



INFORMATION TECHNOLOGY

R2024

**CURRICULUM
&
SYLLABI**



GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tiruttani

(An Autonomous Institution)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.
Accredited by NAAC with "A++" Grade & An ISO 9001:2015 Certified Institution.

B.TECH. INFORMATION TECHNOLOGY CURRICULUM REGULATIONS - 2024

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABI (SEMESTER I TO VIII, PROFESSIONAL ELECTIVES, OPEN ELECTIVES,
MANAGEMENT ELECTIVES, NON – CREDIT MANDATORY COURSES)
(FOR THE STUDENTS ADMITTED DURING 2024)

SEMESTER-I									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	IP24101	Induction Programme	-	-	-	-	-	0	-
THEORY COURSES									
2	HS24101	Professional English	HS	3	-	-	3	3	60/40
3	MA24101	Algebra and Calculus	BS	3	1	-	4	4	60/40
4	PH24101	Engineering Physics	BS	3	-	-	3	3	60/40
5	CY24101	Engineering Chemistry	BS	3	-	-	3	3	60/40
6	GE24101	Problem Solving and Python Programming	ES	3	-	-	3	3	60/40
7	TA24101	Heritage of Tamils	HS	1	-	-	1	1	60/40
PRACTICAL COURSES									
8	GE24102	Problem Solving and Python Programming Laboratory	ES	-	-	4	4	2	40/60
9	PC24101	Physics and Chemistry Laboratory	BS	-	-	4	4	2	40/60
10	HS24102	English Laboratory	HS	-	-	2	2	1	0/100
TOTAL				16	1	10	27	22	

SEMESTER-II									
S.NO	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	MA24201	Statistics and Numerical Techniques	BS	3	1	-	4	4	60/40
2	GE24201	Engineering Graphics	ES	2	-	3	5	4	60/40
3	PH24201	Physics for Information Science	BS	3	-	-	3	3	60/40
4	CS24201	C Language Programming	PC	3	-	-	3	3	60/40
5	TA24201	Tamils and Technology	HS	1	-	-	1	1	60/40
THEORY CUM PRACTICAL COURSES									
6	EE24203	Basic Electrical and Electronics Engineering	ES	3	-	2	5	4	50/50
PRACTICAL COURSES									
7	GE24202	Engineering Practices Laboratory	ES	-	-	4	4	2	40/60
8	CS24202	C Language Programming Laboratory	PC	-	-	4	4	2	40/60
9	HS24201	English Communication Laboratory	HS	-	-	4	4	2	40/60
TOTAL				15	1	17	33	25	

SEMESTER-III									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	CS24301	Data Structures and Algorithms	PC	3	-	-	3	3	60/40
2	CS24302	Programming in Java	PC	3	-	-	3	3	60/40
3	EC24303	Computer Organization and Digital Principles	ES	3	-	-	3	3	60/40
4	MA24303	Discrete Mathematics	BS	3	1	-	4	4	60/40
THEORY CUM PRACTICAL COURSES									
5	CS24303	Foundations of Data Science	PC	3	-	2	5	4	50/50
6	CS24304	Operating Systems	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
7	CS24305	Data Structures and Algorithms Laboratory	PC	-	-	4	4	2	40/60
8	CS24306	Programming in Java Laboratory	PC	-	-	4	4	2	40/60
TOTAL				18	1	12	31	25	

SEMESTER-IV									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	CS24401	Database Management Systems	PC	3	-	-	3	3	60/40
2	GE24401	Environmental Science and Engineering	ES	2	-	-	2	2	60/40
3	MA24401	Probability and Statistics	BS	3	1	-	4	4	60/40
4	CS24402	Cryptography and Network Security	PC	3	-	-	3	3	60/40
THEORY CUM PRACTICAL COURSES									
5	IT24401	Compiler Design	PC	3	-	2	5	4	50/50
6	CS24404	Computer Networks	PC	3	-	2	5	4	50/50
PRACTICAL COURSES									
7	CS24405	Database Management Systems Laboratory	PC	-	-	4	4	2	40/60
TOTAL				17	1	8	26	22	

SEMESTER – V

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24501	Object Oriented Software Engineering	PC	3	-	-	3	3	60 / 40
2	CS24502	Cloud Computing	PC	3	-	-	3	3	60 / 40
3	CS24503	Mobile Application Development	ES	3	-	-	3	3	60 / 40
4	GE24501	Professional Ethics and Human Values	HS	2	-	-	2	2	60 / 40
5		Open Elective I	OEC	3	-	-	3	3	60 / 40
6		Professional Elective – I	PEC	-	-	-	-	3	-
7		Professional Elective – II	PEC	-	-	-	-	3	-
PRACTICAL COURSES									
8	CS24504	Object Oriented Software Engineering Lab	PC	0	0	4	4	2	40 / 60
9	CS24505	Mobile Application Development Lab	PC	0	0	4	4	2	40 / 60
TOTAL				-	-	-	-	24	

SEMESTER – VI

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24601	Artificial Intelligence	PC	3	0	0	3	3	60 / 40
2		Open Elective – II	OEC	3	0	0	3	3	60 / 40
3		Open Elective – III	OEC	3	0	0	3	3	60 / 40
4	IT24601	Embedded Systems and IoT	ES	3	0	0	3	3	60 / 40
5		Non-Credit Mandatory Course – I	MC	3	0	0	3	0	0 / 100
6		Professional Elective – III	PEC	-	-	-	-	3	-
7		Professional Elective – IV	PEC	-	-	-	-	3	-
PRACTICAL COURSES									
8	CS24603	Artificial Intelligence Laboratory	PC	0	0	4	4	2	40 / 60
9	CS24S01	Professional Skills Development Lab – I	EEC	0	0	2	2	1	0 / 100
TOTAL				-	-	-	-	21	

SEMESTER – VII

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24701	Web Technology	PC	3	0	0	3	3	60 / 40
2		Management Elective	HS	3	0	0	3	3	60 / 40
3		Open Elective – IV	OEC	3	0	0	3	3	60 / 40
4		Non – Credit Mandatory Course – II	MC	3	0	0	3	0	0 / 100
5		Professional Elective – V	PEC	-	-	-	-	3	-
PRACTICAL COURSES									
6	CS24702	Web Technology Lab	PC	0	0	4	4	2	40 / 60
7	IT24701	Summer Internship	EEC	0	0	0	0	2	0 / 100
8	CS24S02	Professional Skill Development Lab – II	EEC	0	0	2	2	1	0 / 100
TOTAL				-	-	-	-	17	

