Competitive Programming-Certain Techniques	

Web links for Theory & Lab	
1	https://www.geeksforgeeks.org/fundamentals-of-algorithms/
2	https://www.hackerrank.com/domains/algorithms

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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

Course Code	:	GE23421
Course Title	:	Soft Skills-I
Teaching Period	:	4th 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	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	The aim of this activity is to

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

Course Learning Outcome:

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

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

Semester V

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23531	**Web Programming** Common to III B.E. CSE, CSE(CS), AIML, CSD and IT	PC	1	0	6	4

Objectives:
• To convey the Internet and Its Application in Real world.
• To introduce the fundamentals of web programming through HTML and CSS.
• To establish the application of Javascript in designing interactive web pages.
• To investigate various elements of ReactJS.
• To design user interfaces to deploy in the real time

UNIT-I	**WEB BASICS, HTML AND CSS**	4
Introduction - World wide web and its evolution - E-mail, Telnet, FTP, E–commerce, Cloud Computing, Video conferencing - Internet service providers, IP Address, URL, Domain Name Servers - Web Browsers, Search Engine -Web Server vs Application Server, HTML Tags, Structure - Block Elements, Text Elements- Lists, Images, section, article, and aside Elements CSS Overview - CSS Rules, CSS Syntax and Style - Class Selectors, ID Selectors, span and div Elements - Cascading, style Attribute, style Container, External CSS Files - CSS Properties: Color Properties, Font Properties, line-height Property, Text Properties, Border Properties. Element Box, padding Property, margin Property - Hosting a Website and GIT		
UNIT-II	**Client Side Programming - Java Script**	2
Hello World Web Page - Buttons, Functions, Variables, Identifiers - Assignment Statements and Objects - Document Object Model, Forms: form Element, Controls, Text Control Accessing a Form's Control Values, reset and focus Methods – Event Handler Attributes: onchange, onmouseover, onmouseout. While Loop, External JavaScript Files, do Loop, Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements-Manipulating CSS with JavaScript- Using z-index to Stack Elements-Textarea Controls - Pull-Down Menus-List Boxes- Canvas and Drawing - Event Handler and Listener.		
UNIT-III	**Server Side Programming - PHP**	5
Introduction- Working principle of PHP -Variables - Constants - Operators - Flow Control and Looping - Arrays - Strings - Functions - File Handling -PHP and HTML - Simple PHP scripts - Databases with PHP. Bootstrap Background and Features - Getting Started with Bootstrap - Grids - Components - Menus and Navigations - Plugins - Flexbox& Layouts.		
UNIT-IV	**REACTJS**	2
React Environment Setup - ReactJS Basics - React JSX - React Components: React Component API - React Component Life Cycle - React Constructors - React Dev Tools - React Native vs ReactJS.		
UNIT-V	**REACT DATAFLOW**	2
React Dataflow: React State - React Props - React Props Validation - Styling React - Hooks and Routing - Deploying React - Case Studies for building dynamic web applications.		
		Total Contact Hours: 15

List of Experiments	
1	Explore various terminologies related to Internet (ISP, Email, Telnet, FTP, Web browsers, Search Engines)
2	Experiment the use of basic HTML elements.
3	Demonstrate the applications of Lists, Tables, Images, Section, article and aside elements.
4	Investigate the various components of CSS.
5	Develop web pages using HTML and various elements of CSS.
6	Designing simple dynamic webpages using Javascript.

7	Build web pages using While Loop, External JavaScript Files, do Loop, Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements.
8	Manipulating CSS with JavaScript- Using z-index to Stack Elements-Textarea Controls - Pull-Down Menus- List Boxes- Canvas and Drawing - Event Handler and Listener.
9	React Environment Setup - ReactJS Basics - React JSX - React Components: React Component API.
10	Understand React Component Life Cycle and apply React Constructors - React Dev Tools - React Native vs ReactJS
11	Envisage React Dataflow: React State - React Props - React Props Validation - Styling React - Hooks and Routing
12	Deploying React - Case Studies for building dynamic web applications.
	Contact Hours : 60
	Total Contact Hours : 75

Course Outcomes: At the end of this course students will be able to

- Apply various elements of HTML and CSS.
- Design interactive web pages using JavaScript.
- Create Dynamic Web Applications using ReactJS.
- Deploy and host web applications in Local Servers or Cloud platforms.
- Building React Applications

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23531.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CR23531.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CR23531.3	3	3	3	3	3	-	-	2	2	-	2	2	3	3	3
CR23531.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CR23531.5	3	3	3	3	3	2	2	2	-	-	3	3	3	3	3
Average	3	3	3	3	3	1.8	2	2	2.3	2	1.8	2.4	3	3	2.6

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CS23533	**Foundations of Artificial Intelligence** Common to B.E CSE and B.E. CSE(CS)	PC	3	0	2	4

Objectives:	
●	Understand the fundamental characteristics of problem-solving agents.
●	Explore various problem-solving strategies and their applications.
●	Develop the ability to solve problems under different constraints.
●	Apply AI techniques to real-world applications such as expert systems.
●	Gain a comprehensive understanding of different learning models in AI.

UNIT-I	**FOUNDATIONS OF ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING AGENTS**	**9**
Problems of AI, AI technique, 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	**AI SEARCH TECHNIQUES**	**9**
Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search		
UNIT-III	**GAME THEORY AND STATISTICAL REASONING**	**9**
Game theory - Adversarial search – optimal decisions in games – alpha-beta search –. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory		
UNIT-IV	**KNOWLEDGE REPRESENTATION AND REASONING**	**9**
Propositional Logic: Syntax, semantics, inference rules-Modus Ponens-Resolution- First-Order Logic (FOL): Syntax, semantics, quantifiers, unification. -Predicate Logic: Representing facts and rules, inference in FOL-Semantic Networks: Representing relationships between concepts- inferences in first-order logic – forward chaining – backward chaining - Fuzzy Logic- Natural Language Processing (NLP): Basic concepts, text representation, parsing		
UNIT-V	**INTRODUCTION TO MACHINE LEARNING**	**9**
Exploring sub-discipline of AI: Machine Learning, Supervised learning, unsupervised learning, Reinforcement learning: Active and Passive Learning, Classification problems, Regression problems, clustering problems, Introduction to neural networks and deep learning		
	Contact Hours : 45	

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

Lab Specifications:

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

Course Outcomes: On completion of the course, the students will be able to	
●	Understand fundamental concepts of knowledge representation, problem-solving, and learning methods in AI.
●	Identify and apply the appropriate agent strategy to solve a given problem
●	Represent problems using First-Order Logic and Predicate Logic
●	Develop AI applications such as expert systems and chatbots
●	Recommend suitable learning algorithms (supervised, unsupervised, or semi-supervised) based on problem requirements

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

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

Reference Links:	
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/

SUGGESTED ACTIVITIES

- Case study Discussion
- Flipped classroom – Comparing of Different Algorithms
- Activity Based Learning, Quiz, Mind Mapping

SUGGESTED EVALUATION METHODS

- Mini Projects, Assignment problems, Quizzes

CO-PO-PSO-Mappings

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23533.1	3	3	-	2	2	-	-	-	-	-	-	2	3	2	2
CS23533.2	3	3	2	2	3	-	-	-	-	-	-	2	3	3	2
CS23533.3	3	3	2	2	3	-	-	-	-	-	-	2	3	2	2
CS23533.4	3	3	3	3	3	2	2	2	2	2	2	3	3	3	2
CS23533.5	3	3	2	2	3	-	-	-	-	-	-	2	3	2	2
Average	3	3	2.25	2.2	2.8	2	2	2	2	2	2	2.2	3	2.4	2

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23531	Ethical Hacking	PC	3	0	2	4

Objectives:	
•	Understand Core Concepts of Information Security.
•	Develop Skills in Footprinting and Reconnaissance.
•	Master Techniques in Session Hijacking.
•	Hack and Secure Web Servers and Applications.
•	Perform SQL Injection and Hack Wireless Networks.

UNIT I	INTRODUCTION	9
Elements of Information Security, Cyber Kill Chain Methodology, MITRE ATT&CK Framework, Hacker Classes, Ethical Hacking, Information Assurance (IA), Risk Management, Incident Management, PCI DSS, HIPPA, SOX, GDPR.		
UNIT II	**FOOTPRINTING AND RECONNAISSANCE**	**9**
Footprinting, Advanced Google Hacking Techniques, Deep and Dark Web Footprinting, Competitive Intelligence Gathering, Website Footprinting, Website Mirroring, Email Footprinting, Whois Lookup, DNS Footprinting, Traceroute Analysis, Footprinting Tools.		
UNIT-III	**SESSION HIJACKING**	**9**
Session Hijacking, Types of Session Hijacking, Spoofing, Application-Level Session Hijacking, Man-in-the-Browser Attack, Client-side Attacks, Session Replay Attacks, Session Fixation Attack, CRIME Attack, Network Level Session Hijacking, TCP/IP Hijacking, Session Hijacking Tools, Session Hijacking Detection Methods, Session Hijacking Prevention Tools.		
UNIT IV	**HACKING WEB SERVERS AND WEB APPLICATIONS**	**9**
Web Server Operations, Web Server Attacks, DNS Server Hijacking, Website Defacement, Web Cache Poisoning Attack, Web Server Attack Methodology, Web Server Attack Tools, Web Server Security Tools, Patch Management, Patch Management Tools, Web Application Architecture, Web Application Threats, OWASP Top 10 Application Security Risks – 2021, Web Application Hacking Methodology, Web API, Webhooks, and Web Shell, Web API Hacking Methodology, Web Application Security.		
UNIT-V	**SQL INJECTION AND HACKING WIRELESS NETWORKS**	**9**
SQL Injection, Types of SQL injection, Blind SQL Injection, SQL Injection Methodology, SQL Injection Tools, Signature Evasion Techniques, SQL Injection Detection Tools, Wireless Terminology, Wireless Networks, Wireless Encryption, Wireless Threats, Wireless Hacking Methodology, Wi-Fi Encryption Cracking, WEP/WPA/WPA2 Cracking Tools, Bluetooth Hacking, Bluetooth Threats, Wi-Fi Security Auditing Tools, Bluetooth Security Tools.		
	Total Contact Hours :	**45**

List of Experiments	
1	Perform footprinting on the target network using search engines, web services, and social networking sites.
2	Perform website, email, whois, DNS, and network footprinting on the target network.
3	Perform Session Hijacking using various Tools.
4	Detect Session Hijacking.
5	Perform Web Server Reconnaissance using Various Tools.
6	Enumerate Web Server Information.
7	Perform Web Application Reconnaissance using Various Tools.
8	Perform Web Spidering.
9	Perform Web Application Vulnerability Scanning.
10	Crack FTP Credentials using a Dictionary Attack.

11	Perform Cross-site Request Forgery (CSRF) Attack.	
12	Identify XSS Vulnerabilities in Web Applications.	
13	Detect Web Application Vulnerabilities using Various Web Application Security Tools.	
14	Perform an SQL Injection Attack Against MSSQL to Extract Databases.	
15	Detect SQL Injection Vulnerabilities using Various SQL Injection Detection Tools.	
16	Footprint a Wireless Network.	
17	Create a Rogue Access Point to Capture Data Packets.	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Apply Ethical Hacking Techniques.
•	Conduct Comprehensive Reconnaissance.
•	Effectively Secure Web and Application Servers.
•	Detect and Prevent Session Hijacking Attacks.
•	Mitigate Risks from SQL Injection and Wireless Attacks.

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

Textbooks:	
1.	Michael T. Simpson, Kent Backman, and James E. Corley, "Hands-On Ethical Hacking and Network Defense", Second Edition, Delmar Cengage Learning, 2010.
2.	Patrick Engebretson, "The Basics of Hacking and Penetration Testing", First Edition, Syngress, 2013.
3.	Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Second Edition, Wiley, 2011.

Reference Books (s)/Web links:	
1.	Justin Seitz, "Black Hat Python: Python Programming for Hackers and Pentesters", Second Edition, No Starch Press, 2021.
2.	Daniel Graham, "Ethical Hacking", First Edition, No Starch Press, 2021

CO-PO-PSO Matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CR23531.1	3	3	2	3	3	-	-	2	2	1	-	2	3	3	2
CR23531.2	3	3	-	3	2	-	-	2	-	1	-	1	3	3	2
CR23531.3	3	2	3	3	3	2	1	2	-	1	-	1	3	3	2
CR23531.4	3	3	-	3	2	-	-	2	-	-	-	2	3	3	3
CR23531.5	3	3	2	3	3	1	-	2	-	-	-	2	3	3	3
Average	3	2.8	2.3	3	2.6	1.5	1	2	-	1	-	1.6	3	3	2.4

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23532	**Cyber and Digital Forensics**	**PC**	**3**	**0**	**2**	**4**

Objectives:	
•	Have an introduction into the process of Cyber Forensics.
•	Understand the Environment of forensics.
•	Learn process of collecting evidences.
•	Gain working knowledge of analyzing evidences using tools.
•	Learn other sources of evidences and its future challenges.

