COIMBATORE INSTITUTE OF TECHNOLOGY, COIMBATORE – 641 014
(An Autonomous Institution affiliated to ANNA UNIVERSITY, CHENNAI)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
REGULATIONS 2023 CHOICE BASED CREDIT SYSTEM

B. E. Computer Science and Engineering

VISION

To evolve as a leading department in the field of computer science and engineering education which nurtures the students to be globally competent professionals.

MISSION

Mission 1: Imparting value-based technical education to develop globally competent engineers capable of providing secure and "Out-of-the-Box" computing and information technology solutions.

Mission 2: Promoting collaborative learning and research with industry and Research organizations for continuous knowledge transfer and enhancement.

Mission 3: Enabling the graduates to adapt to the rapidly changing technology with strong fundamentals.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: Graduates will acquire sound knowledge in mathematical, scientific, and engineering fundamentals and knowledge in Information and Communication technology to analyze, formulate and solve real-life problems.

PEO 2: Graduates will encompass entrepreneurship skills and the ability to develop, and implement innovative, integrated, and secure information technology solutions with the support of state-of-the-art technology for meeting global challenges and changing requirements.

PEO 3: Graduates will possess a professional and ethical attitude, leadership qualities, a desire for lifelong learning, and the ability to work in multidisciplinary teams in meeting broader societal needs.

PROGRAM OUTCOMES (POs)

Twelve Graduate Attributes as given by NBA as per Washington Accord agreement should be considered for all the UG programmes without any change for POs.

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problemsreaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **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.

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.

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.

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.

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.

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

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

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

11. **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.

12. **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)

PSO1: Able to formulate and analyze real-world problems with the application of AI, ML, Cloud Computing, DevOps, SDN, Computer Vision, Data Analytics, IoT, and Security

PSO2: Able to apply the knowledge gained through Software Engineering, Algorithm analysis, and Database Technologies for Industry and Research projects

MAPPING OF PROGRAMME EDUCATIONAL OUTCOMES WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC COUTCOMES

PEOs	PROGRAMME OUTCOMES												PSOs	
	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
1	3	3	3	3	2	2	2	2	3	3	3	3	3	3
2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	2	2	3	3	3	3	2	3	3	3

B. E. Computer Science and Engineering

CURRICULA AND SYLLABI
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYH111	Technical English	HSC	2	2	0	4	4
2	23FYM115	Matrices and Vector Calculus	BSC	3	1	0	4	4
3	23FYP115	Applied Physics	BSC	3	0	0	3	3
4	23FYC115	Applied Chemistry -I	BSC	3	0	0	3	3
5	23CS111	C Programming	ESC	3	0	0	3	3
PRACTICALS								
1	23FYH122	English Communication Skills Laboratory	BSC	0	0	2	2	1
2	23CS121	Engineering Graphics	BSC	0	0	2	2	1
3	23CS122	C Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
1	23FYH121	Heritage of Tamils	HSC	15 Hours			15 Hours	1
2	23MC101	Induction Programme	MC	15 Days			15 Days	--
3	23MC102	Soft Skills	EEC	15 Hours			15 Hours	--
			TOTAL	14	3	8	25	22

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYM215	Fourier Series and Differential Equations	BSC	3	1	0	4	4
2	23CS211	Electron Devices	BSC	3	0	0	3	3
3	23FYC211	Applied Chemistry -II	BSC	3	0	0	3	3
4	23CS212	Digital Design	ESC	3	0	0	3	3
5	23CS213	Object Oriented Programming	ESC	3	0	0	3	3
PRACTICALS								
1	23CS221	Digital Design Laboratory	ESC	0	0	2	2	1
2	23CS222	Object Oriented Programming Laboratory	ESC	0	0	2	2	1
3	23FPC221	Basic Sciences Laboratory	HSC	0	0	4	4	2
MANDATORY COURSES								
1	23CC221/ 23CC222/ 23CC223/ 23CC224	Co-Curricular Activities-NSS/YRC/RSP/Sports	MC	15 Hours			15 Hours	1
2	23FYC221	Environmental Science and Engineering	HSC	15 Hours			15 Hours	1
3	23FYH222	Tamils and Technology	HSC	15 Hours			15 Hours	1
TOTAL				15	1	08	24	23

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23M315	Linear Algebra and Complex Variables	BSC	3	1	0	4	4
2	23CS311	Data Structures and Algorithms	PCC	3	1	0	4	4
3	23CS312	Discrete Mathematics	BSC	3	0	0	3	3
4	23CS313	Operating Systems	PCC	3	0	0	3	3
5	23CS314	Java Programming	PCC	3	0	0	3	3
PRACTICALS								
1	23CS321	Data Structures and Algorithms Laboratory	PCC	0	0	3	3	1.5
2	23CS322	Operating Systems Laboratory	PCC	0	0	3	3	1.5
3	23CS323	Java Programming Laboratory	PCC	0	0	2	2	1
MANDATORY COURSES								
1	23MC301	Induction Programme	MC	1 Week			1 Week	-
2	23MC321	Human Values and Professional Ethics	MC	15 Hours			15 Hours	1
3	23MC322	Design Thinking	EEC	15 Hours			15 Hours	1
TOTAL				**15**	**2**	**8**	**25**	**23**

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Design and Analysis of Algorithm	PCC	3	1	0	4	4
2	T2	Database Management Systems	PCC	3	0	0	3	3
3	T3	Statistical Data Analysis	BSC	3	0	0	3	3
4	T4	Computer Architecture	PCC	3	0	0	3	3
5	T5	Formal Languages and Automata Theory	PCC	3	0	0	3	3
PRACTICALS								
1	P1	Database Management Systems Laboratory	PCC	0	0	3	3	1.5
2	P2	Design and Analysis of Algorithm Laboratory	PCC	0	0	3	3	1.5
3	P3	Python Programming	BSC	0	0	4	4	2
MANDATORY COURSES								
1	MC1	Value Added Course - I	EEC	15 Hours			15 Hours	-
2	MC2	Community Service and Engineering	MC	15 Hours			15 Hours	-
TOTAL				**15**	**1**	**10**	**26**	**21**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Computer Networks	PCC	3	0	0	3	3
2	T2	Software Engineering	PCC	2	0	2	4	3
3	T3	Compiler Design	PCC	3	1	0	4	4
4	T4	Elective –I	PEC	3	0	0	3	3
5	T5	Elective –II	PEC	3	0	0	3	3
PRACTICALS								
1	P1	Computer Networks Laboratory	PCC	0	0	2	2	1
2	P2	Compiler Design Laboratory	PCC	0	0	3	3	1.5
3	P3	Web Technology Laboratory	PCC	0	0	3	3	1.5
		Inplant Training	EEC	2 weeks			2 weeks	1
MANDATORY COURSES								
1	MC1	Seminar And Technical Writing	EEC	15 Hours			15 Hours	1
2	MC2	Value Added Course - II	MC	15 Hours			15 Hours	-
TOTAL				14	1	10	25	22

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Embedded Systems and Internet Of Things	PCC	3	0	0	3	3
2	T2	Machine Learning	PCC	3	0	0	3	3
3	T3	Data Mining and Data Warehousing	PCC	3	0	0	3	3
4	T4	Elective - III	PEC	3	0	0	3	3
5	T5	Elective - IV	PEC	3	0	0	3	3
PRACTICALS								
1	P1	Embedded Systems & Internet of Things Laboratory	PCC	0	0	3	3	1.5
2	P2	Machine Learning Laboratory	PCC	0	0	3	3	1.5
3	P3	Exploratory Data Analysis Laboratory	PCC	0	0	2	2	1
		Innovation and Practices	EEC	0	0	4	4	2
MANDATORY COURSES								
1	MC1	HACKATHON	EEC	15 Hours			15 Hours	1
TOTAL				15	0	12	27	22

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Artificial Intelligence	PCC	3	1	0	4	4
2	T2	Cryptography and Network Security	PCC	3	1	0	4	4
3	T3	Big Data Analytics	PCC	3	0	0	3	3
4	T4	Elective -V	PEC	3	0	0	3	3
5	T5	Elective –VI	PEC	3	0	0	3	3
PRACTICALS								
1	P1	Artificial Intelligence Laboratory	PCC	0	0	3	3	1.5
2	P2	Network Security Laboratory	PCC	0	0	2	2	1
3	P3	Big Data Analytics Laboratory	PCC	0	0	3	3	1.5
TOTAL				**15**	**2**	**8**	**25**	**21**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Elective –VII	PEC/O EC	3	0	0	3	3
2	T2	Elective –VIII	PEC/O EC	3	0	0	3	3
PRACTICALS								
1	P1	Project Work and Viva-Voce	EEC	0	0	12	12	6
TOTAL				**6**	**0**	**12**	**18**	**12**

LIST OF PROFESSIONAL ELECTIVE COURSES:

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	CREDITS
1.	PE1	UNIX INTERNALS	PE	3	0	0	3	3
2.	PE2	DIGITAL MARKETING	PE	3	0	0	3	3
3.	PE3	ENTERPRISE RESOURCE MANAGEMENT	PE	3	0	0	3	3
4.	PE4	DIGITAL FORENSICS	PE	3	0	0	3	3
5.	PE5	SOFTWARE PROJECT MANAGEMENT	PE	3	0	0	3	3
6.	PE6	SOFTWARE TESTING AND QUALITY ASSURANCE	PE	3	0	0	3	3
7.	PE7	RECOMMENDER SYSTEMS.	PE	3	0	0	3	3
8.	PE8	ENGINEERING ECONOMICS AND MANAGEMENT	PE	3	0	0	3	3
9.	PE9	CUSTOMER RELATIONSHIP AND MANAGEMENT	PE	3	0	0	3	3
10.	PE10	SOFT COMPUTING	PE	3	0	0	3	3
11.	PE11	MULTIMEDIA AND ANIMATION	PE	3	0	0	3	3
12.	PE12	MOBILE COMPUTING	PE	3	0	0	3	3
13.	PE13	OBJECT ORIENTED ANALYSIS AND DESIGN	PE	3	0	0	3	3
14.	PE14	AD HOC NETWORKS	PE	3	0	0	3	3
15.	PE15	WIRELESS SENSOR NETWORKS	PE	3	0	0	3	3
16.	PE16	KNOWLEDGE ENGINEERING	PE	3	0	0	3	3
17.	PE17	DATA SCIENCE	PE	3	0	0	3	3
18.	PE18	ROBOTIC PROCESS AUTOMATION	PE	3	0	0	3	3
19.	PE19	QUANTUM COMPUTING	PE	3	0	0	3	3
20.	PE20	CYBER SECURITY	PE	2	0	2	4	3
21.	PE21	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	PE	3	0	0	3	3

LIST OF OPEN ELECTIVE COURSES OFFERED FOR THE STUDENTS OF OTHER UG PROGRAMMES:

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C	UG PROGRAMME
1.	OE1	Introduction to Customer Relationship Management	OE	3	0	0	3	3	All Branches
2.	OE2	Fundamentals of Software Engineering	OE	3	0	0	3	3	All Branches
3.	OE3	Internet Programming	OE	3	0	0	3	3	All Branches
4.	OE4	Introduction to Data Warehousing and Data Mining	OE	3	0	0	3	3	All Branches
5.	OE5	Introduction to Embedded Systems	OE	3	0	0	3	3	All Branches

Professional Electives for Major Verticals

Vertical 1 - Web Technology Frameworks					
Course Code	Course Name	L	T	P	C
V11	FRONT END WEB DEVELOPMENT	2	0	2	3
V12	JAVASCRIPT FRAMEWORKS	2	0	2	3
V13	BACKEND WEB DEVELOPMENT	2	0	2	3
V14	WEB SERVER ADMINISTRATION	2	0	2	3
V15	APPLICATION DEVELOPMENT	2	0	2	3
V16	DEVOPS	2	0	2	3

Vertical 2 - Cloud Computing Technologies					
Course Code	Course Name	L	T	P	C
V21	OPEN SOURCE SYSTEMS	2	0	2	3
V22	DISTRIBUTED SYSTEMS	3	0	0	3
V23	STORAGE TECHNOLOGIES	3	0	0	3
V24	VIRTUALIZATION	3	0	0	3
V25	CLOUD COMPUTING	3	0	0	3
V26	SECURITY AND PRIVACY IN CLOUD	3	0	0	3

Vertical 3 - Artificial Intelligence, Machine Learning and Data Science					
Course Code	Course Name	L	T	P	C
V31	EXPLORATORY DATA ANALYSIS	3	0	0	3
V32	GENERATIVE AI	2	0	2	3
V33	NEURAL NETWORKS AND DEEP LEARNING	3	0	0	3
V34	NATURAL LANGUAGE PROCESSING	2	0	2	3
V35	COMPUTER VISION	3	0	0	3
V36	EVOLUTIONARY ALGORITHMS	3	0	0	3

Vertical 4 - Creative Media					
Course Code	Course Name	L	T	P	C
V37	MULTIMEDIA DATA COMPRESSION AND STORAGE	3	0	0	3
V38	VIDEO CREATION AND EDITING	2	0	2	3
V39	UI AND UX DESIGN	2	0	2	3
V40	DIGITAL MARKETING	2	0	2	3
V41	VISUAL EFFECTS	2	0	2	3
V42	GAME DEVELOPMENT	2	0	2	3

Minor Vertical Offered for Other Departments

Minor Vertical – Cyber Physical Systems					
Course Code	Course Name	L	T	P	C
MV1	CYBER PHYSICAL SYSTEMS	3	0	0	3
MV2	COMMUNICATIONS FOR CYBER PHYSICAL SYSTEMS	3	0	0	3
MV3	MALWARE ANALYSIS	3	0	0	3
MV4	SECURITY AND PRIVACY OF CYBER PHYSICAL SYSTEMS	2	0	2	3
MV5	RISK ANALYSIS	3	0	0	3
MV6	COMPUTER FORENSICS	3	0	0	3

SUMMARY

Category; BSC – Basic sciences, HSC– Humanities and Social Sciences, ESC–Engineering sciences, PCC –Professional Core, PEC- Professional Elective, OEC-Open Elective Course, EEC –Employability Enhancement Course, MC – Mandatory Course

B.E.										
Sl. No.	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	4	2							6
2	BSC	12	10	7	5					34
3	ESC	5	8							13
4	PCC	14	16	14	13	15				72
5	PEC/OEC					6	6	6	6	24
6	EEC			1		2	3		6	12
7	MC	1	3	1						5
									TOTAL CREDITS	166

23FYH111	TECHNICAL ENGLISH	L	T	P	C
		2	2	0	4

MODULE I - FOCUS ON LANGUAGE: GRAMMAR & VOCABULARY   6

Embedded Sentence – Numerical Adjectives - Subject Verb Agreement – If Conditionals – Active Passive Voice – Reported Speech - Idiomatic Expressions - Business and Job Related Vocabulary - Relative Clause – Pronouns – Adjectives - Degrees of Comparison - Technical Vocabulary – Avoidance of Jargon - Collocations - Formal and Informal Vocabulary – Verbal Analogy - Tenses - Prepositions – Articles – Homophones and Homonyms - One Word Substitutes –Linking Words

MODULE II - TECHNICAL COMMUNICATION   6

Importance of Technical Communication - Objective & Characteristics of Technical Communication – General and Technical Communication – Process of Communication - Levels of Communication – Flow of Communication –Visual Aids in Technical Communication - Barriers to Communication: Noise – Classification of Barriers –Non-verbal Communication: Kinesics – Proxemics- Chronemics.

MODULE III - READING& LISTENING   6

Reading Comprehension Techniques: Understanding Technical Articles – Skimming and Scanning – Summarizing–- Intensive & Extensive Reading- Note Making – SQ3R Reading Technique - Meaning and Art of Listening-Importance of Listening & Empathy in Communication – Reasons for Poor Listening – Traits of a good listener – Listening to Technical Talks – Listening to TED/INK Talks

MODULE IV – WRITING   6

Paragraph Writing – Interpreting Charts and Graphs – Instructions – Checklists – Recommendations – Describing a Process – Extended Definitions – Essay Writing – Report Writing – Minutes of the Meetings -Email Writing - Essay Writing - Job Application Letters

MODULE V – SPEAKING   6

Introducing Oneself- Asking for and Giving Directions – Seeking Clarification – Speaking about a Process – Introduction to Technical Presentation – Mechanics of Presentation – Achieving Confidence, Clarity & Fluency – Vocal Cues - Barriers to Speaking – Types of Speaking – Persuasive Speaking – Public Speaking

Tutorials and Practical Sessions based on the above syllabus

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Apply the rules of the Grammar and construct grammatically correct sentences
CO2: Categorize the barriers to communication and formulate solutions.
CO3: Identify the nuances of Technical Communication
CO4: Interpret texts using reading and listening strategies
 CO5: Demonstrate effective business writing and Presentation Skills

Tutorial : 30 PERIODS
THEORY: 30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:
1. Praveen Sam D & Shoba K N, "A Course in Technical English" CUP, 2020.
2. Meenakshi Raman, Sangeeta Sharma, "Technical Communication – Principles and Practice", Oxford University Press, New Delhi, 2015

REFERENCES:
1. Sudharshana N. P & Savitha C, "English for Engineers", CUP, 2018.
2. Steve Hart, Aravind R. Nair & Veena Bhambhani, "Embark – English for Undergraduates", CUP, 2016.
3. Jack C Richerds, "Interchange - 2", CUP, Fourth Edition, Chennai, 2015.
4. Lourdes Joavani Rayen & Shoba K N, "Communicative English", CUP, 2018.

ONLINE RESOURCES:
Technical English for Engineers - NPTEL course

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

	L	T	P	C
23FYM115	**MATRICES AND VECTOR CALCULUS**			
	3	1	0	4

MODULE I   MATRICES   **9+3**

Eigenvalues and Eigenvectors of a real matrix –Characteristic Equation- Properties of Eigenvalues and Eigenvectors -Cayley-Hamilton theorem (Without Proof) - Diagonalization by an orthogonal transformation - Quadratic form – Canonical form-Transformation of quadratic form to canonical form.

MODULE II   DIFFERENTIAL CALCULUS   **9+3**

Jacobian -Taylor's series for functions of two variables – Maxima and minima of functions of two variables-Lagrange's method of undetermined multipliers.

MODULE III   MUTIPLE INTEGARALS   **9+3**

Double integrals – Change of order of integration in Double integrals - Area enclosed by plane curves – Triple integrals – Applications: Area and Volume

MODULE IV   VECTOR CALCULUS   **9+3**

Vector differentiation -Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields.
Vector Integration- Line, Surface and Volume integrals - Green's, Gauss divergence and Stokes' theorems (statement only)- Simple applications involving cube and rectangular parallelepiped.

MODULE V   ORDINARY DIFFERENTIAL EQUATIONS   **9+3**

Second and higher order linear differential equations with constant coefficients-Method of variation of parameters - Cauchy-Legendre equation- System of simultaneous linear differential equations with constant coefficients.

COURSE OUTCOMES

At the end of the course, students will be able to
CO 1: make use of computational techniques and algebraic skills in the study of eigenvalues, eigenvectors and transformation.
CO 2: compute partial derivatives of multivariable functions and determine maxima and minima of functions.
CO 3: fluency in multiple integration using standard methods.
CO 4: compute gradient, divergence and curl of a vector point function and related identities and evaluation of line, surface and volume integrals.
CO 5: solve higher order linear differential equations with constant coefficient and variable coefficient.
CO 6: apply the concepts of matrix and calculus in solving engineering problems.

<div align="right">

THEORY: 45 PERIODS

TUTORIAL:15 PERIODS

TOTAL : 60 PERIODS

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TEXT BOOKS:

1. "Higher Engineering Mathematics" by Grewal B.S., 44th Edition, Khanna Publishers -(2021).
2. "Advanced Engineering Mathematics" by Erwin Kreyszig,10th Edition, John Wiley &Sons (2015).

REFERENCES:
1. "Thomas Calculus" by Joel R. Hass, Christopher E. Heil, Maurice D. Weir, 15th Edition, Pearson (2022).
2. "Higher Engineering Mathematics" by B. V. Ramana Kindle Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi (2018).
3. "Advanced Engineering Mathematics" by Bali N, Goyal M and Watkins C, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2015.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23FYP115	APPLIED PHYSICS	L	T	P	C
		3	0	0	3

MODULE I - LASER   9

Absorption and emission - Spontaneous emission - Stimulated emission - Einstein's theory of stimulated emission - Conditions for Laser action – Population inversion – Sources of excitation – Active medium – Resonant cavity - Nd-YAG laser - CO2 laser - Semiconductor laser – Applications – 3D profiling, laser drilling and laser welding

MODULE II - FIBER OPTICS   9

Optical fiber - Advantages of optical fiber as wave guide and propagation of light in optical fibers - Numerical aperture and acceptance angle - Structure of optical fiber - Fiber optical materials - Types of optical fibers - Single and multimode fibers -Step index and graded index fibers – Applications - Fiber optic communication system, Fiber endoscope

MODULE III - CONDUCTING AND DIELECTRIC MATERIALS   9

Conductors - classical free electron theory of metals - Electrical and thermal conductivity-Wiedemann - Franz law - Lorentz number - Draw backs of classical free electron theory. Dielectric materials: Permittivity – Polarizability – Electrical susceptibility – dielectric constant - electronic, ionic, orientational and space charge polarization - internal field - Clausius- Mosotti relation (derivation)

MODULE IV – QUANTUM PHYSICS   9

Concept of matter waves - de –Broglie wavelengths in terms of voltage and energy - Compton effect - Expression for Compton shift - Physical significance of wave function - Schrödinger's wave equation - Time independent and time dependent equation - Particle in a box (one dimension) - Electron microscope – Scanning Electron microscope (SEM)

MODULE V – NANO MATERIALS   9

Nanomaterials – Importance of size distribution and control – Quantum confinement effect - Preparation of nano materials – Top down and Bottom up approach - Physical vapour deposition – Chemical vapour deposition method – ball milling method - properties of nano particles structural, thermal, magnetic and optical properties - Applications of nanomaterials

COURSE OUTCOMES
At the end of the course, students will be able to
- **CO1:** *Recall the basic principles and theories of laser operation and classify different types of lasers based on their operating principles*
- **CO2:** *Acquire knowledge about the optical fibre, demonstrating a comprehensive understanding of their application in optical communication systems*
- **CO3:** *Understand the concepts of the classical free electron theory to analyze and solve problems related to conducting materials and provide an overview of the fundamentals of dielectric materials*
- **CO4:** *Explain the fundamental principles, concepts of quantum theory and electron microscope*
- **CO5:** *Identify the synthesis approaches used for preparing nanomaterials, properties and application of nanomaterials*
- **CO6:** *Apply the knowledge of conducting, dielectric materials, quantum physics and nanomaterials to propose innovative solutions or approaches for practical applications*

TOTAL : 45 PERIODS

TEXT BOOKS:

1. V Rajendran, "Engineering Physics", Tata McGraw Hill Education Private Limited, 2012.

2. M N Avadhanulu, P G Kshirsagar & TVS Arun Murthy, "A Textbook of Engineering Physics", 11th edition, S. Chand Publishing 2018.

3. P K Palanisamy, "Engineering Physics", 4th edition, Scitech publications (India) Pvt. Ltd. 2014.

REFERENCES:

1. K. Thyagarajan, Ajoy Ghatak, "Lasers: Fundamentals and applications", Springer Science & Business Media, 2010.

2. Gerd Keiser, "Optical Fiber Communications" 4th edition, McGraw-Hill Companies, Inc, 2000

3. Pillai. S.O, Solid State Physics, New Age International Pvt. Ltd, 2009

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23FYC115	Applied Chemistry -1	L	T	P	C
		3	0	0	3

MODULE I - CORROSION AND ITS PREVENTION 9

Corrosion- Definition -Classifications: Chemical corrosion and Electro chemical corrosion- mechanism-Pilling Bedworth rule. Galvanic corrosion, differential aeration corrosion, pitting corrosion, waterline corrosion and soil corrosion. Factors influencing corrosion. Corrosion control -cathodic protection, selection of materials and proper designing. Protective Coatings-Inorganic coating-surface preparation-Electro plating method applied to Cr and Ni

MODULE II - ENGINEERING MATERIALS 9

Refractories- classification, properties [refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling] Manufacture of alumina, magnesite and zirconia bricks. Polymer composites- fiber reinforced plastics. Glasses – types and composition, laminated glass, glass wool.Paints – constituents and their functions, Special paints-fire retardant, water repellant, temperature indicating and luminous paints. Varnish-constituents and types

MODULE III - POLYMERIC MATERIALS 9

Classification, degree of polymerization, average molecular weights, polydispersity. Polymerization reactions – chain and condensation. Thermal properties -glass transition temperature(Tg) – factors affecting Tg - determination by DSC. Mechanical properties – significance in fabrication of electronics. Electrical insulating properties - dielectric breakdown - aging of polymer insulations - discharges in voids, electrical treeing. Thermal and photochemical degradations. Additives - plasticisers, stabilisers, functional additives

MODULE IV – CONDUCTING PROPERTIES OF MATERIALS 9

Molecular orbital treatment of bonding in metals, insulators, semiconductors – direct band and indirect band, elemental, p-doped, n-doped, stoichiometric compound semiconductors and chalcogen semiconductors. Crystal defects and their influence on properties of materials – intrinsic defects - Schottky and Frenkel, non-stoichiometric compounds, extrinsic defects - oxide ion conductors - applications

MODULE V – NANO MATERIALS 9

Nanomaterials and bulk materials; Size-dependent properties - types of nanomaterials: Definition, properties, and uses of – nanoparticle, nanorod and nanotube. Preparation of nanomaterials: chemical vapour deposition, electrodeposition, precipitation, thermolysis and laser ablation. Applications of nanomaterials in medicine and electronics

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: *Apply the remedial measures for preventing corrosion*
CO2: *Use the suitable engineering materials for various engineering applications*
CO3: *Develop the polymeric based product and implement in hardware applications*
CO4: *Choose the material based on the property and apply it as per the need*
CO5: *Apply the nanomaterials in electronics and medicine*
CO6: *Apply the knowledge of recycling and recovering new products*

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Wiley Engineering Chemistry, Wiley India Pvt.Ltd.New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing

5.   Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley

6.   Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing

7.   A Text book of Engineering Chemistry, SS Dara &Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.

8.   A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.

9.   Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.

10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.

11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996 Extraction of gold from E-waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).

12. Handbook of Organic Materials for Optical and (Opto)Electronic Devices: Properties and Applications (Woodhead Publishing Series in Electronic and Optical Materials), Woodhead Publishing; 1st edition (31 August 2013)

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS111	C Programming	L	T	P	C
		3	0	0	3

MODULE I - INTRODUCTION TO PROGRAMMING 8

Fundamentals of programming - Flowcharts. Programming strategies (Introduction): top-down, structured programming, object oriented programming. INTRODUCTION TO C: C data types – C compilation and execution. Operators: hierarchy of operators- associativity of operators – expressions. Single dimensional arrays – console I/O functions: formatted I/O: scanf(), printf()- getchar(), putchar()

MODULE II - CONTROL STATEMENTS 9

if statements, if-else statement, nested if statements- ternary operators-while loop, do-while loop, for loop-break statement- continue statement- switch case statement- goto statement and statement label

MODULE III - POINTERS AND ARRAYS 9

Array of pointers – multidimensional arrays – pointers and strings –standard string library functions: strlen(), strcpy(), strcat(),strstr() and strcmp()- dynamic memory allocation and deallocation

MODULE IV – FUNCTION 9

Function declaration and prototypes- parameter passing- recursion-command line arguments- function pointers- passing pointers to functions- passing arrays to functions- passing function to other functions. Storage classes- C preprocessor

MODULE V – STRUCTURES AND FILES 10

Definition of structure – array of structures – pointer to structures – self-referential structures- union – Bit fields – typedef – enum data type – high level file I/O – text and binary file processing- low level file IO and processing

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: *Knowledge in the basic concepts of C programming and ability to write C programs for simple applications.*
CO2: *Ability to design, analyze problems and interpret data.*
CO3: *Demonstrate the concept of arrays and their representation in programming languages.*
CO4: *Analyze and evaluate the behavior and correctness of programs that utilize pointers.*
CO5: *Knowledge to experiment with engineering problems using C concepts like functions and structures.*
CO6: *Ability to read from and write to files.*

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Byron S.Gottfried, "Programming with C", Third Edition, Schaum's series, Tata McGraw Hill, New Delhi, 2010.

REFERENCES:

1. M. Ritchie, Dennis., W. Kernighan, Brian. "C Programming Language", Second edition, N.p., CreateSpace Independent Publishing Platform, 2017.

2. Herbert Schildt, "C The Complete Reference", Tata McGraw Hill, 4th Edition, 2017.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23FYH122	ENGLISH COMMUNICATION SKILLS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

Experiments using the following concepts:

- Speech Sounds
- Vocabulary
- Reading Comprehension
- Listening Practice
- Dialogue Writing
- Conversational Exercise
- Creative Writing
- Greeting & Thanking
- Complaining, Apologizing & Congratulating
- Alphabet Series & Letter Series Word Formation
- Para Jumbles & Synonyms and Antonyms
- Sentence Completion & Correction
- Presentation Skills
- Group Discussion
- Interview Skills

COURSE OUTCOMES

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

CO1: Generate language structures accurately and speak fluently.
CO2: Use appropriate functional expression and converse effectively.
CO3: Apply critical reading skills and strategies proficiently to comprehend text.
CO4: Demonstrate effective presentation, Interview and Group Discussion Skills.
CO5: Generate language structures accurately and speak fluently.