SEMESTER – VIII

S.No	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
PRACTICAL COURSES									
1	IT24801	Project Work / Internship	EEC	0	0	20	20	10	40 / 60
Total				-	-	20	20	10	

TOTAL CREDITS 166

SUMMARY

Name of then Programme: Computer Science and Engineering										
S.No	Subject Area	Credits Per Semester								Total Credits
		1	2	3	4	5	6	7	8	
1	HS	5	3			2		3		13
2	BS	12	7	4	4					27
3	ES	5	10	3	2	3	3			26
4	PC		5	18	16	10	5	5		59
5	PEC					6	6	3		15
6	OEC					3	6	3		12
7	EEC						1	3	10	14
8	Non – Credit Mandatory						✓	✓		
TOTAL		22	25	25	22	24	21	17	10	166

MANDATORY COURSE

NON-CREDIT MANDATORY COURSE I								
S. N O	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	MX24C71	Introduction to Women and Gender Studies	MC	3	-	-	3	-
2	MX24C72	Elements of Literature	MC	3	-	-	3	-
3	MX24C73	Disaster Risk Reduction and Management	MC	3	-	-	3	-
4	MX24C74	Film Appreciation	MC	3	-	-	3	-

NON-CREDIT MANDATORY COURSE II								
S. N O	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	MX24C75	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	3	-	-	3	-
2	MX24C76	History of Science and Technology in India	MC	3	-	-	3	-
3	MX24C77	Industrial Safety	MC	3	-	-	3	-
4	MX24C78	Political and Economic Thought for a Human Society	MC	3	-	-	3	-
5	MX24C79	State, Nation Building and Politics in India	MC	3	-	-	3	-

MANAGEMENT ELECTIVE

MANAGEMENT ELECTIVE								
S. N O	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	GE24M01	Principles of Management	HS	3	-	-	3	3
2	GE24M02	Total Quality Management	HS	3	-	-	3	3
3	GE24M03	Engineering Economics and Financial Accounting	HS	3	-	-	3	3
4	GE24M04	Human Resource Management	HS	3	-	-	3	3
5	GE24M05	Knowledge Management	HS	3	-	-	3	3
6	GE24M06	Industrial Management	HS	3	-	-	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Software Technologies	Vertical IV Cloud computing and data center technologies	Vertical V cyber security	Vertical VI Artificial Intelligence and Machine Learning	Vertical VII Emerging Trends
Big Data Technology	Web Programming Essentials	Software Project Management	Cloud Services Management	Digital and Mobile Forensics	Ethical AI	Robotic Process Automation
Exploratory Data Analysis	Web Application Security	Service Oriented Architecture	Software Defined Networks	Social Network Security	Natural Language Processing	Neural Networks and Deep Learning
Business Analytics	UI and UX Design	Agile Methodologies	Distributed Computing	Cryptocurrency and Blockchain Technologies	Computer Vision and Image Processing	Cyber Security
Image and Video Analytics	DevOps	Software Testing	Storage Technologies	Ethical Hacking	Reinforcement Learning	Quantum Computing
Computer Vision	Web Frameworks	Human- Computer Interaction	Data Warehousing	Security and Privacy in Cloud	Optimization Techniques	Edge Computing
Recommendation Systems	App Development	Software Quality Assurance	Virtualization	Network Security	Knowledge engineering	Human Augmentation
Text and Speech Analysis	Principles of Programming Languages	Information Storage Management	Stream Processing	Fundamentals of Cryptography	Machine Learning Techniques	3D Printing and Design
Data mining and OLAP	Agile software development	Game Development	Cloud Automation Tools and Applications	Cyber Forensic	Deep Learning and Intelligent Systems	AWS Cloud Services

PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL 1: DATA SCIENCE**

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24P01	Exploratory Data Analysis	PEC	2	0	2	4	3
02	CS24P02	Big Data Technology	PEC	3	0	0	3	3
03	AD24P05	Business Analytics	PEC	3	0	0	3	3
04	AD24P17	Image and Video Analytics	PEC	3	0	0	3	3
05	AD24P04	Computer Vision	PEC	3	0	0	3	3
06	AD24P02	Recommendation Systems	PEC	3	0	0	3	3
07	CS24P03	Text and Speech Analysis	PEC	3	0	0	3	3
08	CS24P04	Data mining and OLAP	PEC	2	0	2	4	3

VERTICAL 2: FULL STACK DEVELOPMENT

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	IT24P01	Web Programming Essentials	PEC	2	0	2	4	3
02	CS24P05	DevOps	PEC	3	0	0	3	3
03	CS24P06	UI and UX Design	PEC	2	0	2	4	3
04	CS24P07	Web Application Security	PEC	3	0	0	3	3
05	CS24P08	Web Frameworks	PEC	3	0	0	3	3
06	CS24P09	App Development	PEC	3	0	0	3	3
07	CS24P10	Principles of Programming Languages	PEC	3	0	0	3	3
08	CS24P11	Agile software development	PEC	3	0	0	3	3

VERTICAL 3: SOFTWARE TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24P12	Software Testing	PEC	3	0	0	3	3
02	CS24P13	Software Project Management	PEC	3	0	0	3	3
03	IT24P02	Service Oriented Architecture	PEC	3	0	0	3	3
04	CS24P14	Agile Methodologies	PEC	2	0	2	4	3
05	CS24P15	Human- Computer Interaction	PEC	3	0	0	3	3
06	CS24P16	Software Quality Assurance	PEC	3	0	0	3	3
07	IT24P03	Information storage management	PEC	3	0	0	3	3
08	CS24P17	Game development	PEC	2	0	2	4	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES**

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24P18	Cloud Services Management	PEC	2	0	2	4	3
02	CS24P19	Data Warehousing	PEC	2	0	2	4	3
03	IT24P04	Software Defined Networks	PEC	2	0	2	4	3
04	CS24P20	Storage Technologies	PEC	3	0	0	3	3
05	CS24P21	Virtualization	PEC	3	0	0	3	3
06	CS24P22	Stream Processing	PEC	3	0	0	3	3
07	CS24P23	Cloud Automation Tools and Applications	PEC	3	0	0	3	3
08	CS24P24	Distributed Computing	PEC	3	0	0	3	3