UNIT I	**DIGITAL FORENSICS PROCESS**	**9**
Forensic Science, Digital Forensics, Digital Evidence, Digital Forensics Process – Identification, Collection, Examination, Analysis, Presentation Phases. Cyber Crime Law- International Legal Framework of Cybercrime Law, Digital Crime, Investigation Methods for Collecting Digital Evidence.		
UNIT II	**FORENSICS ENVIRONMENT**	**9**
Hardware and Software Environments – Storage Devices, Operating System, File Systems, Metadata, Locating evidence in file systems-Password security, Encryption, and Hidden files. Case study –linking the evidence to the user, Data Analysis using forensics tool ILookIX		
UNIT-III	**COLLECTING EVIDENCES**	**9**
Use of Digital Evidence, File Metadata and Correlation with Other Evidence, Technical Complexities of Digital Evidence. Data carving, Date and time problems, Physical Acquisition and Safekeeping of Digital Evidence. Forensic Imaging Processes. Case Study – IXImager, Understanding ASB container		
UNIT IV	**ANALYZING EVIDENCES**	**9**
Selecting and Analyzing Digital Evidence - Locating digital evidence, categorizing files, eliminating superfluous files, The Event Analysis tool, Cloud Analysis tool, The Lead Analysis tool, Volume Shadow Copy analysis tools, Validating the Evidence. Case study – illustrating the recovery of deleted evidence held in volume shadows.		
UNIT-V	**OTHER SOURCES OF EVIDENCES**	**9**
Windows and Other Operating Systems as Sources of Evidence, Examining Browsers, E-mails, Messaging Systems, and Mobile Phones, Internet and Cloud. -Challenges in Digital Forensics.		
	Total Contact Hours :	**45**

List of Experiments	
1	Study of Computer Forensics and different tools used for forensic investigation
2	Live Forensics Case Investigation using Autopsy
3	Recover Deleted Files using Forensics Tools
4	Find Last Connected USB on your system (USB Forensics)
5	View Last Activity of Your PC
6	Extraction of Browser Artifacts
7	Comparison of two Files for forensics investigation by Compare IT software
8	Collecting Email Evidence in Victim PC
9	Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.

10	Extract Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Identify the need for cybercrime investigation.
•	Understand the hardware and software components responsible for seeking evidence.
•	Have knowledge on the techniques used for collecting evidences.
•	Analyse the evidence through suitable tools.
•	Examine other sources of evidences.

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

Textbooks:	
1.	Richard Boddington, Practical Digital Forensics, First Edition, , PACKT publishing, 2016

Reference Books (s)/Web links:	
1.	John R.Vacca, Computer Forensics, Second Edition, Cengage Learning, 2005.
2.	Richard E.Smith, Internet Cryptography, Third Edition, Pearson Education, 2008.
3.	Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, Third Edition, Prentice Hall, 2013.

CO-PO-PSO Matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CR23532.1	3	2	-	-	1	2	1	3	2	1	-	-	2	-	1
CR23532.2	3	2	2	1	3	1	-	-	-	-	-	-	3	2	-
CR23532.3	2	2	2	1	3	1	-	-	-	1	-	-	3	3	-
CR23532.4	1	3	3	3	3	-	-	1	2	2	-	-	2	3	2
CR23532.5	2	3	2	3	3	2	1	1	1	-	-	1	1	3	3
Average	2.2	2.4	2.2	2	2.6	1.5	1	1.6	1.6	1.3	-	1	2.2	2.7	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
CS23432	**Software Construction** Common to B.E. CSE, CSE(CS), CSD, AIML, AIDS and IT	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.
● **S**tudents can understand security best practices for software construction in Azure, including identity and access management (IAM), data encryption, network security to build secure and compliant software solutions.

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

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

Course Outcomes: On completion of course, students will be able to
● **D**emonstrate 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.
● **I**mplement end-to-end CI/CD pipelines using Azure DevOps, GitHub Actions, or Azure Pipelines, automating the build, test, and deployment processes for software applications, resulting in increased efficiency and reliability of software delivery.
● Optimizing software applications for performance and scalability on Azure, employing techniques such as auto-scaling, caching strategies, and performance tuning to ensure optimal performance under varying workloads.
● Develop skills in monitoring and diagnostics using Azure Monitor and Application Insights, enabling them to proactively monitor the health, performance, and availability of software applications, and diagnose and troubleshoot issues efficiently.
● Deeply understand security best practices for software construction in Azure, including identity and access management, data encryption, network security, and compliance standards, enabling them to build secure and compliant software solutions.Gain practical experience in designing, developing, and deploying software applications on Azure, preparing them for real-world scenarios and equipping them with the skills needed to succeed in software development roles in industry.

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

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

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

CO - PO – PSO matrices of course

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

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

Course Code	:	GE23521
Course Title	:	Soft Skills-II
Teaching Period	:	5th 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 (Theory course)	Category	L	T	P	C
CR23611	**Cyber Laws and Security Policies**	PC	3	0	0	3

Objectives:	
•	Learn about the field of Cyber Crime
•	Acquire knowledge of various types of attacks on mobile devices and their security policies
•	Understand the concept of Cyberspace and know the security aspects of cyber laws
•	Understand the various sections in Information Technology Act
•	Learn about cybersecurity policies and security standards compliances

UNIT I	**Introduction to Cyber Crime**	**9**
Introduction-Cyberspace-Cybersquatting-Cyberpunk- Cyber Warfare – Prevention of Cybercrime– Cybercrime and Information Security– Classification of Cybercrime– The Indian IT Act 2000		
UNIT II	**Cyber Offences and Cyber Crime**	**9**
Strategic Attacks–Types of Attacks–Proliferation of Mobile and Wireless Devices– Trends in Mobility Wireless Era–Security Challenges Faced by Mobile Devices–Attacks on Mobile Devices–Security Implications for Organizations–Measures for Handling Mobile Phones Related Security Issues–Security Policies and Measures in Mobile Computing Era and Laptops		
UNIT-III	**Cyberspace and Cyber Law**	**9**
Introduction to e-commerce–Contract Aspects in Cyber Law–Security Aspects in Cyber Law–Intellectual Property Aspect and Evidence Aspect in Cyber Law–Global Trends in Cyber Law–Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking		
UNIT IV	**Information Technology Act**	**9**
Introduction of Cybercrime and Cybersecurity– Information Technology Act 2000–Penalties–Adjudication and Appeals–Offences–Cyber Appellate Tribunal		
UNIT-V	**Cybersecurity Policies and Compliances**	**9**
Cybersecurity Frameworks–NIST–ISO/IEC 27000–PCI Compliance–GDPR–CCPA–HIPAA–FISMA		
	Total Contact Hours :	**45**

Course Outcomes:	
On completion of course you will be able to	
•	Comprehend the fundamentals of cyber crime
•	Identify and mitigate mobile device security threats
•	Interpret and apply cyber laws in cyberspace
•	Navigate the Information Technology Act 2000
•	Implement cybersecurity policies and compliance standards

Suggested Activities:	
•	Kahoot Quiz
•	Group discussion – Developing Cyber Security Policies for College

Textbooks:	
1.	Nilakshi Jain and Ramesh Menon, “Cybersecurity and Cyber Laws”, Wiley, 2021

Reference Books (s)/Web links:	
1.	Alfred Basta, Nadine Basta and Mary Brown, "Cyber Security and Cyber Laws", Cengage, 2018
2.	Jeff Kosseff, "Cybersecurity Law", 2nd Edition, Wiley, 2019.
3.	Tari Schreider, "Cybersecurity Law, Standards and Regulations", 2nd Edition, Rothstein Publishing, 2020.
4.	Justice Yatindra Singh, "Cyber Laws", Sixth Edition, Universal Law Publishing, 2016.

CO-PO-PSO Matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CR23611.1	3	2	-	-	-	3	2	3	-	-	-	1	1	-	-
CR23611.2	3	3	-	-	3	-	-	-	-	-	-	2	2	1	-
CR23611.3	2	2	-	-	2	3	1	3	-	2	-	-	3	2	1
CR23611.4	2	2	1	2	1	3	-	2	-	2	-	-	1	2	3
CR23611.5	3	2	-	-	3	-	2	3	1	1	1	-	2	3	3
Average	2.6	2.2	1	2	2.2	3	1.6	2.7	1	1.6	1	1.5	1.8	2	2.3

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23631	Malware Analysis	PC	3	0	2	4

Objectives:	
•	Learn about malware type and various file formats
•	Acquire knowledge about various static analysis tool for classification of malware
•	Learn about the tools for dynamic analysis and to do code injection and hooking
•	Understand various obfuscation techniques, memory forensics and detecting kernel rootkits
•	Learn about threat intelligence, Incidence Response and Case studies on malware

UNIT I	INTRODUCTION	9
Overview of Malware – Definitions and Types- Malware Analysis Techniques– PE32 File Format– ELF File Format–Assembly Language Primer-CPU Registers-Data Transfer Instructions-Arithmetic Operations-Bitwise Operations-Branching and Conditionals.		
UNIT II	**STATIC ANALYSIS TECHNIQUES**	**9**
Introduction– Determining File Type– Fingerprinting the Malware– Antivirus Scanning– Extracting Strings– File Obfuscation– PE Header Inspection– Fuzzy Hashing– Import Hash– Section Hash– Yara Malware Classification– Disassembly using IDA–Reverse Engineering using Ghidra		
UNIT-III	**DYNAMIC ANALYSIS TECHNIQUES**	**9**
Introduction– Lab Environment Overview– System and Network Monitoring Tools– Steps Involved in Dynamic Analysis– Analyzing a Malware Executable– Dynamic Link Library Analysis– Code Injection-Remote DLL Injection-Remote Shell Code Injection– Hooking-IAT-Inline-Memory Patching using Shim.		
UNIT IV	**ADVANCED ANALYSIS TECHNIQUES**	**9**
Overview of Obfuscation Technique-Malware Encryption-Malware Unpacking–Memory Forensics-Memory Acquisition-DumpIt-Volatility-Enumerating Processes-Detecting API Hooks-Kernel Mode Rootkits.		
UNIT-V	**THREAT INTELLIGENCE AND CASE STUDIES**	**9**
Threat Intelligence-Common Indicators of Compromise-Tools–SANS Incident Response Steps–Incident Response and Malware Remediation–Case Studies-Stuxnet-WannaCry Ransomware-Clop Ransomware		
	Total Contact Hours :	**45**

List of Experiments		
1	Setting up a Secure Virtual Machine Environment for Malware Analysis.	
2	Develop script to check multiple files in VirusTotal malware repository.	
3	Develop a Yara script to check for malware/benign files.	
4	Analyzing Malware with Static Analysis tools– strings- floss-ssdeep-IDA.	
5	Dynamic Analysis of Malware Samples using Debuggers.	
6	Analyzing Network Traffic Generated by Malware with Wireshark/Tcpdump.	
7	Mobile Malware Analysis -TryHackMe Platform	
8	Perform Memory Forensics using Volatility	
9	Analyzing Advanced Malware Techniques using RootkitRevealer	
10	Investigate Ransomware Attack using ProcDot – TryHackMe Platform	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Analyze PE32 and ELF executable file
•	Perform static analysis of malware
•	Perform dynamic analysis of malware and do code injection
•	Analyze obfuscated code, memory forensics and rootkits
•	Apply threat intelligence to real-world scenarios and analyze malware

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

Textbooks:	
1.	K.A. Monappa, “Learning Malware Analysis”, First Edition, Packt, 2018.