TOTAL: 30 PERIODS

CO PO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1:									2	3		1		
CO2:									2	3		1		
CO3:									2	3		1		
CO4:									2	3		1		
CO5:									2	3		1		
Avg.									2	3		1		

1-low, 2-medium, 3-high

23CS121	ENGINEERING GRAPHICS	L	T	P	C
		0	0	2	1

MODULE I - INTRODUCTION TO COMPUTER AIDED ENGINEERING GRAPHICS   6

Principles of Engineering Graphics and their significance, Drawing Instruments and their uses, BIS conventions, lettering and Dimensioning Practice. AutoCAD User Interface – Menu system, draw, command, tool bars (draw, modify, annotations, layers etc.) – status bar (ortho, grid, snap, iso etc.)

MODULE II - CONCEPT OF PROJECTIONS AND PROJECTION OF SOLIDS   10

Theory of projection – types of projections; orthographic Projections: – Conventions – First and Third Angle projections. Projections of Points, Projections of Lines, Projections of planes. Projections of Solids: Projections of regular solids prism and pyramid inclined to both planes. Practice with AutoCAD software

MODULE III - ISOMETRIC PROJECTIONS   14

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Simple Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa. Practice with AutoCAD software

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: *Incorporate the BIS and ISO standards in Engineering Drafting*
CO2: *Imagine and visualize the geometric details of engineering objects*
CO3: *Develop the surfaces for sheet metal working*
CO4: *Communicate ideas through technical drawings with the help of AutoCAD software*
CO5: *Interpret orthographic and isometric views of objects*
CO6: *Apply computer aided design and drafting tools to fulfil the design criteria of industry standards and practices*

TOTAL : 30 PERIODS

TEXT BOOKS:

1. S. Trymbaka Murthy, Computer Aided Engineering Drawing, International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2013.
2. K. Venugopal, V. Prabhu Raja – Engineering Graphics, New Age International Publishers, 2017.

REFERENCES:
1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Venugopal K (2007), Engineering Drawing and Graphics + AutoCAD, New Age International.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS122	C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

Experiments using the following concepts:

- Operators
- Decision Statements
- Control Statements
- Functions
- Arrays
- Pointers
- Strings
- Structures
- Macros
- Files

COURSE OUTCOMES

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

CO1: Ability to write, compile and debug C Programs
CO2: Develop simple programs using Decision making statements and looping constructs.
CO3: Practice operations on arrays and pointer.
CO4: Practice operations on strings.
CO5: Practice modularization of the given problem using functions.
CO6: Write programs using structures and files.

TOTAL : 60 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23FYM215	FOURIER SERIES AND DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

MODULE I   FOURIER   SERIES   9+3

Dirichlet's conditions – General Fourier series – Even and odd functions – Half range sine series – Half range cosine series– Parseval's identity – Harmonic analysis.

MODULE II   NUMERICAL SOLUTIONS OF LINEAR SYSTEMS AND ORDINARY DIFFERENTIAL EQUATIONS   9+3

Solution of algebraic and transcendental equation by Newton Raphson method-, Gauss Seidel method- Numerical solution of first order ordinary differential equations - Modified Euler's method- Runge- Kutta fourth order method-Milne's predictor and corrector method

MODULE III   PARTIAL DIFFERENTIAL EQUATIONS   9+3

Formation of Partial Differential equations - Solutions of first order   Linear partial   differential equations (Lagrange's linear Partial Differential equations)- Linear Homogeneous partial differential equations   of second and higher order with constant coefficients.

MODULE IV   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9+3

Classification of partial   differential equations - Method of separation of variables – Solutions of one dimensional wave equation – One dimensional equation of heat flow equation.

MODULE V   NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9+3

Elliptic equations- Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit method (Bender- Schmidt's method) – One dimensional wave equation by explicit method.

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Characterize physical models by using Fourier series.
CO2: Explain the fundamental concepts of numerical solutions of linear systems and ordinary differential equations and their role in modern mathematics.
CO3: Use different forms of partial differential equations in their respective fields.
CO4: Find the solution of Heat and wave equations.
CO5: Formulate concrete problems and finding the solutions of partial differential equations by numerical methods.
CO6: Learn and apply the techniques of solving Fourier series and Partial differential equations.

THEORY: 45 PERIODS
TUTORIAL:15 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers -(2021).

2. B.V.Ramana, "Higher Engineering Mathematics", Kindle Edition (2018), Tata MCGraw-Hill Publishing Company Limited, New Delhi.

REFERENCES:

1. Srimanta Pal and Subodh Chandra Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.

2. Erwinkreyszig, "Advanced Engineering Mathematics",10th Edition(2015), John Wiley&Sons,.

3. Sastry S.S, "Introductory Methods of Numerical Analysis", 5th Edition (2012), Prentice Hall India Learning Private Limited.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS211	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

MODULE I - SEMICONDUCTOR MATERIALS   9

Intrinsic semiconductors – Carrier concentration – Mobility and electrical conductivity - Variation of electrical conductivity with temperature - band gap energy determination - Extrinsic semiconductors - Carrier concentration in N type and P type Semiconductors (No derivation) - Variation of carrier concentration and electrical conductivity with temperature – Hall effect – Determination of Hall coefficient – applications

MODULE II - PN JUNCTIONDIODE   9

PN junction diode - Formation of PN junction – Diffusion and drift current* - forward and reverse bias characteristics - Diode Resistance – Transition or space charge Capacitance – Diffusion or storage capacitance – Switching Characteristics - Break down mechanisms - Avalanche and Zener breakdown - Zener diode - forward and reverse bias characteristics

MODULE III - BIPOLAR JUNCTION TRANSISTOR   9

NPN – PNP transistor – Operation - Early effect – Input and Output characteristics of CE, CB, CC – Operating Point (Q–point) - bias stability - Method of transistor biasing - Fixed Bias and Voltage-Divider Bias – Thermal run away – Multi emitter transistor

MODULE IV - FIELD EFFECT TRANSISTORS   9

JFET - Types – construction - Drain and Transfer characteristics – Pinch off voltage and its significance - Use of JFET as Voltage Variable Resistor - Applications of JFET.
MOSFET - Enhancement MOSFET – Depletion MOSFET – Drain and Transfer characteristics - Comparison of MOSFET with JFET – Comparison of FET and BJT

MODULE V - DIGITAL SYSTEMS AND DIGITAL IC FAMILIES   9

Digital system – Number system - Decimal, Binary, Octal, Hexadecimal, BCD, Conversions - Complements - TTL logic, standard TTL, CMOS Logic families (Inverter, NAND&NOR Gates) - comparison of TTL and CMOS families

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Analyse the physics of semiconductors and identify the variation of the Fermi level in semiconductors and explain the concept of bandgap determination
CO2: Understand the formation of PN junction and operation, switching characteristics of PN junction diode **CO3:** Acquire knowledge about working details, biasing methods and major application of BJT
CO4: Familiarize the operation and application of various field effect transistors
CO5: Provide an overview of the digital number systems and TTL Logic and CMOS Logic families
CO6: Understand the diode and transistor operations, digital systems, design the digital electronic circuits and realize the simple practical circuits

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, SatyabrataJit, "Electronic Devices and Circuits", Tata McGraw-Hill, Second Edition, 2015
2. Salaivahanan, "Electron Devices and Circuits", Tata McGraw-Hill, New Delhi, 2,2017

3. M. Morris Mano and Micheal D. Ciletti,, "Digital Design With an Introduction to the Verilog HDL,",Pearson Education, 5th edition, 2014.

REFERENCES:

1. V.Rajendran., Engineering Physics, Tata McGraw Hill, Publishing Company, New Delhi, 2017.
2. Kasap, S.O. - Principles of Electronic Materials and Devices, (Special Indian Edition) McGraw-Hill Education, 3rd Edition, 2017.
3. Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata McGrawHill Inc. 2017
4. Robert L. Boylstead and Louis Nashelsky, "Electronic Devices and Circuit Theory", 9th Edition, Prentice-Hall of India, New Delhi, 2015.
5. Thomas L. Floyd, "Electronic Devices", 9th Edition, Pearson Education Asia, 2017

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	-	1	-	1	1	1	-	1	1	-	1	2	1
2	3	-	2	-	2	2	1	-	1	2	-	1	2	1
3	2	-	2	-	2	2	1	-	1	2	-	1	2	1
4	3	-	2	-	2	2	1	-	1	2	-	1	2	1
5	3	-	3	-	3	3	1	-	1	2	-	1	2	1
6	3	-	2	-	3	3	1	-	1	2	-	1	2	1
Avg.	3	-	2	-	2	2	1	-	1	2	-	1	2	1

1-low, 2-medium, 3-high

		L	T	P	C
23FYC211	**Applied Chemistry -II**	3	0	0	3

MODULE I - Sensors   9

Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors (Flame photometry) and Optical sensors (colorimetry). Sensors for the measurement of dissolved oxygen (DO).

Electrochemical sensors - Types of electrochemical sensor, Gas sensor - O_2 sensor, Biosensor - Glucose sensor, Sensorsfor pharmaceuticals. Electrochemical gas sensors for SOx and NOx. Disposable sensors in the detection of biomolecules and pesticides

MODULE II - Energy Systems   9

Introduction to batteries, construction, working and applications of Lithium ion, Sodium ion batteries, Air batteries -Zinc air battery, Lithium air batteries. Solar photovoltaic cell - Introduction, construction and working - advantages, and disadvantages. Quantum Dot Sensitized Solar Cells (QDSSC's)- Principle, Properties and Applications. Generation of energy (green hydrogen) by electrolysis of water and its advantages

MODULE III - Memory Devices   9

Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices, Classification of electronic memory devices, types of organic memory devices (organic molecules – Volatile and non-volatile materials, polymeric materials, organic-inorganic hybrid materials)

MODULE IV - Display Systems   9

Electroluminescence, Electrochemiluminesence- exciton, OLED materials– emitters- charge transfer complexes, metal chelates, polycyclic aromatic oligomers, conjugated polymers – polyphenylenes, Liquid crystalline polymers- classification - chemical constitution and applications.Properties and functions of Silicon (Si), Germanium (Ge), Copper (Cu), Aluminium (Al) and Brominated flame retardants in computer

MODULE V - E-Waste   9

Introduction, sources of e-waste, Composition, Characteristics, and Need of ewaste management. Toxic materials used in manufacturing electronic and electrical products; health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling - separation, thermal treatments, hydrometallurgical extraction, pyrometallurgical methods, direct recycling

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Apply the working principle of different sensors in IOT
CO2: Choose the materials based on the working principles
CO3: Apply the mechanisms of organic and polymeric materials in memory devices.
CO4: Develop the electroluminescence and polymeric materials for electronics
CO5: Choose the non-toxic materials and use it in electronics and electrical devices
CO6: Apply the knowledge of recycling and recovering new products

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Wiley Engineering Chemistry, Wiley India Pvt.Ltd.New Delhi, 2013- 2nd Edition.

2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi

3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd

4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing

5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley

6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing

7. A Text book of Engineering Chemistry, SS Dara &Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.

8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.

9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.

10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.

11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996 Extraction of gold from E-waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).

12. Handbook of Organic Materials for Optical and (Opto)Electronic Devices: Properties and Applications (Woodhead Publishing Series in Electronic and Optical Materials), Woodhead Publishing; 1st edition (31 August 2013)

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS212	DIGITAL DESIGN	L	T	P	C
		3	0	0	3

MODULE I - BOOLEAN ALGEBRA & MINIMIZATION TECHNIQUES   9

Boolean Algebra - Basic Definitions – Theorems & Properties -Canonical and Standard Forms. Simplification of Boolean Functions – Karnaugh Maps- Don't Care Conditions. NAND and NOR Implementation. Quine-McCluskey (Tabulation) Method

MODULE II - COMBINATIONAL LOGIC   9

Analysis Procedure-Design Procedure-Code Converters-Adders -Half Adder - Full Adder-Binary Adder-Carry Look-ahead Generator -Subtractor- Half Subtractor - Full Subtractor-BCD Adder- Binary Multiplier- Magnitude Comparator- Decoders- Encoders-Priority Encoder- Multiplexers-Demultiplexers

MODULE III - SEQUENTIAL LOGIC   8

Storage Elements: Latches-Flip Flops-Analysis of Clocked Sequential Circuits: State Table - State Diagram - State Equations- Flip Flop Input Equations-Analysis with D, JK and T flipflops. State Reduction and Assignment. Flip Flop Excitation Tables-Design Procedure

MODULE IV - REGISTERS AND COUNTERS   9

Registers – Shift Registers: Serial Transfer-Serial Addition-Universal Shift Register- Binary ripple counter-BCD ripple counter. Synchronous counters-Design Procedure for synchronous counters - Ring Counter-JohnsonCounter

MODULE V - MEMORY PROGRAMMABLE LOGIC   10

Random access memories: Read write operations-Timing Waveforms-Types of Memory. Memory Decoding-Read Only Memory: Combinational Circuit Implementation-Types of ROM-Combinational PLDs-Programmable Logic Arrays (PLA)-Programmable Array Logic (PAL). Associative Memory: Hardware Organization - Match Logic - Read and Write Operation. Cache Memory: Associative mapping - Direct Mapping - Set Associative Mapping - Writing into Cache - Cache Initialization-Flash Memory

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Demonstrate the operations of logic gates and verify boolean algebra theorems
CO2: Illustrate the boolean expression in SOP and POS Standard forms
CO3: Experiment with the various combinational logic circuits.
CO4: Analyze the working of R-S, J-K, D and T Flip flops
CO5: Construct the various sequential logic circuits
CO6: Describe the various types of memory, memory organization and its operations

TOTAL : 45 PERIODS

TEXT BOOKS:

1.   M. Morris Mano and Micheal D. Ciletti,, "Digital Design With an Introduction to the Verilog HDL,"Pearson Education, 5th edition, 2014.
2.   Morris Mano, "Computer System Architecture ", Pearson Education, Third Edition, 2017.

REFERENCES:

1. Boukhobza, J., Olivier, P., "Flash Memory Integration: Performance and Energy Issues", United Kingdom: Elsevier Science, 2017
2. Charles H. Roth Larry L. Kinney, Raghunandan G. H. "Fundamentals of Logic Design", Cengage Learning, 1st edition, 2019.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
23CS213	**OBJECT ORIENTED PROGRAMMING**	3	0	0	3

MODULE I - INTRODUCTION TO OBJECT ORIENTED PROGRAMMING   9
Object oriented paradigm- Evolution of programming paradigms- Structured vs object oriented programming- Elements of object oriented programming - objects- classes-Encapsulation and Data abstraction - Inheritance - Polymorphism- Benefits of OOP - Applications of OOP - Structure of C++ program - C++ tokens-Keywords - Identifiers - Constants- Data types-Operators - Scope Resolution Operator -Control Structures

MODULE II - CLASSES AND OBJECTS   9

Introduction of Classes- Class Definition- Defining a Members- Objects - Access Control- Class Scope- Scope Resolution Operator- Inline functions - Memory Allocation for Objects- Static Data Members- Static Member Functions - Arrays of Objects- Objects as Function Arguments- Friend Functions.
Introduction to Constructors- Default Constructors- Parameterized Constructors- Copy Constructors-Constructor overloading – Destructors

MODULE III - INHERITANCE AND POLYMORPHISM   9

Introduction to inheritance- Defining Derived Classes- Single Inheritance- Multiple Inheritance- Multilevel Inheritance- Hierarchical Inheritance- Hybrid Inheritance.Polymorphism, Compile time polymorphism, Runtime polymorphism, Overloading- Function Overloading, Operator overloading

MODULE IV - VIRTUAL FUNCTIONS AND EXCEPTION HANDLING   9

Introduction to Memory management, new operator and delete operator, Pointers to objects, Pointers to Derived Classes, Virtual Functions
Basics of Exception Handling, Types of exceptions, Exception Handling Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions

MODULE V - I/O STREAMS, FILES AND TEMPLATES   9

C++ Streams Classes - Unformatted I/O Operations - Formatted Console I/O Operations – I/O manipulators – File handling – Hierarchy of File Stream Classes - Opening and Closing a file - File modes - File Pointers and their Manipulators - Sequential access - Random access – Error Handling file operations
Introduction to Templates, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Describe the core principles of Object-Oriented Programming (OOP) and its significance
CO2: Understand dynamic memory management techniques using pointers, constructors, destructors, etc
CO3: Demonstrate skill in implementing classes and objects in C++, including encapsulation, inheritance, and polymorphism.
CO4: Apply advanced C++ features like templates and exception handling to improve program adaptability and reliability
CO5: Solve programming challenges by utilizing OOP techniques effectively, fostering a deeper understanding of problem-solving in C++ development
CO6: Implement robust C++ programs that leverage the power of OOP concepts to create modular and maintainable code

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mastering C++, 2/e by Venugopal, Tata McGraw Hill, 2017.
2. The Complete Reference C++, Herbert Schlitz, 4th Edition, McGraw Hill Education, 2017.

REFERENCES:

1. The C++ Programming language, Bjarne Stroustrup, 3rd edition, Pearson Education, 2002.
2. Thinking in C++, Volume 1 & 2 by Bruce Eckel, Chuck Allison, 2nd edition, Pearson Education, 2000.
3. Object Oriented Programming in Turbo C++, Robert Lafore, 4th edition, Pearson Education, 1991.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	2										1	
2	3	2	2										1	
3	3	2	2										1	
4	3	2	2										1	
5	3	2	2										1	
6	3	2	2										1	
Avg.	**3**	**2**	**2**										**1**	

1-low, 2-medium, 3-high

23CS221	DIGITAL DESIGN LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Verification of Boolean algebra theorems and postulates.

2. Design of Half adder, Full adder, Half subtractor and Full subtractor.

3. Design of combinational circuits using NAND and NOR gates.

4. Design of Encoders, Decoders, Multiplexer and De-Multiplexer circuits.

5. Design and implementation of Priority Encoder.

6. Implementation of Boolean functions using Multiplexers.

7. Realization of R-S, J-K, D and T Flip flops.

8. Design of synchronous sequential circuits.

9. Design of counters

10. Realization of Shift registers.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Demonstrate the operations of logic gates and verify boolean algebra theorems
CO2: Implement the Boolean expression in SOP and POS Standard forms
CO3: Experiment with the various combinational digital circuits.
CO4: Practice Encoders, Decoders, Multiplexer and De-Multiplexer circuits
CO5: Analyze the working of R-S, J-K, D and T Flip flops
CO6: Construct the various sequential digital circuits

TOTAL : 30 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS222	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Control statements in C++

2. Functions in C++

3. Classes and Objects

4. Constructors and Destructors

5. Inheritance

6. Polymorphism

7. Virtual Functions

8. Exception Handling

9. File Handling

COURSE OUTCOMES

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

CO1: Utilizing C++ capabilities in program design and implementation

CO2: Elaborate on object-oriented principles and their implementation in C++

CO3: Develop programs with reusability

CO4: Demonstrate proficiency in object-oriented development through practical applications in C++

CO5: Evaluate problem descriptions and constructing object-oriented software with adherence to best coding practices

CO6: Apply common software patterns in object-oriented design and recognizing their relevance in various development contexts

TOTAL : 30 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
23FPC221	**BASIC SCIENCES LABORATORY**	0	0	4	2

LIST OF EXPERIMENTS
CHEMISTRY LABORATORY

1. Determination of strength given ClusingNaOH by pH measurement.
2. Determination of Alkalinity of water.
3. Determination of equivalent conductance of a strong electrolyte.
4. Estimation of Dissolved Oxygen in water sample.
5. Determination of sodium in water sample by flame photometry.
6. Estimation of iron in water sample by spectrophotometry.
7. Determination Of Corrosion rate steel in acid media by weight loss method.
8. Estimation of Ferrous Ion By Potentiometric Titration.

PHYSICS LABORATORY

1. Determination of wavelength of LASER light using optical grating.
2. Determination of the capacitance value of an unknown capacitor by charging and discharging.
3. Calibration of Voltmeter and Ammeter using potentiometer.
4. Determination of the dielectric constant of a material through capacitance measurement.
5. Determination of Band gap of a Semiconductor.
6. Study of I-V characteristics of solar cell and determination of its efficiency.
7. Study of I-V characteristics of PN junction diodes.
8. Implementation of basic Logic Gates using NAND and NOR gates.

COURSE OUTCOMES
CHEMISTRY LABORATORY

At the end of the course, students will be able to
CO1: Apply the knowledge of detecting dissolved oxygen, alkalinity and metal ions in water sample
CO2: Implement different types of elemental analysis through titrations like volumetric, potentiometric and conductometric.
CO3: Handle analytical tools such as spectrophotometer, flame photometer, and potentiometer.

PHYSICS LABORATORY

At the end of the course, students will be able to
CO1: Learn experimental techniques for measuring the wavelength of monochromatic light, perform measurements and calculations to determine the capacitance of an unknown capacitor and understand the working principles of potentiometers.
CO2: Analyze experimental data to calculate the dielectric constant of the material, conduct experiments to measure the band gap of a semiconductor material and learn about the operation principles of solar cells
CO3: Interpret the behavior of the diode under forward and reverse bias conditions and verify the truth tables of implemented logic gates through experimentation

TOTAL : 60 PERIODS

REFERENCES:

1. Physics Laboratory Manual Department of Physics, CIT

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
23FYC221	**ENVIRONMENTAL SCIENCE & ENGINEERING**	1	0	0	1

MODULE I - NATURAL RESOURCES   3

Forest resources: Use and over-exploitation and deforestation.
Water resources: Use and over- utilization of surface and ground water. Dams - benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

MODULE II - ENVIRONMENTAL POLLUTION   3

Sources, causes, effects and management of air pollution, water pollution, soil pollution and radioactive pollution. Solid waste management

MODULE III - ECOSYSTEM AND BIODIVERSITY   3

Concept of an ecosystem- structure and functions- food chain and food webs
Biodiversity-types, Importance and values of biodiversity, India as a mega diversity nation, hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity

MODULE IV - GREEN CHEMISTRY   3

Significance of green chemistry - basic components of green chemistry. Industrial applications of green chemistry-green fuels-e-green propellants and bio catalysts

MODULE V - GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT   3

Water conservation, Rain water harvesting, Climate change, Ozone depletion, Acid rain, Greenhouse effect and global warming.
Disaster management- Earthquakes, Floods, Landsides and cyclones

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Apply the concept of natural resources.
CO2: Implement the remedial measures to control environmental pollution.
CO3: Use the concept of conserve the biodiversity.
CO4: Apply the components of green chemistry in environment.
CO5: Develop remedy for global environmental issues.

TOTAL : 15 PERIODS

TEXT BOOKS:

1. S.S.Dara, "Text book of Environmental chemistry and Pollution Control", S.Chand & Company Ltd, New Delhi, 2011.
2. R.Rajagopalan, "Environmental Studies", Oxford University Press New Delhi, 2015.

REFERENCES:

1. Surinder Deswal & Dr.Anupama Deswal, "A Basic course in Environmental Studies", Dhanpat Rai & Co (P) Ltd, New Delhi, 2013.
2. Benny joseph, "Environmental Studies", Tata McGraw-Hill Publishing company Limited, New Delhi, 2018.
3. Anubha Kaushik & C.P,Kaushik, "Environmental Science and Engineering", New Age International Publishers, 2nd Edition, 2006.

4. Dr.S.Amalraj, "Introduction to Environmental Science and Technology", Laxmi publications (P) Ltd, New Delhi , New Edition, 2005.
5. Vidhya Thakur, "A Text book of Environmental Science", Scientific Publishers (India) 2019.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23M315	LINEAR ALGEBRA AND COMPLEX VARIABLES	L	T	P	C
		3	1	0	4

MODULE I   VECTOR SPACES   9+3

Vector Spaces - Linear Independence - Basis and Rank- Linear Mappings- Matrix Representation of Linear Mappings- Basis Change.
Inner Products- Lengths and Orthogonality - Orthogonal sets Orthogonal Projections
(Gram-Schmidt Orthogonalization only).

MODULE II   MATRIX DECOMPOSITIONS   9+3
Matrix Decompositions- Determinant and Trace- Eigen values and Eigenvectors- Cholesky Decomposition- Singular value Decomposition.

MODULE III   COMPLEX DIFFERENTION   9+3
Analytic functions – Necessary and sufficient conditions –Cauchy-Riemann equations - Properties of analytic functions– Harmonic conjugates – Construction of analytic function. Bilinear transformation.

MODULE IV   COMPLEX INTEGRATION   9+3
Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor and Laurent series - Singularities – Residues – Cauchy's Residue theorem.

MODULE V   FOURIER TRANSFORMS   9+3
Fourier transform pair – Sine and Cosine transforms –Properties (Without proof) –Applications to evaluate simple real integrals- Transforms of simple functions –Parseval's identity**.**

COURSE OUTCOMES
At the end of the course, students will be able to
CO 1: Incorporate suitable methods of linear mappings and orthogonal projections and implement the same for applications in machine learning algorithms.
CO 2: Learn the concepts of matrix decompositions and implement in Programming problems.
CO 3: Examine the standard techniques of complex variable, analytic function and its properties.
CO 4: Gain knowledge on the ideas of complex integration.
CO 5: Understand the Fourier transform techniques and use it for solving various Engineering problems.
CO 6: Apply the concepts of Linear algebra and complex variables in real life problems.

THEORY: 45 PERIODS
TUTORIAL: 15 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:
1. "Higher Engineering Mathematics" by Grewal B.S, Khanna Publishers,44[th]Edition,2021.
2. "Linear Algebra and its Applications", by David C. Lay, 6th Edition, Pearson   Education, 2021.

REFERENCES:
1. "Introduction to Linear Algebra", by Gilbert Strang, Wellesley Cambridge Press and SIAM, 6th Edition, 2022.
2. "Advanced Engineering Mathematics", by Erwin Kreyszig, John Wiley& Sons ,10th Edition, 2015.
3. "Higher Engineering Mathematics", by B.V.Ramana, Tata MC Graw-Hill Publishing Company Limited, Kindle Edition, 2018.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS311	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	1	0	4

MODULE I   DATA REPRESENTATION AND INTRODUCTION TO ALGORITHMS   9

What is a Data and Data Structure? - Representation of Numbers: Integer, Real- Representation of Characters - Definition of an Algorithm - Importance of algorithm analysis and time/space complexity- Asymptotic notation (Big O, Omega, and Theta) - Basic algorithmic analysis techniques (worst-case, average-case, and best-case analysis)

MODULE II   LISTS, STACKS, AND QUEUES   9

List-Definition – Basic Operations – Array Representation of Linear List - Polynomial Representation in Arrays- Stacks, Queues – Definition, Operations - Time complexity of List operations in Arrays - Application of Stacks: Function Calls – Conversion of Infix to Postfix Expression - Evaluation of Postfix Expressions - Priority Queue and Dequeues

MODULE III   LINKED LISTS   9

Linked Lists -Singly, Doubly and Circular Linked Lists- Basic Operations - Polynomial Representation in Linked List - Linked Stacks and Queues - Time complexity of List operations in Linked Lists

MODULE IV   SEARCH TREES AND HASH TABLE   9

Linear Search – Binary Search – Trees, Binary Trees – Definition, Representations, Tree Traversals, Binary Tree Representation of General Trees – Applications - Binary Search Tree-Insertion, Search and Deletion- AVL Trees – Red-Black Trees- B-Trees- Trie Data Structure - Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing - Time Complexity for Searching Algorithms

MODULE V   GRAPHS   9

Basic Concepts – Graph Representations - Graph Traversals –Connected Components – Bi-connectivity - Minimum Spanning Trees – Kruskal Algorithm – Prim's Algorithm - Topological Sorting- Shortest Path Algorithms – Dijkstra Algorithm- Bellman Ford Algorithm - Floyd-Warshall Algorithm

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Use Asymptotic notations and analyse algorithms efficiency
CO2: Implement Linear data structures
CO3: Implement Linked Lists
CO4: Implement Non-Linear data Structures
CO5: Derive algorithms and infer their relationship to data structures
CO6: Apply data structure concepts to real-world applications

THEORY: 45 PERIODS
TUTORIAL:15 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:
1. Horowitz E., Sahni S., and Rajasekaran Sanguthevar, "Fundamental of Computer Algorithms", University Press, Second Edition, 2008.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
3. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill, Second edition, 2008..

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS312	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

MODULE I   MATHEMATICAL LOGIC   9

Connectives – Statement Formulas and Truth tables- Well-formed formulas- Tautologies- Equivalence of Formulas-Duality Law- Tautological Implications- Functionally complete sets of connectives- other Connectives- Disjunctive and Conjunctive normal forms- Principals of Disjunctive and Conjunctive normal Forms.

MODULE II   INFERENCE THEORY AND PREDICATE CALCULUS   9

Rules of inferences – Consistency of premises and indirect method of proof – Predicate Calculus- Variables and Quantifiers- Theory of Inference for the Predicate Calculus – Formulas Involving more than one Quantifier.

MODULE III   MATHEMATICAL INDUCTION AND COMBINATORICS   9

Mathematical Induction: Strong Induction and well-ordering-Principles of Mathematical Induction (Without proof) – Proof of Statements –Proof of Summation formulae. The basics of counting – The pigeonhole principle – Recurrence relation- Solving linear recurrence relations.

MODULE IV   GRAPH THEORY   9

Graphs and graph models-Graph terminology and special types of graph – Matrix representation of graphs and graph isomorphism – Connectivity- Euler and Hamilton path.