VERTICAL 5: CYBER SECURITY

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	IT24P05	Ethical Hacking	PEC	2	0	2	4	3
02	IT24P06	Social Network Security	PEC	3	0	0	3	3
03	CS24P25	Network Security	PEC	2	0	2	4	3
04	CS24P26	Cryptocurrency and Blockchain Technologies	PEC	3	0	0	3	3
05	IT24P07	Digital and Mobile Forensics	PEC	3	0	0	3	3
06	CS24P27	Security and Privacy in Cloud	PEC	3	0	0	3	3
07	CS24P28	Fundamentals of Cryptography	PEC	3	0	0	3	3
08	IT24P08	Cyber Forensic	PEC	3	0	0	3	3

VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24P29	Machine Learning Techniques	PEC	2	0	2	4	3
02	AD24P06	Natural Language Processing	PEC	3	0	0	3	3
03	CS24P30	Computer Vision and Image Processing	PEC	3	0	0	3	3
04	AD24P15	Reinforcement Learning	PEC	3	0	0	3	3
05	AD24P21	Optimization Techniques	PEC	3	0	0	3	3
06	CS24P31	Deep Learning and Intelligent Systems	PEC	2	0	2	4	3
07	AD24P01	Knowledge Engineering	PEC	3	0	0	3	3
08	AD24P20	Ethical AI	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL 7: EMERGING TECHNOLOGIES**

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24P32	Robotic Process Automation	PEC	2	0	2	4	3
02	AD24P12	Neural Networks and Deep Learning	PEC	2	0	2	4	3
03	IT24P09	Cyber Security	PEC	3	0	0	3	3
04	CS24P33	Quantum Computing	PEC	3	0	0	3	3
05	CS24P34	AWS Cloud Services	PEC	2	0	2	4	3
06	CS24P35	Human Augmentation	PEC	3	0	0	3	3
07	CS24P36	3D Printing and Design	PEC	3	0	0	3	3
08	CS24P37	Edge Computing	PEC	3	0	0	3	3

OPEN ELECTIVES

OPEN ELECTIVE - I

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	CS24910	Green Computing	OEC	3	0	0	3	3
02	CS24911	Internet Marketing and E-Commerce	OEC	3	0	0	3	3
03	ME24901	Applied Design Thinking	OEC	3	0	0	3	3
04	MG24903	Business Strategy	OEC	3	0	0	3	3
05	CS24906	Cyber Law	OEC	3	0	0	3	3
06	RA24903	Foundation of Robotics	OEC	3	0	0	3	3
07	AS24901	Space Science	OEC	3	0	0	3	3

OPEN ELECTIVE - II

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	RA24902	Remote Sensing Concepts	OEC	3	0	0	3	3
02	MF24901	Reverse Engineering	OEC	3	0	0	3	3
03	CS24909	E-Waste Management	OEC	3	0	0	3	3
04	BT24902	Lifestyle Diseases	OEC	3	0	0	3	3
05	BM24902	Medical Informatics	OEC	3	0	0	3	3
06	GI24901	Geographical Information System	OEC	3	0	0	3	3
07	PY24901	Pharmaceutical Nanotechnology	OEC	3	0	0	3	3

OPEN ELECTIVE - III

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	AI24903	IT in Agricultural System	OEC	3	0	0	3	3
02	CS24908	Augmented Reality and Virtual Reality	OEC	3	0	0	3	3
03	EE24906	Embedded Systems Design	OEC	3	0	0	3	3
04	EC24903	Microprocessor and Microcontroller	OEC	3	0	0	3	3
05	MA24901	Graph Theory	OEC	3	0	0	3	3
06	AD24903	Multivariate Data Analysis	OEC	3	0	0	3	3
07	MG24904	NGOs and Sustainable Development	OEC	3	0	0	3	3
08	MG24902	Democracy and Good Governance	OEC	3	0	0	3	3
09	MR24901	Mechatronics	OEC	3	0	0	3	3
10	AU24901	Batteries and Management System	OEC	3	0	0	3	3

OPEN ELECTIVES

OPEN ELECTIVE - IV

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
01	IM24901	World Class Manufacturing	OEC	3	0	0	3	3
02	AU24902	Electric and Hybrid Vehicles	OEC	3	0	0	3	3
03	FD24904	Traditional Indian Foods	OEC	3	0	0	3	3
04	PT24901	Basics of Plastics Processing	OEC	3	0	0	3	3
05	IE24902	Resource Management Techniques	OEC	3	0	0	3	3
06	BM24903	Wearable Devices	OEC	3	0	0	3	3
07	MF24902	Cost management of Engineering projects	OEC	3	0	0	3	3
08	AI24901	Urban agriculture	OEC	3	0	0	3	3
09	SF24902	Industrial Hygiene	OEC	3	0	0	3	3
10	RA24904	Drone Technologies	OEC	3	0	0	3	3

SEMESTER-I
Common To All Branches
(B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH)

HS24101	PROFESSIONAL ENGLISH	L 3	T 0	P 0	C 3

COURSE OBJECTIVES:

- Improve the communicative competence of learners.
- Help learners use language effectively in academic /work contexts.
- Build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- Develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- Use language efficiently in expressing their opinions via various media

UNIT I INTRODUCTION OF EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing** - Writing emails / letters introducing oneself. **Grammar** - Present Tense (simple and progressive); Question types: Why/ Yes or No/ and Tags. **Vocabulary** - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION 9

Reading-Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. **Writing** - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) **Grammar**-Past tense(simple); Subject Verb Agreement; and Prepositions. **Vocabulary**-Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs

UNIT III DESCRIPTION OF PROCESS AND PRODUCT 9

Reading – Reading advertisements, gadget reviews; user manuals. **Writing** - Writing definitions; instructions; and Product /Process description. **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION**9**

Reading–Newspaper articles; Journal reports–and Non-Verbal Communication (tables, pie charts etc.,). Writing–Note-making/Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart , graph etc., to verbal mode) Grammar–Forms of Verbs, Articles; Pronouns- Possessive & Relative pronouns. Vocabulary-Collocations; Fixed/Semi fixed expressions.

UNIT V EXPRESSION OF VIEWS**9**

Reading–Reading editorials; and Opinion Blogs; Writing–Minutes of Meeting, Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary-Cause & Effect Expressions–Content vs Function words.

Total: 45 Periods**COURSE OUTCOMES:**

After completion of this course, the students should be able to

CO1:Use appropriate words in a professional context.

CO2:Gain understanding of basic grammatical structures and use them in right context.

CO3:Read and interpret and also infer information presented in tables, charts, denotative and connotative meanings of technical texts and other graphic forms.

CO4:Write definitions, descriptions, narrations and essays on various topics.

TEXTBOOKS:

1. English for Engineers & Technologists Orient Black Swan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology CambridgeUniversityPress,2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. K N. Shoba, and Dr. Lourdes Joevani Department of English, Anna University.