Reference Books (s)/Web links:	
1.	Michael Sikorski and Andrew Honig, “Practical Malware Analysis”, First Edition, No Starch Press, 2017.
2.	Michael Hale Ligh, Steven Adair, "Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code", First Edition, Wiley, 2010.
3.	https://www.varonis.com/blog/how-to-use-ghidra
4.	https://cocomelonc.github.io/tutorial/2021/10/03/malware-analysis-1.html
5.	https://learn.microsoft.com/en-us/archive/msdn-magazine/2002/february/inside-windows-win32-portable-executable-file-format-in-detail
6.	https://ics.uci.edu/~aburtsev/238P/hw/hw3-elf/hw3-elf.html
7.	https://www.codeproject.com/Articles/246545/Stuxnet-Malware-Analysis-Paper
8.	https://any.run/malware-trends/wannacry

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23631.1	3	2	-	2	3	-	-	-	-	-	-	-	3	2	1
CR23631.2	2	3	-	2	3	-	-	-	-	-	-	1	2	3	-
CR23631.3	2	3	-	3	3	-	-	-	-	2	-	-	2	3	1
CR23631.4	3	2	-	3	2	-	-	-	-	-	-	1	3	2	3
CR23631.5	3	3	-	2	3	-	-	3	-	2	-	-	2	3	3
Average	2.6	2.6	-	2.4	2.8	-	-	3	-	2	-	1	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 course)	Category	L	T	P	C
CR23632	Blockchain Technologies	PC	3	0	2	4

Objectives:	
•	To teach the concepts of blockchain technologies
•	To understand the technical aspects of crypto currencies, block chain technologies, and distributed consensus
•	To familiarize potential applications for Bit coin-like crypto currencies
•	Integrate ideas from blockchain technology into their own projects
•	Design, build, and deploy smart contracts and distributed applications

UNIT I	INTRODUCTION	9
Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).		
UNIT II	**CRYPTOGRAPHIC FUNDAMENTALS**	**9**
Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256, signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.		
UNIT-III	**BIT COIN**	**9**
Bit coin - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.		
UNIT IV	**ETHEREUM**	**9**
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts.		
UNIT-V	**BLOCK CHAIN-RECENT TRENDS**	**9**
Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct Non interactive Argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – Sybil attacks, Selfish mining, 51% attacks - advent of algorand, and Sharding based consensus.		
	Total Contact Hours :	**45**

List of Experiments		
1	Develop a simple blockchain using python	
2	Creating and Building up Bitcoin Wallet	
3	Ethereum Wallet	
4	Building a Private Ethereum Network and Deploying Smart Contract	
5	Ethereum Smart Contract	
6	Creating and Building up Crypto Token	
7	Creating a Business Network using Hyperledger	
8	Building and Deploying Multichain Private Blockchain	
	Contact Hours :	**30**
	Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Understand emerging abstract models for Block chain Technology.
•	Analyse the concept of bit coin and mathematical background behind it.
•	Apply the tools for understanding the background of crypto currencies.
•	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
•	Understanding of latest advances and its applications in Block Chain Technology.

Suggested Activities:	
•	Assignment problems.
•	Class presentation/Discussion
•	Application Development using Smart Contracts

Textbooks:	
1.	Melanie Swan, "Block Chain: Blueprint for a New Economy", First Edition, O'Reilly, 2015.

Reference Books (s)/Web links:	
1.	Daniel Drescher, "Block Chain Basics", First Edition, Apress, 2017
2.	Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", First Edition, Packt Publishing, 2012.
3.	Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014
4.	https://bitcoin.org/bitcoin.pdf

CO-PO-PSO Matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CR23632.1	3	2	-	-	2	-	-	-	-	-	-	2	3	2	-
CR23632.2	3	3	-	-	3	-	-	-	-	-	-	-	2	3	-
CR23632.3	2	2	-	2	3	-	-	-	-	1	-	-	3	2	-
CR23632.4	3	3	-	2	2	-	-	-	-	-	-	1	3	2	3
CR23632.5	3	3	-	2	2	-	-	3	-	2	-	-	2	3	3
Average	2.8	2.6	-	2	2.4	-	-	3	-	1.5	-	1.5	2.6	2.6	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
AI23331	**Fundamentals of Machine Learning** Common to B.E. CSE, CSE(CS), AIML, CSD, AIDS and IT	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 – silhouttes – hierarchical clustering – k-d trees. **Dimensionality Reduction:** – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis.		
UNIT-V	**REINFORCEMENT LEARNING**	**8**
Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal-difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control.		
	Contact Hours : 45	

List of Experiments				
1	A python program to implement univariate regression, bivariate regression and multivariate regression.			
2	A python program to implement Simple linear regression using Least Square Method			
3	A python program to implement logistic model.			
4	A python program to implement single layer perceptron.			
5	A python program to implement multi layer perceptron with back propagation.			
6	A python program to do face recognition using SVM classifier.			
7	A python program to implement decision tree.			
8	A python program to implement boosting.			
9	A python program to implement KNN and K-means.			
10	A python program to implement dimensionality reduction – PCA.			
11	Mini project – develop a simple application using tensorflow / keras.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**75**

Course Outcomes:

On completion of the course, the students will be able to	
●	Understand fundamentals of machine learning.
●	Apply the linear models for tuning parameters.
●	Understand and explore the machine learning algorithms with classification.
●	Apply machine learning algorithms with clustering and feature extraction.
●	Apply reinforcement learning techniques for various applications.

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

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

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

CO - PO – PSO matrices of course

COs/POs& PSOs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
AI23331.1	3	3	2	-	-	-	-	-	1	-	-	-	3	1	-
AI23331.2	3	3	3	2	-	2	-	-	-	-	-	2	2	3	-
AI23331.3	3	3	3	2	3	-	-	2	2	-	-	-	-	3	-
AI23331.4	3	3	3	-	3	1	-	-	-	-	1	2	2	-	-
AI23331.5	3	3	2	3	2	-	-	1	3	-	3	3	3	3	1
Average	3	3	2.6	2.3	2.6	1.5	-	1.5	2	-	2	2.3	2.5	2.5	1

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

Subject Code	Subject Name	Category	L	T	P	C
GE23627	Design Thinking and Innovation (Type - Project based learning)	EEC	0	0	4	2

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

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

Activities:

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

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

Activities:

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

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

Activities:

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

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

Activities:

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

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

Activities:

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

Course Outcomes: On completion of the course, the students will be able to	
CO1	Construct design challenge and reframe the design challenge into design opportunity.
CO2	Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.
CO3	Develop ideas and prototypes by brainstorming.

CO4	Organize the user walkthrough experience to test prototype
CO5	Develop smart strategies and implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.

Assessment:

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

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

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

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

CO-PO-PSO Matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
GE23627.1	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2
GE23627.2	3	2	3	3	3	2	2	3	3	3	3	3	2	3	2
GE23627.3	3	2	3	3	3	2	2	3	3	3	3	3	2	3	2
GE23627.4	3	2	3	3	3	2	2	3	3	3	3	3	3	2	3
GE23627.5	3	2	3	3	3	2	2	3	3	3	3	3	2	3	2
Average	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2.4**	**2.6**	**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 Course)	Category	L	T	P	C
CS23621	Mobile Application Development Laboratory	PC	0	0	4	2

Objectives:
● Get started developing in Kotlin, and learn the basics of the Kotlin programming language: data types, operators, variables, control structures, and nullable versus non-nullable variables.
● Get an introduction to Android development and UI basics.
● Learn Android app architecture using Kotlin.
● Learn best practices, guidelines, and tools for effective Android app design.
● To understand the capabilities and limitations of mobile devices

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

Course Outcomes: On completion of the course, students will be able to
● Learn the basics of Kotlin, including data types, operators, variables, control structures, and handling nullable and non-nullable variables.
● Develop Android apps and the basics of user interface design.
● Become familiar with the architecture of Android apps and how to structure them using Kotlin.
● Learn the best practices, guidelines, and essential tools needed for designing effective Android apps.
● Develop an understanding of what mobile devices can and cannot do, which is crucial for mobile app development.

Text Books:	
1.	Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin, by Dawn Griffiths, David Griffiths, Shroff/O'Reilly, Third Edition.
2.	Learn Kotlin for Android Development: The Next Generation Language for Modern Android Apps Programming, Peter Späth, Apress, First Edition.
Reference Books:	
1.	Android Development with Kotlin: Enhance your skills for Android development using Kotlin, Marcin Moskala, Igor Wojda, Packt Publishing Limited, 2017.

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

Course Code	:	GE23621
Course Title	:	Problem-Solving Techniques
Teaching Period	:	6th 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 Outcomes:

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23731	**Blockchain Development in Hyperledger Fabric**	**PC**	**2**	**0**	**2**	**3**

Objectives:	
•	To understand the fundamentals of blockchain and overview of hyper ledger Fabric
•	To gain hands-on experience in developing chaincodes
•	Acquire skills in developing decentralized applications using fabric.
•	Gain a deep understanding of advanced Fabric concepts such as channels and private data collections.
•	Learn deployment strategies for Fabric networks in production environments.

UNIT I	**INTRODUCTION TO BLOCKCHAIN**	**6**
Introduction to Blockchain Technology-Overview of Hyperledger Fabric-Understanding Fabric Architecture-Components of Hyperledger Fabric-Setting up Development Environment		
UNIT II	**HYPER LEDGER FABRIC FUNDAMENTALS**	**6**
Fabric Network Setup-Chaincodes Development-Smart Contracts in Fabric-Ledger and Transactions-Membership Services Provider (MSP) in Fabric		
UNIT-III	**FABRIC APPLICATION DEVELOPMENT**	**6**
Developing Applications with Hyperledger Fabric-Integration with External Systems-Asset Management in Fabric-Querying the Ledger-Event Handling in Fabric		
UNIT IV	**ADVANCED TOPICS IN HYPER LEDGER FABRIC**	**6**
Fabric Channels-Private Data Collections-Endorsement Policies-Fabric Security Best Practices-Performance Optimization in Fabric		
UNIT-V	**DEPLOYMENT AND MANAGEMENT**	**6**
Deployment Strategies for Fabric Networks-Network Maintenance and Upgrades-Monitoring and Logging in Fabric-Troubleshooting Fabric Applications-Future Trends in Hyperledger Fabric		
	Total Contact Hours :	**30**

List of Experiments	
1	Setting up Hyperledger Fabric Development Environment
2	Developing and Deploying a Simple Chaincodes
3	Implementing Asset Management with Fabric
4	Querying Ledger Data with Fabric
5	Integration with External Systems
6	Implementing Fabric Channels for Privacy
7	Endorsement Policy Configuration
8	Fabric Network Deployment and Management
9	Monitoring and Logging Fabric Networks
10	Troubleshooting Fabric Applications
Contact Hours :	**30**
Total Contact Hours :	**75**

Course Outcomes:	
On completion of course you will be able to	
•	Explain the course principles of blockchain and set hyper ledger fabric for blockchain development
•	Demonstrate competence in writing and deploying chaincodes
•	Proficient in developing decentralized applications on the Hyperledger Fabric platform
•	Design and implement Fabric networks with advanced features like channels and private data collections.
•	Demonstrate the ability to deploy Fabric networks in production environments using appropriate strategies.

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

Textbooks:	
1.	Matt Zand, Xun Wu and Mark Anthony Morris, "Hands-On Smart Contract Development with Hyperledger Fabric V2: Building Enterprise Blockchain Applications", First Edition, O'Reilly, 2021
2.	Imran Bashir, "Mastering Blockchain:Distributed ledger technology, decentralization, and smart contracts" Second Edition, Packt, 2018

Reference Books (s)/Web links:	
1.	Nakul Shah, "Blockchain for Business with Hyper-ledger Fabric", First Edition, BPB Publications, 2019
2.	Narendranath Reddy Thota,"Mastering Hyperledger Fabric - Master The Art of Hyperledger Fabric on docker, docker swarm and Kubernetes", First Edition, Independently published, 2020
3.	Nitin Gaur, "Blockchain with Hyperledger Fabric", Second Edition, Packt, 2020

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23731.1	3	2	-	-	3	-	-	-	-	1	-	2	3	2	-
CR23731.2	3	3	-	2	3	-	-	-	-	-	-	-	3	3	-
CR23731.3	3	3	2	2	3	-	-	-	2	1	2	-	3	3	2
CR23731.4	2	3	3	2	3	-	-	-	2	-	3	-	3	3	3
CR23731.5	3	3	3	2	3	-	-	-	-	2	3	-	3	3	3
Average	2.8	2.8	2.6	2	3	-	-	-	2	1.3	2.6	2	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:"-"

PROFESSIONAL ELECTIVES (PE)

CYBER SECURITY

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CR23A11	**Security Assessment and Risk Analysis**	**PE**	**3**	**0**	**0**	**3**

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

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

Course Outcomes:	
On completion of course you will be able to	
•	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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A11.1	3	3	-	2	2	2	1	2	-	1	-	2	3	3	2
CR23A11.2	2	3	-	3	3	-	-	-	-	1	-	1	3	3	2
CR23A11.3	3	3	3	3	3	2	1	2	-	-	-	2	3	3	2
CR23A11.4	3	2	3	3	3	-	2	2	-	-	-	1	3	3	2
CR23A11.5	3	3	2	3	3	2	2	3	-	-	-	2	3	3	2
Average	2.8	2.8	2.6	2.8	2.8	2	1.5	2.25	-	1	-	1.6	3	3	2

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

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS23A11	MALWARE DETECTION AND ANALYSIS	PE	3	0	0	3

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		
	Contact Hours:	**45**
	Total Contact Hours :	**45**

Course Outcomes: On completion of course you 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

Textbooks:	
1	Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012.
2.	Abhijit Mohanta, Anoop Saldanha, Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware, 2020, 1st edition, Apress .