MODULE V   ALGEBRAIC STRUCTURES   9

Rings, Integral domains and Fields –Definitions and Examples- Coding theory - Error Detection-Correction – Hamming Distance - Minimum distance - Group Code, Linear Code and Cyclic Codes – Single error correction; Encoding and Decoding Techniques.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Apply logical reasoning in verifying the correctness and validity of simple instances of valid logical arguments.
CO2: Learn the basic concepts of Inference theory and Predicate Calculus to acquire knowledgeto solve the problems.
CO3: Understand the concept of mathematical induction and combinatorics
CO4: Construct Graphs and Graph models and their representations
CO5: Learn the basic concepts of rings, integral domains, fields, encoding and decoding procedures
     for error detection and correction
CO6: Apply the basic concepts of Inference theory, mathematical induction, combinatorics and graph theory in solving real life problems.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. "Discrete Mathematical Structures with Applications toComputer Science", by Tremblay J.P and Manohar R, 30th Reprint Tata Mc Graw Hill Pub.Co. Ltd, New Delhi,2011
2. "Discrete and Combinatorial Mathematics : An Applied Introduction", by Grimald R.P, Fifth Edition , Pearson Education Asia, Delhi, 2019.
3. "Graph Theory with applications to engineering & Computer Science" by Narsingh Deo, Prentice Hall Inc., Englewood Cliffs N.J, 1974.

REFERENCES:

1. "Discrete Mathematics with Applications", by Kenneth H Rosen, 8th Edition, Tata McGraw Hill, 2021.
2. "Theory of Computer Science", by K.L.P Mishra, Third Edition, N. Chandrasekaran, Prentice Hall of India Private Limited, 2006.
3. "Discrete Mathematics", by Lipschutz S and Mark Lipson, 3rd Edition, Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2010.
4. " A Text Book of Graph Theory", by R. Balakrishnan, K. Ranganathan, Second edition, Springer,2012.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
23CS313	**OPERATING SYSTEMS**	3	0	0	3

MODULE I   OPERATING SYSTEM OVERVIEW   8

Objectives and functions of OS - Evolution of OS - -System call - Virtual machine-Symmetric Multiprocessing - Microkernel- Multiprocessor and Multicore Organization- OS Design Considerations for Multiprocessor and Multicore .

MODULE II   PROCESS SCHEDULING   9

Process – Process States – Process description. Threads: Processes and Threads- Types of Threads- Uniprocessor Scheduling Types of Processor Scheduling - Scheduling Algorithms: FCFS, SPN, SRT, Round Robin, Priority, Multi-Level Queue.

MODULE III   MUTUAL EXCLUSION AND SYNCHRONIZATION   9

Principles of concurrency - Mutual exclusion: Software and hardware approaches - Semaphores - Monitors - Message Passing - Readers/ Writers problem. Deadlock and Starvation: Principles of deadlock - Deadlock Prevention - Deadlock Detection - Deadlock Avoidance.

MODULE IV   MEMORY MANAGEMENT   10

Memory management requirements - Memory partitioning - Loading and Linking - Paging-Segmentation. Virtual Memory: Hardware and control structures – Virtual Memory Management Policies: Fetch Policy, Placement policy, Replacement policy- Resident set management - Cleaning policy - Load control.

MODULE V   I/O MANAGEMENT AND FILE MANAGEMENT   9

I/O devices - Organization of I/O function - OS design issues - I/O buffering - Disk scheduling.File management: Overview - File organization and access - File directories - File sharing - Record blocking-Secondary storage management.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Understand the fundamental concepts and principles of operating systems, including process management, memory management, file systems, and input/output operations.
CO2: Design and implement algorithms for process scheduling, memory allocation, and disk management.
CO3: Apply principles of concurrency and synchronization to solve common problems in concurrent programming.
CO4: Analyze and apply concepts related to deadlock detection and prevention.
CO5: Apply memory management techniques, such as paging, segmentation, and virtual memory.
CO6: Demonstrate the knowledge of file systems, including file organization and access methods.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Ninth Edition, 2018.

REFERENCES:
1. Silberchatz, Galvin, Gagne, "Operating System Concepts", John Wiley, Tenth Edition, 2018.
2. Dhananjay M. Dhamdhere, "Operating System a Concept Based Approach " McGraw Hill Publication, Third Edition ,2017.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS314	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO JAVA   10
Java and Internet - Byte Code - Features of Java - Java Development Environment- Java Programming: Methods and Classes- Constructor - Garbage Collection - Overloading - Inheritance - Overriding -Packages and Interfaces - Java I/O systems -String Handling : String, String Buffer and StringBuilder.

MODULE II   EXCEPTION HANDLING   8
Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - User defined Exceptions.

MODULE III   THREADS   9
Multithreaded Programming : Thread Model - The Main Thread - Creating a Thread - Creating MultipleThreads – Thread priorities - Synchronization - Inter thread communication..

MODULE IV   SWING AND EVENT HANDLING   9

Introduction to Abstract Window Tool kit - Swing class : Key Swing features - JComponent – Swing Menu Basics – Model view Controller Architecture- Event Handling: The Delegation Event Model -Event class: Keyboard and Mouse events handling..

MODULE V   COLLECTIONS FRAMEWORK AND DATABASE CONNECTIVITY   9
Collections overview- Collections Classes – Spliterator - Working with maps - Comparators – Arrays - Data Base Connectivity: basic structure of JDBC API.

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COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Design objects for specific applications in java.
CO2: Analyse the concepts of Exception Handling and its types.
CO3: Apply the concepts of multithreading
CO4: Demonstrate the concepts of event handling.
CO5: Use the concepts of collections framework
CO6: Illustrate database connectivity.

TOTAL : 45 PERIODS

TEXT BOOKS:
   1. Herbert Schildt, " Java The Complete Reference ", Tata McGraw Hill Education, 12th Edition,2021
   REFERENCES:
   1. Cay S. Horstmann "Core Java, Volume I: Fundamentals", Oracle Press, 12th Edition 2021
   2. Cay S. Horstmann "Core Java, Vol. II-Advanced Features", Oracle Press, 12th Edition,2022

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS321	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	3	1.5

List of Experiments:

Implement the operations and applications of the given data structures using arrays/Linked list
1. Lists
2. Stack
3. Queue
4. Binary Search Trees
5. Balanced Trees
6. Graphs

COURSE OUTCOMES

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

CO1: Apply data structures concepts in applications
CO2: Implement algorithms and analyze their efficiency
CO3: Design and develop efficient data structures
CO4: Debug and troubleshoot data structure implementations
CO5: Collaborate and communicate effectively in a team
CO6: Solve real world scenarios using suitable data structures

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS322	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments:

1. System calls - fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
2. I/O system calls -open, close, read, write, create, lseek, dup.
3. Simulate UNIX commands - ls, grep, chmod, passwd, who, date.
4. Shell programming.
    - Simple functions.
    - Basic tests.
    - Loops.
    - Patterns.
    - Expansions.
    - Substitutions.

5. Process Scheduling- FCFS, SJF, Priority and Round robin.
6. Synchronization using semaphores, Message Queues and Shared Memory.
7. Implementation of Interprocess Communication.
8. Implementation of memory management schemes –first fit, Best fit, worst fit and page replacement algorithms.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Demonstrate a clear understanding of fundamental operating system concepts and principles, including process management, memory management, file systems, and scheduling algorithms.
CO2: Knowledge in using different system and I/O calls, UNIX commands and shell programming.
CO3: Implement elementary UNIX system command.
CO4: Ability to compare and contrast various CPU scheduling algorithms.
CO5: Demonstrate algorithms for Inter process communication and memory management.
CO6: Devise programs to test synchronization problems.

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

23CS323	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments:

1. Control statements in Java
2. Classes
3. Inheritance
4. Exception Handling
5. Packages & Interface
6. Multithreading
7. Swing
8. Case study Database Connectivity
9. Collections Framework

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Create effective java applications using fundamental object-oriented programming concepts.
CO2: Demonstrate advanced java concepts like Exception handling, Multithreading and Swing.
CO3: Design and develop java applications for real world problems.
CO4: Apply the concepts of Socket programming
CO5: Use the concepts of collections framework.
CO6: Illustrate database connectivity.
.

TOTAL : 30 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	DESIGN AND ANALYSIS OF ALGORITHM	L	T	P	C
		3	1	0	4

MODULE I   TIME COMPLEXITY ANALYSIS   7

Introduction – Rate of growth of functions-Asymptotic notations (Revisited)- Internal Sorts: Selection Sort, Bubble Sort, Insertion Sort -Heap Sort(Priority Queue)-Time Complexity Analysis of Sorting Algorithms

MODULE II   DIVIDE AND CONQUER   9

Introduction -Merge Sort-Quick Sort- Maximum sub array sum- Closest Pair of Points -Complexity Analysis- Recurrence relations and methods to solve them: Recursion tree, substitution, Master Method

MODULE III   BACKTRACKING AND BRANCH AND BOUND ALGORITHMS   9

Backtracking-Introduction - 8 Queens Problem-Hamiltonian Cycle – Branch and Bound-Introduction - Job Assignment Problem - Traveling Salesman Problem

MODULE IV   DYNAMIC PROGRAMMING AND GREEDY ALGORITHMS   10
Dynamic Programming – 0/1 Knapsack Problem-Optimal Binary search trees- Greedy Approach- Huffman Coding- Fractional Knapsack problem-Activity Selection Problem.

MODULE V   STRING ALGORITHMS, NETWORK FLOW, AND COMPLEXITY   10

String Matching Algorithms- Rabin-Karp algorithm - Network Flow- Definition-Maximum Flow-Ford Fulkerson algorithm - Introduction to P, NP, NP-complete – Definition

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Perform Time Complexity Analysis of Algorithms.
CO2: Apply Sorting Algorithms to Solve Real-World Problems
CO3: Understand the fundamental concepts of different algorithm design techniques
CO4: Design efficient algorithms for moderately difficult computational problems, using various   algorithm
        design techniques taught in the course
CO5: Solve Real World Network Flow Problems
CO6: Apply string algorithms to solve real-world challenges in Pattern Matching.

TOTAL : 45 PERIODS

TEXT BOOKS:
   1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 4th Edition, Prentice Hall of India, 2022.
   2. Anany Levitin, "Introduction to the design and analysis of Algorithms", Pearson, Third edition, 2011

REFERENCES:
   1. Horowitz E., Sahni S., and Rajasekaran Sanguthevar, "Fundamental of Computer Algorithms", Universities Press (Computer Science), Second Edition, 2008.
   2. Steven S.Skiena, " The Algorithm Design Manual", 2nd Edition, Springer,2008

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**DATABASE MANAGEMENT SYSTEMS**	3	0	0	3

MODULE I   INTRODUCTION AND RELATIONAL MODEL   8

Purpose of DBMS - Views of data – Database Languages - Database Engine – Application and Architecture - Database users and Administrators. Entity- Relationship(E-R) Model: complex attributes- Mapping Cardinalities – Keys - Weak Entity Sets – Symbols used in ER notation. Structure of Relational Databases - Relational Algebra - Codd's Rule.

MODULE II   INTRODUCTION TO SQL   6

SQL: Data Definition - Basic Structure - Set operations - Aggregate functions - Nested Sub queries - Complex queries - Modification of the database. Joins - Views - Integrity Constraints-Triggers

MODULE III   DATABASE DESIGN   10

Features of good relational design - Decomposition using Functional Dependencies – Normal Form - Functional Dependency theory - Normalization using Functional Dependencies

MODULE IV   STORAGE   10

RAID, Indexing and Hashing: Basic concepts, Ordered Indices: Dense and Sparse Indices - Multilevel Indices. B+-Tree Index Files: Structure of a B+-Tree - Queries in B+-Trees. Hash Indices

MODULE V   TRANSACTION MANAGEMENT   11

Transaction Concepts – Storage Structures -Transaction Atomicity and Durability- Transaction Isolation – Serializability - Transaction Isolation and Atomicity. Concurrency control: Lock Based Protocols: Locks, Granting of Locks, 2-phase locking protocol - Timestamp Based Protocols - Validation based protocols - Deadlock Handling. Recovery Systems: Failure classification - Log based Recovery - Recovery and Atomicity

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the basic concepts, architecture and relational database theory of database management systems
CO2: Demonstrate the features of ER model and apply relational algebra operations on real world applications
CO3: Use appropriate SQL queries with suitable   constraints for a given database application
CO4: Apply Normalization concepts while designing the database
CO5: Ability to use different Database Storage structures, access techniques and Indexing methods in Database applications
CO6: Understand transaction processing concepts, Concurrency Control mechanism and Database Recovery methods and the ability to apply the concepts in the design of Database applications

TOTAL : 45 PERIODS

TEXT BOOKS:
1.   Abraham Silberschatz, Henry F.Korth, S.Sudharshan, "Database System Concepts", McGraw-Hill, Seventh Edition, 2020

REFERENCES:

1.   Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Seventh Edition, 2017.
2.   Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill Education, Third Edition, 2014

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	STATISTICAL DATA ANALYSIS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO STATISTICS   9

Introduction-Descriptive and Inferential Statistics- Types of Data –Levels of Measurement-Types of Variables – Applications of Statistics- Describing data with Tables and Graphs-Describing data with averages- Describing Variability – Normal Distribution and Standard (z) scores--Relationships among Data: Correlation- Regression

MODULE II   PROBABILITY   9

Probability Axioms - Conditional Probability - Laws of total probability - Baye's theorem. One Dimensional Random variables - Discrete case and Continuous case - Distributions: Binomial, Poisson and Normal Distributions

MODULE III   SAMPLING THEORY   9

Large samples –Testing of hypothesis about population mean-difference between two means-two Standard deviations. Small samples – t-distribution -Testing of hypothesis about the population mean- difference between two sample means-F-distribution - Testing of hypothesis for equality of two Variances –Chi-Square Distribution –Test for goodness of fit – Independence of Attributes

MODULE IV   STATISTICS QUALITY CONTROL   9

Statistical basis for control charts-Control Charts for variables – Control for the sample Mean $\overline{X}$ -Chart and Sample Range R-Chart – Control chart for sample Standard Deviations-Chart – Control charts for Attributes: Control chart for proportion of defectives p- Chart- Chart for number of defectives np- Chart and Control chart for the number of defectives in a unit c- Chart

MODULE V   DESIGN OF EXPERIMENTS   9

One way and Two-way classification - Completely Randomized Design - Randomized Block Design - Latin Square Design

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Organize and summarize the different kinds of data in Statistics and analyze statistical data graphically using frequency distributions
CO2: Apply the basic probability axioms and concepts
CO3: Solve the different types large and small sample problems by using the testing of hypothesis
CO4: Incorporate the ideas of statistical process control that are imperative for the effective understanding of scientific problems
CO5: Utilize the analysis of variance for experimental designs
CO6: Assimilate ideas of probability distributions, correlation, regression, sampling techniques and design of experiments in solving statistical problems

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert S.Witte, John S.Witte, " Statistics", Eleventh Edition, - Wiley Publications, 2017.
2. Jay L Devore, "Probability and Statistics for Engineering and Sciences", Cengage Learning, 2015

REFERENCES:

1. Sheldon M.Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Third edition, Academic Press , 2004
2. R. Lyman Ott and Michael Longnecker, "An Introduction to Statistical Methods & Data Analysis", Seventh Edition, Cengage Learning, 2016
3. Devore, J.L, Probability and Statistics for Engineering and Sciences, Cengage Learning, Eighth Edition, New Delhi, 2014.
4. Ronald E. Walpole, Raymond H. Meyers, Sharon L. Meyers, "Probability and Statistics for Engineers and Scientists", Pearson Education, 2012.
5. I. Miller and M. Miller, Mathematical Statistics, Pearson Education Inc., Asia Seventh Edition, New Delhi, 2011.
6. Richard Johnson, Miller and Freund's Probability and Statistics for Engineer, Prentice Hall of India Private Ltd., EighthEdition, New Delhi, 2011

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

MODULE I   COMPUTER ARITHMETIC   9

Arithmetic algorithms for Additions, Subtraction, Multiplication and Division on Signed magnitude, 2's complement numbers and Floating-point Numbers

MODULE II   MACHINE INSTRUCTIONS AND ARITHMETIC OPERATIONS   9

Memory Locations and Addresses- Instruction and Instruction sequencing- Addressing modes –Stacks – Subroutines- RISC and CISC styles-Encoding of Machine Instructions

MODULE III   BASIC PROCESSING UNIT   9

Fundamental Concepts - Instruction Execution - Hardware Components-Instruction Fetch and execution steps-Control signals - Hardwired Control. CISC style processors

MODULE IV   PIPELINING   9

Basic Concepts –Pipeline Organization-Pipelining Issues- Data dependencies - Memory delays- Branch delays - Resource limitations – Performance Evaluation-Superscalar Operation

MODULE V   I/O ORGANIZATION   9

Accessing I/O Devices: I/O Device Interface - Program-Controlled I/O. Interrupts: Enabling and Disabling Interrupts – Handling Multiple Devices - Controlling I/O Device Behavior – Processor Control Register - Bus Structures – Bus Operation- Arbitration-Interface circuits-Direct Memory Access

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Demonstrate the working of the algorithm for performing arithmetic operations
CO2: Understand the concepts of instruction sequencing and addressing modes
CO3: Analyze the instruction execution along with the data flow path
CO4: Describe the concept of pipelining and superscalar processors
CO5: Describe the working principle of I/O devices
CO6: Analyze the working of processing unit and RISC and CISC Architecture

                                                                    TOTAL : 45 PERIODS
TEXT BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraj Manjikian, "Computer Organization and Embedded Systems", McGraw-Hill, Sixth Edition, 2017.
2. Morris Mano, "Computer System Architecture ", Pearson Education, Third   Edition, 2017 (Computer Arithmetic)

REFERENCES:

1. Sheldon M.Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Third 1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Tenth Edition, 2016.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware / Software Interface", Morgan Kaufmann, Fifth Edition, 2013.
3. John P. Hayes, "Computer Architecture and Organization", McGraw Hill, Third Edition,2017

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2										1		1
2	2	2		1								1		1
3	2	2		1								1		1
4	1	2		2			1					1		1
5	1	1	2	1			1					1		1
6	2	2		1								1		1
Avg.	2	2	2	1			1					1		1

1-low, 2-medium, 3-high

COURSE CODE	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

MODULE I   FINITE AUTOMATA   9

Alphabets- Strings- Languages- Finite Automata-Definitions- Non-Deterministic Finite Automata- Deterministic Finite Automata-Finite Automata with epsilon moves – Equivalence of epsilon NFA and NFA – Equivalence of NFA and DFA – Minimization of Finite Automata- Applications of Finite Automat.

MODULE II   REGULAR EXPRESSION AND PROPERTIES OF REGULAR LANGUAGES   9

Regular expressions- Definition-Operations on Regular expressions- Equivalence of Regular Expressions and FA- Pumping Lemma for regular languages-Closure Properties of regular languages.

MODULE III   CONTEXT-FREE GRAMMAR AND PROPERTIES OF CONTEXT-FREE LANGUAGES   9

CFG –Definitions-Derivation Trees –Ambiguous Grammars-Simplification of CFG- Chomsky Normal Form-Pumping Lemma for Context-Free Languages – Closure Properties of Context-Free Languages

MODULE IV   PUSH DOWN AUTOMATA   9

Push Down Automata: Informal Description- Formal Definition – Languages of a Pushdown Automata – Acceptance by empty Stack and Final State-Equivalence of Pushdown Automata and CFG

MODULE V   TURING MACHINE AND PROPERTIES OF RECURSIVE LANGUAGES   9

Introduction– Turing Machine–Formal Definition - Turing Machine as Language Acceptor, Turing Machine as a computer of Integer functions–Types of TM-Properties of Recursive and
Recursively Enumerable Languages- Chomsky Hierarchy of Languages

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Understand the basic properties of formal languages and grammars
CO2: To design Finite State Machines for Solving Problems
CO3: To understand Regular expressions, Regular Languages, and their properties
CO4: To construct a Context-Free Grammar for any given language and to understand CFL and its properties
CO5: To design PushDown Automata for solving problems
CO6: To design Turing Machine for solving problems and to understand language hierarchy

TOTAL : 45 PERIODS

TEXT BOOKS:

1. John.E.Hopcroft, Jeffery.D Ullman, Rajeev Motwani, Introduction to Automata Theory, Languages and Computations, Third Edition, 2009.
2. Michael Sipser, Introduction to the Theory and Computation, Third edition, 2012.
3. Peter Linz - An introduction to Formal Languages and Automata, Sixth edition,2012
4. K. L. P Mishra, N. Chandrashekaran , Theory of Computer Science-Automata Languages and
Computation, 2nd edition, 2003

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Database Creation, Insertion and Deletion.

2. Queries based on DML commands.

3. Aggregate Functions.

4. Subqueries and Joins.

5. Group by clause and DATE functions.

6. Views and Triggers.

7. PL/SQL Procedures.

8. Using Cursors and Functions in PL/SQL blocks.

9. ODBC Connectivity.

COURSE OUTCOMES

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

CO1: Illustrate various DDL, DML, TCL commands so as to perform various database operations
CO2: Analyse the various constraints to populate the database through SQL Queries
CO3: Demonstrate solutions using DML and TCL commands and solve queries for real world applications
CO4: Apply different working concepts of views and triggers using SQL Queries
CO5: Develop an open database connectivity by establishing connections between front end & databases
CO6: Apply various PL/SQL features such as procedures, functions and report generation

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	DESIGN AND ANALYSIS OF ALGORITHM LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

Sorting Algorithms

Implement the following sorting algorithms
1. Insertion sort,
2. Selection sort
3. Quick sort
4. Heap sort

Algorithm Design Techniques

1. Implement the N Queens problem using Backtracking.
2. Implement Merge sort using the divide and conquer method.
3. Solve Huffman coding using a greedy approach.
4. Implement String Matching algorithms (Rabin-Karp algorithm).
5. Implementation of optimal binary search tree.

COURSE OUTCOMES

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

CO1: To solve sorting problems.
CO2: Design efficient algorithms for solving real world problems.
CO3: Apply algorithmic problem-solving techniques.
CO4: Perform algorithm analysis and optimization.
CO5: Apply algorithmic strategies for specific domains.
CO6: Apply string matching algorithms to solve practical problems in text processing.

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Python statements- Data types and variables
2. Python operators
3. Conditional statements and looping
4. Lists, Tuples, Dictionaries
5. User defined functions.
6. String Manipulations
7. Files, Errors and Exceptions
8. Modules and Packages
9. Advanced Python Libraries –Numpy, Scikit-learn.
10. Data Manipulation with Pandas.

COURSE OUTCOMES

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

CO1: Demonstrate control statements, decision making statements to solve given problems
CO2: Use Python data structures such as lists, tuples & dictionaries for representing compound data
CO3: Solve real world problems using functions and String operations
CO4: Demonstrate file concept in Python Programming
CO5: Point out errors and demonstrate exceptions in python programming
CO6: Apply modules and packages in Python for solving problems

TOTAL : 60 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   7

Introduction: Internet- The Network Core-Packet Switching, Circuit Switching- Delay, loss, throughput in packet switched networks- Protocols layers and their service models-TCP/IP Protocol suite –OSI Model

MODULE II   APPLICATION LAYER   8

Principles of Network applications- The web and HTTP- overview of HTTP, Persistent and non-persistent connections, HTTP message format- FTP-Electronic Mail in the Internet-DNS-Peer-Peer applications

MODULE III   TRANSPORT LAYER   10

Introduction and Transport Layer services-Multiplexing and Demultiplexing- connectionless Transport: UDP-Connection oriented Transport: TCP-TCP segment structure, Round-Trip Time Estimation and Timeout, TCP Connection Management-TCP congestion control and Flow Control

MODULE IV   NETWORK LAYER   10

Introduction-Virtual Circuit and Datagram Networks-The Internet Protocol (IP): Forwarding and Addressing in the Internet-Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm-Broadcast and Multicast Routing- Routing in the Internet: Inter-AS Routing: BGP

MODULE V   LINK LAYER   10

Introduction -Error Detection and Correction-Multiple Access Links and Protocols: Random Access Protocols-Switched Local Area Networks: Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs)- Multiprotocol Label Switching (MPLS)

COURSE OUTCOMES

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

CO1: Summarize the layered architecture of computer networks, factors influencing the performance of networks.
CO2: Demonstrate the services of application layer protocols and develop applications for client server model using socket functions.
CO3: Demonstrate the working of TCP and UDP protocols.
CO4: Analyze and examine the IP addressing schemes in any given networking scenario.
CO5: Describe the routing protocols, link layer access protocols with their functions and formats.
CO6: Apply Framing, error and flow control techniques.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. James F. Kurose & Keith W. Ross, Computer Networking A Top-down approach, Eight Edition, Pearson Education, 2022.

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill, 2013.
2. William Stallings, Data and Computer Communications, 8th edition, Pearson PrenticeHall, 2007.
3. Larry L .Peterson and Bruce S. Davie, Computer Networks A Systems Approach, Fifth edition, Morgan Kaufman, 2012.
4. Andrew S Tanenbaum and David J. Wetherall, Computer Networks, Fifth Edition, Pearson, 2010

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	SOFTWARE ENGINEERING	L	T	P	C
		2	0	2	3

MODULE I   INTRODUCTION   10

Introduction – The Software problem – Software Engineering Problem – Software Engineering Approach – Software Process – Characteristics of a Software Process – Software Development Process –Software Life cycle models- Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods - Introduction to Agile process- SCRUM- Extreme Programming

MODULE II   SOFTWARE REQUIREMENTS AND ANALYSIS   9

Requirements Analysis and Specification - Requirements Gathering and Analysis- Value of good SRS - Requirement process- Requirement Specification - desirable characteristics, components and Structure of requirements document - Functional Specification with use cases - basics - DFDs - Data Dictionary –ER Diagram- Validation

MODULE III   SOFTWARE DESIGN AND CODING   9

Design concepts - Cohesion and Coupling- Function-oriented Design –Object Oriented Design- Detailed Design – Verification – Metrics - Programming Principles and Guidelines – Incrementally Developing Code- Code inspection – Metrics

MODULE IV   TESTING   9

Testing Fundamentals - Levels of Testing: Unit Testing - Integration Testing - System Testing - Acceptance Testing - Testing Process - Black Box Testing: Equivalence Class Partitioning - Boundary Value Analysis - White box Testing: Control Flow based criteria - Data Flow based Testing – Metrics

MODULE V   SOFTWARE PROJECT MANAGEMENT   8

Software Project Estimation: Decomposition Techniques-COCOMO Model- Estimation for Object Oriented Projects-Specialized Estimation Techniques

COURSE OUTCOMES

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

CO1: Illustrate the various software life cycle models along with Agile and choose an appropriate model for a given application

CO2: Outline the functional and nonfunctional requirements to analyze data flow, ER diagrams and build Software Requirement Specifications

CO3: Model the requirements by following design principles, suitable architectural styles and software design methodologies

CO4: Construct the coding standards and practices in developing software applications

CO5: Solve the defects by applying various testing techniques

CO6: Estimate the various kinds of projects using Estimation Techniques

TOTAL : 45 PERIODS

TEXT BOOKS:

1.   Pankaj Jalote,"Software Engineering A Precise Approach", Wiley India, Third Edition, 2012.
2.   Roger. S. Pressman, "Software Engineering A Practitioner's Approach", McGraw Hill International Edition, Eighth Edition, 2019.

REFERENCES:
1.   David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2.   Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**COMPILER DESIGN**	3	1	0	4

MODULE I INTRODUCTION AND LEXICAL ANALYSIS   6

Compilers and Interpreters - The structure of a Compiler - Phases of a compiler - Symbol table - Finite Automata and Lexical Analysis: The role of Lexical Analyzers, Input Buffering - Specification and Recognition of Tokens

MODULE II FINITE AUTOMATA AND REGULAR EXPRESSION   7

Regular expressions - Finite automata: NFA, DFA, Minimization of DFA – Converting Regular expression to DFA- Language for Specifying Lexical Analyzers

MODULE III SYNTAX ANALYSIS   12

Need and Role of the Parser - Context Free Grammars- Top down Parsing: Recursive Descent Parser **-** Predictive Parser - Bottom Up Parsing- Shift Reduce Parser –Operator Precedence Parser - LR Parser SLR-CLR-LALR Parser - Error Handling and Recovery in Syntax Analyzer

MODULE IV SDT AND INTERMEDIATE CODE GENERATION   10

Syntax Directed Translation - Synthesized and Inherited attributes - Implementation of syntax directed translators - Intermediate code - Quadruples and Triples - Generation of Three Address Code - Declarations - Assignment Statements - Arrays - Boolean Expressions - Backpatching - Flow of Control Statements

MODULE V CODE OPTIMIZATION AND GENERATION   10

Principal Sources of Optimization - DAG representation of Basic blocks - Optimization of Basic Blocks – Loop Optimization - Global Data Flow Analysis - Issues in Code generation - A Simple Code Generator Algorithm - Peephole optimization

COURSE OUTCOMES

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

CO1: Understand the techniques in different phases of a compiler
CO2: Design a lexical analyser for a regular language
CO3: Write Regular expression and context free grammars for given languages
CO4: Apply different parsing algorithms to develop a parser
CO5: Understand semantics rules (SDT), intermediate code generation and run-time environment
CO6: Implement code generation and apply code optimization techniques

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alfred V.Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman "Compilers: Principles, Techniques and Tools", Pearson Education,Inc., Second Edition,2014.
2. Alfred V. Aho and Jeffrey D. Ullman, "Principles of Compiler Design", Narosa Publishing House pvt. ltd., Twenty fifth Reprint 2002.

REFERENCES:

1. Jean Paul Tremblay and Paul G.Sorenson., "Theory and Practice of Compiler Writing", BS Publication, Reprint 2008.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Usage of networking commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
3. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
4. TCP / UDP sockets.
5. Concurrent Server
6. Sliding window protocol
7. Error detection and control
8. FTP / TELNET / ARP / RARP protocols.
9. Multicasting / Broadcasting
10. Study of Network simulator (NS2) and Performance evaluation of various routing protocols

COURSE OUTCOMES

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

CO1: Demonstrate the different types of Networking cables
CO2: Implement different models of servers using Socket functions
CO3: Analyze error detection and error correction codes
CO4: Implement and analyze routing and congestion issues in network design
CO5: Simulate the working of protocols used in different layers of networks and analyze its performance

TOTAL : 30 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	COMPILER DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Implementation of Finite Automata.