REFERENCEBOOKS:

1. Technical Communication– Principles and Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book on Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English for Technical Communication (With CD) By Aysha Viswa Mohan, McGraw Hill Education, ISBN: 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate–Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		2		2	2		3	3	2	2		2	2
CO2		2		2		2	2		3	3	2	2		2	2
CO3		2		2		2	2		3	3	2	3		2	2
CO4		1		2		3	2		3	3	2	3		2	2
Avg		1.75		2		2.25	2		3	3	2	2.5		2	2

1 - Low, 2 - Medium, 3 - High

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1:Demonstrate the matrix techniques in solving the related problems in engineering and technology.

CO2:Apply differential calculus tool to solve engineering applications.

CO3:Use differential calculus ideas on functions several variables.

CO4:Evaluate the area and volume by applying the concept of multiple integration.

CO5:Utilize the concept of vector calculus in evaluating integrals.

TEXTBOOKS:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10th Edition,
2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCEBOOKS:

1. M. K. Venkataraman, “Engineering Mathematics”, Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, 5th Edition, New Delhi, 2017.
3. H. K. Dass and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Limited, 3rd Edition 2014.
4. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2					2		2	3		1	1
CO2	3	3	1	2					2		2	3		1	1
CO3	3	3	2	2					2		2	3		1	1
CO4	3	3	1	1					2		2	3		1	1
CO5	3	3	2	2					2		2	3		1	1
Avg	3	3	1.6	1.6					2		2	3		1	1

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

PH24101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS

9

Multi particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia theorems of M. I – moment of inertia continuous bodies – M.I of a diatomic molecule rotational energy state of a rigid diatomic molecule torque – rotational dynamics of rigid bodies – conservation of angular momentum gyroscope torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES

9

The Maxwell's equations wave equation; Plane electromagnetic waves in vacuum, properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter Source of electromagnetic waves. EM waves: Energy, momentum, intensity and radiation pressure Cell phone reception. Reflection and transmission of electromagnetic waves from a non conducting medium vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS

9

Simple harmonic motion – resonance – analogy between electrical and mechanical oscillating systems – waves on a string – standing waves – traveling waves – Energy transfer of a wave – sound waves – Doppler effect. Reflection and refraction of light waves – total internal reflection – interference – Michelson interferometer – Theory of air wedge and experiment. Theory of laser – characteristics – Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd YAG laser, CO2 laser, semiconductor laser – Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS

9

Photons and light waves – Electrons and matter waves – Compton effect – Schrodinger equation (Time dependent and time independent forms) – Physical meaning of wave function – particle in a infinite one dimensional (1D) potential well Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS

9

The harmonic oscillator (qualitative) Barrier penetration and quantum tunneling(qualitative) Tunneling microscope – Resonant diode – Finite potential wells (qualitative) Bloch's theorem for particles in a periodic potential – Basics of Kronig Penney model and origin of energy bands.

Total: 45 Periods

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Recognized the importance of mechanics.

CO2: Express their knowledge in electromagnetic waves.

CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Illustrate the importance of quantum physics.

CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXTBOOKS:

1. D. Kleppner and R. Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M. Purcell and D.J. Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw Hill (Indian Edition), 2017.

REFERENCEBOOKS:

1. R. Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. Halliday, R. Resnick and J. Walker. Principles of Physics, Wiley (Indian Edition), 2015.

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1					1				1			
CO2	3	2	1	2		2		2				1			
CO3	3	2	2		2			2				2			
CO4	3		1		3	2	3	1				1			1
CO5	3		2	1		2		2				2			1
Avg	3	2	1.4	1.5	2.5	2	3	1.6				1.4			1

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

CY24101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, Water quality parameters: Definition and significance of color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II NANOCHEMISTRY 9

Basics: Distinction between molecules, non materials and bulk materials; Size dependent properties (optical, electrical, mechanical and magnetic); Types of non material's: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol gel, solvothermal, laser ablation, chemical vapor deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES 9

Phase rule: Introduction, definition of terms with examples. One component system water system; Reduced phase rule; Construction of a simple eutectic phase diagram Thermal analysis; Two component system: lead silver system Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites definition and examples.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking octane number, diesel oil – cetane number; Power alcohol and biodiesel. natural gas compressed natural gas (CNG) liquefied petroleum gases(LPG). Combustion of fuels: Introduction: Calorific value higher and lower calorific values, Theoretical calculation

of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis ORSAT Method. CO₂ emission and carbon footprint.

UNIT V ENERGY SOURCES AND STORAGE DEVICES

9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor environmental consequences of fossil fuel Importance of renewable energy sources Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Batteries: Types of batteries lead acid battery Solid Battery – Lithium Battery, Lithium ion; Battery Electric vehicles working principles; Fuel cells: H₂ O₂ fuel cell, microbial fuel cell.

Total: 45 Periods

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1:Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2:Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nonmaterial for engineering and technology applications.

CO3:Apply the knowledge of phase rule and composites for material selection.

CO4:Analyze the quality of fuel and its various uses.

CO5:Recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXTBOOKS:

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, “A text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.

REFERENCEBOOKS:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1	2							
CO2	2		1	1	2	2	2	1				3			1
CO3	3	1						2				3			
CO4	3	1	1			1	3	2				2			
CO5	3	2	2	2		3	3	1				3			
Avg	2.8	1.5	1.33	1.5	2	1.75	2.25	1.6				2.75			1

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

GE24101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, operators, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and conditional (if), alternative (if else), chained conditional (if elif else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, GCD, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, Predefined modules (Numpy Pandas, Matplotlib, Scipy, Django) packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0 100).

Total: 45 Periods

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1:Develop algorithmic solutions to simple computational problems.

CO2:Develop and execute simple Python programs.

CO3:Write simple Python programs using conditionals and loops for solving problems.

CO4:Represent compound data using Python lists, tuples, dictionaries etc.