3.	M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software. 2012, 1st edition, No Starch Press.

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CS23511.1	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.2	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.3	2	1	1	1	-	1	-	1	-	-	1	-	2	2	2
CS23511.4	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
CS23511.5	2	3	2	2	2	1	-	-	--	-	-	-	2	2	2
Average	2	1.8	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 course)	Category	L	T	P	C
CR23A31	Ethical Hacking and Security	PE	2	0	2	3

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

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

List of Experiments	
1	Conduct a basic penetration test using Metasploit to exploit a known vulnerability in a controlled environment.
2	Use NMAP to scan a network and identify open ports and services.
3	Perform a web vulnerability scan using Burp Suite and document the identified vulnerabilities and their potential impacts.
4	Perform a vulnerability scan using Nessus and generate a detailed report on the findings, including recommended remediation steps.
5	Conduct a web application security test using OWASP ZAP. Document vulnerabilities and provide remediation recommendations.
6	Assess the security of a sample application and provide a detailed report on vulnerabilities and

	recommended hardening measures.	
7	Perform a risk assessment on a sample IT system and present a risk management plan.	
8	Perform Social Engineering attack	
9	View and capture network traffic using Wireshark	
10	Explore dig tool for finding out vulnerabilities	
	Contact Hours :	**30**
	Total Contact Hours :	**60**

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

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

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CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	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	2.6	2.2

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23A32	Digital and Mobile Forensics	PE	2	0	2	3

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

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

List of Experiments		
1	Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.	
2	Data extraction from call logs using Sleuth Kit.	
3	Data extraction from SMS and contacts using Sleuth Kit.	
4	Extract installed applications from Android devices.	
5	Extract diagnostic information from Android devices through the adb protocol.	
6	Generate a unified chronological timeline of extracted records,	
7	Implement the sql query database and to handle sqlite in browser	
8	Hide InvisibleSecrets in the initial screen using Steganography	
	Contact Hours :	**30**
	Total Contact Hours :	**60**

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

Textbooks:	
1	Andre Arnes, "Digital Forensics", Wiley, 2018.
2	Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.
Reference Books (s)/Web links:	
1.	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
2.	Dejay, Murugan, "Cyber Forensics", 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A32.1	3	2	2	3	3	-	2	3	-	-	2	3	3	2	2
CR23A32.2	2	3	3	2	3	2	2	3	2	2	-	3	3	3	2
CR23A32.3	3	3	2	3	3	-	-	3	2	-	3	3	3	2	3
CR23A32.4	3	3	3	3	3	2	-	3	-	2	-	3	3	3	3
CR23A32.5	2	2	3	2	3	-	2	3	-	-	-	3	2	3	2
Average	2.6	2.6	2.6	2.6	3	2	2	3	2	2	2.5	3	2.8	2.6	2.4

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23A33	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	PE	2	0	2	3

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

Reference Books (s)/Web links:	
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
2.	Don and Tapscott, Alex, "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World", 2018, Penguin
3.	Andreas M. Antonopoulos, "Internet of Money", 2018
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A33. 1	3	2	3	-	1	-	-	-	1	-	1	2	2	1	2
CR23A33. 2	2	2	2	-	1	-	-	-	1	-	1	2	2	1	2
CR23A33. 3	2	2	3	-	2	-	-	-	1	-	1	2	2	1	2
CR23A33. 4	2	2	2	-	2	-	-	-	1	-	1	2	2	1	2
CR23A33. 5	2	2	2	-	2	-	-	-	1	-	1	2	2	1	2
Average	2.2	2	2.6	-	1.6	-	-	-	1	-	1	2	2	1	2

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

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CR23A34	Security and Privacy in Cloud	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.		
	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: On completion of the course, the students 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 Book(s) / Web link(s):	
1	Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models(SaaS, PaaS, and IaaS)", First Edition, Wiley,2014.
2	Tom White, "Hadoop: The Definitive Guid". Yahoo Press, 2014.
3	Rajkumar Buyya, Christain Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
4	John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
5	Thomas Erl, Zaigham Mahood, Ricardo Puttini- "Cloud Computing, Concept, Technology and Architecturel", 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A34.1	3	2	1	-	2	-	-	-	-	1	-	2	2	1	-
CR23A34.2	2	3	2	2	3	1	-	2	-	-	1	2	3	2	-
CR23A34.3	2	2	3	-	3	-	-	1	1	-	-	1	2	2	-
CR23A34.4	2	2	1	-	2	2	1	3	-	1	-	1	2	1	1
CR23A34.5	2	3	2	1	2	2	1	3	-	1	2	1	2	1	2
Average	2.2	2.4	1.8	1.5	2.4	1.6	1	2.25	1	1	1.5	1.4	2.2	1.4	1.5

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CR23A35	Social Network Security	PE	2	0	2	3

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

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

Textbooks:	
1.	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2.	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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A35.1	2	3	3	2	3	-	-	-	1	2	-	2	3	2	1
CR23A35.2	3	3	2	-	3	3	-	3	-	1	-	2	3	2	2
CR23A35.3	2	3	2	3	3	-	-	2	-	1	-	2	3	3	1
CR23A35.4	1	3	2	-	2	-	-	2	-	1	-	1	2	2	1
CR23A35.5	2	3	3	2	3	2	-	3	-	1	2	2	3	2	2
Average	2	3	2.4	2.3	2.8	2.5	-	2.5	1	1.2	2	1.8	2.8	2.2	1.4

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
CS23A35	Web Application Security	PE	2	0	2	3

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:	
On completion of course you will be able to	
•	Understand the fundamentals of web application security
•	Apply security principles in developing a secure web application
•	Identify common web vulnerabilities that are exploited by hackers
•	Identify the secure model for web application development and deployment
•	Apply best practices for mitigations of vulnerabilities

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

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

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

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A35.1	3	2	-	2	3	2	-	2	-	-	-	2	3	-	-
CR23A35.2	3	3	3	2	3	2	-	2	1	2	-	2	3	2	-
CR23A35.3	3	3	2	3	3	2	-	2	1	2	-	2	3	2	-
CR23A35.4	3	3	3	3	3	2	-	2	1	2	-	2	3	3	2
CR23A35.5	3	3	3	3	3	2	2	3	2	3	2	3	3	3	3
Average	3	2.8	2.8	2.6	3	2	2	2.2	1.3	2.3	2	2.2	3	2.5	2.5

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

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CR23A36	Information Security and Management	PE	2	0	2	3

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

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

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

Course Outcomes: On completion of the course, the students will be able to	
•	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 Book(s)/Web link(s):	
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	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:"-"

Data Science

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AI23A31	SOCIAL NETWORK ANALYSIS	PE	3	0	2	4

OBJECTIVES:

The students will be able

- To understand the concept of semantic web and social network analysis
- To apply ontology for knowledge representation and integration of social network data
- To identify and analyse communities within social networks using various detection methods
- To examine human behaviour in social web and related communities
- To analyse various visualizing tools for social networks.

UNIT I	INTRODUCTION	9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II	MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	9

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

UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	9

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

UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	9

Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	9

Graph Networks- Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TOTAL: 45 PERIODS

List of Experiments (can be implemented using any tools: Python (NetworkX), MATLAB,Gephi.

1) Implement a program to compute centrality measures
2) Implementation of community detection using various algorithms
3) Simulation of Diffusion of Information or Influence
4) Implementation of Link Prediction
5) Write a program and analyse Network Resilience and Robustness
6) Simulation of Opinion Dynamics
7) Simulation of Social Influence in Marketing Campaigns
8) Implementation of Sentiment Analysis in Social Media Networks
9) Creation of Network Visualization using different Layouts
10) Mini Project -Modelling and tracking the evolution of a network over time, studying the addition of nodes and edges based on specific growth models (e.g., preferential attachment).

	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Suggested Activities:

- Role play- Social Media creation (Unit 1).
- Mind Map, Poster Design - Ontology (Unit 2).
- Flipped Classroom – Web creation (Unit 3).
- Poster Design – Cyber Security (Unit4).
- Implementation of small module- Community Channel(Unit5).

COURSE OUTCOMES:

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

•	Develop semantic web related applications.
•	Represent knowledge using ontology.
•	Predict human behaviour in social web and related communities.
•	Visualize social networks.
•	Social awareness and its laws

TEXT BOOKS:

1	John Scott , "Social Network Analysis: Research Methods", 1st Edtion, Kindle Edition, 2021
2	David Knickerbocker, "Network Science with Python:Explore the networks around us using network science, Social network analysis, and Machine learning" ,Packt Publishers, 2023
3.	Stephen P Bongatti "Analyzing Social Networks using R". SAGE publishers Ltd., 2021

REFERENCES:

1.	Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2019.
2.	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2021.
3.	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2021.

CO – PO – PSO matrices of course

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AI23A31.1	3	3	2	2	3	2	1	2	2	2	2	3	3	2	2
AI23A31.2	3	3	2	2	3	2	1	1	2	2	2	3	3	2	3
AI23A31.3	3	3	3	2	3	2	1	2	2	2	2	3	3	3	3
AI23A31.4	3	3	3	2	3	2	1	2	2	2	2	3	3	3	2
AI23A31.5	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 course)	Category	L	T	P	C
AD23A32	EXPLORATIVE AND FORECASTING ANALYTICS	PE	2	0	2	3

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

UNIT I	EXPLORATORY DATA ANALYSIS	6
Generating Summary Statistics- Preparing Data for EDA- Visualizing Data in Python- Preparing for visualization-Visualizing data in Matplotlib-Visualizing data in Seaborn-Visualizing data in GGPLOT		
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 Smoothening-ARIMA-SARIMA.		
UNIT V	**ADVANCED FORECASTING MODELS**	**6**
Forecasting with auto ARIMA, Facebook Prophet-Forecasting multivariate time series using VAR models-Forecasting with RNN using Keras-Forecasting with LSTM using Keras.		
	Contact Hours : 30	

List of Experiments	
1	Clean and analyze the Bitcoin Historical Data from Kaggle to calculate daily summary statistics and identify any missing values. **Evaluation Parameters:** Accuracy in handling time-specific missing values and the relevance of summary statistics generated.
2	Create line plots and decompose the Daily Temperature of Major Cities dataset from Kaggle to reveal trends, seasonality, and residuals. **Evaluation Parameters:** Effectiveness in revealing underlying patterns and anomalies in data.
3	Develop a series of box plots and violin plots for the Global Financial Indices dataset from the Data Market repository, focusing on capturing distribution variations over time. **Evaluation Parameters:** Ability to interpret and articulate findings from the distribution shapes and their changes over time.
4	Visualize the correlation matrix for multiple time series variables from the Multivariate Economic Statistics dataset using heat maps and network diagrams, emphasizing the strength and direction of relationships. **Evaluation Parameters:** Clarity in displaying correlations, effectiveness in using colors and layout to represent data complexities.
5	Perform data cleaning, transformation, and feature engineering on the Stock Market Data from Kaggle to prepare it for time series modeling. **Evaluation Parameters:** Creativity in feature engineering and thoroughness in preprocessing steps.
6	Apply Moving Average and Exponential Smoothing models to establish baseline forecasts using the Electricity Consumption Data from Kaggle. **Evaluation Parameters:** Accuracy of forecasts and suitability of the model chosen for the data's nature.
7	Construct and tune an ARIMA model using Daily Financial Market Data from Quandl, focusing on optimal parameter selection. **Evaluation Parameters:** Model's fit to the data and predictive accuracy.
8	Implement LSTM networks to forecast future patient admissions using the Hourly Patient Admission Data from the PhysioNet database. **Evaluation Parameters:** Effectiveness of the neural network architecture and its tuning.
9	Forecast a system of multiple interrelated economic indicators using Vector Autoregression (VAR) with the Multivariate Economic Statistics from the Data Market repository. **Evaluation Parameters:** Integration of multiple time series inputs and forecasting accuracy.
10	**Mini Project: Time Series Forecasting** **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. **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. **Datasets:** 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**	**2**	**2.3**	**3**	**2**	**2.5**	**3**	**2**	**2.5**	**2.6**	**2**	**3**

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AI23A35	Recommendation Systems	PE	2	0	2	3

Objectives: This course will enable students
• To understand the goals and models of the recommender systems
• To analyse the different neighbor recommendation and models
• To understand the basic components of content-based systems
• To evaluate Knowledge based recommendation and Hybrid approaches
• To evaluate the recommender system by design and metrics.