2. Study of Flex and Bison Tools.

3. Programs using Flex and Bison Tools.

4. Implementation of Parsing Techniques.

5. Design of toy compiler using Flex and Bison and LLVM.

COURSE OUTCOMES

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

CO1: Implement the types of Finite Automata
CO2: Recognize the use Flex and Bison tool
CO3: Design Lexical analyzer for given language using Flex
CO4: Design Lexical and Syntax analyzer for given language using Flex and Bison
CO5: Implement and analyze parsing techniques
CO6: Design toy compiler using Flex, Bison and LLVM

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Experiment with Client side scripting using JavaScript
2. Create a Simple web application using Servlet
3. Create a Simple web application using PHP/ JSP
4. Develop an Application to demonstrate cookies and session management.
5. Demonstrate Database connectivity using Servlet and JSP/ PHP
6. Create a Form and validate it using AJAX
7. Display a XML document from server in the form of HTML table in client side.
8. Develop an application that make use of database.
9. Develop E- commerce application
10. Examine the developed web application using testing techniques

COURSE OUTCOMES

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

CO1: Conceptualize and plan an internet-based business that applies appropriate business models and web technologies
CO2: To select and apply markup languages for processing, identifying, and presenting information in web pages
CO3: Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations
CO4: Incorporate best practices in navigation, usability and written content to design websites that give users easy access to the information
CO5: To create a static website using HTML and add dynamic functionality to it by using java Script
CO6: To gain expertise in web based strategic business alignment prioritizing security, navigation and dynamic script functionalities to facilitate a successful internet business

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	INPLANT TRAINING	L	T	P	C
		0	0	12	6

COURSE OUTCOMES

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

CO1: Apply theoretical concepts and principles learned in their engineering course work to real world industry problems.
CO2: Develop and enhance their technical skills, gaining hands-on experience with industry standard tools, technologies and methodologies.
CO3: Improve their professional communication skills, including the ability to present technical information effectively both orally and in writing.
CO4: Demonstrate improved problem solving and critical thinking abilities.
CO5: Gain experience working in the team environments.
CO6: Acquire insights into industry practices and standards.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3									3	3	3
CO2	3	3	3	3	3							3		
CO3	3	3			3					3				
CO4	3	3		3								3		
CO5	3	3				3		2	3	3	2			
CO6	3	3				3	3	3	3	3				
Avg.	3	3	3	3	3	3	3	3	3	3	2	3	3	3

COURSE CODE	EMBEDDED SYSTEMS AND INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Module I   INTRODUCTION TO EMBEDDED SYSTEM   10

Characteristics of Embedded system - Challenges in Embedded System - Embedded System Design Process - CPU Power Consumption.-Components for embedded programs - Models of programs - Performance analysis and optimization of program size - Power analysis and optimization.

Module II   ARM PROCESSOR   9

Architecture overview - Registers - Special Registers - Operation mode - Stack memory operations - Reset sequence- 5 Stage pipeline organization - Arm instruction execution

Module III   ARM ASSEMBLY LANGUAGE PROGRAMMING   9

Data Processing instructions-Data Transfer Instructions- Control flow Instructions - Writing Simple ALP - Memory Map - Bit Band Operations -Unaligned transfers - Exclusive access -Endian mode -Memory protection unit Overview - Power Management

Module IV   INTERNET OF THINGS COMMUNICATION PLATFORMS   9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS-6LoWPAN- CoAP - MQTT

Module V   IOT ARCHITECTURE, ANALYTICS, AND APPLICATIONS   8

M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities - Data and Analytics for IoT: IoT Middleware, Data analytics for IoT -Smart city, Smart health and wearable devices, Environment monitoring and surveillance.

COURSE OUTCOMES
At the end of the course, students will be able to
 CO1: Develop proficiency in the various components and protocols utilized in hardware systems.
 CO2: Understand the features of embedded Systems and architecture of ARM Processor.
 CO3: Develop simple Assembly Language Programs.
 CO4: Identify and analyze the various components and technologies used in IoT systems.
 CO5: Apply various IoT protocols in multi-disciplinary domains
 CO6: Implement communication protocols and networking techniques for IoT systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman. Sixth Edition 2023 (E-book).
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Third Edition, Newnes, (Elsevier), 2013.

3. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
4. J.P Vasseur, A. Dunkels, "Interconnecting Smart Objects with IP: The next Internet", Morgan Kufmann, 2010 (COMPONENTS IN INTERNET OF THINGS).
5. Z.Shelby, C.Bormann, 6LOWPAN: The wireless Embedded Internet", Wiley, first edition, 2011 (6LOWPAN)

REFERENCES:

1. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015
2. Dr. OvidiuVermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to Market deployment", River publishers, 2022.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Module I   INTRODUCTION   9

Machine Learning-Types of Machine Learning - Supervised Learning - Regression –Classification-The Bias-Variance Trade off. Neural Networks- Hebb's Rule- Mcculloch And Pitts Neurons - Limitations Of The Mcculloch And Pitts Neuronal Model- The Perceptron - The Learning Rate - The Bias Input - The Perceptron Learning Algorithm - Logic Functions – Implementation- Linear Separability- The Exclusive Or (Xor) Function - Back-Propagation of Error - Multi-Layer Perceptron in Practice - Examples of Using the MLP - Deriving Back-Propagation.

Module II   PROBABILISTIC LEARNING AND KERNEL BASED LEARNING   9

Gaussian Mixture Models - The Expectation-Maximisation (Em) Algorithm - Information Criteria - Nearest Neighbour Methods -Nearest Neighbour Smoothing-Efficient Distance Computations: The Kd-Tree - Distance Measures. Support Vector Machines: Optimal Separation- Kernels-Support Vector Machine Algorithm -Extensions to the SVM.

Module III   REINFORCEMENT LEARNING   9

Overview -Markov Decision Processes- Values -Using Reinforcement Learning- The Difference Between SARSA and Q-Learning- Uses Of Reinforcement Learning

Module IV   UNSUPERVISED LEARNING AND ENSEMBLE LEARNING   9

The K-Means Algorithm - Vector Quantisation - The Self-Organising Feature Map. Ensemble Learning: Boosting – Adaboost-XGBoost- Bagging -Random Forests- Different Ways to Combine Classifiers**.**

Module V   DIMENSIONALITY REDUCTION   9

Linear Discriminant Analysis- Principal Component Analysis- Factor Analysis-Independent Component Analysis- Locally Linear Embedding-Isomap.

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Apply the basics of machine learning methods in understanding regression and classification models.
CO2: Demonstrate supervised and unsupervised learning methods in making rational decisions and to minimize risk and learn from data.
CO3: Train a multi-layer perceptron for different applications.
CO4: Apply reinforcement learning methods in solving problems.
CO5: Analyze the performance of ensemble learning methods in classification problems.
CO6: Identify appropriate dimensionality reduction techniques in selecting appropriate features for training the machine learning model.

TOTAL: 45 PERIODS

TEXT BOOK

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman Hall/CRC Second Edition, 2014, ISBN: 978-1466583283.
2. Tianqi Chen and Carlos Guestrin. XGBoost: A Scalable Tree Boosting System. In 22nd SIGKDD Conference on Knowledge Discovery and Data Mining, 2016(Only for XGBoost)

REFERENCE BOOKS

1. EthemAlpaydin, "Introduction to Machine Learning", PHI Learning Pvt. Ltd Third edition, 2015, ISBN: 978-8120350786. (Introduction, Parametric methods, Dimensionality Reduction, Multilayer Perceptron)
2. Zhi-Hua Zhou," Ensemble Methods: Foundations and Algorithms", A Chapman & Hall Book, CRC Press, 2012. (AdaBoost Algorithm, Bagging Algorithm, Random Tree Ensembles)
3. Tom Mitchell, "Machine Learning", McGraw-Hill, First Edition, 2017, ISBN: 978-1259096952. (Concept Learning, Reinforcement Learning).

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	DATA MINING AND DATA WAREHOUSING	L	T	P	C
		3	0	0	3

Module I   DATA MINING AND DATA WAREHOUSING   6

Data Mining- Diversity of data types-Mining various Kinds of knowledge- Data mining: confluence of multiple disciplines-Data mining and applications. Data Warehouse: Basic concepts - Data Warehouse Modelling: schema and measures-OLAP operations- Data cube computation methods.

Module II   DATA PREPROCESSING   9

Data, measurements, and data pre-processing: Data types- Statistics of data- Similarity and distance measures- Data quality, data cleaning, and data integration- Data transformation-Dimensionality reduction.
.

Module III   ASSOCIATION RULES   9

Pattern mining: Basic concepts- Frequent itemset mining methods-Pattern evaluation methods. Mining various kinds of patterns-Mining compressed or approximate patterns- Constraint-based pattern mining-Mining sequential patterns-Mining subgraph patterns.

Module IV   CLUSTERING   9

Cluster analysis- Partitioning methods- Hierarchical methods- Density-based and grid-based methods-Evaluation of clustering- Probabilistic model-based clustering-Clustering high-dimensional data

Module V   CLASSIFICATION   12

Basic concepts- Decision tree induction- Bayes classification methods- Lazy learners - Linear classifiers-Model evaluation and selection-Techniques to improve classification accuracy- Support vector machines-Rule-based and pattern-based classification

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Apply the basic concepts of data mining and data warehousing in the real-world applications
CO2: Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.
CO3: Apply frequent pattern extraction and association rules mining for data analysis
CO4: Analyze different types of data using classification and clustering techniques.
CO5: Demonstrate mining of various types of data and its application to real world problems.
CO6:Identify appropriate data mining technique and evaluate its performance in real life applications
                                                              TOTAL: 45 PERIODS

TEXT BOOK

  1. Jiawei Han, Jian Pei, Hanghang Tong "Data Mining-Concepts and Techniques" Morgan Kaufmann
     Publishers, Fourth Edition, 2022.

REFERENCE BOOKS
 1. Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Fourth Edition, 2017. (Association   Rules and
     Partitioning – CLARA, CLARANS)
 2. George M. Marakas, " Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson
     Education, First Edition, 2011
 3. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition,2010.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	EMBEDDED SYSTEMS AND INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	3	1.5

EMBEDDED EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Basics of Assembly Language Programming
2. Peripheral Interfacing:
   - Seven Segment Display
   - Matrix Keyboard
   - LCD Display
   - Buzzer
3. Programming Robots
4. Digital circuit development using FPGA
5. PIC Microcontroller based application

IOT EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Temperature Sensing and control
2. Smart lighting
3. Smart Appliances
4. Smoke/Gas Detectors
5. Pollution Monitoring
6. Connecting with EDGE devices and data analysis – Using MQTT protocol.
7. Smart irrigation – Actuator control via CoAP communication protocol.

COURSE OUTCOMES
At the end of the course, students will be able to
   CO1 : Gain proficiency in hardware based programming languages.
   CO2 : Develop Simple Assembly Language Program.
   CO3 : Develop Embedded C programs.
   CO4 : Develop applications based on IOT and Sensors.
   CO5: Design any real time application based on IoT
   CO6: Ability to interface and integrate different sensors with Arduino board enabling them to gather data from the physical world.

TOTAL: 45 PERIODS

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

COURSE CODE	MACHINE LEARNING LABORATORY .	L	T	P	C
		0	0	3	1.5

LIST OF EXPERIMENTS:

1. Study and usage of R tool and python
2. Implement a Bayesian classifier for a product sales data
3. Implement a feature selection technique on any public dataset
4. Implement PCA (Dimensionality reduction technique) on text / image data
5. Implement factor analysis (Dimensionality reduction technique) on text/image data
6. Implement a decision tree algorithm for sales prediction/classification in retail sector
7. Implement a predictive model for predicting house prices (regression)
8. Implement a neural network model to forecast the electricity consumption of a household/commercial complex/university/ college

Note : Datasets for the above exercises available in Kaggle and UCI repository mentioned below:

i)   https://www.kaggle.com
ii) http://archive.ics.uci.edu/ml/datasets.html

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Apply various classification techniques for problems using tools like R and Python.

CO2: Apply feature selection and dimensionality reduction techniques on datasets.

CO3: Implement solutions for various prediction problems using appropriate tools.

CO4: Design and develop a neural network for any real-world problem.

CO5: Apply Bayesian Classification techniques for real life data analysis
CO6: Build neural network models to apply in prediction and classification tasks

TOTAL: 45 PERIODS

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	EXPLORATORY DATA ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXERIMENTS:

1. Descriptive Statistics in EDA
2. Handling and Recoding missing value/Null values
3. Data merging
4. OLAP Operations
5. Data representation
6. Time variant analysis
7. Pooled OLS Regression
8. Forecasting
9. Hypothesis testing
10. Case study on Data visualization using Tableau/PowerBi

COURSE OUTCOMES
At the end of the course, students will be able to
CO 1: Calculate and interpret descriptive statistics to summarize datasets effectively and various techniques for handling missing values.
CO 2: Merge datasets using SQL joins.
CO 3: Perform OLAP operations and construct OLAP queries.
CO 4: Select and create appropriate visualizations to represent data and analyze temporal data trends.
CO 5: Apply Pooled OLS regression to real-world datasets and incorporate forecasting models.
CO 6: Interpret the results of hypothesis tests and perform data visualization using Tableau or Power BI

Total :30 Periods

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	1	0	4

MODULE I - INTRODUCTION   9

Foundation of AI - Agents and Environments- Concept of Rationality - Nature of Environments - Structure of Agents-Problem- Solving Agents and examples - Uninformed Search Strategies-Informed (Heuristic) Search Strategies: A*Search - Heuristic Functions.

MODULE II - OPTIMIZATION PROBLEMS   9

Local Search Algorithms and Optimization Problems - Searching with Partial Information. Adversarial Search: Games - Optimal Decisions in Games - Heuristic Alpha-Beta tree search.

MODULE III - CONSTRAINT SATISFACTION PROBLEM   9

Defining Constraint Satisfaction Problems - Constraint Satisfaction Problems - Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems.

MODULE IV - KNOWLEDGE AND REASONING   9

Logic - Propositional Logic - Syntax and Semantics of First - Order Logic - Using First - Order Logic - Knowledge Engineering in First - Order Logic - Propositional vs. First - Order Inference - Forward Chaining - Backward Chaining - Resolution.

MODULE V - UNCERTAIN KNOWLEDGE AND REASONING   9

Acting under uncertainty - Bayes' rule and its use - Representing Knowledge in an Uncertain Domain -The Semantics of Bayesian Networks - Exact Inference in Bayesian Network - Approximate Inference in Bayesian Networks.

COURSE OUTCOMES
At the end of the course, students will be able to
CO 1: Apply and interpret descriptive statistics to summarize datasets effectively and analyze various techniques for handling missing values.
CO 2: Implement merge operations on datasets using SQL joins.
CO 3: Perform OLAP operations and construct OLAP queries.
CO 4: Identify and apply appropriate visualizations to represent data and analyze temporal data trends.
CO 5: Apply Pooled OLS regression to real-world datasets and incorporate forecasting models.
CO 6: Interpret the results of hypothesis tests and perform data visualization using Tableau or Power **BI**

THEORY: 45 PERIODS
TUTORIAL:15 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Fourth Edition, 2022.

REFERENCES:

1. Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education, First Edition, 2013.
2. Dan W. Patterson "Introduction to AI and ES", Pearson Education, First Edition, 2007.
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley publishers, Third Edition, 1992.
4. Elaine Rich, Kevin Knight and Shivashankar, "Artificial Intelligence", McGraw Hill, Third Edition, 2009.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	1	0	4

MODULE I - INTRODUCTION 9

Computer and Network Security Concepts: Security Attacks - Security Services - Security Mechanisms. Introduction to number theory: Fermat's and Euler's theorems - Testing on Primality: Miller Rabin primality test. Modular arithmetic-Euclidean Algorithm.

MODULE II - SYMMETRIC CIPHERS 9

Classical Encryption Techniques: Symmetric Cipher Model - Substitution Techniques: Playfair cipher, vigenere cipher– Transposition Techniques: Columnar Transposition. Block Cipher and the Data Encryption Standard-Advanced Encryption Standard-Block Cipher Operation: Cipher block Chaining mode - Output feedback mode-Counter mode.

MODULE III - ASYMMETRIC CIPHERS AND CRYPTOGRAPHIC HASH FUNCTIONS 9

Public Key Cryptography and RSA: Principles of Public key Cryptosystems - RSA Algorithm-Diffie-Hellman Key Exchange - Elliptic Curve Arithmetic - Elliptic Curve Cryptography. Cryptographic hash functions: Applications-Requirements and Security-Secure Hash Algorithm-SHA-3.Message Authentication Codes : Requirements – Functions

MODULE IV - KEY MANAGEMENT AND USER AUTHENTICATION 9

Digital Signatures: Digital Signatures-NIST Digital Signature Algorithm- Elliptic Curve Digital Signature Algorithm. Key Management and Distribution: Distribution of public keys-X.509 Certificates- Public-Key Infrastructure. User Authentication: Kerberos

MODULE V - NETWORK SECURITY 9

Transport Layer security: Transport Layer security –Secure Shell (SSH). Electronic Mail Security: Pretty Good Privacy-S/MIME. IP Security: Policy- Encapsulating Security Payload - Cryptographic primitives in block chain. Intruders - Intrusion detection - Malicious Software: Viruses and Related Threats – Virus Countermeasures - Distributed DoS attacks. Firewalls: Firewall Design Principles.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Apply the symmetric and asymmetric ciphering algorithms for security attacks and threats.
CO2: Apply modern algebra and number theory to understand cryptographic algorithms and vulnerabilities.
CO3: Illustrate hashing and message authentication concepts based on mathematical terminology associated with it.
CO4: Use the concepts of key management and user authentication techniques.
CO5: Describe various protocols for network security to protect against the threats in the networks.
CO6: Identify the software security issues in the network and resolve it.

THEORY: 45 PERIODS
TUTORIAL:15 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Eight Edition, 2022.
2. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Fourth Edition, 2005.(Intrusion Detection System,Firewalls)

REFERENCE BOOKS

1. Behrouz A.Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Third Edition, 2015.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, Third Edition, 2013.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

MODULE 1-BIG DATA 9

Big data characteristics - Data in the Warehouse and Hadoop - Big Data Use Cases- Understanding Big Data Storage – A General Overview of High-Performance Architecture - HDFS - Map Reduce and YARN, HADOOP ECOSYSTEM: Hadoop distributed file system: HDFS Concepts, Hadoop File systems, Data Flow

MODULE 2- MAPREDUCE 9

MapReduce (MR) basics: Functional Programming Roots, Mappers and Reducers, The Execution Framework, Partitioners and Combiners, MR algorithm design: Local Aggregation, Pairs and Stripes, Computing Relative Frequencies, Secondary Sorting, Relational Joins, Inverted Indexing for Text Retrieval: Web Crawling, Inverted Indexes - Baseline and Revised Implementation

MODULE 3- MINING DATA STREAMS 9

Stream data model – Sampling data streams – Filtering Streams- counting distinct elements in a stream – Estimating moments- Counting ones in a window- Decaying Windows

MODULE 4- PROGRAMMING WITH PIG 9

Introduction – installation and execution – PIG Data Model – PIG Latin – Input, Output- Relational Operators – User Defined Functions - Developing and Testing Pig Latin Scripts – Embedding Pig Latin in Python .

MODULE 5- HBASE AND HIVE 9

HBASE: HBase data model, Hbase Vs RDBMS-HIVE: Databases in Hive – HiveQL: Data Definition – Data Manipulation – Queries – Views – Indexes – Schema Design

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Identify the challenges and opportunities associated with Big Data analytics.
CO2: Understand the basics of big data analytics and exposure to state-of-the-art data analytic tools and techniques.
CO3: Apply appropriate Map Reduce Logic for solving computational problems.
CO4: Demonstrate Big data analytics using Hadoop
CO5: Acquire knowledge on fundamental techniques and principles in data stream analytics.
CO6: Use tools like PIG, Hive, Hbase with Hadoop

TOTAL : 45 PERIODS

TEXT BOOKS
1. Tom White, "Hadoop: The Definitive Guide", O`Reilly Publishers, USA, Third Edition, 2012.(Hadoop ecosystem, PIG,HIVE and HBASE))
2. Jimmy Lin and Chris Dyer, "Data Intensive Text Processing using MapReduce", Morgan and Claypool Publishers, USA, First Edition, 2010.(MapReduce)
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2012. (Mining Data Streams)

REFERENCE BOOKS
1. SeemaAcharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS BusinessSeries, First Edition, 2012.
3. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",Elsevier, First Edition, 2007.

4. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
5. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
6. Balamurugan Balusamy, Nandhini Abirami. R, Seifedine Kadry, and Amir H. Gandomi, "Big Data: Concepts, Technology, and Architecture", First Edition. 2021 John Wiley & Sons, Inc.
7. Paul Zikopouloset al, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data",McGraw Hill Professional, USA, First Edition,2012.(Big Data)

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	ARTIFICIAL INTELLIGENCE LABORATORY.	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS
1. Implementing state space search algorithms
   - Hill climbing algorithms
   - A* Algorithm
2. Solving 4-Queens problem
3. Solving traveling salesman problem
4. Adversarial search and Game Playing
5. Knowledge representation and inference - Predicate logic using Prolog
6. Designing a Chatbot application.
7. Information retrieval using semantic search

COURSE OUTCOMES

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

CO1: Analyze and formalize the problem as a state space graph and solve it using appropriate search methods.

CO2: Apply Design heuristics and different search techniques in problem solving.

CO3: Implement optimal decision making in game playing.

CO4: Attain the capability to represent various real life problems using logic-based techniques and use this to perform inference or planning.

CO5: Apply knowledge representation and natural Language processing concepts in implementing chatbot applications and semantic search

CO6: Identify suitable search strategy to solve the given problem and analyze the performance of the chosen strategy.

TOTAL: 45 PERIODS

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Working with Wireshark -packet sniffing tool

2. Demonstrate on port scanning and vulnerability assessment using Metasploit and Nmap.

3. Monitoring security events and anomalous network activities using CISCO packet analyzer

4. Implementation of substitution and transposition techniques.

5.Implementation Symmetric and Asymmetric ciphering security mechanisms

6.Implementation of Diffie-Hellman Key Exchange algorithm

7.Compute Message Digest using SHA hashing algorithm

8.Compute Digital signature using NIST digital signature algorithm

9.Demonstrate on web application vulnerability assessment using N-stalker.

10.Demonstrate on intrusion detection system using Snort.

11.Demonstrate on malware detection using rootkit hunter.

COURSE OUTCOMES

At the end of the course, students will be able to
CO1 : Use different tools for secure data transmission.
CO2: Understand the various substitution and transposition techniques.
CO3: Apply symmetric ciphering algorithms for security attacks and threats.
CO4: Apply asymmetric ciphering algorithms for security attacks and threats.
CO5: Compute message digest using hashing algorithms.
CO6: Analyze the working of network-based intrusion detection systems.

TOTAL: 30 PERIODS

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

COURSE CODE	BIG DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).

2. Implement various file management tasks in Hadoop:

    i. Adding files and directories

    ii. Retrieving files

    iii. Deleting files

3. MapReduce applications on Hadoop cluster.

4. Process Unstructured data into NoSQL data and perform operations such as NoSQL query with API.

5. Perform K-means clustering using map reduce.

6. Develop Pig Scripts and User defined functions (UDF)

7. Embedding PIG Latin in Python

8. Semi structured data processing using "Pig" (e.g: Log analysis)

9. Install "HIVE" and Perform query processing on "Hive" (E.g: create, alter, and drop databases, tables, views, functions, and indexes.)

10. Application development using SPARK.

COURSE OUTCOMES

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

CO1: Understand the implementation of Hadoop, PIG and HIVE.

CO2: Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks.

CO3: Experiment with MapReduce and NoSQL queries in Hadoop frameworks

CO4: Implement MapReduce programs in variety of applications

CO5: Apply different data processing tools like Pig, Hive.

CO6: Design and develop application using SPARK

TOTAL: 45 PERIODS

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	Project Work and Viva-Voce	L	T	P	C
		0	0	12	6

COURSE OUTCOMES

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

CO1: Conduct comprehensive research to identify a relevant and significant problem in their firld of study.

CO2: Design and develop an innovative solution using appropriate methodologies, tools, and technologies

CO3: Demonstrate technical proficiency in implementing their project solution including coding, testing and debugging.

CO4: Apply project management principles to plan, execute and deliver their project within the given time frame and resource constraints.

CO5: Effectively communicate their project outcomes through written reports, oral presentations and visual aids.

CO6: Understand and apply ethical and professional practices in their project work including data privacy, intellectual property and team work.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	UNIX INTERNALS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO KERNEL   9
Basic Commands & Directory Hierarchy: Basic commands, Navigating directories, Intermediate commands.Kernel Concepts: Architecture of UNIX operating system - Introduction to system concepts - Kernel data structures. - The Buffer Cache: Buffer headers - Structure of Buffer pool - Scenarios for retrieval of a buffer - Reading and writing disk blocks - Advantages and disadvantages of Buffer Cache.

MODULE II   INTERNAL REPRESENTATION OF FILES   9
Inodes - Structure of regular file - Directories - Conversion of pathname to an inode - Super block - Inode assignment to a new file - Allocation of disk blocks - Overview of System Calls for the file system: Open, Close, Read, Write, File Creation, Creation of Special files, Link, Unlink.requirements, Cyber Physical System Application, Case study of Cyber Physical Systems

MODULE III   STRUCTURE OF PROCESSES   9
Process States and Transitions - Layout of System Memory - The Context of a Process - Saving the Context of a Process - Manipulation of the Process Address Space - Sleep.
Process Control: Process Creation, Signals, Process Termination, Awaiting process termination, invoking other programs

MODULE IV   PROCESS SCHEDULING AND MEMORY MANAGEMENT POLICIES   9
Process Scheduling: Algorithm - Scheduling parameters - examples of Process Scheduling - Controlling Process priorities - Fair Share Scheduler. Memory Management Policies: Swapping - Demand Paging - A Hybrid system with Swapping and Demand Paging.

MODULE V   I/O SUB SYSTEM AND INTERPROCESS COMMUNICATION   9
Driver Interfaces - Disk Drivers - Terminal Drivers - Streams. Inter Process Communication: Pipes, Shared Memory, Messages, Semaphores - Network communication

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 : To provide a comprehensive introduction to SHELL programming.
CO2 : Outline the architecture of Unix Operating System and the internal operations of file system and process management.
CO3 : Discuss Allocation of Disk Blocks and Manipulation of inode for process and file management.
CO4 : Apply the concepts of file systems in Unix kernels
CO5 : Examine Process Scheduling and memory management strategies on Unix Operating System.
CO6 : Summarize the working Methodology of various IPC Mechanisms and device driver Interfaces.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Maurice J Bach, "The Design of Unix Operating System ", Pearson Education, First Edition, 2015.
2. Brian Ward, "How Linux works", No Starch Press, Second Edition, 2015

REFERENCES:
1. Uresh Vahalia, "Unix Internals: The New frontiers", Pearson Education, Second Edition, 2010.
2. Robert Love, "Linux Kernel Development - Developer's Library", 3rd Edition, Pearson Education, 2010.
3. John Strang, Jerry Peek, Grace Todino, "Learning the UNIX OS", O'Reily, Fifth Edition, 2014.
4. Remy Card, Eric Dumas, Franck Mevel, "The Linux Kernel Book", Wiley India, 2013.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO ONLINE MARKET   **9**
Online Market space- Digital Marketing Strategy- Components – Opportunities for building Brand Website – Planning and Creation – Content Marketing.

MODULE II   SEARCH ENGINE OPTIMISATION   **9**
Search Engine optimisation – Keyword Strategy- SEO Strategy – SEO success factors -On-Page Techniques – Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

MODULE III   E- MAIL MARKETING   **9**
E- Mail Marketing – Types of E- Mail Marketing – Email Automation – Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

                                                                              9
MODULE IV   SOCIAL MEDIA MARKETING

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.

                                                                              9
MODULE V   DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics – Changing your strategy based on analysis- Recent trends in Digital marketing.

COURSE OUTCOMES
At the end of the course, students will be able
CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment..
CO2: To focus on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
CO3: To know the key elements of a digital marketing strategy.
CO4: To express how Mobile Marketing is utilized in achieving profiling and targeting
CO5: To study how the effectiveness of a digital marketing campaign can be measured
CO6: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TOTAL : 45 PERIODS

<u>**TEXT BOOKS:**</u>

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938 ISBN:788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**ENTERPRISE RESOURCE MANAGEMENT**	3	0	0	3

MODULE I   INTRODUCTION   9

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining - OLAP--SCM.

MODULE II   ERP IMPLEMENTATION   10

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring.

MODULE III   THE ERP BUSINESS MODULE   9

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management Quality Management - Sales and Distribution.

MODULE IV   THE ERP MARKET & ERP - PRESENT AND FUTURE   9

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business-Future Directions and Trends in ERP

MODULE V   SAP   8

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench

COURSE OUTCOMES
At the end of the course, students will be able to
CO1:Describe the operational aspects of ERP system and its related technologies.
CO2 :Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.
CO3 :Categorize the business modules of an ERP package in order to define the functionality of various departments in a company.
CO4:Analyze the ERP market place and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.
CO5 : Predicting the Future Directions and Trends in E- Business
CO6 : Summarizing the Three Tier Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench

TOTAL : 45 PERIODS

TEXT BOOKS:
 1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
 2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006. (SAP)

REFERENCES:
1. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2011.
2. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**DIGITAL FORENSICS**	3	0	0	3

MODULE I   INTRODUCTION TO COMPUTER FORENSICS   9
Computer Forensics Fundamentals - Types of Computer Forensics Technology - Types of Computer Forensics Systems - Types of Vendor and Computer Forensics Services.