CO5:Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.
3. Python Data Science Handbook: Essential Tools for Working with Data, Second Edition (Grayscale Indian Edition) by Jake VanderPlas.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc Graw Hill, 2018. Comparison of Existing and Revised Syllabus

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							1	2		
CO2	3	3	3	1	2							1	1		
CO3	3	3	3	1	2							1	1	1	
CO4	3	2	1	1	2						1	1	1	1	
CO5	3	2	1	2	1						1	1	1	1	
Avg	3	2.6	2.2	1.4	1.8						1	1	1.2	1	

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

TA24101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India Dravidian Languages – Tamil as a Classical Language Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature Management Principles in Thirukural Tamil Epics and Impact of Buddhism & Jainism in Tamil Land Bakthi Literature Azhwars and Nayanmars Forms of minor Poetry Development of Modern literature in Tamil Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture Bronze icons Tribes and their handicrafts Art of temple car making Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments Mridhangam, Parai, Veenai, Yazh and Nadhaswaram Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature Aram Concept of Tamils Education and Literacy during Sangam Age Ancient Cities and Ports of Sangam Age Export and Import during Sangam Age Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle The Cultural Influence of Tamils over the other parts of India – Self Respect Movement Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total: 15 Periods

TEXT CUM REFERENCE BOOKS

1. தமிழக வரலாறு மக்களும் பண்பாடு மற்றும் கல்வியியல் பணிகள் கழகம்.
2. கணினித் தமிழ் முன்னவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி னவனக நதிக்கனரயில் சங்ககால நகர நாகரிகம் (ததால்லியல் துறை வவளியீடு).
4. வபாருனந ஆற்றங்கனர நாகரிகம் (ததால்லியல் துறை வவளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

GE24102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python based solutions to real world problems.
- To use Python data structures lists, tuples, dictionaries.
- To do input/output with files in Python.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc. operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (Reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real time/technical applications using File handling. (Copy from one file to another, word count, longest word)
10. Implementing real time/technical applications using Exception handling. (Divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

Total: 60 Periods

COURSE OUTCOMES:

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

CO1 : Develop algorithmic solutions to simple computational problems

CO2 : Develop and execute simple Python programs.

CO3 : Implement programs in Python using conditionals and loops for solving problems.

CO4 : Process compound data using Python data structures.

CO5 : Utilize Python packages in developing software applications.

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2						3	2	2	2	
CO2	3	3	3	3	2						3	2	1		1
CO3	3	3	3	3	2						3		1		
CO4	1	2			1						1		1	1	
CO5	2	2			2						2		1	1	1
Avg	2.3	2.5	1.5	1.8	1.8						2.3	0.6	2.6	0.5	

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

PC24101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

PHYSICS LABORATORY

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

EXPERIMENT TOPICS: (Any seven experiments to be conducted)

1. Torsional pendulum Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non uniform bending Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser Determination of the wave length of the laser using grating
6. Air wedge Determination of thickness of a thin sheet/wire
7. a) Optical fibre Determination of Numerical Aperture and acceptance angle
b) Compact disc Determination of width of the groove using laser.
8. Acoustic grating Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box Determination of Band gap of a semiconductor.
11. Photoelectric effect
13. Michelson Interferometer.
14. Melde's string experiment
15. Experiment with lattice dynamics kit.

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles.

EXPERIMENT TOPICS: (Any seven experiments to be conducted)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample. Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

COURSE OUTCOMES:

Upon completion of the course, the students should be able to

CO1 : Analysis the Modulus of elasticity of materials.

CO2 : Illustrate the Laser and Optical fiber.

CO3 : Determine the wavelength of Ultrasonic wave in Liquid.

CO4 : Analyze the effect of chloride in water and DO present in sample water.

CO5 : Identify basicity acidity and pH of the materials

TEXT BOOKS:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's, Textbook of Quantitative Chemical Analysis (2009).

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1			2	2	1				2			
CO2	3	1	2			1	2	1				1			1
CO3	3	2	1	1			1	1							2
CO4	2	1	2			2	2	1							
CO5	2	1	2		1	2	2	1				1			1
Avg	2.6	1.3	1.6	1	1	1.4	1.8	1				1.3			1.3

1 Low, 2 Medium, 3 High

SEMESTER I
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

HS24102	ENGLISH LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English languages skills by engaging the listening, speaking and grammar learning activities that is relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening for general information specific details conversation: Introduction to classmates Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking making telephone calls Self Introduction; Introducing a friend; politeness strategies making polite requests, making polite offers, replying to polite requests and offers understanding basic instructions (filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6

Listening Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking Narrating personal experiences / events Talking about current and temporary situations & permanent and regular situations* describing experiences and feelings engaging in small talk describing requirements and abilities.

UNIT III DESCRIPTION OF PROCESS/ PRODUCT 6

Listening Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description describing locations in workplaces Giving instruction to use the product explaining uses and purposes Presenting a product describing shapes and sizes and weights talking about quantities (large & small) talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures and educational videos. Speaking – Small Talk; discussing and making plans talking about tasks talking about progress talking about positions and directions of movement talking about travel preparations talking about transportation

UNIT V DISCUSSION 6

Listening –Listening to debates/discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions talking about a given topic giving opinions understanding a website describing processes

Total: 30 Periods

COURSE OUTCOMES:

At the end of the course, learners will be able

CO1 : To listen and comprehend complex academic texts

CO2 : To speak fluently and accurately in formal and informal communicative contexts

CO3 : To express their opinions effectively in both oral and written medium of communication

Assessment Pattern

- Conduction of Assessment to test speaking and writing skills

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2		3		2	3		3	3	3	1		2	2
CO2		2		3		2	3		3	3	3	1		2	2
CO3		2		3		1	1		1	3	1	1		2	2
Avg		2		3		1.6	2.3		2.3	3	2.3	1		2	2

1 Low, 2 Medium, 3 High

SEMESTER-II
Common To All Branches
(B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH)

MA24201	STATISTICS AND NUMERICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The student should be made to:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples)
– Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

One way and two - way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method-
Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative
methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi’s method
for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL
INTEGRATION9+3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION 9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

Total: 60 Periods

COURSE OUTCOMES

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

CO1 : Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2 : Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3 : Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4 : Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO5 : Solve the partial and ordinary differential equations with initial and boundary condition by using certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1						2	2	1		
CO2	3	2	1	2	2						2	3	1		
CO3	2	2	1	1	1						2	2	1		
CO4	2	3	1	1	1						1	3		1	
CO5	2	3	1	1	1						2	2		1	
Avg	2.2	2.6	1	1.2	1.2						1.8	2.4	1	1	

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

GE24201	ENGINEERING GRAPHICS	L	T	P	C
		2	0	3	4

COURSE OBJECTIVES:

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

UNIT-I PLANE CURVES AND PROJECTION OF POINTS 5+9

Importance of graphics in engineering applications–Use of drafting instruments– BIS conventions and specifications–size, layout and folding of drawing sheets– lettering and dimensioning. (Not for examination)
 Curves used in engineering practices: Conics–construction of ellipse, parabola and hyperbola by eccentricity method, cycloidal curves–construction of cycloid, construction of involutes of square and circle–drawing of tangents and normal to the above curves. Orthographic projection – principles – principal planes – first angle projection – projection of points.