UNIT I	**INTRODUCTION**	6
Introduction: Goals of Recommender System, Basic models of Recommender Systems, Domain-Specific Challenges in Recommender System, Applications		
UNIT II	**COLLABORATIVE FILTERING**	6
User-based nearest neighbour recommendation, Item based nearest neighbour recommendation, Clustering and Neighbourhood-Based Model, Graph models for Neighbourhood-Based Model		
UNIT III	**CONTENT-BASED RECOMMENDATION**	6
Basic components of content-based systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content based versus Collaborative Filtering		
UNIT IV	**KNOWLEDGE BASED RECOMMENDATION AND HYBRID APPROACHES**	6
Knowledge based recommendation: Constraint based recommenders, Case based recommenders. Hybrid approaches: Weighted, Switching, Cascade, Meta-level Hybrids, Mixed Hybrids		
UNIT V	**Evaluating Recommender System**	6
Introduction, Evaluation Paradigms, General goals of evaluation Design, Design issues: Case Study of Netflix, Accuracy metrics, Limitations of Evaluation metrics.		
		Total Contact Hours:30

Text Book(s):
1. Charu C. Aggarwal,,Recommender Systems: The Textbook., 1st edition, Springer ,2016

Reference Books(s) / Web links:
1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, 3rd edition, Springer,2022
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, 1st edition, Springer, 2013.
3. Francesco Ricci, Lior Rokach, Bracha Shapira, Paul B. Kantor, Recommender Systems Handbook, 2nd ,Springer ,2010
4. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, 1st edition, Cambridge University Press, 2011.

List of Experiments			
1	Implement Data similarity measures using Python		
2	Implement dimension reduction techniques for recommender systems		
3	Implement user profile learning		
4	Implement content-based recommendation systems		
5	Implement collaborative filter techniques		
6	Create an attack for tampering with recommender systems		
7	Implement accuracy metrics like Receiver Operated Characteristic curves		
	Contact Hours	**:**	**30**

	Total Contact Hours	**:**	**60**

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

- To learn the goal and applicability of recommendation systems in various fields.
- To gain knowledge of model based collaborative filtering techniques used in recommendation system
- To acquire knowledge of basics of content based recommendation system.
- To develop skills on knowledge based and hybrid recommendation systems.
- To understand the evaluation of the recommendation system.

SUGGESTED ACTIVITIES

- **Design Taxonomy:** Applications of recommendation systems in various domains (e.g., e-commerce, entertainment, social media, etc.). **(Unit 1).**
- **Flipped Classroom -** To explore and analyze graph models in collaborative recommender systems. **(Unit 2).**
- **Role play –**To represent different methods for learning user profiles (e.g., feature extraction, user feedback, demographic-based methods). **(Unit 3).**
- **Poster Design –** To create posters illustrating case-based recommenders and knowledge-based recommendation. **(Unit4).**
- **Implementation of small module-** Implement a small module to evaluate the accuracy metrics of a recommender system (such as Precision, Recall, and F1-Score). **(Unit5).**

SUGGESTED EVALUATION METHODS

- **Develop Case Studies -** Identify and analyze various issues associated with recommender systems, such as cold-start problems, scalability, bias, and privacy concerns. Example: A case study analyzing Netflix's cold-start problem or how Amazon handles recommendation bias. **(Unit 1).**
- **Tutorial problems -** To evaluate students' understanding of the vulnerabilities in collaborative recommender systems and methods of mitigating these vulnerabilities. Example Problem: How can an attacker exploit user ratings in a collaborative recommender system, and what countermeasures can be applied? **(Unit 2).**
- **Quiz -** Quiz will test students' understanding of the fundamental components and architecture of content-based recommender systems. **(Unit 3).**
- **Assignment problems-** To understand and implement constraint-based recommenders, where recommendations are made by satisfying a set of pre-defined constraints. Example Problem: Design a constraint-based recommender system that recommends a set of vacation destinations considering factors like budget, distance, weather, and user preferences. **(Unit 4).**
- **Quiz –** Quiz will evaluate students' knowledge on how to evaluate recommender systems using real historical datasets. **(Unit5).**

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
AI23A35.1	3	3	2	2	1	-	3	-	-	-	-	-	3	-	-
AI23A35.2	3	3	2	2	2	-	-	-	-	-	-	-	3	3	-
AI23A35.3	3	2	3	2	2	-	-	2	-	2	-	1	3	3	-
AI23A35.4	3	3	3	2	3	-	-	2	1	1	-	1	3	3	-
AI23A35.5	3	3	3	2	3	-	-	2	1	1	-	1	3	3	1
Average	3	3	2.6	2	2.2	-	3	2	1	1.3	-	1	3	3	1

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
IT23D31	**Deep Learning Concepts** Common to IT, CSE, CSE(CS)	PE	3	0	0	3

Objectives:
• To understand the fundamental principles, theory and approaches for learning with deep neural networks.
• To learn the main variants of deep learning (such convolutional and recurrent architectures), and their typical applications \
• To understand the key concepts, issues and practices when training and modelling with deep architectures
• To understand how deep learning fits within the context of other ML approaches
• To evaluate and optimize deep learning models

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

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

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

- Problem solving sessions
- Capstone Projects
- Activity Based Learning

SUGGESTED EVALUATION METHODS

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

Text Book(s):

1.Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", The MIT Press , Nov 2016

2. Rajiv Chopra, "Deep Learning: A Practical Approach", Khanna Publication , 1st Edition, Jan 2018.

3. Charu C. Aggarwal , Neural Networks and Deep Learning, Springer International Publishing AG, 2023.

4. J Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley, 2021.

Reference Books(s) / Web links:

1. MOOC, Deep Learning By Google, https://in.udacity.com/course/deep-learning--ud730

2. MOOC, Deep Learning https://www.coursera.org/specializations/deep-learning

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PSO2	PSO3
IT23D31.1	3	2	3	-	1	-	-	1	2	2	3	3	3	2	2
IT23D31.2	3	2	3	-	2	-	-	-	1	2	2	2	3	2	2
IT23D31.3	3	2	3	-	1	-	-	1	-	2	2	2	3	2	2
IT23D31.4	3	2	3	-	2	-	-	-	1	2	1	1	3	1	2
IT23D31. 5	3	2	3	-	1	-	-	1	-	2	2	1	3	1	2
Average	3	2	3	-	1.4	-	-	1	1.3	2	2	1.8	3	1.7	2

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

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
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 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. Datasets: a. Kaggle Sentiment Analysis Dataset. b. LibriSpeech Dataset for speech data. c. Custom recordings of feedback using PyAudio or mobile apps. 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. Datasets: a. BBC News Classification Dataset (pre-classified news articles). b. Newsgroups Dataset (multi-category news data). 3. Spam Email Detection Using Machine Learning and Word Embeddings" 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. Datasets: a. SpamAssassin Public Dataset. b. 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**	**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**
AD23B32.1	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
AD23B32.2	**3**	**3**	**2**	**2**	**3**	**1**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**2**	**2**
AD23B32.3	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**2**	**3**
AD23B32.4	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**
AD23B32.5	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
Average	**2.8**	**2.8**	**2.6**	**2.6**	**2.8**	**1.8**	**1.4**	**1.4**	**2.2**	**2**	**1.8**	**2.6**	**3**	**2.2**	**2.2**

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

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23A31	Business Analytics	PE	2	0	2	3

Objectives:
● Understand the Fundamentals of Business Analytics.
● Develop Spreadsheet Proficiency for Analytics.
● Master Data Visualization Techniques.
● Learn Descriptive Statistical Analysis.
● Explore Probability Distributions and Data Modeling.

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

List of Experiments	
1.	Excel essentials: Introduction to the Interface an Source Data Formatting Navigation Shortcuts Format Painter Insert Delete Rows and Columns Autofill Data Sorting Filtering Custom Lists
2	Excel Formulas Logical Formulas IF & IFS Formulas Statistical Formulas Lookup Formulas Index and Match Switch Text Formulas Date and Time Formulas
3	Excel Data Visualization Inserting a Chart in Excel

	Changing Elements in a Chart Select Data Method Format Chart Elements Line Chart, Area Chart, Pie Chart, Donut Chart, Histogram & Pareto Chart, Waterfall Chart, Heat Maps, Combo Chart, Sparkline Dynamic Charts Funnel Chart, Slope Chart, Dumbbell Chart Highlight Points in Time Highlight Min and Max Actual vs Target	
4	Excel Pivot Table Introduction to the Source Data Inserting a Pivot Table Understanding the Field List Clear, Select and Move Functions Refreshing Pivot Table Number Formatting in Pivot Table Conditional Formatting in Pivot Table Sorting in Pivot Table Filtering in Pivot Table Grouping in Pivot Table Pivot Table Layouts Table Styles and Other Important Options Summarize Values By Calculated Fields Pivot Charts Slicers	
5	Mini Project	
	Contact Hours:	**30**
	Total Contact Hours:	**60**

Course Outcomes: On completion of the course, the students will be able to
● Apply Business Analytics Techniques.
● Utilize Advanced Excel Functions.
● Create and Interpret Data Visualizations.
● Perform Descriptive Statistical Analysis.
● Model Business Scenarios Using Probability.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A31.1	2	2	3	1	1	-	-	-	1	2	1	1	3	2	1
CS23A31.2	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CS23A31.3	2	2	3	3	2	-	-	-	3	1	1	3	3	1	2
CS23A31.4	2	1	1	2	2	-	-	-	3	3	2	1	1	3	1
CS23A31.5	2	3	2	3	2	-	-	-	3	3	1	3	3	1	1
Average	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2	2.8	1.6	1.4

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
AD23A37	**Image and Video Analytics**	**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 FaceNet Gesture Recognition.		
UNIT V	**VIDEO ANALYTICS**	**6**
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem - ResNet architecture-ResNet 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: "-"

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
AD23B31	Image Processing and Computer Vision	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 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 transformations - Photometric image formation - The digital camera- Image processing - Point operators - Linear filtering -More neighborhood operators -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 and energy-based methods - 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 – Online Prediction- Example		
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:
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Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AI23A36	BIG DATA ANALYTICS	PE	2	0	2	3

Objectives:	
•	To understand the basic concepts of big data and Hadoop.
•	To have knowledge on accessing , storing and manipulating the huge data from different sources.
•	To implement Map-Reduce programs for processing big data.
•	To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
•	To analyze big data using machine learning techniques.

UNIT I	INTRODUCTION TO BIG DATA	6
Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data,Typical data warehouse and Hadoop environment. **Big Data Analytics:** Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools , NoSQL, Hadoop.		
UNIT-II	**HADOOP AND MAP REDUCE**	**6**
Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator). **Introduction to Map Reduce Programming:** Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.		
UNIT III	**MONGODB**	**6**
Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.		
UNIT IV	**FUNDAMENTALS OF APACHE PIG, HIVE**	**6**
Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). **Introduction to Pig:** What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.		
UNIT V	**SPARK AND DATA ANALYSIS**	**6**
Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. **Text, Web Content and Link Analytics:** Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph		
	Contact Hours : 30	

List of Experiments	
1.	Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories, Retrieving files, Deleting files and directories. **Note:** A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

2.	Develop a MapReduce program to implement Matrix MultiplicationSuggested Dataset: Iris Dataset			
3.	Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.			
4.	Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.			
5.	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB			
6.	Pig Latin scripts to sort, group, join, project, and filter the data			
7.	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.			
8.	Implement a word count program in Hadoop and Spark.			
9.	Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample data.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes:	
On completion of the course, the students will be able to	
•	Identify and list various Big Data concepts, tools and applications.
•	Develop programs using HADOOP framework.
•	Learn the working principles of big data management using MongoDB
•	Use Hadoop Cluster to deploy Map Reduce jobs, PIG,HIVE and Spark programs
•	Analyze the given data set and identify deep insights from the data set.

Text Books:	
1	Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2	Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

Reference Books:	
1	Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
2	Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016.
3	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition
4	Mohammed Guller, "Big Data Analytics with Spark", Apress, 2015

Web Links:	
1	https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
2	https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
3	https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&index=4
4	https://www.youtube.com/watch?v=GG-VRm6XnNk
5	https://www.youtube.com/watch?v=JglO2Nv_92A

CO - PO – PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI23A36.1	3	3	2	2	1	-	-	1	-	-	-	1	3	3	1
AI23A36.2	3	3	2	2	2	-	-	2	-	-	-	1	3	3	2
AI23531.3	3	3	3	2	2	-	-	2	-	-	-	1	3	3	1
AI23A36.4	3	3	3	2	3	1	1	2	1	1	-	1	3	3	3
AI23A36.5	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
AI23632	**NATURAL LANGUAGE PROCESSING**	**PE**	**2**	**0**	**2**	**3**

Objectives:

- To introduce the fundamental concepts of Natural Language Processing (NLP for analysing words based on statistical measures and CORPUS.
- To understand the principles of morphological analysis and language modeling using finite state machines and n-gram models.
- To explore vector semantics and learn how to represent words and their relationships through embeddings and similarity measures.
- To analyze and implement Hidden Markov Models (HMMs) and their applications in Part-Of-Speech (POS) tagging
- To study the architecture of transformers and large language models, including pre-training and evaluation techniques.