MODULE II   CYBER CRIME INVESTIGATION AND EVIDENCE   9
Introduction to Cyber Crime Investigation - Evidence collection and data seizure: Collection options - Types of evidence - Rules of evidence - Duplication and preservation of digital evidence - Documentation and Reporting.

MODULE III   COMPUTER FORENSICS ANALYSIS   9
Discovery of electronic evidence - E-Discovery - Identification of data - Data Recovery Tools and Procedures - Importance of Log Analysis in forensic analysis - Storage Formats for Digital Evidences - Performing RAID data acquisitions.

MODULE IV   INTRUSION DETECTION   9
Network forensics scenario, Network vs. Host based detection - Network based and host based intrusion detection systems: Architecture - Detection engine - Benefits and challenges, Detection mechanism, Signatures, Traffic analysis, Intrusion detection

MODULE V   SURVEILLANCE AND IT-ACT   9
The Information Warfare Arsenal of the Future - Surveillance Tools for Information Warfare of the Future - IT Act: Concepts - Sections, Digital laws and legislation, Basics of Indian evidence act: IPC - CrPC.

COURSE OUTCOMES

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

CO1: Acquire knowledge on the Computer Forensics fundamentals.

CO2: Familiarize with evidence collection and analysis procedures and ability to deploy in practice.

CO3: Gain knowledge on the investigative measures.

CO4: Evaluate the role of surveillance tools and their impact on information warfare and digital investigations.

CO5: Interpret relevant sections of the IT Act, IPC, and CrPC

CO6: Analyze ethical issues and challenges in computer forensics, including privacy concerns and professional conduct.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. John R. Vacca, "Computer forensics: Computer Crime Scene Investigation", Second Edition, Charles River Media, Firewall, 2015.
2. Paul E Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall, USA, 2007.
3. Vivek Sood, "Cyber Law Simplified", Tata McGraw Hill, New Delhi, 2008.

REFERENCES:
1. Warren G Kruse II and Jay G Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, USA, 2010.
2. Eogen Casey, "Digital Evidence and Computer Crime", Elsevier, USA, 2011.
3. Chad Steel, "Windows Forensics: The Field Guide for Conducting Corporate Computer Investigations" Wiley India, 2006.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I   PROJECT EVALUATION AND PLANNING   9

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

MODULE II   PROJECT LIFE CYCLE AND EFFORT ESTIMATION   9

Software process and Process Models – Choice of Process models – Rapid Application
development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

MODULE III   ACTIVITY PLANNING AND RISK MANAGEMENT   9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

MODULE IV   PROJECT MANAGEMENT AND CONTROL   9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

MODULE V   STAFFING IN SOFTWARE PROJECTS   9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

COURSE OUTCOMES

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

CO1: Understand Project Management principles while developing software.

CO2: Gain extensive knowledge about the basic project management concepts, framework and the process models.

CO3: Obtain adequate knowledge about software process models and software effort estimation techniques.

CO4: Estimate the risks involved in various project activities.

CO5: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

CO6: Learn staff selection process and the issues related to people management

                                                                TOTAL : 45 PERIODS

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1.Robert K. Wysocki —Effective Software Project Management – Wiley Publication, 2011.
2.Walker Royce: —Software Project Management- Addison-Wesley, 1998.
3.Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO TESTING AND TEST DESIGN STRATEGIES-I   9

Introduction to Testing as an Engineering Activity: The role of Process in Software Quality, Testing as a Process, Overview of Testing Maturity Model(TMM) - Testing Fundamentals: Basic Definitions, Software Testing Principles, Tester's Role in a Software Development Organization - Defects, Hypothesis and Test: Origins of Defect, Defect Classes, the defect Repository and Test Design.

Strategies and Methods for Test Case Design I: Test Case Design strategies -Black Box Approach to Test Case Design- Random Testing- Equivalence Class Partitioning- Boundary Value Analysis- Other Black Box Test Design Approaches- COTS- Black box Methods and TMM level 2 goals.

MODULE II   TEST DESIGN STRATEGIES-II   6

Strategies and methods for test case design II: White Box Approach to Test Case Design- Test Adequacy Criteria -Coverage and Control flow graphs - Covering Code Logic- Paths- Additional White Box Test Design Approaches: Data Flow, Loop Testing, Mutation Testing- White Box Testing Methods and the TMM.

MODULE III   LEVELS OF TESTING   13

Need for levels of testing - Unit Test : Functions, Procedures, Classes, and Methods as Units- Unit Test planning - Designing the Unit Tests - The Class as a Testable Unit and Special Considerations - Test Harness. Integration test: Goals - Integration strategies for Procedures, Functions and Classes- Designing Integration Tests- Integration test Planning.

System test: Functional testing, Performance testing, Stress Testing, Configuration Testing, Security Testing, Recovery Testing- Regression Testing- Alpha, Beta, Acceptance Testing.

Testing Goals, Policies & Plans: Introductory concepts -Testing/Debugging goals & Policies - Test planning - Test Plan Components- Reporting test results -Role of three critical groups.

Reviews: Types of Reviews-Inspection - walkthroughs - Components of Review plan-Review Check List-Review Metrics.

MODULE IV TESTING WEB APPLICATIONS   5

Testing Concepts for Web Apps- the Testing Process- Content Testing- User Interface Testing- Component Level Testing- Navigation Testing- Configuration Testing- Security Testing - Performance Testing.

MODULE V   SOFTWARE QUALITY ASSURANCE, STANDARDS AND PROCESS   12 MODELS

Quality Concepts - Quality - Software Quality - Garvin's Quality Dimensions - McCall's Quality Factors - ISO 9126 Quality factors-Cost of Quality - Achieving software Quality - SQA Infrastructure - CASE Tools for Software Quality. **Software Quality Assurance:** Elements of SQA - SQA tasks, Goals, Attributes & Metrics - Statistical SQA - Software Reliability-ISO 9000 Quality standard - SQA Plan. **Software process Improvements:** The CMMI - The People CMM

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 : Describe testing fundamentals, Testing principles, TMM levels and classify the defects
CO2 : Apply suitable Black box and White Box testing techniques and design Test cases in practice.
CO3 : Understand the levels of Testing, develop Test Plans, Testing goals & policies and perform reviews for practical applications.
CO4 : Relate Unit and System Testing strategy to understand the software's quality and reliability

CO5 : Ability to test different types of Web Applications, understand security and performance aspects of testing.

CO6 : Outline Software Quality attributes and Software Quality Assurance functions and Prepare Software Quality Assurance plans.

TOTAL : 45 PERIODS

TEXT BOOK:
1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2010, Reprint.
2. Roger. S. Pressman "Software Engineering A Practitioner's Approach, 7e", McGraw Hill International Edition, 2014. (Testing Web Applications, Software Quality and Quality Assurance, Quality Standards and Process Models)
3. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009 (CASE Tools form Software Quality, SQA Infrastructure)

REFERENCES:
1. Yogesh Singh, " Software Testing", Cambridge University Press, 2012
2. Kshirasagar Naik, Priyadhrshini Tripathy, "Software Testing and Quality Assurance", John wiley & sons Inc Publication, 2008
3. Nina S Godbole, " Software Quality Assurance-Principles and Practice", Narosa Publishing, Second Edition, 2016

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

	L	T	P	C
COURSE CODE	3	0	0	3

RECOMMENDER SYSTEMS

MODULE I   INTRODUCTION TO RECOMMENDER SYSTEMS   9
Goals- Basic models of Recommender systems – Domain specific challenges in recommender systems – Advanced Topics and Applications – Data Mining methods for recommender systems – Data pre-processing - Classification – Cluster analysis –Association rule mining.

MODULE II   CONTENT BASED RECOMMENDER SYSTEMS   9
Introduction - Basic components of Content-based systems – Preprocessing and feature extraction – Feature representation and cleaning - Collecting user likes and dislikes – supervised feature selection and weighting – Learning user profiles and filtering – Trends and future research.

MODULE III   COLLABORATIVE FILTERING   9
Introduction – key properties of rating matrices-Predicting ratings with neighbourhood based methods– Clustering and neighbourhood based methods-Dimensionality reduction and neighbourhood methods-A regression modelling view of neighbourhood methods-Grah models for neighbourhood-based methods- Model –based collaborative filtering –Introduction – Decision and regression trees – Rule based collaborative filtering – Naïve bayes collaborative filtering .

MODULE IV KNOWLEDGE BASED AND CONTEXT SENSITIVE RECOMMENDER SYSTEMS

                                                                                             9
Constraint based recommender systems – Case based recommender systems – Context sensitive recommender systems – The Multidimensional Approach – Contextual prefiltering : A Reduction based approach – Post Filtering methods –Contextual modelling.

MODULE V   ATTACK RESISTANT AND EVALUATING RECOMMENDER SYSTEMS   9
Introduction – Types of attacks- Detecting attacks on recommender systems-strategies of robust recommender systems –Designing robust recommendation algorithms- Evaluating paradigms- General goals of evaluation design – Design issues in offline recommender evaluation – Accuracy metrics in offline evaluation – Limitation of evaluation measures

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the fundamentals and challenges of recommender systems.
CO2: Develop a content-based recommender system.
CO3: Designing of the predictive system using various classification, clustering and regression models.
CO4: Build knowledge-based resilient recommender systems.
CO5: Ability to analyse the various security threats and attacks**.**
CO6: Evaluate the recommender systems.
                                                    TOTAL : 45 PERIODS

 TEXT BOOKS:
1.Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011).
REFERENCES:
1.Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2.Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 202

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

	L	T	P	C
COURSE CODE **ENGINEERING ECONOMICS AND MANAGEMENT**	3	0	0	3

MODULE I   INTRODUCTIONTO ENGINEERING ECONOMICS   **9**

Basic Concepts of Engineering Economics: Definition and scope of engineering economics-Time value of money-Interest rates and compounding-Economic Analysis Techniques: Present worth analysis-Annual worth analysis-Future worth analysis

MODULE II   COST ESTIMATION AND ANALYSIS   **9**

Cost Concepts and Classifications: Direct and indirect costs-Fixed and variable costs-Overhead costs-Cost Estimation Methods-Analogous estimation-Parametric estimation-Bottom-up estimation

MODULE III DECISION MAKING UNDER UNCERTAINTY   **9**

Risk and Uncertainty in Engineering Projects-Probability concepts-Decision trees-Sensitivity analysis-Risk Management Techniques-Monte Carlo simulation-Real options analysis-Insurance and hedging

MODULE IV ENGINEERING MANAGEMENT PRINCIPLES   **9**

Organization and Leadership-Organizational structures-Leadership styles-Motivation theories-Project Management-Project planning and scheduling-Resource allocation-Performance measurement

MODULE V   SUSTAINABLE ENGINEERING AND CORPORATE SOCIAL RESPONSIBILITY

        9

Sustainability Principles in Engineering-Triple bottom line-Life cycle assessment-Sustainable development goals-Corporate Social Responsibility-Ethical considerations in engineering-Social and environmental impact assessment-Stakeholder engagement

COURSE OUTCOMES

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

CO1: Apply economic principles to analyze engineering projects and make informed decisions.

CO2 : Estimate project costs accurately and apply cost control techniques effectively.

CO3 : Evaluate and manage risks associated with engineering projects using appropriate techniques.

CO4 : Demonstrate proficiency in project management principles and tools.

CO5 :Recognize and address sustainability and corporate social responsibility issues in engineering practice.

CO6: Communicate effectively and work collaboratively in interdisciplinary teams**.**

                        TOTAL : 45 PERIODS

TEXT BOOKS:
1. **.**"Engineering Economy" by William G. Sullivan, Elin M. Wicks, and C. Patrick Koelling
2. "Cost Accounting: A Managerial Emphasis" by Charles T. Horngren, Srikant M. Datar, and Madhav V. Rajan
3. Project Management for Engineering, Business, and Technology" by John M. Nicholas and Herman Steyn

REFERENCES:
1. "Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle
2. "Fundamentals of Engineering Economics" by Chan S. Park
3. "Engineering Ethics: Concepts and Cases" by Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins
4. "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" edited by David Crowther and Nicholas Capaldi

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   9

Most profitable Customer - CRM: Custom centered database, Managing campaigns, Evolution of marketing, Closed loop marketing, CRM architecture - Customer profitability - Customer acquisition - Cross selling - Customer retention - Customer segmentation

MODULE II   BUILDING THE BUSINESS CASE   9
Introduction - Uncovering the needs for data mining - Defining the business value - The costs - Deploying Data mining for CRM: Introduction - Define the problem - Define the user - Define the data - Scope the project - Trial - Quality assurance - Education Launch - Continuation

                                                                                       9

MODULE III COLLECTING CUSTOMER DATA
Introduction - Three types of customer data - Collecting customer data - Connecting customer - Customer data and privacy - Privacy and data mining - Guidelines for privacy - Legal issues associated with data mining.

MODULE IV SCORING YOUR CUSTOMER   9
Introduction - Process - Scoring architectures and configurations - Preparing the data - Integrating scoring with other applications- Optimizing the CRM process: Introduction - Improved customer profitability through optimization - Optimized CRM - Complete loop - Optimal CRM process - Optimization techniques.

MODULE V   OVERVIEW OF DATA MINING AND CRM TOOL MARKETS   9
Introduction - Data mining market place - Taxonomy of data mining tools - Tool assessment attributes and methodology - Tool evaluation -Data mining tool: WEKA -CRM tools - Next generation for CRM.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 : State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.
CO2 : Describe the business value, its costs and deploying data mining for CRM.
CO3 : Understand the type of collecting and connecting the customer data with proper guidelines for privacy.
CO4 : Infer the scoring architectures and configurations to improve the process.
CO5 : Apply the various CRM optimization techniques to optimize the CRM process in order to improve customer profitability.
CO6 : Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1.   Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.2.Ian H.Witten ,Eibe Frank, Mark A.Hall, "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufmann, Fourth Edition, 2016

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	SOFT COMPUTING	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC   9
Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

MODULE II   NEURAL NETWORKS   9
Supervised Learning Neural Networks – Perceptrons - Back Propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks.

MODULE III GENETIC ALGORITHMS   9

Introduction - Genetic Algorithm and Search Space - Basic Terminologies in Genetic Algorithm - Operators in Genetic Algorithm - Classification of Genetic Algorithm - Advantages and Limitations of Genetic Algorithm - Applications of Genetic Algorithm.

MODULE IV NEURO FUZZY MODELING   9
ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

MODULE V   APPLICATIONS   9
Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction: CANFIS modeling for color recipe prediction.

COURSE OUTCOMES
At the end of the course, students will be able to
CO 1: Basic knowledge of fuzzy rules and operations.
CO 2: Develop inference systems using different Fuzzy Logic concepts.
CO 3: Understand the concept of neural networks to solve problems related to machine and deep learning algorithms.
CO 4: Apply the concept of genetic algorithm to obtain optimization in research problems.
CO 5: Knowledge and modelling of the neurological concepts with fuzzy logic.
CO 6: Solve real problems using a soft computing approach and evaluate various soft computing approaches for a given problem

TOTAL : 45 PERIODS

TEXT BOOK:
1. Jang J.S.R., Sun C.T and Mizutami,Neuro Fuzzy and Soft computing , Prentice hall New Jersey, 1998.
2. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.

REFERENCES:
1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

MODULE I   GRAPHICS PRIMITIVES, 2D TRANSFORMATION AND VIEWING   9
Output primitives: points and lines - line drawing algorithms - circle and ellipse drawing algorithms - polygon generating and filling algorithms. 2D Transformations: Basic Transformations - matrix representation - translation - rotation - scaling - general pivot point rotation - general fixed point scaling - general scaling directions - reflection - shear. Viewing: window to view port coordinate transformation - point clipping - Cohen and Sutherland line clipping algorithm - Sutherland and Hodgeman polygon clipping algorithm.

MODULE II   3D CONCEPTS, TRANSFORMATION AND VIEWING   9
3D display methods- 3D object representation: polygon surfaces - curved lines and surfaces - Quadric surfaces - Introduction to Spline Representations - Bezier curves and surfaces. 3D Transformations: Translation - Rotation - Scaling - 3D Viewing: view plane - projections - clipping.

MODULE III MULTIMEDIA SYSTEM DESIGN   9
Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system - Defining objects - Multimedia Data Interface standards - Multimedia databases.

MODULE IV COMPRESSION AND DECOMPRESSION   9
Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale& Still Video Image Compression-Video Image Compression - Audio Compression

MODULE V   MULTIMEDIA APPLICATIONS   9
Content Based Information Retrieval - Multimedia Communications- Multimedia Information Sharing and Retrieval – Applications. Social Media Sharing, Online Social Networking- Virtual Reality- Multimedia for Portable Devices- Collaborative Multimedia Applications.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 : To understand the foundational concepts of multimedia components and systems

CO2 : Demonstrate the working of graphics output primitive algorithms, clipping algorithms and apply two dimensional geometric transformations.

CO3 : Illustrate three dimensional object representation, transformations and concepts involved in spline representation.

CO4 : Describe the Multimedia concepts, its architecture and its real world applications.

CO5 : Ability to understand the importance of various multimedia applications.

CO6 : Analyze various compression techniques for the efficient transmission of Multimedia data.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M., "Computer Graphics", Prentice Hall of India, Second Edition, 2008.

2. Prabhat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall of India, Reprint 2007. (Multimedia Systems Design, Compression and Decompression)

3. Ze Nian Li, Mark S Drew and Jiangchuan Liu, " Fundamentals of Multimedia", Second Edition, Springer,2014. (Multimedia Applications)

REFERENCES:

1. Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.
2. John F.Koegal Buford, "Multimedia System", Pearson Education Limited, Reprint 2008.
3. Ranjan Parekh, "Principles of Multimedia", Tata McGraw Hill, Second Edition, 2013.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	2									1	2	2
2	2	1	1	1								1		2
3	2	2	1	1								1		2
4	1	1	2	1			2					1		2
5	1	1	2	1			2					1		2
6	1	2	2	2			2					1		2
Avg.	2	2	2	1			2					1	2	2

1-low, 2-medium, 3-high

COURSE CODE	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION 9
Mobile Communication - Mobile Computing - Mobile Computing Architecture - Mobile Devices - Mobile System Networks - Data Dissemination - Mobility Management - Security - Introduction to Cellular Systems - Global System for Mobile Communication -General Packet Radio Services and their architectures.

MODULE II MOBILE IP NETWORK LAYER 9
Mobile IP overview - IP packet delivery - Agent Discovery registration - Tunneling and Encapsulation - Route optimization - Reverse Tunneling - IPv6 - IP Micro Mobility Support - Dynamic Host Configuration Protocol.

MODULE III MOBILE TRANSPORT AND APPLICATION LAYER 9 Mobile
TCP - Fast Retransmit / Fast Recovery - Transmission Timeout Freezing - Selective Retransmission - Transaction oriented TCP - TCP over 2.5/3G Wireless Networks. WAP Architecture, Datagram Protocol, Transport Security, Transaction Protocol, Session Protocol - Application Environment-WML - WML Script - Wireless Telephony Application

MODULE IV DATA DISSEMINATION AND SYNCHRONIZATION 9
Data Delivery Mechanisms - Synchronization - Synchronization Software - Synchronization Protocol- SyncML - Synchronized Multimedia Markup Language (SMIL).

MODULE V MOBILE APPLICATION DEVELOPMENT 9
Features of Palm OS, Symbian OS, Android OS: Development framework - Developing application for android - Development tools - Application Lifecycle - Externalizing Resources - Application class - Android activities.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 : Identify the strength, limitations of mobile networks and discuss the technologies for mobile communication.

CO2 : Describe the basic working principle of Mobile IP and express different scenarios for performing mobile communication.

CO3 : Analyze TCP variations for mobility support and discuss WAP architecture.

CO4 : Explain different types of data dissemination and synchronization mechanisms for mobile computing.

CO5 : Develop simple android mobile applications using development tools.

CO6 : Understanding the application lifecycle in Android and implementing effective lifecycle management strategies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, Third Edition 2019.

2. Jochen Schiller, "Mobile Communications", Pearson Education India, Second Edition, 2008. (Mobile Transport And Application Layer)

3. Reto Meier, "Professional Android 4 Application Development", Wiley India Pvt Ltd, Third Edition ,2012. (Mobile Application Development)

REFERENCES:

1.   Stojmenovic and Cacute," HandBook of Wireless Networks and Mobile Computing", Wiley, 2006.

2.   Reza Behravanfon , " Mobile Computing Principles: Designing and Developing Mobile Applications with UML & XML" , Cambridge University Press , 2004.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

MODULE I   OBJECTS AND OOS   7
Objects-Attributes: object state and properties-Object behaviour and methods-Object Respond to messages-Encapsulation and information Hiding-Class Hierarchy -Polymorphism-Aggregation and Object Containment-The software development Process.

MODULE II   OBJECT ORIENTED METHODOLOGIES   9
Rumbaugh - Booch - Jacobson - Patterns - Frameworks - Unified approach.

MODULE III UNIFIED MODELING LANGUAGE   11
Static and dynamic models -UML Diagrams :Class diagram : Notation- Object diagram - Class interface notation - Binary Association notation, Association Rule - Qualifier -Multiplicity - OR Association - Association Class - N-ary association - Aggregation and Composition - Generalization. Use case diagram : Actors-Use Cases-Use case Diagram-Include and Extend Relationships-Generalization. Interaction Diagrams : Sequence Diagrams - Collaboration Diagrams. State chart diagram: Activity diagram Implementation diagrams: Component diagram - Deployment diagram.

MODULE IV OBJCET ANALYSIS AND DESIGN   9
Classification Theory-Noun Phrase Approach-Classes, Responsibilities and Collaborators

MODULE V   PROCESS   9
Macro Process: Content Dimension - Time Dimension - Milestones and Phases – Iterations Micro Process: The analysis and Design Process - Micro process and levels of abstraction - Associations-Super-Sub Class Relationships-A-Part-of Relationships-Aggregation-Object-Oriented Design Axioms-Corollaries

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 :Describe the fundamental aspects of Object Models.

CO2 :Identify classes and Objects and establish relationships among classes and objects.

CO3 :Selection and Application of appropriate object oriented design methodologies in real world applications.

CO4 :Construct Class, Use Case and Interaction Diagrams for software specifications.

CO5 :Illustrate the object-oriented software development process and work flow

CO6 :Attain proficiency in understanding and implementing both macro and micro processes in system development

TOTAL : 45 PERIODS

TEXT BOOKS:
1.   Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, Singapore, Second Reprint, 2008.
2.   Grady Booch, Robert A.Maksimchuk, Michael. W. Engle, Bobbi J. Young, JIM Conallen, Kelli A. Houston "Object Oriented Analysis and Design with Applications", Third Edition, Pearson Education Inc., USA, 2007.

REFERENCES:
1.   Rumbaugh J, Blaha M, Premerlani W, Eddy F and Lorensen W, "Object Oriented Modeling and Design", Prentice Hall of India/ Pearson Education, New Delhi, 2004.

2.   Kendall Scott, martin Fowler, "UML Distiled : A brief guide to the standard Object modeling Language", Addison Wesley, USA, 2009.

3.   Atul Kahate, "Objetct Oriented Analysis and Design", Tata McGraw-Hill, New Delhi 2007.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	AD HOC NETWORKS	L	T	P	C
		3	0	0	3

MODULE I   MAC PROTOCOLS   9
Ad Hoc Wireless Networks & MAC Protocols: Introduction - Issues in Ad Hoc Wireless Networks - Issues in Designing a MAC Protocol for Ad hoc Wireless Networks - Classification of MAC Protocols - Contention-Based: MACAW, Busy Tone Multiple Access Protocols - Contention-Based with Reservation Mechanisms: Distributed Packet Reservation Multiple Access Protocol -Collision Avoidance Time Allocation Protocol - Contention-Based with Scheduling Mechanisms: Distributed Priority Scheduling- MAC Protocols that use Directional Antennas.

MODULE II   ROUTING PROTOCOLS   9
Issues in Designing a Routing Protocol for Ad hoc Wireless Networks - Classifications of Routing Protocols-Table-Driven:Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing Protocol On-Demand: Dynamic Source Routing-Ad Hoc On Demand Distance Vector Routing Protocol-Location- Aided Routing-Signal Stability based Adaptive Routing Protocol - Hybrid : Core Extraction Distributed Ad Hoc Routing Protocol- Zone Routing Protocol

MODULE III MULTICAST ROUTING   10
Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - Classification of Multicast RoutingProtocols - Tree-Based: Bandwidth efficient Multicast Routing Protocol-Multicast Core Extraction Distributed Ad Hoc Routing-MAODV - Mesh-based: On Demand Multicast Routing Protocol, Core Assisted Mesh Protocol-Multicasting with Quality of Service Guarantees - Application Dependent Multicast Routing.

MODULE IV TRANSPORT LAYER PROTOCOLS & SECURITY ISSUES   7

Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks-Classification of Transport Layer Solutions-TCPover Ad Hoc Wireless Networks - Security in Ad-Hoc Wireless Networks-Requirements-Issues-Attacks-Key Management in AdHoc Wireless Networks-Secure Routing: Secure Efficient Ad Hoc Distance Vector Routing Protocol, Authenticated Routing for Ad
Hoc Networks.

MODULE V QUALITY OF SERVICE & ENERGY MANAGEMENT   10
Issues and challenges in providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions: MAC Layer Solutions:Cluster TDMA - Network Layer Solutions: Ticket Based Protocol-QoS Frameworks for Ad Hoc Wireless Networks: INSIGNIA-INORA-SWAN- Energy Management in Ad Hoc Wireless Networks: Classification - Battery Management Schemes – System Power Management Schemes.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 : Recognize the issues involved in designing MAC protocol and describe the different type of MAC protocols in wireless Ad-Hoc Network

CO2 : Choose appropriate routing protocols for a given networking scenario and demonstrate the routing process with its merits and demerits

CO3 : Point out the characteristics and compare the qualitative behavior of various multicast routing protocols.

CO4 : Discuss various transport layer solutions employed in wireless Adhoc networks.

CO5 : Outline the QoS support and energy management schemes in wireless Adhoc networks.

CO6*:* Understanding the significance of energy management in sustaining QoS in Ad Hoc Wireless Networks
                                                                                        TOTAL : 45 PERIODS

TEXT BOOKS:

1. C.Siva Ram Murthy, B.S.Manoj, "Ad-Hoc Wireless Networks- Architectures and Protocols", Prentice Hall, First Edition,
2012.

REFERENCES

1. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, First Edition, 2009.
2. Carlos DE MoraisCordeiro. Dharma Prakash Agrawal, " Ad-Hoc and Sensor Networks -Theory and Applications", World scientific Publishing corporation pvt ltd,Second Edition, 2011

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   9
BASIC sensor network Architecture-Generation of sensor network - challenges - hardware and software components of wireless nodes-operating environment - Applications: Home control. Building Automation-Medical applications.

MODULE II   MAC PROTOCOLS
Schedule based protocols: Self-organizing MAC for Sensor nets (SMACS), Low Energy **10** Adaptive Clustering Hierarchy (LEACH)- Random Access based protocols - Sensor MAC protocol, IEEE 802.15.4 and Zigbee Reference Model - Super frame structure- Frame types - Modes of operation: Contention based channel Access - Beacon less mode.

MODULE III ROUTING PROTOCOLS   11
Data Dissemination and Gathering - Challenges and Design Issues - Flooding - Sensor Protocols for Information via Negotiation (SPIN) - LEACH - Power Efficient Gathering in Sensor Information System (PEGASIS) - Directed Diffusion - Geographical routing.

MODULE IV TRANSPORT CONTROL PROTOCOLS   8
Design issues - Congestion Detection and Avoidance (CODA) - Event to Sink Reliable Transport (ESRT) - Reliable Multi Segment Transport (RMST) - Pump Slowly Fetch Quickly (PSFQ) - GARUDA - Ad-hoc Transport Protocol (ATP).

MODULE V OPERATING SYSTEM AND PERFORMANCE MODELS   7
OS Design Issues - Features of Tiny OS, MANTIS - Performance Modeling of WSN : Performance Metrics - Basic Models: Traffic Models - Energy Models - Node model - Network models: MAC model - Routing Model - System Model.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 : Describe the sensor network architecture and its applications.

CO2 : Describe the different MAC protocols used in wireless sensor networks and their applications.

CO3 : Demonstrate knowledge of routing protocols developed for WSN.

CO4 : Describe and explain the function of Transport control protocols for WSN.

CO5 : Outline the features of OS and performance models of wireless sensor networks

CO6 : Analyze different network models employed in performance modeling

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", Second Edition, John Wiley, 2011.

REFERENCES
1. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, First Edition, 2005.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks",Wiley, First Edition, 2007.
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2010.
4. Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks - A Networking Perspective", Wiley India,First Edition, 2014.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I   REASONING UNDER UNCERTAINTY   9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods- Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

MODULE II   METHODOLOGY AND MODELING   9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

MODULE III ONTOLOGIES – DESIGN AND DEVELOPMENT   9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain-Understanding and Concept Elicitation – Modelling-based Ontology Specification.

MODULE IV REASONIING WITH ONTOLOGIES AND RULES   9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching -Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

MODULE V LEARNING AND RULE LEARNING   9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement Overview – Rule Generation and Analysis – Hypothesis Learning.

CO1: Understand the basics of Knowledge Engineering.
CO2: Apply methodologies and modelling for Agent Design and Development.
CO3: Design and develop ontologies.
CO4: Apply reasoning with ontologies and rules.
CO5: Understand the machine learning concepts and modelling.
CO6: Ability to solve problems through the knowledge of rule-based learning.