UNIT-II PROJECTION OF LINES AND PLANE SURFACES 5+9

Projection of straight lines (only first angle projection) inclined to both the principal planes – determination of true lengths and true inclinations by rotating line method and traces.
 Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT-III PROJECTION OF SOLIDS AND SECTION OF SOLIDS 5+9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.
 Sectioning of solids in simple position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

UNIT-IV DEVELOPMENT OF SURFACE AND ISOMETRIC PROJECTIONS 5+9

Development of lateral surfaces of simple and sectioned solids – prisms, pyramids cylinders and cones. Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids –prisms, pyramids, cylinders, cones and combination of two solid objects in simple vertical positions.

UNIT-V FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS 5+9

Visualization concepts–representation of three dimensional objects – layout of views–freehand sketching of multiple views from pictorial views of objects.
 Principle of perspective projection – terminology –perspective projection of simple solids-prisms, pyramids, cylinder and cone by visual ray method.

UNIT-VI**COMPUTER AIDED DRAFTING (Not for examination)****5**

Introduction to drafting packages: Initial Setup Commands, Coordinate system in AutoCAD, UCS, WCS, and MCS. Draw Commands, Modify Commands, View Commands, Annotation commands, 2D Drawings and 3D Models -Simple Exercises.

Total: 75 Periods**COURSE OUTCOMES**

On successful completion of this course, the student will be able

CO1 : To construct different plane curves and to comprehend the theory of projection.

CO2 : To project orthographic projections of lines and plane surfaces.

CO3 : To draw the projection of simple solids and sectional solids.

CO4 : To draw the development of lateral surfaces of sectional solids and Isometric projections of solids.

CO5 : To perform freehand sketching of multiple views from pictorial view and visualize perspective view of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 51th Edition, 2012.
2. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 31th Edition, 2018.

REFERENCE BOOKS:

1. Varghese P I., "Engineering Graphics", McGraw Hill Education (I) Pvt. Ltd., First Edition, 2013.
2. Venugopal K. and PrabhuRaja V., "Engineering Graphics", New Age International (P) Limited, 12th Edition, 2014.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 23th Edition, 2017.
4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2					2		3		2	1		
CO2	3	2	2					2		3		2	1		
CO3	3	2	2					2		3		2	1		
CO4	3	2	2					2		3		2	1		
CO5	3	2	2					2		3		2	1		
Avg	3	2	2					2		3		2	1		

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
B. Tech-AI&DS, IT, B.E.-CSE

PH24201	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of classical and quantum electron theories and energy band structures
- To enable the students to learn the basics of semiconductor physics and its applications in various devices.
- To establish the properties of magnetic materials and their applications in data storage.
- To understand the functioning of optical materials for optoelectronics
- To instill the basics of quantum structures and their applications in nano electronics.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory -Expressions for electrical conductivity and thermal conductivity - Wiedemann-Franz law – success and failures – electron in metals – degenerate states – Quantum free electron theory – Fermi-Dirac statistics – Fermi-Dirac distribution function- Effect of temperature – Density of energy states – Electron in periodic potential – Energy bands in solids – Tight binding approximation - Electron effective mass – Concept of hole.

UNIT II SEMICONDUCTOR PHYSICS 9

Intrinsic semiconductors – energy band diagram –direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – Extrinsic semiconductors - Carrier concentration in n-type & p-type semiconductors – variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – carrier transport in semiconductor – drift and diffusion transport – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT III MAGNETIC MATERIALS 9

Magnetic dipole moment – Origin of magnetic moments – Bohr magneton – magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory – Hysteresis – M versus H behavior hysteresis loop – Hard and soft magnetic materials – examples and uses– Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) – photo current in a P- N diode – solar cell – photo detectors - LED – Organic LED – Optical storage techniques.

UNIT V NANOMATERIALS & NANO DEVICES 9

Introduction - quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - resonant-tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing - quantum states

– classical bits – quantum bits or qubits –CNOT gate - multiple qubits – Bloch sphere – quantum gates – advantage of quantum computing over classical computing.

Total: 45 Periods

COURSE OUTCOMES:

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

CO1 : Explain the classical and quantum electron theories, and energy band structures

CO2 : Apply the basics of semiconductor physics in various electronic applications

CO3 : Explore the properties of magnetic materials and their applications in data storage.

CO4 : Illustrate the functioning of optical materials for optoelectronics

CO5 : Utilize the basics of quantum structures and their applications in Nanoelectronics devices.

TEXT BOOKS

1. Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley(Indian Edition),2007.
2. S.O. Kasap. “Principles of Electronic Materials and Devices”, McGraw-Hill Education (Indian Edition), 2020.
3. ParagK.Lala, “Quantum Computing: A Beginner's Introduction”, McGraw-Hill Education (Indian Edition), 2020

REFERENCES

1. Charles Kittel, “Introduction to Solid State Physics”, Wiley India Edition, 2019.
2. Y.B.Band and Y.Avishai, “Quantum Mechanics with Applications to Nanotechnology and Information Science”, Academic Press, 2013.
3. V.V.Mitin, V.A.Kochelap and M.A.Stroscio, “Introduction to Nano electronics”, Cambridge Univ.Press, 2008.
4. G.W.Hanson, “Fundamentals of Nanoelectronics”, Pearson Education (Indian Edition) 2009.
5. B.Rogers, J.Adams and S. Pennathur, “Nanotechnology: Understanding Small Systems”, CRC Press, 2014.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			1			1		1					
CO2	3	2	2	1	2	1	2	2		1		2			
CO3	3	2	1	1	2	1	1	1		1		2			1
CO4	3	3	2	2	2		1	2		1		2	1		1
CO5	2	3	2	1	1	1		2		1		2	2	2	2
Avg	2.8	2.6	1.75	1.25	1.6	1	1.3	1.6		1		2	1.5	2.0	1.3

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
B. Tech-AI&DS, IT, B.E.-CSE

CS24201	C LANGUAGE PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand basics of Unix/Linux and the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C and Implementation of simple projects using C

UNIT I BASICS OF C PROGRAMMING

9

Introduction to UNIX/LINUX - basic Commands with shell scripting- Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives -Compilation process

UNIT II ARRAYS AND STRINGS

9

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS

9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION

9

Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

UNIT V FILE PROCESSING and Implementation

9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments – Implementation of simple projects using C (Program Design, Program Coding, Program Testing and Debugging).