UNIT-I	**INTRODUCTION TO NATURAL LANGUAGE PROCESSING**	**6**
Introduction to NLP - Various stages of NLP –NLP Pipeline, The Ambiguity of Language: Parts of Speech, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language: Cross entropy, Text Prepossessing: Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis		
UNIT-II	**MORPHOLOGY AND LANGUAGE MODELLING**	**6**
Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.Bag of words, skip-gram, Continuous Bag-Of-Words, N gram model, n -gram Models over Sparse Data: Bins: Forming Equivalence Classes- - Statistical Estimators- Combining Estimators		
UNIT-III	**VECTOR SEMANTICS AND EMBEDDINGS**	**6**
Lexical Semantics-Vector Semantics-Words and Vectors-Cosine for measuring similarity- TF-IDF: Weighing terms in the vector- Pointwise Mutual Information (PMI) -Applications of the TF-IDF or PPMI vector models- Word2vec -Visualizing Embeddings-Semantic properties of embeddings-Bias and Embeddings-Evaluating Vector Models		
UNIT-IV	**MARKOV MODEL AND POS TAGGING**	**6**
Markov Model: Hidden Markov model, Three Fundamental questions of HMM, Implementation properties, and Variants of HMMs, Multiple input observation. **POS**: The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging.		
UNIT-V	**TRANSFORMERS AND LARGE LANGUAGE MODELS**	**6**
The Transformer - Attention-Transformer Blocks- Parallelizing computation using a single matrix X , The input: embeddings for token and position-The Language Modeling Head - Large Language Models : Large Language Models with Transformers -Sampling for LLM Generation -Pretraining Large Language Models -Evaluating Large Language Models		

	Contact Hours	**:**	**30**

List of Experiments	
1.	Develop a morphological analyzer to process and analyze various sentence structures, including interrogative, declarative, and complex sentences with conjunctions. Perform word segmentation and sentence segmentation as part of the analysis. **Suggested Dataset/Corpus: Universal Dependencies (UD) English Treebank**
2.	Design a basic NLP pipeline to preprocess raw text data by performing tokenization, sentence segmentation, and part-of-speech (POS) tagging. Automate the pipeline to process large-scale text efficiently. **Suggested Dataset/Corpus: Universal Dependencies (UD) English Treebank**
3.	Implement a Named Entity Recognition (NER) system using Python libraries such as spaCy or NLTK. Utilize a pre-trained model to extract named entities, including people, organizations, and locations, from a text corpus. **Suggested Dataset/Corpus**: **CoNLL-2003 NER Dataset**
4.	Construct unigram, bigram, and trigram models to analyze their performance on sparse data. Compare the language models based on perplexity and their effectiveness in predicting word sequences. **Suggested Dataset/Corpus**: **The Brown Corpus**
5.	Implement n-gram language models (unigram, bigram, trigram, etc.) and apply smoothing techniques like Laplace smoothing to address data sparsity. Evaluate the models on a large text corpus for accuracy and perplexity. **Suggested Dataset/Corpus**: **Google Ngram Dataset**
6.	Design a spelling correction model using a combination of morphological rules and n-gram probabilities. Test the model on a dataset containing deliberately misspelled words and compare it to established spell-check systems. **Suggested Dataset/Corpus**: **Birkbeck Spelling Error Corpus**
7.	Implement the Term Frequency-Inverse Document Frequency (TF-IDF) model and use cosine similarity to compare the similarity between documents in a given corpus. Visualize the similarity matrix for better insight. **Suggested Dataset/Corpus**: **20 Newsgroups Dataset**
8.	Train a Word2Vec model on a given text corpus and visualize the resulting word embeddings using dimensionality reduction techniques like t-SNE or PCA. Analyze the semantic relationships between words in the embeddings. **Suggested Dataset/Corpus**: **Text8 Dataset**
9.	Build a Hidden Markov Model (HMM) for part-of-speech (POS) tagging. Train the model on a tagged corpus and evaluate its accuracy on a test dataset. **Suggested Dataset/Corpus**: **Universal Dependencies (UD) Treebank**
10.	Use a pre-trained Transformer model (e.g., BERT) to build a sentiment analysis model. Fine-tune the model on a dataset of tweets, classify sentiment (positive, neutral, negative), and evaluate its performance using accuracy and F1-score. **Suggested Dataset/Corpus**: **Sentiment140 Dataset**
11	Use a pre-trained language model to perform sentiment analysis or keyword extraction on a dataset of WhatsApp chat data. Analyze the conversational patterns, emotions, and key topics discussed in the chats. **Suggested Dataset/Corpus**: **WhatsApp Chat Export (User-Generated Data)**
12	Implement a question-answering system using a pre-trained BERT model. Input a passage and a question, and use the model to extract the correct answer from the passage. Evaluate the system on accuracy and relevance of the answers. **Suggested Dataset/Corpus**: **SQuAD (Stanford Question Answering Dataset)**
13	**Mini Project** • Choose a Topic: Identify a deep learning problem of interest, such as image classification, text generation, or anomaly detection. • Research related works 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	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Analyze the different stages in the NLP pipeline and perform statistical analysis on the data.
•	Apply morphological analysis techniques and construct n-gram models for language processing.
•	Evaluate the effectiveness of word embeddings and semantic vector models
•	Implement and analyze Hidden Markov Models (HMMs) for Part-Of-Speech (POS) tagging and compare their effectiveness..
•	Design and evaluate transformer-based large language models for text generation and other NLP applications

Textbooks:	
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),1st edition, Pearson,2024

Reference Books:	
1	Christopher D. Manning and HinrichSchutze, "Foundations of Natural Language Processing", 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003 2009.
2	NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
3	James Allen "Natural Language Understanding", Pearson Publication, 8th Edition. 2012
4	Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2nd edition, 2019.
5	Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2016
6	Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI23632.1	3	3	2	2	3	2	1	2	2	2	2	3	3	2	2
AI23632.2	3	3	2	2	3	2	1	1	2	2	2	3	3	2	3
AI23632.3	3	3	3	2	3	2	1	2	2	2	2	3	3	3	3
AI23632.4	3	3	3	2	3	2	1	2	2	2	2	3	3	3	2
AI23632.5	3	3	3	3	3	2	1	2	3	3	3	3	3	3	3
Average	3	3	2.6	2	2.2	1	1	1.8	1	1	2.2	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: "-"

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).		
	Contact Hours:	**30**

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

8	Develop simple MR enabled gaming applications.	
	Contact Hours:	**30**
	Total Contact Hours:	**60**

Course Outcomes: On completion of the course, the students will be able to
● Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences.
● The strength of how VR and AR systems work.
● Choose, develop, explain, and defend the use of particular designs for AR and VR experiences.
● Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.
● Identify and examine state-of-the-art AR and VR design problems and solutions from the industry and academia.

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 Course)	Category	L	T	P	C
CD23C22	Data Visualization	PE	0	0	6	3

Objectives:	
●	To introduce students to Excel's basic and advanced data visualization techniques.
●	To familiarize students with Tableau.
●	To develop skills in using Power BI.
●	To enable students to design comprehensive visual dashboards.
●	To apply knowledge through a capstone project.

List of Experiments			
Excel for Data Visualization			
1	**Data Manipulation and Cleaning** • Using Functions and formulae for Data Cleaning. • Sorting, Filtering and Data Validation techniques.		
2	**Excel Charts and Tools** • Getting started with charts (Bar, Line, Pie). • Advanced charts (Histograms, Box plots, Area Chart, Bubble chart).		
3	**Excel Advanced Features** • Using PivotTables for data analysis. • Dynamic Dashboards with Slicers and Timeline.		
Data Visualization with Tableau			
4	**Getting Started with Tableau** • Connecting to data and basic visualizations. • Interactive Dashboards and Storytelling. • Filters, Pages, Hierarchies, Sorting and Dates.		
5	**Advanced Data Manipulation Techniques** • Calculated fields and parameters. • Calculations and Expressions -Total and Aggregations, Automatic and Custom split. • Organizing Data and Visual Analytics – Reference lines and bands, Clusters, Forecasting, Trend lines, Summary Card.		
Data Visualization with Power BI			
6	**Introduction to Power BI** • Getting started with Data importing and transforming with Power Query. • Report designing with basic visualizations and using the visualization pane. • Measures, Filters. • Features of Power BI- Drill through, Hierarchies.		
7	**Advanced Power BI** • DAX. • Creating complex reports and dashboards.		
8	**Capstone Project -** Students will select a real-world dataset and use any tools (Excel, Tableau, and Power BI) to create comprehensive dashboards.		
		Total Contact Hours	**:90**	**90**

Course Outcomes: On completion of the course you will be able to	
•	Create basic and advanced visualizations in Excel for data analysis.
•	Develop interactive dashboards and perform data manipulations in Tableau.
•	Design reports and apply DAX for advanced reporting in Power BI.
•	Integrate and organize data to create comprehensive dashboards using various visualization tools.
•	Apply their learning to solve real-world data visualization problems using Excel, Tableau, and Power BI.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD23C32.1	3	2	2	1	2	-	-	-	-	-	-	-	3	2	1
CD23C32.2	3	3	2	2	3	1	-	-	-	-	-	-	3	3	2
CD23C32.3	3	2	3	2	3	-	1	-	-	-	-	-	3	3	2
CD23C32.4	3	3	3	2	3	-	1	1	-	-	-	-	3	3	3
CD23C32.5	3	3	3	3	3	2	2	1	1	1	2	1	3	3	3
Average															

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:
● To understand the history and overview of game design
● To develop the Game design document
● To apply the concepts of game loop, collision detection and Cameras
● To understand the concepts of graphics in game design
● 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		
	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
● Understand the history and overview of game design
● Understand and develop the game design document
● Understand the collision mechanism, cameras and game loops
● Analyse and apply graphic design approaches for designing an game
● 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 Book(s) / Web link(s):	
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A39.1	3	2	1	2	2	2	-	1	1	2	-	2	3	2	1
CS23A39.2	3	3	2	3	3	1	1	2	2	2	-	3	3	3	2
CS23A39.3	2	3	3	3	3	2	-	2	2	3	-	3	3	3	3
CS23A39.4	3	3	2	3	2	2	-	2	2	2	-	3	3	3	2
CS23A39.5	3	2	2	3	2	2	2	1	2	2	1	3	3	2	3
Average	2.8	2.6	2	2.8	2.4	1.8	1.5	1.6	2.6	2.2	1	2.8	3	2.6	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
Common for B.E Programme CSE, CSE(CS) and B.Tech Programme in IT						

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

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: On completion of the course, the students 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 Books:

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

Reference Books:

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., Khazanchi, 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	1	2	2	2	-	3	1	2	-	2	3	2	1
CS23B31.2	3	3	2	3	3	1	1	2	2	2	-	3	3	3	2
CS23B31.3	2	3	3	3	3	2	-	2	2	3	-	3	3	3	3
CS23B31.4	2	3	2	3	2	2	-	3	2	2	-	3	3	3	2
CS23B31.5	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	2.6	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
IT23E31	**Graphics and Multimedia**	**PE**	3	0	0	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**	9
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**	9
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**	**9**
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**	**9**
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**	**9**
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:45

Course Outcomes:
• 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) (UNIT/ Module Wise) – Could suggest topic

- Problem solving sessions
- Flipped classroom - Comparing SOA with Client-Server and Distributed architectures
- Survey on various storage technologies
- Activity Based Learning
- Implementation of small module

SUGGESTED EVALUATION METHODS

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

Text Book(s):
1.Donald Hearn and Pauline Baker M, "Computer Graphics", 2nd Edition, Prentice Hall, 2014.
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. Hughies, 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 (Lab Oriented Theory Course)	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 measured.

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

UNIT V	DIGITAL TRANSFORMATION	6
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.		
	Contact Hours:	**30**

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

Course Outcomes: On completion of the course, the students will be able to
● To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
● To focusses on how digital marketing can be utilised by organisations and how its effectiveness can measured.
● To know the key elements of a digital marketing strategy
● To study how the effectiveness of a digital marketing campaign can be measured .
● To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 course)	Category	L	T	P	C
CD23721	**Visual Effects**	**PE**	**0**	**0**	**6**	**3**

Objectives:
● To Undestand the basic principles of visual effects, including CGI, compositing, and integration with liveaction footage.
● To learn how to combine multiple elements (live-action,CGI, background) seamlessly into a single frame.
● To explore techniques for creating and animating 3D models and environments for VFX projects.
● To understand how to track motion in footage to integrate 3D elements effectively with real-world video.
● To learn to simulate natural phenomena such as fire, smoke,water, nd explosions for realistics effects.