TOTAL : 45 PERIODS

 TEXT BOOKS:
1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press,First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4
- 7 , Unit 5 – Chapter 8, 9)

REFERENCES
1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning,Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations,

Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1stEdition,2001.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	DATA SCIENCE	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION   9

Data science- Benefits and uses of data science and big data- Facets of data- The data science process- The bi
data ecosystem and data science

MODULE II   STATISTICAL INFERENCE AND THE DATA SCIENCE PROCESS   9

Statistical Thinking in the Age of Big Data - Exploratory Data Analysis- The Data Science Process- Overview of
the data science process- Defining research goals and creating- Retrieving data - Cleansing, integrating, and
transforming data - Exploratory data analysis- Build the models - Presenting findings and building applications..

MODULE III LEARNING ALGORITHMS AND MODELS   9

Need for machine learning in data science - The modeling process- Types of machine learning - Semi-
supervised learning- Three Basic Algorithms - Linear Regression -k- Nearest Neighbors (k-NN) -k-means.

MODULE IV DATA VISUALIZATION (Matplotlib / Seaborn)   9

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms,
Binnings, and Density- Customizing Plot Legends Customizing Color bars - Multiple Subplots Text and
Annotation Customizing. Ticks Customizing- Matplotlib: Configurations and Stylesheets - Three - Dimensional
Plotting in Matplotlib - Geographic Data with Base map Visualization with Seaborn.

MODULE V APPLICATIONS AND RECENT TRENDS   9

Social network analysis- Social Network Analysis at Morning Analytics- Terminology from Social Networks-
Data Leakage-case study- Avoid Leakage- Evaluating Models**.**

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 : Provide the knowledge and expertise to become a proficient data scientist.
*CO2 : Demonstrate an understanding of statistics and machine learning concepts that are vital for data
science.*
CO3 : Produce Python code to statistically analyse a dataset.
CO4: Understand and implements the concepts of machine learning in data science.
*CO5 : Critically evaluate data visualisations based on their design and use for communicating stories from
data.*
CO6: Understand the various real-time applications through data science.

                                          TOTAL : 45 PERIODS

TEXT BOOKS:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly, First Edition,
   2013. (UNIT II,UNIT III ,UNIT V).
2. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science" Manning Publications, 2016 (UNIT I,
   II, III)
3. Jake VanderPlas ,"Python Data Science Handbook Essential Tools for Working with Data, 2016 (UNIT IV)

REFERENCES

1. https://colab.research.google.com/github/jakevdp/PythonDataScienceHandbook/blob/master/notebook
   s/04.00- Introduction-To-Matplotlib.ipynb

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO ROBOTIC PROCESS AUTOMATION   6
Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

MODULE II   AUTOMATION PROCESS ACTIVITIES   6
Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

MODULE III APP INTEGRATION, RECORDING AND SCRAPING   6
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

MODULE IV EXCEPTION HANDLING AND CODE MANAGEMENT   6
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

MODULE V DEPLOYMENT AND MAINTENANCE   6
Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the basic concepts of Robotic Process Automation.
CO 2: Expose to the key RPA design and development strategies and methodologies.
CO 3: Learn the fundamental RPA logic and structure.
CO 4: Explore the Exception Handling, Debugging and Logging operations in RPA.
CO 5: Learn to deploy and Maintain the software bot.
CO 6: Solve the real-world problems using RPA process.

TOTAL : 60 PERIODS

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

REFERENCES

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

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

MODULE I FUNDAMENTAL CONCEPTS   **9**

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms –Experimental Quantum Information Processing – Quantum Information.

MODULE II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS   **9**
Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application:Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications –EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

MODULE III QUANTUM COMPUTATION   **9**
Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers

9
MODULE IV QUANTUM INFORMATION
Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy

MODULE V QUANTUM INFORMATION THEORY   **9**
Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the basics of quantum computing.
CO2: Understand the background of Quantum Mechanics.
CO3: Analyse the computation models.
CO4: Model the circuits using quantum computation.
CO5: Understand the quantum operations such as noise and error–correction.
CO6: Appreciate the need of quantum computing.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum
Information", Tenth Edition, Cambridge University Press, 2010.

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University
Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge
University Press, 2007.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	CYBER SECURITY	L	T	P	C
		2	0	2	3

MODULE I INTRODUCTION   6

Cyber Security – History of Internet – Impact of Internet – CIA Triad; 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 – Cyber crime and Punishment.

MODULE II ATTACKS AND COUNTERMEASURES   6

OSWAP; 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.

MODULE III RECONNAISSANCE   5

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

MODULE IV INTRUSION DETECTION   5

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

MODULE V INTRUSION PREVENTION   5

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

COURSE OUTCOMES

At the end of the course, students will be able to
  CO1: Explain the basics of cyber security, cyber crime and cyber law
  CO2: Classify various types of attacks.
  CO3: Learn the tools to launch various attacks.
  CO4: Apply various tools to perform information gathering
  CO5: Apply intrusion techniques to detect intrusion
  CO6: Apply intrusion prevention techniques to prevent intrusion

TOTAL : 60 PERIODS

TEXT BOOKS:
1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)
3. https://owasp.org/www-project-top-ten/

REFERENCES
1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", 4th edition, Jones & Bartlett Learning Publishers, 2021 (Unit 2).

2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2013 (Unit 3).
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2010 (Unit 3).
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Global Edition, Pearson Education, 2018 (Units 4 and 5).
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

PRACTICAL EXERCISES: **15 PERIODS**
1. Install Kali Linux on Virtual box
2. Explore Kali Linux and bash scripting
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Understand the nmap command d and scan a target using nmap
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
6. Use Metasploit to exploit an unpatched vulnerability
7. Install Linus server on the virtual box and install ssh
8. Use Fail2banto scan log files and ban Ips that show the malicious signs
9. Launch brute-force attacks on the Linux server using Hydra.
10. Perform real-time network traffic analysis and data pocket logging using Snort

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES**	3	0	0	3

MODULE I   INTRODUCTION TO BLOCK CHAIN   9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain,
Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

MODULE II   BITCOIN AND CRYPTOCURRENCY   9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

MODULE III BITCOIN CONSENSUS   9

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner,Mining Difficulty, Mining Pool- Permissioned model and use cases.

MODULE IV HYPERLEDGER FABRIC & ETHEREUM   9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

MODULE V BLOCKCHAIN APPLICATIONS   9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance- Case Study.

COURSE OUTCOMES

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

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and
practice in the crypto currency domain.

CO3: Understand how the individual components of the Bitcoin protocol make the whole system works:
transactions, script, blocks, and the peer-to-peer network

CO4: Understand the functions of Blockchain as a method of securing distributed ledgers, ensuring consensus on their contents through algorithms.

CO5: Apply hyper ledger Fabric and Ethereum platform to implement the Blockchain
Application.

CO6: Exploit the use cases where blockchain concepts are deployed.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies",O'Reilly, 2014.

REFERENCES

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	Front End Web Development	L	T	P	C
		2	0	2	3

MODULE I   Introduction to HTML 6

Introduction to HTML- Editors- Elements-Attributes-Headings and paragraphs -Bold, italic, emphasis and Strong- Structural and semantic markup- Lists - Links- Images-Tables-Forms- HTML5 forms- Extra Markups- Flash Videos and Audios.

MODULE II   Introduction to CSS 6

Introduction to CSS: Rules, Properties and Values- Colors: Css3 HSL colors- Text- Boxes- Lists- Tables -Forms- Layout- Images- HTML5 Layout- Flexbox- Process and Design.

MODULE III   JavaScript 6

Introduction to script- objects and properties-linking javascript with html and css -statements-comments-variables- datatypes-arrays-expressions-operators-functions-method-objects-built in objects: browser object model, document object model, global javascript objects- decisions and loops, DOM, events.

MODULE IV   Jquery 6

Introduction To Jquery -Similarities To Dom- Finding Elements- Looping- Chaining- Content- Attributes- Css Properties- Each- Event Methods - Filters - Forms - Box - Page-Plugins.

MODULE V   JSON 6

Introduction to JSON- JSON data types- Creating JSON – Parsing JSON- Data Interchange- Serving JSON- Posting JSON -JSON data persistence

PRACTICALS:

HTML

- Embed a YouTube video or a Google Map into an HTML page using appropriate HTML tags.
- Develop a simple login form with HTML and validate the username and password using JavaScript.

CSS

- Create a CSS file and link it to an HTML document to change the text color, font size, and background color of a paragraph.
- Apply CSS styles to create a responsive layout for a webpage that adapts to different screen sizes.

JavaScript

- Create a JavaScript program that prompts the user for their age and displays a message based on their age (e.g., "You are a child", "You are a teenager", "You are an adult").
- Create a JavaScript program to validate a form by checking if all required fields are filled in.

Jquery

- Create a jQuery program that fades in an image when it is clicked and fades it out when it is clicked again.
- Develop a jQuery program that dynamically loads content from an external file and displays it on a webpage.

Json

- Create a JSON file containing an array of objects representing different products, such as their name, price, and description. Write a program to read the JSON file and display the product information on a webpage.
- Create a JSON-based quiz application where questions and answers are stored in a JSON file, and the program retrieves and displays them to the user.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

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

CO1: Develop interactive websites and UI (User Interface) applications using JavaScript and HTML

CO2: Construct responsive websites using CSS.

CO3: Implement javascript and appreciate javaScript supports Object oriented pattern

CO4: Write applications that manipulate the Document Object Model to fetch and display information using jQuery

CO5: Design web applications using jquery and JSON

CO6: Gain practical skills in building dynamic and interactive web applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Duckett, Jon. HTML & CSS Design and Build Websites. 2nd ed., John Wiley & Sons, 2011.
2. Duckett, Jon. JavaScript and JQuery: Interactive Front-End Web Development. John Wiley & Sons, 2014.
3. "Beginning JSON" Ben Smith ,Apress, 2015

REFERENCES:

1. Chris Aquino and Todd Gandee, "Front-End Web Development: The Big Nerd Ranch Guide", Big Nerd Ranch Guides, 2020.
2. "HTML5: The Missing Manual" by Matthew MacDonald, 2014.
3. "JSON for Beginners: Your Guide to Easily Learn JSON in 7 Days" iCode Academy, 2020

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	3						1		3	2
2	3	\3	1	1	2						2		3	2
3	3	3	1		2						1		3	2
4	3	1	1		2						1		3	2
5	3	1	1		2						2		3	2
6	3	2	1		2						1		3	2
AVG.	3	2	1	1	2						1		3	2

1-low, 2-medium, 3-high

COURSE CODE	JAVASCRIPT FRAMEWORKS	L	T	P	C
		2	0	2	3

MODULE I   ReactJS Overview   6
Introduction to JSX-Es6 const and let – ReactDOM-Complex Javascript in JSX-ES6 arrow functions and classes.

MODULE II   Basics in React   6
Internal Component State- ES6 Object Initializer-Unidirectional Data Flow-Bindings-Event Handler-Interactions with Forms and Events-ES6 Destructuring- Components- React with API: Lifecycle Methods -Fetching Data -ES6 Spread Operators -Conditional Rendering -Client- server Search -Paginated Fetch -Client Cache- Error Handling – Axios

MODULE III   Advanced React Components   6
Code organization and Testing- Ref a DOM element-Loading-Higher order components-
Advanced Sorting-State management in React- Deployment.

MODULE IV   AngularJS Overview   6
AngularJS- Introduction-Basic AngularJS Directives and Controllers- Unit testing in AngularJS -AngularJs Forms and Inputs

MODULE V   AngularJS Services and Filters   6
AngularJS services-Server communication using $http-Unit testing services and XHR-AngularJs Filters- Routing using ngRoute

PRACTICALS:
ReactJS

- Create a React component that displays a simple greeting message with a name passed as a prop.
- Implement a React component that allows users to add items to a list and dynamically renders the list on the webpage.
- Build a React component that utilizes React hooks, such as useState and useEffect, to manage state and side effects.

AngularJS

- Implement an AngularJS service that manages and shares data between different components within the application.
- Build an AngularJS application that utilizes dependency injection to inject and use external dependencies or services.
- Implement an AngularJS filter that formats dates in a specific format (e.g., DD/MM/YYYY or MMM DD, YYYY).

TOTAL : 15 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Develop a foundational understanding of client-side JavaScript frameworks
CO2: Apply the knowledge of React to create own functional application
CO3: Apply knowledge of different Angular features such as directives, components, and
        Services
CO4: Create a front-end web application with AngularJS
CO5: Understand and apply filters of AngularJs
CO6: Understand and apply services of AngularJs

TOTAL : 45 PERIODS

TEXT BOOKS:

1. The Road to React: The React.js with Hooks in JavaScript Book (2023 Edition) by Robin Wieruch (UNIT 1,2,3)
2. AngularJs:Up and Running,ShyamSesadhri, Brad Green, 2014,OReily Media (UNIT 4,5)

REFERENCES:

1. "Fullstack React: The Complete Guide to ReactJS and Friends" by Accomazzo Anthony, Murray Nathaniel, and Lerner Ari (2020).

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	3						1		3	2
2	3	\3	1	1	3						2		3	2
3	3	3	1		3						1		3	2
4	3	1	1		3						1		3	2
5	3	1	1		3						2		3	2
6	3	2	1		3						1		3	2
AVG.	3	2	1	1	3						1		3	2

1-low, 2-medium, 3-high

COURSE CODE	BACKEND WEB DEVELOPMENT	L	T	P	C
		2	0	2	3

MODULE I   NodeJS   6
Understanding Node.Js-Core Node.JS- Node.Js Packages-Events and Streams – Getting Started with HTTP-Introducing Express – Persisting Data

MODULE II   NOSQL   6
NoSQL Concepts-CAP Theorem-ACID vs Base- NoSQL Technologies-CouchDB-Cassandra-Riak-HBase-CAP Properties

MODULE III   Implementing NoSQL in MongoDB   6
Configuring Accounts and Access Control-Managing Databases and collections from MongoDBShell- Finding Documents in collections from MongoDBShell-Data Finding Operations in MongoDBShell-Manipulating Documents in MongoDB Collections-Grouping-Aggregation-MapReduce

MODULE IV   MongoDB and Web Applications   6
Implementing MongoDB in PHP, Python, and NodeJS applications-Accessing and
working with MongoDB Data in PHP- Accessing and Working with MongoDB Data in
Python- Accessing and Working with MongoDB Data in NodeJS-Database Administration
in MongoDBShell-Replication and Sharding

MODULE V   Working with Web API and Web Services   6
SOAP and REST- Key REST elements-Resource Representations- Response Codes and Error Handling-Principles of REST API Design-Authentication-Versioning-REST in Action

PRACTICALS:
- Create a Node.js program that reads a file from the file system and displays its contents on the console.
- Build a Node.js program that connects to a MongoDB database and performs CRUD (Create, Read, Update, Delete) operations on a collection.
- Create a Node.js program that uses the Socket.io library to implement real-time communication between a server and multiple clients.
- Implement a Node.js server that serves static files (HTML, CSS, images) and handles routing for different URLs.
- Implement a Node.js script that imports a large dataset into MongoDB, performs data preprocessing or transformations, and stores the modified data in a new collection.

TOTAL : 15 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Develop a foundational understanding of Node.Js
CO2: Understand the functioning of NoSQL databases along with their key characteristics
CO3: Understand data storage, data modeling, ingestion, query, in MongoDB
 CO4: Understand sharding, and data replication in MongoDB
CO5: Create APIs based on REST architectural principles
CO6: Implement a RESTful backend API for storing and retrieving data

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Beginning Node.Js, Basarat Ali Sayad, ApressPublications, 2014 (UNIT 1)
2. Data Modeling with NoSQL Database,2nd edition, Ajit Singh, Sultan Ahmed,2021 (UNIT 2)
3. NoSQL with MongoDB in 24 Hours, Sams Teach Yourself, Brad Dayley, 2014(UNIT 3,4)
4. The REST API Design Handbook, George Reese, 2012, (UNIT 5)

REFERENCES:

1. "Learning Node.js: A Hands-On Guide to Building Web Applications in JavaScript" by Marc Wandschneider, 2016
2. Building RESTful Web Services with Node.js" by Valentin Bojinov, 2015

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1		3						1		3	2
2	3	\3	1		2						2		3	2
3	3	3	1		2						1		3	2
4	3	1	1		3						1		3	2
5	3	1	1		3						2		3	2
6	3	2	1		3						1		3	2
AVg.	3	2	1		3						1		3	2

1-low, 2-medium, 3-high

COURSE CODE	WEB SERVER ADMINISTRATION	L	T	P	C
		2	0	2	3

MODULE I   Server Administration I   **6**
Apache Server - Building The Server -Installing Apache -Requirements -Installing Apache from RPM Packages-Configuring Apache -Configuring the Apache Server using the HTTP Configuration Tool.

MODULE II   Server Administration II   **6**
NGINX Server- Base module directives- What are base modules- Nginx process architecture - Core module directives - Testing your server: Creating a test server- Performance tests-HTTP Configuration- HTTP core module - Structure blocks -Module directives - Socket and host configuration -Client requests.

MODULE III   Server Administration - Linux server administration   **6**
Basic System Administration Control: The Root User -Root User Password -Root User Access: sudo-System Time and Date – The Linux Auditing System: auditd -Virtual Machine Manager: virt-manager (Red Hat)-Kernel-Based Virtualization Machine (KVM)-Web - Alternate Web Servers -Apache Web - Linux Apache Installations - Proxy Servers Configuring Client -The squid.conf File - Caches -Connecting to Caches - Administrative Settings.

MODULE IV   Version Control with GIT   **6**
Introduction to GIT - Git ComponentsGit Characteristics Foundational Concepts-Repositories- Git Object Store- Index-Content-Addressable Database-Git Tracks Content- Pathname Versus Content - Git and GitHub- About GitHub -Types of GitHub Accounts - GitHub in the Git Ecosystem -Hosting a Repository in GitHub -Repository View-Code-Issues-Pull Requests

MODULE V   UI/UX Design Patterns: Wire Frames   **6**
Introduction to Wireframes - Responsive Design: Introduction and Primary navigation -Secondary and utility navigation - Wayfinding - Common Form Elements – Homepage Content Strategies - Examples of Homepage Content Strategies - Wireframing Tools.

PRACTICALS:
- Task Management System: Build a web application that allows users to create and manage tasks, assign them to team members, set deadlines, and track progress. Implement server-side functionality using Node.js, utilize Git for version control, and apply UI/UX design patterns like responsive design and intuitive task organization.
- E-commerce Website: Develop an e-commerce platform where users can browse products, add them to a cart, proceed to checkout, and make purchases. Use server-side technologies like Node.js for handling backend operations, Git for version control, and follow UI/UX design patterns such as clear product categorization, intuitive navigation, and smooth checkout processes.
- Social Media Application: Create a social media platform where users can register, post updates, follow other users, like and comment on posts, and engage in discussions. Utilize server-side technologies like Node.js for handling user authentication, data storage, and real-time updates, use Git for version control, and apply UI/UX design patterns for intuitive user profiles, content feeds, and interactive user interactions.
- Blogging Platform: Develop a blogging website where users can create and publish articles, categorize them, and engage in discussions through comments. Use server-side technologies like Node.js for managing articles, user authentication, and comments, utilize Git for version control, and apply UI/UX design patterns for visually appealing article layouts, easy navigation, and engaging comment sections.
- Project Management Tool: Build a collaborative project management tool that allows teams to

create projects, assign tasks, track progress, and communicate within the platform. Utilize server-side technologies like Node.js for handling project data, user authentication, and real-time updates, utilize Git for version control, and apply UI/UX design patterns for clear project organization, task visualization, and smooth communication features.

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1: Describe the fundamental aspects of open source Apache web server
functionalities

CO2: Understand the NGINX Server functionalities

CO3: Identify the requirements of Linux based server design for open source enabling
technologies

CO4: Understand Version control with GIT

CO5: Understand UI/UX design patterns

CO6: Construct robust UX service with interactive architectures using wire frames

TOTAL : 60 PERIODS

TEXT BOOKS:

1. **APACHE Web Server (Unit 1)**
   Run Your Own Web Server Using Linux & Apache by Stuart Langridge2005
2. **NGINX Server (Unit 2)**
   Nginx HTTP Server: Harness the power of Nginx to make the most of your infrastructure and serve pages faster than ever before, 4th Edition Martin Bjerretoft Fjordvald, Clement Nedelcu, 2018.
3. **Server Administration - Linux server administration (Unit 3)**
   Linux: The Complete Reference, Sixth Edition by Richard Petersen, 2017
4. **Version Control with GIT (Unit 4)**
   Version Control with Git, 3rd Edition by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022 Publisher(s): O'Reilly Media, Inc. ISBN: 9781492091196
5. **UI/UX (Unit 5)**
   Jesse James Garrett, The Elements of User Experience: User-centered Design for the Web, New Riders; 2 editions 2010

REFERENCES:

1. Dr. Erich Gamma, Ralph Johnson, Richard Helm and John Vlissides, Design Patterns: Elements of Reusable Object - Oriented Software, Pearson, 2008.
2. Buxton, B., Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann, (2007).

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	3						1		3	2
2	3	\3	1	1	3						2		3	2
3	3	3	1	1	3						1		3	2
4	3	1	1	2	3	1					1		3	2
5	3	1	1	2	3	1					2		3	2
6	3	2	1	2	3	1					1		3	2
AVg.	3	2	1	2	3	1					1		3	2

1-low, 2-medium, 3-high

COURSE CODE	APPLICATION DEVELOPMENT	L	T	P	C
		2	0	2	3

MODULE I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT   **6**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

MODULE II NATIVE APP DEVELOPMENT USING JAVA   **6**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

MODULE III HYBRID APP DEVELOPMENT   **6**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

MODULE IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE   **6**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

MODULE V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS   **6**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

PRACTICALS:

- Using react native, build a cross platform application for a BMI calculator.
- Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
- Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
- Design and develop a cross platform application for day to day task (to-do) management.
- Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
- Write programs using Java to create Android application having Databases
  - For a simple library application.
  - For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1: Develop Native applications with GUI Components.

CO2: Develop hybrid applications with basic event handling.

CO3: Implement cross-platform applications with location and data storage capabilities.

CO4: :Develop web applications with cloud database access.

CO5: Implement cross platform applications with basic GUI and event handling.

CO6: Understand about application debugging and application performance

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, June 2015
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, Jan 2019

REFERENCES:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning **Approach, Pawan Lingras, Matt Triff, Rucha Lingras**

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	3						1		3	2
2	3	\3	1	1	3						2		3	2
3	3	3	1		3						1		3	2
4	3	1	1		3						1		3	2
5	3	1	1		3						2		3	2
6	3	2	1		3						1		3	2
AVG.	3	2	1	1	3						1		3	2

1-low, 2-medium, 3-high

COURSE CODE	DevOps	L	T	P	C
		2	0	2	3

MODULE I   Introduction to DevOps   6

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and
Github.

MODULE II   COMPILE AND BUILD USING MAVEN AND GRADLE   6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test,
package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and
build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

MODULE III   CONTINUOUS INTEGRATION USING JENKINS   6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job,Configuring a
Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin,
Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to
work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

MODULE IV   CONFIGURATION MANAGEMENT USING ANSIBLE   6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible
modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in
ansible

MODULE V   BUILDING DEVOPS PIPELINES USING AZURE   6

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a
sample code, Modify azure-pipelines.yaml file

PRACTICALS:
- Create Maven Build pipeline in Azure
- Run regression tests using Maven Build pipeline in Azure
- Install Jenkins in Cloud
- Create CI pipeline using Jenkins
- Create a CD pipeline in Jenkins and deploy in Cloud

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous
           Deployment using Jenkins by

CO3: Build and automate test cases using Maven and Gradle.

CO4: Ability to Perform Automated Continuous Deployment

CO5: Ability to do configuration management using Ansible

CO6: Understand to leverage Cloud-based DevOps tools using Azure DevOps

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans",First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	OPEN SOURCE SYSTEMS	L	T	P	C
		2	0	2	3

CLOUD COMPUTING TECHNOLOGIES

MODULE I   INTRODUCTION TO OPEN SOURCE TECHNOLOGIES   8
Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/Linux and the Free Software Movement - Linux Distributions - Advantages of Free Software and GNU/Linux - Free Software Licenses- GNU Build systems: Autoconf, Automake, Libtool, Autogen, GNU make - Linux Installation and Hardware Configuration- Apache Web Server : Introduction - Starting, Stopping and restarting Apache-Configuration.

MODULE II   OPEN SOURCE NON RELATIONAL DATABASES   9
Why NoSQL - Aggregate Data Models - More Details on Data Models - Distribution Models -Consistency.

MODULE III   IMPLEMENTATION OF NON RELATIONAL DATABASES   10
Key Value Databases - Document Databases - Column-Family Stores - Graph Databases Beyond NoSQL. Case study: Querying on Non relational Databases.

MODULE IV   OPEN SOURCE PROGRAMMING LANGUAGES   9
PHP: Essential PHP- Operators and flow control- Strings and Arrays – Functions – PHP Browser Handling power - Working with PHP and MYSQL database

MODULE V   PYTHON   9
Python-Regular expressions: Match function-Search function-Matching Vs Searching-Modifiers-Patterns, Database: Executing queries-Transactions- Python numpy, Python Pandas, Python Matplotlib.

THEORY :30 PERIODS

PRACTICALS:
- Study of basic Linux basic commands and vi editor usage.
- Constructing make files using make, autoconf and autogen.
- NoSQL-Mongo DB/Couch DB
- PHP basic programming: Variables, Operators, Functions, Arrays - String manipulation, Database connectivity, File handing
- Python – Match Function, Search Function ,Database, Numpy, Pandas, Matplotlib
- Case study project

PRACTICAL:30 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: List the various open source Licenses and understand the Linux build systems.
CO2: Illustrate the concept of NoSQL Database and to choose the Appropriate No-SQL DataBase Types.
CO3: Implement NoSQL Database for real world application.
CO4: Recall open source programming languages like PhP
CO5: Demonstrate real time applications using Python programming languages/scripts
CO6: Understand the apache web server and configuration

TOTAL : 60 PERIODS

TEXT BOOKS:

1. James Lee and Brent Ware, "Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP", Addison Wesley Publiser, First Edition, 2009 (Reprint). (Introduction to Open Source Technologies, Open Source Programming Languages, Open source web server)
2. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence", AddisonWesley, Reprint 2019. (Open Source Non Relational Databases, Types of Non Relational Databases, Implementation of Non Relational Databases)
3. Mark Lutz, "Learning Python", O'Reilly Media Fifth Edition, 2017 (Reprint).(Python)
4. Steven Holzner, "PHP: The Complete Reference", TMH Edition Second Reprint 2008 (Reprint)

REFERENCES:

4. N. B. Venkateshwarlu, "Introduction to Linux: Installation and Programming (Ed)", BS Publishers (An NRCFOSS Publication)Reprint 2014.
5. Wesley J.Chun, "Core Python Programming" Prentice Hall, Third Edition, 2012.
6. Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**DISTRIBUTED SYSTEMS**	3	0	0	3

MODULE I INTRODUCTION AND PROCESS COMMUNICATION   12
Characterization of Distributed Systems - Examples - Resource Sharing - Challenges - web. System Models - Architectural and Fundamental Models. InterProcess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client- Server Communication - Group Communication

MODULE II DISTRIBUTED OBJECTS and OS SUPPORT   11
Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call. The OS Layer - Protection - Processes and Threads - Communication and Invocation - OS Architecture Distributed File Systems: File Service Architecture

MODULE III OS-NAMING SERVICES   6
Name Services: Name Services and the domain Name System-Directory Services.Time and Global States : Clocks, Events and Process States.

MODULE IV SYNCHRONISATION and MUTUAL EXCLUSION   6
Synchronizing Physical Clocks - Logical Time And Logical Clocks Global States.Coordination and Agreement: Distributed Mutual Exclusion - Elections - Multicast Communication.

MODULE V CONSISTENCY MODEL PROTOCOLS   10
Data-centric consistency models: Continuous consistency- Consistent ordering of operations. Client-centric consistency models: Eventual consistency - Monotonic Reads - Monotonic Writes - Read your writes - Writes Follow Reads. Consistency protocols: Continuous Consistency - Primary-Based Protocols - Replicated-Write Protocols - Cache- Coherence Protocols.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the challenges and issues in applying various distributed system
     models in real time applications
CO2: Demonstrate interprocess communication using Remote Method Invocation and
     Remote Procedure Call
CO3: Apply various thread based protocols in OS layer protection for distributed file
     service architectures.
CO4: Apply various distributed algorithms related to clock synchronization, concurrency
     control, deadlock detection, load balancing, voting etc.
CO5: Analyze different consistency models and define coherence protocols for Data-
     centric and Client-centric systems.
CO6: Understand the variations in using distributed system models to develop and
     execute effective distributed process communication systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Pearson Education, Fifth Edition, 2017.
2. Andrew S Tanenbaum, MaartenvanSteen,"Distributed Systems -Principles and Paradigms", Pearson Education, Second Edition, 2015. (consistency&replication only)

REFERENCES:

1. Ajay. D Kshem Kalyani, Mukesh Singhal, "Distributed computing principles, Algorithms and Systems", Cambridge University Press, First Edition, 2011.
2. Mukesh Singhal, Niranjan G. Shivaratri, "Advanced concepts in Operating Systems", First Edition, Tata McGraw Hill, 2017.
3. M.L. Liu, "Distributed computing Principles and Applications", First Edition ,Pearson Education, 2019.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

MODULE I   STORAGE SYSTEMS   9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

MODULE II   INTELLIGENT STORAGE SYSTEMS AND RAID   5

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture

MODULE III   STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION   13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

MODULE IV   BACKUP, ARCHIVE AND REPLICATION   12

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

MODULE V SECURING STORAGE INFRASTRUCTURE   6

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

COURSE OUTCOMES

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

CO1: Outline the functionalities of logical and physical components of storage

CO2: Describe various storage networking technologies

CO3: Identify different storage virtualization technologies

CO4: Discuss the different backup and recovery strategies

CO5: Explain common storage management activities and solutions

CO6: Understand secure storage infrastructure and management

                                                                    TOTAL : 45 PERIODS

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	VIRTUALIZATION	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO VIRTUALIZATION   10
Defining Virtualization- Virtual Machine- Server Virtualization Models- Virtualization Vendors. Hardware Maximization- Architectures-Manage Virtualization.