COURSE OUTCOMES:

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

C01 : Demonstrate basic knowledge on Unix / Linux and C Programming constructs

CO2 : Design and implement applications using arrays and strings

C03 : Develop and implement modular applications in C using functions.

CO4 : Develop applications in C using structures and pointers.

CO5 : Design applications using sequential and random-access file processing and Implementation of simple projects using C

TOTAL: 45 PERIODS

TEXT BOOKS:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Programming in ANSI C || 9th Edition || by Balagurusamy || McGraw Hill · 11 July 2024 | Standard Edition Edition · 4
3. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
4. Linux Essential Commands, Fourth Edition (Grayscale Indian Edition) • Daniel J. Barrett | 11 April 2024 | Fourth Edition -4

REFERENCES:

1. UNIX: The Complete Reference, by Kenneth Rosen. Second Edition.2021.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	1	1	2		3	2	1	2	
CO2	2	3	2	1	2	1	1	1	2		3	2	2	2	
CO3	3	2	2	1	3	1	1	1	2		3	3	2	2	
CO4	2	3	3	1	2	1	2	1	2		3	2	2	3	
CO5	2	2	3	2	1	2			2	1	2	2	2	2	
Avg	2	2	2	1	2	1	1	1	2		3	2	2	2.2	

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
Common To All Branches
(B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH)

TA24201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age -Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads -Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry -Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries –Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries –Sorkuvai Project.

Total: 15 Periods

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மது, - சோழர்காலக் கதைகள் -
சுருத்தி -
கால்நடை பராமரிப்பு - கால்நடைக்காக வளவமைக்கப்பட்ட கணங்கள் -
வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அமைப்புகள் -
மீன்வளம் - கதை மற்றும் கதைகளித்தல் - பெருங்கடல் கதை
பண்டைய -
- அமைச்சர் சுகம்.

அலஊ V

அஊஊயல் தஊழ் மற்றஊம் கணிதத்தஊழ்

3

அஊஊயல் தஊஊன் வளர்ச்ஊ - கணிதத்தஊழ் வளர்ச்ஊ - தஊழ் ஊல்கைள்ஊஊ

செய்தல் - தஊழ் ஂமன்பாஊட்கள் உஊவாக்கம் - தஊழ் இணையக்

கல்ஊக்கழகம் -

தஊழ் ஊன் ஊலகம் - இணையத்ஊல் தஊழ் அகராஊகள் -சாற்ஊவைத்
ஊட்டம்.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு மக்களும் பண்பாடு மற்றும் கல்வியல் பணிகள்
கூழ்ச்சி
2. கணினித் தமிழ் னைவர் இல.ந்தரம். (கடன் ரரம்).
3. கீழ் - வைக நக்கைரல் சங்ககால நகர நாகரிகம் (தோல்யல்
றை
வெளியீடு).
4. பொரு - ஆற்றங்கரை நாகரிகம் (தோல்யல் னைர் வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

SEMESTER-II
Common To B. Tech – AI&DS, IT, B.E – BME, CSE, & MECH

EE24203	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To illustrate the basics of electric circuits and analysis of DC & AC circuits.
- To understand the knowledge in the basics of working principles and application of electrical machines.
- To evaluate the fundamentals of analog electronics and their characteristics.
- To demonstrate the fundamental concepts of digital electronics.
- To compute the functional elements and working of measuring instruments.

UNIT - I BASIC ELECTRIC CIRCUITS 9

DC Circuits: Basic Circuit elements – Ohm’s Law - Kirchhoff’s Laws with Independent Sources – Resistors in Series and Parallel- Current division and Voltage division- Nodal Analysis, Mesh analysis with Independent sources only - Thevenin’s and Norton’s Theorem. Introduction to AC circuit Fundamentals: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor.

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle - DC Machines, EMF equation, Types and Applications. Construction and Working Principle of Transformers & Induction Motors, V/F drives.

UNIT III ANALOG ELECTRONICS 9

PN Junction Diode, Zener Diode – V-I Characteristics & Applications, BJT, SCR, MOSFET, IGBT Types– Basics of Rectifier and Inverter.

UNIT IV DIGITAL ELECTRONICS 9

Number system and its conversion, binary codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers - CT and PT, DSO – Block diagram – Data Acquisition.

Total: 45 Periods

LIST OF EXPERIMENTS:

1. Simulation and experimental verification of electrical circuit using Mesh analysis.
2. Simulation and experimental verification of electrical circuit using Nodal analysis.
3. Measurement of Three Phase Power using two Wattmeter method.
4. Load test on single-phase transformer.
5. Load test on DC shunt motor.
6. VI characteristic of PN junction diode.

7. VI characteristic of Zener Diode.
8. Study of solar PV.

Total: 30 Periods

Total: 75 Periods

COURSE OUTCOMES

After completing this course, the students will be able to

CO1 : Compute the electric circuit parameters.

CO2 : Illustrate the working principle and applications of electrical machines.

CO3 : Plot the characteristics of analog electronics.

CO4 : Summarize the basic concepts of digital electronics.

CO5 : Interpret the operating principles of measuring instruments.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020.
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., Third Edition, 2015.
4. James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015.

REFERENCES:

1. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
2. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 9th edition, 2021.
3. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 7th Edition 2017.
4. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 4th Edition, 2019.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1					1		1		2		1	1
CO2	2	2	1					1		1		2		1	1
CO3	2	2	1					1		1		2		1	1
CO4	2	2	1					1		1		2		1	1
CO5	2	2	1					1		1		2		1	1
Avg	2	2	1					1		1		2		1	1

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

GE24201	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Welding various joints in steel plates using arc welding; machining various simple processes like turning, drilling, and tapping in parts.
- Wiring various electrical joints in common household electrical wire work.
- Soldering and testing simple electronic circuits; assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & MECHANICAL ENGINEERING)

PART I **CIVIL ENGINEERING PRACTICES** **15**

PLUMBING WORK:

- a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
- b. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- c. Preparation of plumbing line sketches for water supply.
- d. Laying pipe connection to the suction and delivery side of a pump
- e. Mixed pipe material connection – Pipe connections with different joining components.

WOOD WORK:

- a. Study of the joints in roofs, doors, windows and furniture.
- b. Making joints like Mortise and Tenon joint, T-Joint and Dovetail joint by sawing, planning and cutting.

PART II **MECHANICAL ENGINEERING PRACTICES** **15**

WELDING WORK:

- a. Welding of Butt joints, Lap joints and Tee joints using arc welding.
- b. Gas welding practice

BASIC MACHINING WORK:

- a. Simple step turning, taper turning
- b. Simple drilling.