	LIST OF EXPERIMENTS
	GREEN SCREEN COMPOSITING
1	**Green Screen Compositing** **Tools:** Adobe After Effects, Nuke, or DaVinci Resolve. **Experiment Variants:** Experiment with different lighting setups on the green screen to minimize spill and maximize keying quality.
2	**Rot scoping Techniques** **Tools:** After Effects, Nuke, Mocha. **Focus Areas:** Vary the complexity by tracking subjects with different motions and adding elements behind or in front of the rotoscoped layer
3	**Motion Tracking and Match Moving** **Tools:** After Effects, Blender, Cinema 4D.

	Variants: Try planar tracking for surfaces and 3D tracking to simulate the camera movement for more immersive VFX scenes
4	Particle Simulation for Environmental Effects **Tools:** Blender, Houdini, Maya. **Experiment Variants:** Adjust particle behaviour to control effects like the density of snow or smoke spread based on environmental conditions
5	**Dynamic Lighting and Shadow Matching** **Tools:** Maya, Blender, or Nuke. **Experiment Variants:** Test different lighting angles, intensities, and shadow softness to match the original footage's conditions.
6	**Physics-Based Animation** **Tools:** Blender, Houdini, Cinema 4D. **Focus:** Experiment with gravity, elasticity, and friction settings to see how they impact object interactions.
7	**Time Manipulation Effects** **Tools:** After Effects, Premiere Pro. **Variants:** Test speed-ramping (changing speeds mid-shot) and frame blending to make fast actions smoother or simulate slow-motion effects
	Total Contact Hours | **90**

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CD23721.1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CD23721.2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CD23721.3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CD23721.4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CD23721.5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-
Average	2	2.5	2	1.8	2	-	1	2	3	2	2	2.2	2	2.4	2

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High) No Correlation: "_"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CD23731	Film Making and Radio Podcasting	PE	2	0	2	3

Objectives:
• To understand the fundamentals of visual storytelling, including scriptwriting and storyboarding.
• To learn the technical aspects of camera operations, lighting, and shot composition.
• To learn technical aspects of audio recording, mixing, and editing.
• To design and produce a variety of radio content such as interviews, advertisements, and podcasts.
• 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		
	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.	
	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
• Students understand the conceptual process of Radio Production.
• Students evaluate the complexities of Radio Production as a means of mass communication.
• Students create the Radio scripts and other practical implications of the radio production.
• Students evaluate the complexities of the Radio Broadcasting in detail.
• 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:1st, 2024.
2	Steven D. Katz, "Film Directing Shot by Shot: Visualizing from Concept to Screen", Routledge, edition: 1st, 2024.
3	David F. O'Connell, "Radio Production", Oxford University, Edition:2nd,2022.
4	Andrew Thom's, "The Radio Producer's Handbook", Sage Publications,dition:1st, 2023**.**

Reference Book(s):	
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
4	https://www.amazon.com/Directing-Techniques-Aesthetics-Michael-Rabiger/dp/1285428982

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CD23731.1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CD23731.2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CD23731.3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CD23731.4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CD23731.5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-
Average	2	2.5	2	1.8	2	-	1	2	3	2	2	2.25	2	2.4	2

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (high) No Correlation-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS23A34	**User Interface Design**	**PE**	2	0	2	3

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

UNIT I	INTRODUCTION	6
An overview of the user interface. Human factors in interface design: memory, chunking, recognition vs. recall. User interface design principles: user familiarity, consistency, minimal surprise, recoverability, user guidance, user diversity. Characteristics of Graphical User Interface: command line, menu selection, form fill-in, direct manipulation, anthropomorphic. Models of user interface - Generation of user interfaces-Graphical User Interface (GUI), Web User Interface (WUI), Voice User Interfaces (VUI), Tangible User Interfaces (TUI), Ubiquitous User Interfaces(UUI. Next generation of user interfaces.		
UNIT II	**INTERFACE DESIGN METHODS**	**6**
Interface Design Methods: Characteristics of a GUI. Information presentation. Interaction styles. Direct manipulation. Direct Manipulation advantages. Indirect manipulation. Command interfaces. Problems with command interfaces. Command languages. Natural language interfaces. User interface design process. Lifecycle models. A simple		

interaction design model. Traditional 'waterfall' life cycle. A life cycle for RAD (Rapid Applications Development). The Star lifecycle model. Usability engineering lifecycle model: features. Menu systems. Problems with menu systems. Multiple user interfaces. Help and message system. Guidelines for error messages. Task analysis and modeling. Content analysis. Work environment analysis.		
UNIT-III	**IMPLEMENTATION OF GRAPHICAL USER INTERFACES**	**6**
Correctly designed software- Software layers. Widgets, buttons, callbacks. Working principles of widgets. Project plan. UI design. Low-level prototypes. Evaluation: user-centered. Users' steps.Evolving user understanding. Result. Colors. Layout.		
UNIT IV	**DIALOG AND STORYBOARDS**	**6**
Alignment on grids. I/O. Dialogs. Dialogs and storyboards. Input prototyping and design. Checks for inputs. Output. Data visualization. Examples. Challenges of visualization. Error messages.		
UNIT-V	**TESTING AND USABILITY ASSESSMENT**	**6**
Testing and Usability Assessment: User interface evaluation. Guiding principles for evaluation. Simple evaluation techniques. Process of evaluation. Approaches to evaluation. User observation. Preparing for user observation. Advantages of observation. Disadvantages of observation. Observation research tips. Importance of usability. Usability testing. Usability testing methods. Qualitative vs. Quantitative observation. Usability attributes. Testing. Formal vs. informal testing. Testing basics process		
	Total Contact Hours :	**30**

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

14.	Perform usability testing on a small application, observing user interactions and documenting issues	OBS Studio for recording, Excel for data analysis.
15.	Execute both formal (structured) and informal (ad hoc) testing on a web application. Compare results.	Selenium, Jupyter Notebook
	Contact Hours:	**30**
	Total Contact Hours:	**60**

Suggested Activities:
● Assignment problems, Quiz. ● Class presentation/Discussion
Course Outcomes: On completion of course you will be able to
● Understand the importance of user interface and benefits of good design.
● Understand the user interface design process and business function
● Understand the types of system menus and navigation schemes.
● Understand the characteristics of windows and device based controls.
● Understand the screen based controls and kinds of tests.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A34.1	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS23A34.2	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS23A34.3	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS23A34.4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS23A34.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3	3	2.75	2.6	2.25	2.8	2.75	3	3	2.67	3	2.67	3	3

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High) No Correlation: "_"

Emerging Technologies

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS23A31	Business Analytics	PE	2	0	2	3

Objectives:
● Understand the Fundamentals of Business Analytics.
● Develop Spreadsheet Proficiency for Analytics.
● Master Data Visualization Techniques.
● Learn Descriptive Statistical Analysis.
● Explore Probability Distributions and Data Modeling.

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

List of Experiments	
1.	Excel essentials: Introduction to the Interface an Source Data Formatting Navigation Shortcuts Format Painter Insert Delete Rows and Columns Autofill Data Sorting Filtering Custom Lists
2	Excel Formulas Logical Formulas IF & IFS Formulas Statistical Formulas Lookup Formulas Index and Match Switch Text Formulas Date and Time Formulas
3	Excel Data Visualization Inserting a Chart in Excel

	Changing Elements in a Chart Select Data Method Format Chart Elements Line Chart, Area Chart, Pie Chart, Donut Chart, Histogram & Pareto Chart, Waterfall Chart, Heat Maps, Combo Chart, Sparkline Dynamic Charts Funnel Chart, Slope Chart, Dumbbell Chart Highlight Points in Time Highlight Min and Max Actual vs Target	
4	Excel Pivot Table Introduction to the Source Data Inserting a Pivot Table Understanding the Field List Clear, Select and Move Functions Refreshing Pivot Table Number Formatting in Pivot Table Conditional Formatting in Pivot Table Sorting in Pivot Table Filtering in Pivot Table Grouping in Pivot Table Pivot Table Layouts Table Styles and Other Important Options Summarize Values By Calculated Fields Pivot Charts Slicers	
5	Mini Project	
	Contact Hours:	**30**
	Total Contact Hours:	**60**

Course Outcomes: On completion of the course, the students will be able to
● Apply Business Analytics Techniques.
● Utilize Advanced Excel Functions.
● Create and Interpret Data Visualizations.
● Perform Descriptive Statistical Analysis.
● Model Business Scenarios Using Probability.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A31.1	2	2	3	1	1	-	-	-	1	2	1	1	3	2	1
CS23A31.2	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CS23A31.3	2	2	3	3	2	-	-	-	3	1	1	3	3	1	2
CS23A31.4	2	1	1	2	2	-	-	-	3	3	2	1	1	3	1
CS23A31.5	2	3	2	3	2	-	-	-	3	3	1	3	3	1	1
Average	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2	2.8	1.6	1.4

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

Subject Code	Subject Name	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

C**ourse Outcomes:** On completion of the course, students will be able to:
● Start working as Junior RPA Developers.
● Understand the fundamental principles of robotic process automation.
● Become familiar with and gain a thorough knowledge of UiPath's software tools.
● Design and build automation robots for business tasks on their own.
● Successfully pass the UiPath Automation Developer Associate v1.0 certification exam.

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

	Reference Books:
1.	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.
2.	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, Tom 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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
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 (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		
	Total 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: On completion of course you 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

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

Textbooks:	
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 Certfied 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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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:"_"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS23A34	User Interface Design	PE	2	0	2	3

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

UNIT I	INTRODUCTION	6
An overview of the user interface. Human factors in interface design: memory, chunking, recognition vs. recall. User interface design principles: user familiarity, consistency, minimal surprise, recoverability, user guidance, user diversity. Characteristics of Graphical User Interface: command line, menu selection, form fill-in, direct manipulation, anthropomorphic. Models of user interface - Generation of user interfaces-Graphical User Interface (GUI), Web User Interface (WUI), Voice User Interfaces (VUI), Tangible User Interfaces (TUI), Ubiquitous User Interfaces(UUI. Next generation of user interfaces.		
UNIT II	**INTERFACE DESIGN METHODS**	**6**
Interface Design Methods: Characteristics of a GUI. Information presentation. Interaction styles. Direct manipulation. Direct Manipulation advantages. Indirect manipulation. Command interfaces. Problems with command interfaces. Command languages. Natural language interfaces. User interface design process. Lifecycle models. A simple interaction design model. Traditional 'waterfall' life cycle. A life cycle for RAD (Rapid Applications Development). The Star lifecycle model. Usability engineering lifecycle model: features. Menu systems. Problems with menu systems. Multiple user interfaces. Help and message system. Guidelines for error messages. Task analysis and modeling. Content analysis. Work environment analysis.		
UNIT-III	**IMPLEMENTATION OF GRAPHICAL USER INTERFACES**	**6**
Correctly designed software- Software layers. Widgets, buttons, callbacks. Working principles of widgets. Project plan. UI design. Low-level prototypes. Evaluation: user-centered. Users' steps.Evolving user understanding. Result. Colors. Layout.		
UNIT IV	**DIALOG AND STORYBOARDS**	**6**
Alignment on grids. I/O. Dialogs. Dialogs and storyboards. Input prototyping and design. Checks for inputs. Output. Data visualization. Examples. Challenges of visualization. Error messages.		
UNIT-V	**TESTING AND USABILITY ASSESSMENT**	**6**
Testing and Usability Assessment: User interface evaluation. Guiding principles for evaluation. Simple evaluation techniques. Process of evaluation. Approaches to evaluation. User observation. Preparing for user observation. Advantages of observation. Disadvantages of observation. Observation research tips. Importance of usability. Usability testing. Usability testing methods. Qualitative vs. Quantitative observation. Usability attributes. Testing. Formal vs. informal testing. Testing basics process		
	Total Contact Hours :	**30**

Experiment No:	Title	Tools
1	Design a UI where users recall visual elements (e.g., icons or text chunks). Evaluate the effect of chunking on user memory.	Pencil Project, Figma.
2.	Develop and compare CLI, GUI, and Voice User Interfaces (VUI) for the same task and assess user satisfaction.	Python (Tkinter for GUI, Speech Recognition for VUI), Terminal
	Create a prototype with familiar and unfamiliar navigation	Proto.io, Wireflow