MODULE II   VIRTUALIZATION INFRASTRUCTURE AND TESTING ENVIRONMENT   9
Planning and Preparation- Network Layer-Preparing Storage- Host Server Preparation. Testing Environment: Testing Levels-Physical and Logical Workspace-Lab Requirement and Environment-Lab Deliverables

MODULE III   VIRTUAL MACHINES AND SERVER VIRTUALIZATION   9
Technologies and Scenarios: Server Virtualization Scenarios-Vendor Offerings- VMware Technology Components- Virtual Machine Formats- VM Disk Types. Work with Virtual Workloads - Provision Virtual Machines

MODULE IV   DESKTOP VIRTUALIZATION   8
Desktop Management Issues- Moving to Desktop Management- Centralized Desktop Management Infrastructures

MODULE V   APPLICATION VIRTUALIZATION AND SECURITY   9
 Application Management Issues – Benefits of AppV- Application Virtualization Products-Key Points on AppV-System Protection Strategies-Recovery Strategy.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Demonstrate the Virtualization Server, Machine and Models
CO2: Exemplifying the Virtualization Infrastructures with Host Server Preparation
CO3: Summarizing Testing Levels with Requirement and Deliverables
CO4: Categorize the Technologies in Server Virtualization to handle and manage Virtual
        Workloads
CO5: Identify the issues in Desktop Management and utilize the Desktop Management
        Infrastructures
CO6: Determine System Protection Strategies to solve Virtualization Security Issues

                                                                    TOTAL : 45 PERIODS
TEXT BOOKS:

1. Danielle Ruest, Nelson Ruest "Virtualization A Beginner's Guide" Tata McGraw-Hill Edition, Network Professional's Library,2009.

REFERENCES:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, TataMcgraw Hill, 2013.
2. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach, 2006
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach" Copyright © 2010 by the McGraw-Hill.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**CLOUD COMPUTING**	3	0	0	3

MODULE I INTRODUCTION   10

Defining a Cloud - Cloud Computing Reference Model – Characteristics and Benefits -Challenges - Principles of Parallel and Distributed Computing: Eras of Cloud Computing-Parallel vs. Distributed Computing-Elements of Parallel Computing: Hardware Architectures for Parallel Processing - Approaches to Parallel Programming - Levels of Parallelism. Elements of Distributed Computing: Concepts and Definitions - Components of a Distributed System -Models for Inter-Process Communication.

MODULE II   CLOUD COMPUTING ARCHITECTURE   9

Introduction- Cloud Reference Model -Architecture -Infrastructure / Hardware as a Service-Platform as a Service -Software as Service-Types of Clouds: Public Clouds - Private Clouds -Hybrid Clouds - Community Clouds -Economics of the Cloud -Open Challenges

MODULE III   VIRTUALIZATION   9

Introduction-Characteristics of Virtualized Environments - Virtualization Techniques: Execution Virtualization - Other Types of Virtualization - Virtualization and Cloud Computing -Pros and Cons of Virtualization - Technology Examples: Xen: Paravirtualization- VMware: Full Virtualization - Microsoft Hyper-V

MODULE IV CLOUD TECHNOLOGIES   8

Hadoop – MapReduce – Virtual Box –Google App Engine - EMC-NetApp- Microsoft – Amazon AWS - Salesforce.com

MODULE V   CLOUD STORAGE AND SECURITY   9

IBM Cloud Object Storage System overview: How IBM Cloud Object Storage System works – Software-defined storage – Typical workloads and use cases – Cloud Storage Providers – S3- Differences between S3 and IBM Cloud Object Storage APIs - Differences between S3 and the IBM Cloud Object Storage System APIs - S3 Object Lock

COURSE OUTCOMES

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

CO1: Summarizing the features of Cloud Computing, Parallel and Distributed Computing

CO2: Inferring the Models to establish the Inter-Process Communication

CO3: Interpreting Cloud Reference Model, Architecture and Services

CO4: Paraphrasing the significance of virtualization techniques and types of virtualization.

CO5: Integrating the Cloud Technologies and Advancements to improve the cloud
environment

CO6: Exemplifying various security features and storage for cloud services

TOTAL : 45 PERIODS

TEXT BOOKS:

3. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, TataMcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Copyright © 2010 by The McGraw-Hill.
3. Vasfi Gucer, Chris de Almeida, Joe Dorio, Israel Feygelman, Max Huber, Michael Knieriemen, Lars Lauber, Jussi Lehtinen, Jaswinder Singh Saini, "IBM Cloud Object Storage System Product Guide" , 2023, IBM Redbooks.

REFERENCES:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   9
System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture - IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public, Private and Hybrid Clouds.

MODULE II   CLOUD INFRASTRUCTURE & SECURITY   13
Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment.   Security Overview - Cloud Security Challenges - Software as a Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security.

MODULE III   SECURING YOUR USERS, DATA, AND APPS IN THE CLOUD   10
Identity Is the New Perimeter -Data is an Organizations' most Important Asset - Cloud Visibility and Consistent Data Protection - Securing apps - Security Monitoring and Analytics - Threat Detection and Prevention.

MODULE IV   CHANGES IN CLOUD SECURITY   7
 Looking at the Direction of Cloud Security-Drafting a Blueprint to Manage Risk - Identify – Protect - Detect - Respond - Recover. Cloud-Centric Approach - Shared Security Model – Zero Trust Utility - Engage with Business Groups, Governance, and DevOps

MODULE V SECURITY RECOMMENDATIONS   6
Early - Potential Exposure Study - Understand the Attacker - Evaluate Your Security and Compliance Options - Secure IaaS and PaaS - Automation to Eliminate Bottlenecks.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1: Understand the basics of cloud computing and various services deployed from a
Cloud architecture supported by different providers.

CO2: Configure and setup cloud and virtual environments and identify security challenges
and manage risks.

CO3: Determine data security technologies for identity management in current Cloud
based WAN networks

CO4: Understand the generic security recommendations and provide customized audit
recommendations for organizational needs.

CO5: Understand the GRC benefits for Information systems and communications and
operations management

CO6: Learn the core skills needed to implement a basic security system in an
organizational environment.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013. [Unit 1]
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. [Unit 2,3]
3. Cloud Security For Dummies, Oracle 3rd Special Edition Published by John Wiley & Sons, Inc. 2021. [Unit 4]
4. Cloud Security & Compliance For Dummies®, Palo Alto Networks® Special Edition, 2019 [Unit 5,6]

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING and DATA SCIENCE

COURSE CODE	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

Module I   FUNDAMENTALS OF EDA   9
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Software tools for EDA - Visual aids for EDA- Data transformation techniques database, reshaping and pivoting, Transformation techniques.

Module II   DESCRIPTIVE STATISTICS   9
Understanding Statistics – Distribution Function – Cumulative Distribution Function – Descriptive Statistics – Measures of Central tendency – Measures of dispersion –Grouping Datasets – Groupby mechanics - Data aggregation – pivot tables and cross tabulations.

Module III   CORRELATION AND TIME SERIES ANALYSIS   9
Types of Analysis - Understanding Univariate, bivariate and multivariate analysis- Discussing multivariate analysis using real life datasets – Outlining Simpson's paradox – Correlation does not imply causation – Understanding the Time series dataset .

Module IV   MODEL DEVELOPMENT AND EVALUATION   9
Hypothesis Testing and Regression – Hypothesis Testing- p hacking – Understanding regression – Model development and Evaluation – Types of Machine Learning – Understanding Supervised Learning – Understanding Unsupervised Learning – Understanding reinforcement learning .

Module V   EDA USING PYTHON   9
Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping .

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Design and evaluate models using the basics of exploratory analysis and visualize the data.
CO2: Characterize the data and conduct descriptive analytics.
CO3: Apply different methods of correlation, time series analysis on various datasets.
CO4: Apply machine learning algorithms to solve real life problems.
CO5: Implement various data manipulation operations on data using Python libraries.
CO6: Validate the models learned from data and report the expected accuracy achieved by the models.
                                                                            TOTAL PERIODS: 45

TEXT BOOKS:
1. Suresh Kumar Mukhiya, and Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017.

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O Reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

CO-PO & PSO MAPPING

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

1 – low, 2 – medium, 3 – high

COURSE CODE	GENERATIVE AI	L	T	P	C
		2	0	2	3

Module I   GENERATIVE MODELING   7

Generative Versus Discriminative Modeling-The Rise of Generative Modeling-Generative Modeling and AI-First Generative Model-The Generative Modeling Framework-Representation Learning-Generative Model Taxonomy. The Generative Deep Learning Codebase-Cloning the Repository-Using Docker-Running on a GPU

Module II   VARIATIONAL AUTOENCODERS   7

Introduction-Autoencoders-The Autoencoder Architecture-Variational Autoencoders-The Encoder-The Loss Function-Training the Variational Autoencoder-Analysis of the Variational Autoencoder.Exploring the Latent Space-Training the Variational Autoencoder-Analysis of the Variational Autoencoder.

Module III   GENERATIVE ADVERSARIAL NETWORKS   6

Introduction-Deep Convolutional GAN (DCGAN)-The Discriminator-The Generator-Training the DCGAN-Analysis of the DCGAN-GAN Training.Wasserstein GAN with Gradient Penalty (WGAN-GP)-Wasserstein Loss-The Lipschitz Constraint-Enforcing the Lipschitz Constraint-TheGradient Penalty Loss-Training the WGAN-GP-Analysis of the WGAN-GP. Conditional GAN (CGAN)-CGAN Architecture-Training the CGAN-Analysis of the CGAN.

Module IV   ADVANCED GANs   5

Pix2Pix GAN- Problem of Image-to-Image Translation-Pix2Pix GAN for Image-to-Image Translation-Pix2Pix Architectural Details-Applications of the Pix2Pix GAN.CycleGAN-Unpaired Image-to-Image Translation With CycleGA-CycleGAN Model Architecture-Applications of CycleGAN. Introduction to BigGAN-Progressive Growing GAN-StyleGAN.

Module V   TRANSFORMERS   5

Introduction-GPT-Attention-Queries, Keys, and Values-Multihead Attention-Causal Masking-The Transformer Block-Positional Encoding-Training GPT-Analysis of GPT.Transformers-T5-GPT-3 and GPT-4-ChatGPT.

PRACTICALS:

- Use VAEs to change facial expressions in photos
- Train GANs to generate images based on your own dataset
- Train your own GPT for text generation
- Train large language models like ChatGPT
- Compose polyphonic music using Transformers

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1: Apply the key concepts that are important to all generative models in real life examples.

CO2: Use Variational Auto-encoders to generate images of faces and morph between faces in the model's latent space

CO3: Demonstrate various generative adversarial networks (GANs) by using it for image generation.

CO4: Build own versions of GPT for text generation.

CO5: Understand and explore the lineage and technical details of various transformer models.

CO6: Apply advanced GANs in image translation applications.

TOTAL PERIODS: 60

TEXT BOOKS:

1. David Foster,Generative Deep Learning, O'Reilly Media, Inc.,2nd Edition, 2023.(UNIT I,II,III,IV)
2. Jason Brownlee ,Generative Adversarial Networks with Python,Ist Edition, 2019.(UNIT V)

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning,The MIT Press ,2016
2. Terrence J. Sejnowski, The Deep Learning Revolution,The MIT Press, 2018

CO-PO & PSO MAPPING

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

1 – low, 2 – medium, 3 – high

COURSE CODE	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO NEURAL NETWORKS   9

Introduction- Basic Architecture of Neural Networks- Power of Function Composition – Common Neural Architectures. Machine Learning with Shallow Neural Networks- Neural Architectures for Binary Classification Models – Neural Architectures for Multiclass Models – Backpropagated Saliency for Feature Selection – Matrix Factorization with Autoencoders.

MODULE II   TRAINING DEEP NEURAL NETWORKS   9

Backpropagation- Setup and Initialization Issues – Gradient-Descent Strategies -Batch Normalization - Acceleration and Compression – Training Deep Learners to Generalize – The Bias-Variance Trade-Off – Generalization Issues in Model Tuning and Evaluation -Penalty-Based Regularization.

MODULE III   RBF NETWORKS AND RESTRICTED BOLTZMANN MACHINES   9

Training an RBF Network -Variations and Special Cases of RBF Networks – Relationship with Kernel Methods. Restricted Boltzmann Machines – Hopfield Networks- The Boltzmann Machine – Restricted Boltzmann Machine- Applications of Restricted Boltzmann Machines.

MODULE IV   RECURRENT NEURAL NETWORK   9

Expressiveness of Recurrent Networks – Architecture of Recurrent Neural Networks- Challenges of Training Recurrent Networks – Echo-State Networks- Long Short-Term Memory (LSTM) – Gated Recurrent Units (GRUs) – Applications of Recurrent Neural Networks.

MODULE V   CONVOLUTIONAL NEURAL NETWORK   9

Basic Structure of a Convolutional Network -Training a Convolutional Network – Case Studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Convolutional Networks

COURSE OUTCOMES

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

CO1: Apply the key concepts behind neural networks and deep learning, including the structure of neural networks, layers, and models.

CO2: Build generalized models for real time applications by training deep neural networks.

CO3: Analyze the key computations of RBF networks, Boltzman machines and use them to build models for various tasks.

CO4: Implement and evaluate the performance of neural networks using popular deep learning networks.

CO5: Demonstrate the use of convolutional and recurrent neural networks in various case studies.

CO6: Design complex neural network architectures for advanced applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Charu Aggarwal,"Neural Networks and Deep Learning: A Textbook" ,Springer International Publishing, First Edition,2018

REFERENCES:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. LazyProgrammer,"Convolutional Neural Networks in Python: Master Data Science and Machine Learning with Modern Deep Learning in Python", 2016.
3. Rajendra Prasad M,"Hands-On Generative Adversarial Networks with Keras: Your guide to implementing next-generation generative deep learning models using Keras and TensorFlow 2.x", 2019.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	NATURAL LANGUAGE PROCESSING	L	T	P	C
		2	0	2	3

Module I   INTRODUCTION TO NLP   7

Introduction to NLP and its applications-Basic text processing techniques: tokenization, stemming, and stop word removal-N-grams and language models. Part-of-speech tagging and parsing-Semantic analysis: word sense disambiguation and named entity recognition-Lexical semantics: word embeddings and distributional semantics.

Module II   VECTOR SEMANTICS AND EMBEDDINGS   7

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

Module III   SENTIMENT ANALYSIS AND OPINION MINING   6

Introduction to sentiment analysis and opinion mining-Sentiment lexicons and machine learning approaches-Aspect-based sentiment analysis

Module IV   MACHINE TRANSLATION   5

Introduction to machine translation-Rule-based and statistical machine translation-Neural machine translation.

Module V   INFORMATION RETRIEVAL   5

Introduction to information retrieval-Vector space models and document similarity-Latent Semantic Analysis (LSA) and Latent Dirichlet Allocation (LDA)

Total: 30 PERIODS

PRACTICALS:

- Create Regular expressions in Python for detecting word patterns.
- Text Pre-processing operations like Tokenization, Filtration, Script Validation, Stop Word Removal,and Stemming.
- Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams using Python NLTK library.
- Performing POS tagging ,Chunking ,Named Entity Recognition on a text corpus.
- Implement the Word2Vec model.

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate Text Processing techniques in NLP applications.

CO2: Analyse and process natural language data, such as text, speech, and social media content.

CO3: Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.

CO4: Design and develop NLP applications using Machine Translation and Information Retrieval methods.

CO5: Extract information from text automatically using concepts and methods from natural language processing.

CO6: Apply data preprocessing techniques to clean and normalize text data for various NLP tasks.

TOTAL PERIODS: 60

TEXT BOOKS:

1. Dan Jurafsky and James H. Martin,"Speech and Language Processing", Pearson Education, 2022

REFERENCES:

1. Manning and Schutze, "Foundations of Statistical Natural Language Processing" MIT Press Cambridge, MA, 1999.
2. Denis Rothman "Transformers for Natural Language Processing",Packt, 2021

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

COURSE CODE	COMPUTER VISION	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   7

Computer vision – Image Formation : Geometric primitives and transformations – Photometric Image Formation - The digital camera .

MODULE II   FEATURES DETECTION AND MATCHING   10

Points and Patches : Feature detectors ,Feature descriptors, Feature Matching, Feature Tracking – Edges: Edge detection, Edge linking – Lines : Successive approximation – Hough Transforms- Vanishing Points.   .

MODULE III   FEATURE-BASED ALIGNMENT   10

2D and 3D feature – based alignment – Pose estimation – Geometric intrinsic calibration – Image Stitching: Motion models – Global alignment – Compositing.

MODULE IV   COMPUTATIONAL PHOTOGRAPHY   9

Photometric calibration – High dynamic range imaging- super-resolution and blur removal- Image matting and compositing – Texture analysis and synthesis – video –based rendering.

MODULE V   RECOGNITION   9

Object detection- Face recognition – Instance recognition –category recognition – context and scene understanding-Recognition databases and test sets.

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Understand the mathematical principles and algorithms behind computer vision.
CO2: Apply the theoretical and practical aspects of computing in image formation and transformations.
CO3: Demonstrate the Image feature using detectors and descriptors.
. **CO4:** Illustrate the common methods for robust image matching and alignment.
CO5: Demonstrate the usage of computational photography in computer vision.
CO6: Apply suitable recognition techniques in various applications.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education, Second Edition, 2015.

REFERENCES:

1. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
3. Manas Kamal Bhuyan, "Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, Taylor & Francis Group, USA 2020.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1		3	1								3	
2	2	1	1	3	1								3	
3	1	1		1									2	
4	1	1	1	1		1							2	
5	1	1	2	2		1							3	
6	1	1	2	2		1							3	
AVG.	1	1	1	2	1	1							3	

1-low, 2-medium, 3-high

			L	T	P	C
COURSE CODE		**EVOLUTIONARY ALGORITHMS**	3	0	0	3

Module I   INTRODUCTION TO OPTIMIZATION AND EVOLUTIONARY ALGORITHMS   9

Optimization - Objective Function - Decision Variables - Solutions of an Optimization Problem - Decision Space - Constraints or Restrictions - State Variables - Local and Global Optima - Near-Optimal Solutions. Searching the Decision Space for Optimal Solutions - Definition of Terms of Meta-Heuristic and Evolutionary Algorithms Principles of Meta-Heuristic and Evolutionary Algorithms - Classification of Meta-Heuristic and Evolutionary Algorithms -General Algorithm - Performance Evaluation of Meta-Heuristic and Evolutionary Algorithms.

Module II   GENETIC ALGORITHMS   9

Introduction - Mapping the Genetic Algorithm (GA) to Natural Evolution - Creating an Initial Population - Selection of Parents to Create a New Generation - Population Diversity and Selective Pressure - Reproduction - Termination Criteria - User-Defined Parameters of the GA

Module III   SIMULATED ANNEALING   9

Mapping the Simulated Annealing (SA) Algorithm to the Physical Annealing Process - Generating an Initial State- Generating a New State -Acceptance Function- Thermal Equilibrium - Temperature Reduction - Termination Criteria -User-Defined Parameters of the SA -Pseudocode of the SA.

Module IV   TABU SEARCH   9

Tabu Search (TS) Foundation - Generating an Initial Searching Point - Neighboring Points - Tabu Lists- Updating the Tabu List- Attributive Memory - Frequency-Based Memory - Recency-Based Memory - Aspiration Criteria - Intensification and Diversification Strategies - Termination Criteria - User-Defined Parameters of the TS - Pseudocode of the TS.

Module V   SWARM INTELLIGENCE   9

Mapping Ant Colony Optimization (ACO) to Ants' Foraging Behavior - Creating an Initial Population - Allocating Pheromone to the Decision Space - Generation of New Solutions - Termination Criteria - User-Defined Parameters of the ACO -Pseudocode of the ACO. Particle Swarm Optimization : Introduction - Mapping Particle Swarm Optimization (PSO) to the Social Behavior of Some Animals - Creating an Initial Population of Particles - The Individual and Global Best Positions - Velocities of Particles - Updating the Positions of Particles - Termination Criteria - User-Defined Parameters of the PSO. Introduction to Mapping Honey-Bee Mating Optimization (HBMO) to the Honey-Bee Colony Structure - Introduction - Mapping the Firefly Algorithm (FA) to the Flashing Characteristics of Fireflies.

COURSE OUTCOMES

At the end of the course, students will be able to
CO1 : Apply the basic concepts of evolutionary algorithms in optimization problems.
CO2 : Represent different types of problems appropriately for genetic algorithms, including encoding solutions, defining fitness functions, and handling constraints.
CO3: Demonstrate simulated Annealing approach for various optimization problems.
CO4: Identify appropriate real life problems to apply Tabu search and evaluate the performance of the approach.
CO5 : Illustrate the application of Swarm intelligence and Firefly algorithms in problem solving.
CO6 : Choose and evaluate appropriate optimization techniques for solving computational problems .

TOTAL PERIODS: 45

TEXT BOOKS:
1. Omid Bozorg-Haddad, Iran Mohammad Solgi, Iran Hugo A. Loaiciga, "Meta-Heuristic and Evolutionary Algorithms for Engineering Optimization", John Wiley & Sons, 2017.

REFERENCES:

1. Marco Dorrigo, Thomas Stutzle, "Ant Colony Optimization", PHI,2005.
2. Eiben A E and Smith J E, "Introduction to Evolutionary Computing", Second edition, Springer, Heidelberg, 2015.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

COURSE CODE	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		3	0	0	3

MODULE I   GRAPHICS PRIMITIVES, 2D TRANSFORMATION AND VIEWING   9
Output primitives: points and lines - line drawing algorithms - circle and ellipse drawing algorithms - polygon generating and filling algorithms. 2D Transformations: Basic Transformations - matrix representation - translation - rotation - scaling - general pivot point rotation - general fixed point scaling - general scaling directions - reflection - shear. Viewing: window to view port coordinate transformation - point clipping - Cohen and Sutherland line clipping algorithm - Sutherland and Hodgeman polygon clipping algorithm.

MODULE II   3D CONCEPTS, TRANSFORMATION AND VIEWING   9
3D display methods- 3D object representation: polygon surfaces - curved lines and surfaces - Quadric surfaces - Introduction to Spline Representations - Bezier curves and surfaces. 3D Transformations: Translation - Rotation - Scaling - 3D Viewing: view plane - projections - clipping.

MODULE III   MULTIMEDIA SYSTEM DESIGN   9
Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system - Defining objects - Multimedia Data Interface standards - Multimedia databases.

MODULE IV   COMPRESSION AND DECOMPRESSION   9
Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale & Still Video Image Compression-Video Image Compression - Audio Compression

MODULE V   MULTIMEDIA APPLICATIONS   9
Content Based Information Retrieval - Multimedia Communications- Multimedia Information Sharing and Retrieval – Applications Social Media Sharing, Online Social Networking- Virtual Reality- Multimedia for Portable Devices- Collaborative Multimedia Applications.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 : Demonstrate the working of graphics output primitive algorithms, clipping algorithms and
          apply two dimensional geometric transformations.
CO2 : Illustrate three dimensional object representation, transformations and concepts involved in
          spline representation.
CO3 : Describe the Multimedia concepts, its architecture and its real world applications.
CO4 : Ability to understand the importance of various multimedia applications.
CO5 : Analyze various compression techniques for the efficient transmission of Multimedia data.
CO6 : Understanding multimedia database for information sharing and retrieval

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M., "Computer Graphics", Prentice Hall of India, Second Edition, 2008.

2. Prabhat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall of India, Reprint 2007. (Multimedia Systems Design, Compression and Decompression).

3. Ze Nian Li, Mark S Drew and Jiangchuan Liu, " Fundamentals of Multimedia", Second Edition, Springer,2014. (Multimedia Applications).

REFERENCES:

1. Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.

2. John F.Koegal Buford, "Multimedia System", Pearson Education Limited, Reprint 2008.

3. Ranjan Parekh, "Principles of Multimedia", Tata McGraw Hill, Second Edition, 2013.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	VIDEO CREATION AND EDITING	L	T	P	C
		2	0	2	3

Module I   FUNDAMENTALS   6
Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression – risks   associated with altering reality through editing.

Module II   STORY TELLING   6
Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management**.**

Module III   USING AUDIO AND VIDEO   6
Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

Module IV   WORKING WITH FINAL CUT PRO   6
Working with clips and the Viewer - working with sequences, the Timeline, and the canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques – Working with Audio - Using Media Tools - Viewing and Setting Preferences.

Module V   WORKING WITH AVID XPRESS DV 4   6
Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

PRACTICALS:

- Write a Movie Synopsis (Individual/Team Writing)
- Present team stories in class.
- Script/Storyboard Writing (Individual Assignment)
- Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements
- Production: Single camera production personnel & equipment, Documentary Production
- Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching
- Write Documentary & Animation Treatment
- Post-production: Editing, Sound design, Finishing

TOTAL: 30 PERIODS

COURSE OUTCOMES

At the end of the course, students will be able to
CO1: Compare the strengths and limitations of Nonlinear editing.
CO2: Identify the infrastructure and significance of storytelling.
CO3: Apply suitable methods for recording to CDs and VCDs.
CO4: Address the core issues of advanced editing and training techniques.
CO5: Design and develop projects using AVID XPRESS DV 4
CO6: Digitizing images by managing resolutions.

TOTAL PERIODS: 60

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw – Hill 2003.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	UI / UX DESIGN	L	T	P	C
		2	0	2	3

Module I   FOUNDATIONS OF DESIGN   **6**   UI vs.
UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking -Brainstorming and Game storming - Observational Empathy

Module II   FOUNDATIONS OF UI DESIGN   **6**
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding –   Style Guides

Module III   FOUNDATIONS OF UX DESIGN   **6**
Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience   Design - Tools and Method used for Research - User Needs and its Goals – Know about Business Goals

Module IV   WIREFRAMING, PROTOTYPING AND TESTING   **6**
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools – Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods -   Synthesizing Test Findings - Prototype Iteration

Module V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE   **6**
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture

PRACTICALS:

- Designing a Responsive layout for an societal application
- Developing an interface with proper UI Style Guides
- Developing Wireflow diagram for application using open source software
- Hands on Design Thinking Process for a new product
- Brainstorming feature for proposed product
- Defining the Look and Feel of the new Project
- Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
- Identify a customer problem to solve
- Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
- Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

TOTAL: 30 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Build UI for user Applications
CO2: Understand the various Research Methods used in Design
CO3: Evaluate UX design of any product or application
CO4: Demonstrate UX Skills in product development
CO5: Implement Sketching principles
CO6: Create Wireframe and Prototype

TOTAL PERIODS: 60

TEXT BOOKS:
1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition,O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	DIGITAL MARKETING	L	T	P	C
		2	0	2	3

Module I   INTRODUCTION TO ONLINE MARKET   6

 Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

Module II   SEARCH ENGINE OPTIMISATION   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

Module 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 maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

Module 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.

Module 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.

PRACTICALS:

- 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.
- Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.
- Demonstrate how to use the Google WebMasters Indexing API
- Discuss an interesting case study regarding how an insurance company manages leads.
- Discuss negative and positive impacts and ethical implications of using social media for political advertising.
- Discuss how Predictive analytics is impacting marketing automation

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: Focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: Understand the key elements of a digital marketing strategy.

CO4: Study how the effectiveness of a digital marketing campaign can be measured

CO5: Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

CO6: Study the various digital transformation strategy

TEXT BOOKS:
1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10:788126566938 ISBN13:788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.

REFERENCES:

1. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
2. PulizziJ Beginner's Guide to Digital Marketing , Mcgraw Hill Education

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	VISUAL EFFECTS	L	T	P	C
		2	0	2	3

Module I   ANIMATION BASICS   6
VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion   paths.

Module II   CGI, COLOR, LIGHT   6
CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

Module III   SPECIAL EFFECTS   6
Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

Module IV   VISUAL EFFECTS TECHNIQUES   6
Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground planedetermination, 3D Match Moving

Module V   COMPOSITING   6
Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep mage compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

PRACTICALS:

Using Natron:

- Understanding Natron Environment
- Working with color and using color grading
- using Channels
- Merging images
- Using Rotopaint
- performing Tracking and stabilizing
- Transforming elements
- Stereoscopic compositing

Using Blender:

- Motion Tracking – camera and object tracking
- Camera fx, color grading, vignettes
- Compositing images and video files
- Multilayer rendering

TOTAL: 30 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Implement animation in 2D / 3D following the principles and techniques
CO2: Use CGI, color and light elements in VFX applications
CO3: Create special effects using any of the state-of-the-art tools
CO4: Apply popular visual effects techniques using advanced tools
CO5: Use compositing tools for creating VFX for a variety of applications
CO6: Study 3D modeling and rendering with color elements

TOTAL PERIODS: 60

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw – Hill 2003.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	GAME DEVELOPMENT	L	T	P	C
		2	0	2	3

Module I   3D GRAPHICS FOR GAME DESIGN   6
Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models –Animation – Controller Based Animation.