3.	elements. Evaluate ease of use with different user groups.	
4	Design two interfaces: one with direct manipulation (drag-and-drop) and another with indirect commands. Compare usability.	JavaScript (with libraries like D3.js), HTML/CSS.)
5.	Conduct task analysis for an app (e.g., online shopping) and document user flows. Create corresponding wireframes.	Lucid chart (free tier), Dia (open source).
6.	Simulate the lifecycle stages for UI design using the RAD model and develop a small interactive interface.	Axure RP, OpenProj.
7.	Implement a form-based GUI using widgets (e.g., radio buttons, text inputs). Add event handling for user interactions.	PyQt, Tkinter.
8.	Experiment with different layouts and color schemes for an app. Collect user feedback on aesthetics and usability.	Figma (free version), GIMP (open source for graphics).
9.	Develop low-fidelity paper prototypes for a banking app and convert them into digital wireframes.	Pencil Project, Inkscape.
10.	Create storyboards to represent the user flow for a mobile app (e.g., food delivery app).	Balsamiq, OpenBoard
11.	Design input forms that validate data (e.g., email, phone number) and display error messages.	HTML/CSS, JavaScript (with Validator.js).
12.	Create a data visualization (e.g., pie charts, bar graphs) for an inventory management system.	Java Script
13.	Conduct a heuristic evaluation of a simple website based on Jakob Nielsen's usability principles.	UsabilityHub, Google Sheets for evaluation recording.
14.	Perform usability testing on a small application, observing user interactions and documenting issues	OBS Studio for recording, Excel for data analysis.
15.	Execute both formal (structured) and informal (ad hoc) testing on a web application. Compare results.	Selenium, Jupyter Notebook
	Contact Hours:	**30**
	Total Contact Hours:	**60**

Suggested Activities:

- Assignment problems, Quiz.
- Class presentation/Discussion

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

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

Textbooks:

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

Reference Books (s)/Web links:

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS23A34.1	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS23A34.2	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS23A34.3	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS23A34.4	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS23A34.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3	3	2.75	2.6	2.25	2.8	2.75	3	3	2.67	3	2.67	3	3

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

Subject Code	Subject Name (Lab Oriented Theory course)	Category	L	T	P	C
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:	
On completion of course you will be able to	
•	Understand the fundamentals of web application security
•	Apply security principles in developing a secure web application
•	Identify common web vulnerabilities that are exploited by hackers
•	Identify the secure model for web application development and deployment
•	Apply best practices for mitigations of vulnerabilities

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

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

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

CO-PO-PSO Matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CR23A35.1	3	2	-	2	3	2	-	2	-	-	-	2	3	-	-
CR23A35.2	3	3	3	2	3	2	-	2	1	2	-	2	3	2	-
CR23A35.3	3	3	2	3	3	2	-	2	1	2	-	2	3	2	-
CR23A35.4	3	3	3	3	3	2	-	2	1	2	-	2	3	3	2
CR23A35.5	3	3	3	3	3	2	2	3	2	3	2	3	3	3	3
Average	3	2.8	2.8	2.6	3	2	2	2.2	1.3	2.3	2	2.2	3	2.5	2.5

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

Subject Code	Subject Name (Lab Oriented Theory course)	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
Coordinate systems: Geometric co-ordinate systems - Cartesian, Cylindrical and Spherical coordinate systems. Display co-ordinate systems - Global, Local, View and Screen coordinate systems. 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.		
UNIT II	**STL FILE FORMAT AND MANIPULATION**	**6**
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.		

UNIT-III	3D PRINTING PROCESSES	6
Vat photo polymerization, Material jetting, Binder jetting, Powder bed fusion, Material extrusion, Directed energy deposition, Sheet lamination, 3D printing Processes limitations and Industrial applications.		
UNIT IV	**INKJET TECHNOLOGY**	**6**
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.		
UNIT-V	**LASER TECHNOLOGY**	**6**
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.		
	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 ▪ Mobile Stand ▪ 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: On completion of course you will be able to
● Outline and examine the basic concepts of 3D Printing technology suing CAD software
● Outline of File Format and manipulation
● Students can able to understand the basics 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

Textbooks:	
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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
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:	
On completion of course you 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:	
On completion of course you will be able to	
•	Tutorial problems.
•	Assignment problems.
•	Quizzes
•	Class presentation/Discussion

Reference Books (s)/Web links:	
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
2.	Don and Tapscott, Alex, "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World", 2018, Penguin
3.	Andreas M. Antonopoulos, "Internet of Money", 2018
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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**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: "-"

Course Code	Subject Name (Theory Course)	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: On completion of the course, the students 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	M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Edition, 2010.
2	Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

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

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	2	-	-	-	-	2	2	3	3	1
CO2	3	3	3	3	2	1	-	-	-	-	2	2	3	3	1
CO3	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
CO4	3	3	2	3	2	1	-	-	-	-	1	1	3	3	1
CO5	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
Average	3.0	3.0	2.4	2.6	2.2	1.2	-	-	-	-	1.4	1.4	3.0	3.0	1.0

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

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

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
IT23C31	**Software Testing**	**PC**	**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

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

Course Outcomes:

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

- 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, Addision 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 Course)	Category	L	T	P	C
IT23B33	**DevOps**	**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		
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 Kubernets.
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: Students will be able to
• Apply DevOps principles and lifecycle workflows to software development.
• Build and manage CI/CD pipelines for application development and deployment.
• Utilize tools like Docker and Kubernetes for containerization and orchestration.
• Implement DevSecOps practices for secure and reliable deployments.
• Demonstrate advanced DevOps practices such as blue-green deployment and testing.

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

- Lab assessment:
- Quizzes and Assignments
- Group project

SUGGESTED ACTIVITIES

Case Study:

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

- Code walkthrough:

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

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

Reference Books(s) / Web links:
1. DevOps Tutorial | Microsoft Azure
2. DevOps Fundamentals- Defining DevOps Principles - GitHub - GitHub Resources

CO-PO-PSO Matrices of course

PO/PSO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23B33.1	3	2	2	–	3	–	–	2	3	2	–	–	2	2	–
IT23B33.2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
IT23B33.3	3	3	3	3	3	2	3	3	3	3	2	3	3	3	3
IT23B33.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
IT23B33. 5	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
Average	3	2.8	2.8	3	3	2	3	2.8	3	2.8	2.75	2.8	2. 6	2.8	3

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

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
IT23B31	C# AND .Net Programming	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 .		
	Contact Hours: 30	

List of Experiments	
1	Write a console application that obtains four int values from the user and displays the product. Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a double; the equivalent command to convert from a string to an int is Convert.ToInt32().
2	Write an application that receives the following information from a set of students: Student Id: Student Name: Course Name: Date of Birth: The application should also display the information of all the students once the

	data is Entered. Implement this using an Array of Structures.
3	Write a program to declare a class “staff” having data members as name and post. Accept this data 5 for 5 staffs and display names of staff who are HOD.
4	Write a program to implement multilevel inheritance from following figure. Accept and display data for one student.

5	Write a program to create a delegate called TrafficDel and a class called TrafficSignal with the following delegate methods.
	Public static void Yellow(){
	Console.WriteLine(“Yellow Light Signal To Get Ready”);
	}
	Public static void Green(){
	Console.WriteLine(“Green Light Signal To Go”);
	}
	Public static void Red(){
	Console.WriteLine(“Red Light Signal To Stop”);
	}
	Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array.

6	Write a program to accept a number from the user and throw an exception if the number is not an even number.
7	Create an application that allows the user to enter a number in the textbox named “getnum”. Check whether the number in the textbox “getnum” is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button “check”.
8	Create a project that calculates the total of fat, carbohydrate and protein. Allow the user to enter into text boxes. The grams of fat, grams of carbohydrate and grams of protein. Each gram of fat is 9 calories and protein or carbohydrate is 4 calories. Display the total calories of the current food item in a label. Use 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:

On completion of the course, the students 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 Books(s)
1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4", Wiley, 2012.
2. Andy Wigley, Daniel Moth, Peter Foot, "Mobile Development Handbook", Microsoft Press, 2007.

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

CO-PO-PSO 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:
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Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
IT23A11	**Internet of Things**	**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 IOT ELEMENT		
UNIT III	**INTERNET OF THINGS HARDWARE AND MANAGEMENT**	9
Building blocks of an IoT Device – Raspberry Pi, Arduino – Sensors, Communication Modules: Bluetooth, Zigbee, RFID - Power Sources –Data Management, Business Processes in IoT		
UNIT IV	**IOT PLATFORMS AND CLOUD MANAGEMENT**	9
Physical servers and cloud - XaaS, M2M , WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django – Designing a RESTful Web API –Google cloud for IoT.		
UNIT V	**TOOLS AND APPLICATIONS**	9
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home		
	Contact Hours: 45	

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

- 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 EVALUATION METHODS

- Mini Projects
- Assignment problems
- Quizzes

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.

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 Madisetti and ArshdeepBahga, ―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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IT23A31.1	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A31.2	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A31.3	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A31.4	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
IT23A31. 5	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3
Average	3	3	-	2	3	2	-	-	2	-	1	2	3	2	3

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

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CR23A37	**Linux System Administration**	**PE**	**1**	**0**	**4**	**3**

Objectives:
• To introduce the key role of an Linux Operating system
• To understand the File system Management of an Linux Operating system
• To emphasize the importance of Server Management concepts of an Enterprise Linux Operating system
• Realize the significance of Software repositories and management and explore the Containerized platform offered by the Linux Operating system
• Comprehend the need of Security vulnerability in Linux Operating system

List of Experiments	
1	**Installation**-Introduction to Red Hat Enterprise Linux - 9.x -RHEL - 9 Installation Procedure
2	**Accessing Systems and Obtaining Support** - Edit Text Files from the Shell Prompt - Configuring SSH Key-based Authentication - Getting Help from Red Hat Customer Portal
3	**Navigating File Systems** - Managing Files Using Command-line Tools - Making Links Between Files
4	**Managing Local Users and Groups** - Describing User and Group Concepts - Gaining Superuser Access - Managing Local User Accounts - Managing Local Group Accounts - Managing User Passwords
5	**Controlling Access to Files** - Managing File System Permissions from the Command Line - Managing Default Permissions and File Access
6	**Managing SELinux Security** - Changing the SELinux Enforcement Mode - Controlling SELinux File Contexts - Adjusting SELinux Policy with Booleans - Investigating and Resolving SELinux Issues
7	**Tuning System Performance** - Killing Processes - Monitoring Process Activity - Adjusting Tuning Profiles - Influencing Process Scheduling
8	**Scheduling Future Tasks** - Scheduling Recurring System Jobs - Managing Temporary Files
9	**Installing and Updating Software Packages** - Installing and Updating Software Packages with DNF - Enabling DNF Software Repositories
10	**Managing Basic Storage** - Managing Package Module Streams - Adding Partitions, File Systems, and Persistent Mounts - Managing Swap Space
11	**Controlling Services and the Boot Process** - Identifying Automatically Started System Processes -

	Controlling System Services	
12	**Controlling Services and the Boot Process** - Root Password Break - Selecting the Boot Target - Resetting the Root Password - Repairing File System Issues at Boot	
13	**Analyzing and Storing Logs** - Reviewing Syslog Files - Reviewing System Journal Entries - Preserving the System Journal - Maintaining Accurate Time	
14	**Managing Networking** - Validating Network Configuration - Configuring Networking from the Command Line - Editing Network Configuration Files - Configuring Host Names and Name Resolution	
15	**Accessing Network-Attached Storage** - Managing Network-Attached Storage with NFS -Automounting Network-Attached Storage	
16	**Running containers** - Deploy Containers - Manage Container Storage and Network Manage Container Storage and Network Resources - Managing Containers as System Services	
17	**Managing Network Security** - Managing Server Firewalls	
	Total Contact Hours	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Demonstrate an understanding of the key role and functionalities of the Linux Operating System in computing environments.
●	Apply knowledge of Linux file system management, including directory structures, permissions, and disk management.
●	Configure and manage essential enterprise server services in a Linux environment to ensure system efficiency and availability.
●	Utilize software repositories, package management tools, and containerized platforms to enhance software deployment and scalability.
●	Assess and implement security measures to mitigate vulnerabilities in Linux-based systems.

Text Book(s):

1. Kenneth Hitchcock, "Linux System Administration for the 2020s: The Modern Sysadmin Leaving Behind the Culture of Build and Maintain", APress, 2022.

Reference Books(s):

1. Scott Alan Miller, "Linux Administration Best Practices: Practical Solutions to approaching the design and management of Linux Systems", Packt, 2022.
2. Adam K, Dean, "Linux Administration Cookbook: Insightful recipes to work with system administration tasks on Linux", Packt, 2018.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CR23A37.1	3	2	-	2	3	-	-	-	1	2	-	2	3	2	-
CR23A37.2	3	3	3	2	3	-	-	-	2	3	-	2	3	3	2
CR23A37.3	3	3	2	3	3	-	-	-	2	2	-	2	3	3	3
CR23A37.4	3	3	3	3	3	-	-	-	2	3	-	2	3	3	3
CR23A37.5	3	3	3	3	3	2	-	-	3	3	2	3	3	3	3
Average	3	2.8	2.7	2.6	3	2	-	-	2.5	2.6	2	2.2	3	2.8	2.7

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