Module II   GAME DESIGN PRINCIPLES   6
Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals –Writing for Preproduction, Production and Post – Production.

Module III   GAME ENGINE DESIGN   6
Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI –Pathfinding.

Module IV   OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS   6
Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

Module V   GAME DEVELOPMENT USING PYGAME   6
Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – GamePhysics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

PRACTICALS:

- Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI, Conceptualize the theme for a 2D game.
- Character design, sprites, movement and character control
- Level design: design of the world in the form of tiles along with interactive and collectible objects.
- Design of interaction between the player and the world
- Developing a 2D interactive using Pygame
- Developing a Puzzle game
- 7 Developing a 3D Game using Unreal

TOTAL: 30 P**ERIODS**

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the basic concepts of 2D and 3D Graphics and Game life cycle
CO2: Understand level design in gaming world and prepare game design documents.
CO3: Implement game engines like Unity and Unreal to develop games.
CO4: Compare various gaming environments and frameworks.
CO5: Design and develop simple games in Pygame.
CO6: Inculcate collaborative working with different game development teams.

Total Hours: 60

TEXT BOOKS:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.

2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.

REFERENCES:

1. Paul Craven, "Python Arcade games", Apress Publishers,2016.

2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.

3. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

MINOR VERTICAL : CYBER PHYSICAL SYSTEMS

COURSE CODE	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I   COMPUTATIONAL FOUNDATION OF CYBER PHYSICAL SYSTEMS   6
Cyber Physical Systems in Real world, Basic Principle of Cyber Physical Systems, Industry 4.0, IIoT

MODULE II   CYBER PHYSICAL SYSTEM DESIGN AND SYSTEM REQUIREMENTS   9

 Cyber Physical Systems Design Recommendations, CPS system requirements, Cyber Physical System Application, Case study of Cyber Physical Systems

MODULE III   CYBER PHYSICAL SYSTEM PLATFORM   10
Hardware platforms for Cyber Physical Systems (Sensors/Actuators, Microprocessor/Microcontrollers), Wireless Technologies for Cyber Physical Systems

MODULE IV   CPS – MODELS AND DYNAMICS BEHAVIORS   10

Structure of Models, Synchronous Reactive models, Dataflow models of computation, Timed models of computation- Continuous Dynamics, Discrete dynamics, Hybrid Systems

MODULE V   Security and Privacy in Cyber Physical Systems   10

        Security and Privacy Issues in CPSs, Local Network Security for CPSs, Internet-Wide   Secure Communication, Security and Privacy for Cloud-Interconnected CPSs, Case Study: Cyber security in Digital Manufacturing/Industry 4.0

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Understand the computational foundation of Cyber Physical Systems (CPS).
CO2: Develop and analyze system requirements for designing effective CPS solutions.
CO3: Understand the hardware platforms and apply wireless technologies relevant to CPS.
CO4: Understand abstraction and various system architectures.
CO5: Analyze the semantics and construct models of a CPS.
C06: Identify and evaluate security and privacy issues specific to CPS and cloud-interconnected CPS.

                                                                    TOTAL : 45 PERIODS
TEXT BOOKS:
1. Principles of Cyber Physical Systems, Rajeev Alur, MIT Press, 2022
2. E. A. Lee, Sanjit Seshia , "Introduction to Embedded Systems – A Cyber–Physical Systems Approach", Second Edition, MIT Press, 2017, ISBN: 978-0-262-53381-2

REFERENCES:
1.   Guido Dartmann, Houbing song, Anke schmeink, "Big data analytics for Cyber Physical System", Elsevier, 2019.
2.   Houbing song, Danda B Rawat, Sabina Jeschke, Christian Brecher, "Cyber Physical Systems Foundations, Principles and Applications", Elsevier, 2017.
3.   Chong Li, Meikang Qiu, "Reinforcement Learning for Cyber Physical Systems with Cyber Securities Case Studies", CRC press, 2019.

4.   Houbing Song, Glenn A.Fink, Sabina Jesche, "Security and Privacy in Cyber-Physical Systems:Foundations, Principles and Solutions", IEEE Press. Mode of Evaluation: Internal Assessment (CAT , Quizzes, Digital Assignments) & Final Assessment Test (FAT).

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

			L	T	P	C
COURSE CODE	**COMMUNICATION FOR CYBER PHYSICAL SYSTEMS**		3	0	0	3

MODULE I   INTRODUCTION   10

IoT Terms and Basic Definitions-Characteristics- Enabling Technologies in IoT-   Sensors – Edge Devices – Embedded Systems – Communications Model- M2M -Wireless Sensor Networks- - Cloud Computing-   Applications and Vision of IoT.

MODULE II   ARCHITECTURE REFERENCE MODEL   6

Physical Devices and Controllers – Connectivity: Communication Model, Protocols, Communication APIs for IoT – Edge Computing- Data Accumulation- Data Abstraction – Application – Collaboration and Processes.

MODULE III   TRANSDUCERS, SENSORS AND ACTUATORS

Defining Transducers, Sensors and Actuators-Workflow – Classification of Transducers, Sensors and Actuators –Interfacing with Embedded Systems-WSN and its Technologies. Layer 1/2 Connectivity Technologies-RFID – NFC-Bluetooth – ZigBee –LoRa -Wi-Fi –WiMAX- LTE – Case Studies.   **10**

MODULE IV   LAYER 3 CONNECTIVITY TECHNOLOGIES

Overview and Motivations – IPv4 Vs IPv6 Addressing – IPv6 Protocol – IPv6Tunneling – IPsec in IPv6- Quality of Service in IPv6- Header Compression Schemes – 6LoWPAN.   **10**

MODULE V   COMMUNICATION PROTOCOLS   9

Classification – Message Queue Telemetry Transport(MQTT) -Architecture – XMPP – Architecture – Advantages – Case studies – DDS-AMQP-Model-Architecture-Protocol-CoAP – Features- Architecture – Applications – REST – Architecture-Case Studies.

COURSE OUTCOMES

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

CO1: Understand the fundamentals of Internet of Things.

CO2: Analyse the communication models and wireless sensor networks within the IoT ecosystem.

CO3: Understand the IoT Architecture Reference Model, including physical devices, controllers, connectivity, communication protocols, and APIs**.**

 CO4: Gain knowledge on the concept of interfacing transducers, sensors, and actuators with embedded systems and various Layer 1/2 connectivity technologies.

CO5: Develop a foundational understanding of Quality of Service (QoS) mechanisms in IPv6.

CO6: Evaluate communication protocols and understand their architecture, features, and applications through case studies.

TOTAL PERIODS: 45 Hours

TEXT BOOKS:

1.Srinivasa K G, Siddesh G.M, Hanumantha Raju R, Internet of Things, CENGAGE, 1st Edition, 2017.

2.Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6, 1st Edition, John Wiley & Sons, 2013.

 3. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, 1st Edition, Wiley Publications, 2019.

REFERENCES:

 1. Sherali Zeadally, Nafaa Jabeur, Cyber Physical System Design with Sensor Networking Technologies, 1st Edition, The Institution of Engineering and Technology, London, UK, 2016.

 2. K.Daniel Wong, Fundamentals of Wireless Communication Engineering   Technologies, 1st Edition, John Wiley & Sons, 2012.

 3.Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, First Edition, Universities Press, 2015.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	MALWARE ANALYSIS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO MALWARE   7
Malware Taxonomy - Malware Attack Life Cycle - The Combat Teams - Anti-malware Products- Reverse Engineering for Windows and Linux systems.

MODULE II   STATIC MALWARE ANALYSIS   7
Fingerprinting the Malware - PE: File types, and header analysis, Extracting Strings - Classifying Malware using YARA - Tools: PEid and TrID, MASTIFF, PE executables.

MODULE III   DYNAMIC MALWARE ANALYSIS REVERSE ENGINEERING   11
Behavior Events Analysis using ProcMon and Autoruns - Detecting Code Injection - Automated dynamic analysis - Sandboxing: Tools and Techniques - Virus Total. Reverse engineering as a process - Binary analysis tools, Disassemblers – Debuggers – Decompilers - Identification and Extraction of Hidden Components - Typical malware behavior - Malware delivery.

MODULE IV   BUILD AND DEBUG THE MALWARE   10
Low-Level Language: Registers, Memory addressing, Opcode bytes - Builder and   debugger: IDA Pro, Ollydebug -Windows API libraries - Packing and Encryption.

MODULE V   ANTI-MALWARE ANALYSIS   10
Anti-debugging - Anti-VM - Anti-emulation - Anti-dumping - SysInternals Suite Tools – Deadlisting - Analysis of HTML scripts - MS Office macro analysis - PDF file analysis – SWFTools – FLASM – Flare.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1: Apply the static and dynamic malware analysis on emerging samples.
CO2: Analyze the executable file and malware classification.
CO3: Understand the disassemblers, debuggers, and decompiles in malware analysis.
CO4: Explore the anti-malware analysis techniques.
CO5: Apply the reverse-engineering of malware for analysis using upcoming tools.
CO6: Obfuscation of data for malware mitigation using emerging tools.   TOTAL PERIODS: 45 Hours

TEXT BOOKS:
  1. Abhijit Mohanta, Anoop Saldanha, "Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware", 2020, 1st edition, Apress (ISBN 978-1-4842- 6192-7), United States.
2. Reginald Wong, "Mastering Reverse Engineering", 2018, 1st edition, Packt Publishing Ltd, Birmingham, ISBN 978-1-78883-884-9, UK.

REFERENCES:

1. M. Sikorski and A. Honig, "Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software", 2012, 1st edition, No Starch Press San Francisco, CA. (ISBN No.: 9781593272906), United States.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	SECURITY AND PRIVACY OF CYBER PHYSICAL SYSTEMS	L	T	P	C
		2	0	2	3

MODULE I   OVERVIEW OF SECURITY AND PRIVACY IN CYBER-PHYSICAL SYSTEMS   5

Introduction, Defining Security and Privacy, Defining Cyber-Physical Systems, Approaches to Secure Cyber-Physical Systems, Threats, threat detection Ongoing Security and Privacy Challenges for CPS.

MODULE II   NETWORK SECURITY AND PRIVACY FOR CYBER-PHYSICAL SYSTEMS   5

Introduction, Security and Privacy Issues in CPSs, Local Network Security for CPSs,   Internet-Wide Secure Communication, Security and Privacy for Cloud-Interconnected   CPSs

**MODULE III   INFORMATION THEORETIC METRICS QUANTIFYING PRIVACY IN CYBER   6
                  - PHYSICAL SYSTEMS**

Social Perspective and Motivation, Information Theoretic Privacy Measures, Privacy Models and Protection, National Security Concerns Arising from Cyber-Physical   Systems, National Security Implications of Attacks on Cyber-Physical Systems
.
**MODULE IV   LEGAL CONSIDERATIONS OF CYBER-PHYSICAL SYSTEMS AND THE
INTERNET OF THINGS   7**
Introduction, Privacy and Technology in Recent History, The Current State of Privacy Law, Meeting Future Challenges

MODULE V   KEY MANAGEMENT IN CPS   7
Introduction, Key Management Security Goals and Threat Model, CPS Key Management Design Principles, CPS Key Management, CPS Key Management Challenges and Open Research Issues

Total: 30 Periods

List of Experiments
1   A Cyber-Resilient Residential Power Management System
2   Attacking HDMI devices through the High Definition Media Interface (HDMI)
3   Privacy-Aware Wearable-Assisted Continuous Authentication Framework
4   Sensitive Information Tracking in IoT Applications
5   Sensor Development Software for IoT Devices
6   Securing Sensory Side-Channels in Cyber-Physical Systems and IoT Devices and Applications
7   Compromised Device Detection
8   A Context-aware Security Framework for Smart Home Systems

Total: 30 Periods

COURSE OUTCOMES
After successfully completing the course, the students should be able to
CO1 Develop the ability to provide security to the cyber-physical systems components.
CO2 Develop the ability to conduct attacks on cyber-physical systems protocols and systems.
CO3 Develop the ability to design cyber-physical systems and architectures that preserves the privacy of the CPS components.
CO4 Acquire the knowledge of security and privacy issues in several application domains that incorporate cyber physical systems
CO5 Understand the network security and privacy issues on cyber physical systems.
CO6 Analyze, interpret and provide solutions to real life problems related to Cyber Physical Systems domain.

TOTAL : 60 Periods

TEXT BOOKS:

1. Houbing Song (Editor), Glenn A. Fink (Editor), Sabina Jeschke (Editor), "Security and Privacy in Cyber-Physical Systems: Foundations, Principles, and Applications" ISBN: 978-1-119-22607-9 October 2017 Wiley-IEEE Press

REFERENCES:

1.Suh, Sang C., et al., eds. Applied cyber-physical systems. Springer New York, 2014.
2."Cybersecurity and Privacy in Cyber-Physical Systems , Yassine Maleh, Mohammad Shojafar, Ashraf Darwish, Abdelkrim Haqiq, 1st Edition, CRC Press, 2019"
3.https://csl.fiu.edu/projects-3/

LIST OF EXPERIMENTS

1.A Cyber-Resilient Residential Power Management System
2.Attacking HDMI devices through the High Definition Media Interface (HDMI)
3.Privacy-Aware Wearable-Assisted Continuous Authentication Framework
4.Sensitive Information Tracking in IoT Applications
5.Sensor Development Software for IoT Devices
6.Securing Sensory Side-Channels in Cyber-Physical Systems and IoT Devices and Applications
7.Compromised Device Detection
8.A Context-aware Security Framework for Smart Home Systems

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	RISK ANALYSIS	L	T	P	C
		3	0	0	3

MODULE I   CYBER PHYSICAL SYSTEMS - RISK ANALYSIS   8

Introduction – Lifecycle Assurance – Background of Assured systems - Risk Management Concepts – Mission Risk analysis – Security Risk – Security risk analysis

MODULE II   CRYPTOGRAPHIC COMPONENTS   8

Cryptographic components – Hash functions – Asymmetric key cryptography –   Digital signatures – Security to state machines – Certified security by design for IOT applications

MODULE III   CPS ASSURANCE   10

CPS Quality Assurance   - Co-Verification Interface Design for High-Assurance CPS - High Assurance Aerospace CPS - Safety Assurance for Machine Learning in CPS

MODULE IV   TRUST MANAGEMENT IN CPS   10

Security and Trust in CPS – Trust boundaries – Trust Decisions – Trust accuracy – Privacy protection Policies – Vulnerability identification – Illustration of various attacks - Challenges

MODULE V   CPS SECURED IMPLEMENTATION   9

Characterization, Analysis, and Recommendations for Exploiting the Opportunities of Cyber- Physical Systems - Energy-Harvesting Low-Power Devices in Cyber-Physical   Systems - Energy Optimization and self-repair in Cyber-Physical Systems

COURSE OUTCOMES

After successfully completing the course, the students should be able to

CO1 Understand the core principles behind CPS assurance.

CO2 Analyze the implementation basics of safety and security properties of CPS.

CO3 Develop safety specifications and invariants for CPS models.

CO4 Understand the safety and security properties to eliminate, reduce or deal with risks.

CO5 Acquire knowledge of technical, management, and policies in cyber physical systems security and safety.

CO6 Identify IOT components along with the cyber-risks and potential threats.

TOTAL PERIODS: 45 Hours

TEXT BOOKS:

1. Cyber Physical Systems: Architecture, Protocol and Applications, Edited by Chi (Harold) Liu and Yan Zhang, CRC Press, 2016

2. Cyber Physical Systems: Foundations, Principles and Applications, Edited by Houbing Song, and others, Elsevier, 2017

REFERENCES:

1. Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016.

2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

3. Secure and Trustworthy Transportation Cyber Physical Systems – Yunchuan   Sun and others, Springer, 2017.

4. Cyber Physical Systems: From Theory to Practice, Edited by Danda B Rawat and others, CRC Press, 2016.

5. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical

Systems Approach, Second Edition, MIT Pre.

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 - high

COURSE CODE	COMPUTER FORENSICS	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION TO DIGITAL FORENSICS   10
Digital forensics fundamentals: Use of Computer Forensics - Benefits of Professional Forensics Methodology - Steps Taken by Computer Forensics Specialists - Case Studies - Types of Computer Forensics Technology: Military, Law Enforcement, Business - Specialized Forensics Techniques - Hidden Data and How to Find It - Protecting Data   from Being Compromised - Internet Tracing Methods.

MODULE II   DIGITAL FORENSICS SYSTEMS AND SERVICES   8
Types of Computer Forensics Systems: Firewall and IDS Security Systems - Storage Area Network Security Systems - Instant Messaging (IM) Security Systems - Biometric Security Systems - Computer Forensics Services: Occurrence of Cyber Crime - Cyber Detectives - Fighting Cyber Crime with Risk Management Techniques - Computer Forensics   Investigative Services - Forensic Process Improvement.

MODULE III   DIGITAL FORENSICS EVIDENCE AND CAPTURE   7
Data Recovery: Data Backup and Recovery, Data-Recovery Solution, Hiding and   Recovering Hidden Data - Evidence Collection and Data Seizure: Collection of Evidence   and Options, Obstacles - Types of Evidence - The Rules of Evidence - Volatile Evidence - Volatile   Memory Forensics- Controlling Contamination: The Chain of Custody, Reconstructing the Attack.

MODULE IV   DATA PRESERVATION AND FORENSICS ANALYSIS   10
Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene - Computer Evidence Processing Steps - Legal Aspects of Collecting and Preserving Evidence - Computer Image Verification and Authentication - Computer Forensics   Analysis: Discovery of Electronic Evidence -Identification of Data - Reconstructing Past Events - disk and file system analysis.

MODULE V   NETWORK AND OPERATING SYSTEM FORENSICS   10
Network forensics: Investigation on virtual network and Email, Internet Artifacts -   Damaging Computer Evidence - System Testing - Operating System Artifacts: Windows System Artifacts, Linux System Artifacts.

COURSE OUTCOMES
After successfully completing the course, the students should be able to
CO1 Learn the fundamentals of digital forensics technology along with different systems and services.
CO2 Recover and seize data from a crime scene without damage, using legal procedures and standards.
CO3 Exhibit knowledge in forensic data acquisition and analysis and investigate artifacts in different operating systems.
CO4 Apply forensics tools and concepts on modern frameworks such as network, email, smart phones, cloud and social media.
CO5 Analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO6 Apply a solid foundational grounding to protect computer network resources from unauthorized activity.

TOTAL PERIODS: 45 Hours

TEXT BOOKS:
1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2015, Second Edition, Charles River Media, Inc. (ISBN No. : 978-1-58450-389-7)
2. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools: Using Open Source Platform Tools, 2011, First Edition, British Library Cataloguing-in-Publication Data. (ISBN No. : 978-1-59749-586-8)

REFERENCES:
1. B. Nelson, A. Phillips, F. Enfinger, and C. Steuart, Guide to Computer Forensics and Investigations, 2019,   Sixth Edition. CENGAGE, INDIA (ISBN: 9789353506261)

CO-PO & PSO MAPPING

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

1 - low, 2 - medium, 3 – high

OPEN ELECTIVES:

COURSE CODE	INTRODUCTION TO CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I   INTRODUCTION   9
Most profitable Customer - CRM: Custom centered database, Managing campaigns, Evolution of marketing, Closed loop marketing, CRM architecture - Customer profitability - Customer acquisition - Cross selling - Customer retention - Customer segmentation.

MODULE II BUILDING THE BUSINESS CASE   10
Introduction - Uncovering the needs for data mining - Defining the business value - The costs - Deploying Data mining for CRM: Introduction - Define the problem - Define the user - Define the data - Scope the project - Trial - Quality assurance - Education Launch - Continuation.

MODULE III COLLECTING CUSTOMER DATA   8
Introduction - Three types of customer data - Collecting customer data - Connecting customer - Customer data and privacy - Privacy and data mining - Guidelines for privacy - Legal issues associated with data mining.

MODULE IV SCORING YOUR CUSTOMER   8
Introduction - Process - Scoring architectures and configurations - Preparing the data - Integrating scoring with other applications- Optimizing the CRM process: Introduction - Improved customer profitability through optimization - Optimized CRM - Complete loop - Optimal CRM process - Optimization techniques.

MODULE V OVERVIEW OF DATA MINING AND CRM TOOL MARKETS   10
Introduction - Data mining market place - Taxonomy of data mining tools - Tool assessment attributes and methodology - Tool evaluation -Data mining tool: WEKA -CRM tools - Next generation for CRM.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 : State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.

CO2 : Describe the business value, its costs and deploying data mining for CRM.

CO3 : Understand the need for Quality assurance in real-time business cases for business continuation

CO4 : Understand the type of collecting and connecting the customer data with proper guidelines for privacy.

CO5 : Demonstrate the scoring process and apply the various CRM optimization techniques to optimize the CRM process in order to improve customer profitability.

CO6 : Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.

2. Ian H.Witten ,Eibe Frank, Mark A.Hall, "Data Mining Practical Machine Learning Tools and Techniques",Morgan Kaufmann, Fourth Edition, 2016

REFERENCES:

1. Francis Buttle, Stan Maklan "Customer Relationship Management: Concepts and Technologies", Routledge, Fourth Edition, 2019.

2. Roger J. Baran, Robert J. Galka, "CRM: The Foundation of Contemporary Marketing Strategy", S.Chand (G/L) & Company Ltd, Second Edition, 2017.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**FUNDAMENTALS OF SOFTWARE ENGINEERING**	3	0	0	3

MODULE I   INTRODUCTION   9

The Software Engineering Discipline - Software Development Projects - Software Life Cycle Models: Use of Life Cycle Models - Classical Waterfall Model-Iterative Waterfall Model-Prototype model-Evolutionary Model-Spiral Model

MODULE II SOFTWARE REQUIREMENTS AND ANALYSIS   8

Requirements Analysis and Specification - Requirements Gathering and Analysis- Value of good SRS - Requirement process- Requirement Specification - desirable characteristics, components and Structure of requirements document - Functional Specification with use cases - basics - developing Use Cases -DFDs - Data Dictionary - ER Diagrams.

MODULE III SOFTWARE DESIGN   10

Design concepts - Cohesion and Coupling- The Open-Closed Principle - Function Oriented Software Design : Structured charts-Structured design methodology - Detailed Design: Logic / Algorithm design - State Modeling of Classes

MODULE IV CODING   7

Programming principles and guidelines - Structured programming - Information hiding - Some programming practices - Coding standards - Code inspection - Planning- Self-review - Group review meeting.

MODULE V TESTING   11

Testing Fundamentals -Black Box Testing: Equivalence Class Partitioning - Boundary Value Analysis - White box Testing: Control Flow based criteria - Data Flow based Testing - Levels of Testing: Unit Testing - Integration Testing - System Testing - Acceptance Testing.

COURSE OUTCOMES

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

CO1:Describe the various software life cycle models and choose an appropriate model for a given application.

CO2:Identify the functional requirements, prepare data flow and ER diagrams.

CO3:Understand and develop the Software Requirement Specifications through various use cases.

CO4:Employ suitable architectural styles, and software design methodologies for various applications,

CO5:Understand the concepts of coding standards and practices in developing practical applications

CO6:Discuss various testing techniques and their application in defect removal.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Pankaj Jalote, "Software Engineering A Precise Approach", Wiley India, Third edition 2012.

2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private

    Limited, Third Edition 2013. (Introduction only)

REFERENCES:

1. Roger.S.Pressman "Software Engineering A Practitioner's Approach", McGraw Hill International Edition, Seventh Edition, 2014.

2. Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

		L	T	P	C
COURSE CODE	**INTERNET PROGRAMMING**	3	0	0	3

MODULE I   BASIC WEB CONCEPTS   9

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication-Review of HTML: Markup Languages, Introduction to HTML-forms - frames - tables.

MODULE II CLIENT SIDE PROGRAMMING   9

Client-side Programming (Review of JavaScript): Introduction, Writing Comments, Variables, Operators, Statements, Alert, Confirm, and Prompt Boxes, Functions, Event and Error Handling, Introduction to Built-in Classes, Form Validation, Cookies.

MODULE III DYNAMIC HTML   9

Dynamic HTML: Introduction - cascading style sheets-object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data.

MODULE IV SERVER SIDE PROGRAMMING   9

Servlets - Deployment of simple servlets - Web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests-Session tracking - Cookies - JDBC - Simple web applications - Multi-tier applications.

MODULE V WEB BASED APPLICATIONS AND ITS TECHNOLOGIES   9

Rails: Overview of Rails-Ajax: Overview of Ajax Rails with Ajax- e-Business Models-e-Marketing-online payments-Security.

COURSE OUTCOMES
At the end of the course, students will be able to
CO1 :Gain knowledge in overview of www and web based applications.
CO2: Understand the importance of client side programming and design a basic application.
CO3 :Design and develop dynamic and Interactive web page using DHTML.
CO4 :Design and develop web applications using servlets.
CO5: Understand the usage of rails and Ajax calls in developing web applications
CO5 :Gain knowledge on E-business models and E-marketing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Deital & Deital, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.

2. Robert W.Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2015.

REFERENCES:

1. Scot Johnson, Keith Ballinger, Davis Howard Chapman, "Special Edition Using Active Server Pages", Prentice Hall of India, paperback 1999.

2. Ravi Kalakota and Andrew B Whinston, "Frontiers of e-commerce", Addison Wesley, paperback 1999.

3. Jeffrey C. Jackson," Web Technologies: A Computer Science Perspective", Pearson Education, Reprint 2011.

4. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, Fourth Edition 2013.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	1	1	3						1		3	2
2	3	\3	1	1	2						2		3	2
3	3	3	1		2						1		3	2
4	3	1	1		2						1		3	2
5	3	1	1		2						2		3	2
6	3	2	1		2						1		3	2
AVG.	3	2	1	1	2						1		3	2

1-low, 2-medium, 3-high

OE04	INTRODUCTION TO DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

MODULE I   BASIC CONCEPTS OF DATABASE SYSTEM   8

Purpose of DBMS - Applications - Views of data - Data Abstraction - Instances and Schemas - Data Models - Database Languages- Relational Databases - Database Architecture - Database users and administrators - History of Database systems.

MODULE II DATA MINING   9

Data Mining - On What Kind of Data-Data Mining Functionalities - Classification of Data Mining Systems - Data Mining Task Primitives - Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining

MODULE III DATA WAREHOUSING   8

Data Warehouse - Introduction-Multidimensional Data Model-Data Warehouse Architecture -Data Warehouse Implementation from Data Warehousing to Data Mining.

MODULE IV DATA PREPROCESSING AND ASSOCIATION RULES   10

Data Preprocessing: Needs Preprocessing the Data - Data Cleaning- Data Integration and Transformation-Data Reduction- Discretization and Concept Hierarchy Generation. Association Rules: Basic concepts - Apriori Algorithm - Generation of association rules from frequent item sets - FP Tree Algorithm - Pattern evaluation methods

MODULE V CLUSTERING AND CLASSIFICATION   10

Cluster analysis - Partitioning Methods - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction.

COURSE OUTCOMES
At the end of the course, students will be able to

CO1 :   Describe the basic concepts, architecture, data models of database management systems

CO2 : Understand the kind of data and appropriate mining techniques to be applied to a dataset.

CO3 :   Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.

CO4 :   Find frequent item sets and generate association rules for the given transactions.

CO5 :   Analyze different types of data and apply classification algorithms

CO6:   Analyse various partitioning methods and apply clustering techniques to various datasets

TOTAL : 45 PERIODS

TEXT BOOKS:

1.   Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill, Sixth Edition, 2013. (Basic Concepts of Database System only)

2.   Jiawei Han & Micheline kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.

REFERENCES:

1.   Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.

2.   Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.

3.   Sam Anahory, Dennis Murray, "Data Warehousing in the Real World ", Pearson Education, Seventh Indian Reprint New Delhi,2003.

4. George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003

5. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high

COURSE CODE	INTRODUCTION TO EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION   10

Characteristics of embedded computing applications- Challenges in embedded computing design - Performance in embedded computing. Embedded System Design Process - Computer Architecture Taxonomy - ARM Processor -Assembly Language Programming.

MODULE II CPU PERFORMANCE   8

I/O Primitives - Busy -Wait I/O - Interrupts - Memory System Mechanisms: Cache, Memory Management Unit and Address Translation - Pipelining - CPU Power Consumption

MODULE III DEVELOPMENT AND DEBUGGING   9

Development environments - Debugging Techniques - Debugging challenges - System Level Performance analysis - Program Level Performance analysis - Program Optimization.

MODULE IV SCHEDULING   10

Scheduling states of a Process-Running Periodic Processes - Preemption - Priorities- Rate Monotonic Scheduling - Earliest Deadline First Scheduling - Priority Inversion - Data dependency

MODULE V NETWORKS   8

Bus Standards: I2C, CAN Bus, Field Bus. CASE STUDY: Alarm Clock, Elevator Controller.

COURSE OUTCOMES

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

CO1 :Examine the characteristics and challenges in embedded system development

CO2 :Identify the parameters affecting CPU performance and develop optimized code

CO3 : Analyze memory system mechanisms such as cache management, memory management units, and address translation for improving CPU performance.

CO4 :Demonstrate the scheduling of a given set of real-time tasks using the appropriate scheduling

   algorithm

CO5 :Design embedded system for simple applications

CO6: Implement scheduling algorithms such as Rate Monotonic Scheduling and Earliest Deadline First to meet timing requirements

                                              TOTAL : 45 PERIODS

TEXT BOOKS:

1.   Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design",

      Morgan Kaufman, Third Edition, 2012

REFERENCES:

1.   Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, First Edition, 2009. (For Scheduling)

2.   David. E. Simon, "An Embedded Software Primer", Pearson Education, First Edition, 2012

3.   Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill, Third Edition, 2014.

CO-PO & PSO MAPPING

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

1-low, 2-medium, 3-high