ASSEMBLY WORK:

- a. Study of centrifugal pump
- b. Study of air conditioner
- c. Study of household mixer.

SHEET METAL WORK:

- a. Making models of a square/Rectangular tray and funnels.

FOUNDRY WORK:

- a. Demonstrating basic foundry operations.

GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING)**PART III ELECTRICAL ENGINEERING PRACTICES 15**

- a. Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
- b. Staircase Wiring.
- c. Fluorescent Lamp wiring with introduction to CFL and LED types.
- d. Energy meter wiring and related calculations/ calibration.
- e. Study of Iron Box wiring and assembly.
- f. Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac).
- g. Study of emergency lamp wiring/Water heater.

PART IV ELECTRONIC ENGINEERING PRACTICES 15**STUDY OF ELECTRONIC COMPONENTS**

- a. Measurement of Resistance of a resistor using Color Coding.
- b. Measurement of AC signal parameters (Peak-Peak, RMS period, Frequency) using CRO.

SOLDERING WORK:

- a. Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- a. Assembling and testing electronic components on a small PCB.

STUDY OF LOGIC GATES:

- a. Verification of logic gates - AND, OR, NOT, NAND, NOR, EXOR, EX-NOR.

ELECTRONIC EQUIPMENT STUDY:

- a. Study on elements of smart phone.
- b. Assembly and dismantle of LED TV.
- c. Assembly and dismantle of computer/ laptop.

Total = 60 Periods

***At end of the semester students should submit the prototypes of their stem projects.**

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1: draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, and tapping in parts.

CO3: assemble simple mechanical assembly of common household equipment's; Make a simple model using sheet metal work.

CO4: wiring of various electrical joints in common household electrical wire work.

CO5: solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO6: understand the concept and verification of logic gates.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1	1	1					2	2	1	1
CO2	3	2			1	1	1					2	2	1	1
CO3	3	2			1	1	1					2	2	1	1
CO4	3	2			1	1	1					2	2	1	1
CO5	3	2			1	1	1					2	2	1	1
CO6	3	2			1	1	1					2	2	1	1
Avg	3	2			1	1	1					2	2	1	1

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

CS24202	C LANGUAGE PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To familiarise with basic UNIX/LINUX Commands and C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

LIST OF EXPERIMENTS:

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. UNIX/LINUX basic Commands, I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

Total: 60 Periods

COURSE OUTCOMES:

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

CO1 : Demonstrate knowledge on C programming constructs.

CO2 : Develop programs in C using arrays.

CO3 : Develop applications in C using strings, pointers, functions.

CO4 : Develop applications in C using structures.

CO5 : Develop applications in C using file processing.

TEXT BOOKS:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Programming in ANSI C || 9th Edition || by Balagurusamy || McGraw Hill · 11 July 2024 | Standard Edition Edition
3. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
4. Linux Essential Commands, Fourth Edition (Grayscale Indian Edition) • Daniel J. Barrett | 11 April 2024 | Fourth Edition -4

REFERENCES:

1. UNIX: The Complete Reference, by Kenneth Rosen. Second Edition.2021.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	1	1	1	-	-	2	1	2	2	2	2	
CO2	2	2	2	1	1	2	-	-	2	-	2	2	2	2	
CO3	2	2	2	2	1	2	-	-	3	-	3	3	3	2	
CO4	2	2	3	2	3	2	-	-	3	-	3	3	3	3	
CO5	2	2	3	2	1	2	-	-	2	1	2	2	2	2	
Avg	2	2	3	2	1	2	-	-	2	1	2	2	2	2	

1 - Low, 2 - Medium, 3 - High

SEMESTER-II
Common To All Branches
B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH

HS24202	ENGLISH COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I SELF INTRODUCTION AND EMAIL DRAFTING 12

Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences-talking about events in life-discussing past events.

Writing: Writing emails (formal & semi-formal).

UNIT II INDIVIDUAL DISCUSSION ON SOCIAL ISSUES 12

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms.

Writing: Writing different types of emails.

UNIT III PRESENTATION ON TECHNICAL AND NON-TECHNICAL TOPICS 12

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages-making comparisons-discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios.

Writing: Short essays and reports-formal/semi-formal letters.

UNIT IV IMPORTANCE OF DESCRIPTIVE WRITING & INSTRUCTIONS 12

Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example- discussing rental arrangements)- understanding technical instructions.

Writing: Writing instructions. Writing a short article.

UNIT V GROUP DISCUSSION AND IMPORTANCE OF RESUME WRITING 12

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions.

Writing: Job application (Cover letter+ Curriculum vitae)- product presentation)

Total: 60 Periods

COURSE OUTCOMES

After completion of this course, the students should be able to

CO1 : Speak effectively in group discussions held in a formal/semi-formal contexts.

CO2 : Discuss, analyze and present concepts and problems from various perspectives to arrive at suitable solutions

CO3 : Write emails, letters and effective job applications.

CO4 : Write critical reports to convey data and information with clarity and precision.

CO5 : Give appropriate instructions and recommendations for safe execution of tasks.

Assessment Pattern

- Conduction of Assessment to test speaking and writing skills

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3		3		3	3		3	3	3	3	1		
CO2		3		3		3	3		3	3	3	3	1		
CO3		2		3		3	3		3	3	3	3	1		
CO4		3		3		3	3		3	3	3	3	1		
CO5		3		3		3	3		3	3	3	3	1		
Avg		2.8		3		3	3		3	3	3	3	1		

1 - Low, 2 - Medium, 3 - High

SEMESTER-III**(Common to B.E - CSE & B.Tech... - IT)**

CS24301	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:**To enable the students to**

- Understand the fundamental concepts of data structures, abstract data types (ADTs), and their importance in programming and algorithm design.
- Develop proficiency in implementing linear and nonlinear data structures such as linked lists, stacks, queues, trees, and graphs.
- Explore and apply various sorting and searching algorithms, understanding their efficiency and use-cases.
- Introduce algorithmic techniques such as dynamic programming, greedy algorithms, divide and conquer, and backtracking.
- Analyse computational problems for NP-completeness and explore exact and approximate solutions using backtracking, branch and bound, and randomized algorithms.

UNIT-I INTRODUCTION TO DATA STRUCTURES**9**

Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, circularly linked lists- Operations for Circularly linked lists, doubly linked list implementation, insertion, deletion and searching operations, applications of linked lists.

UNIT-II STACK AND QUEUE ADT**9**

Definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation. Queue ADT- definition and operations, array and linked Implementations in C, Circular queues Insertion and deletion operations, Dequeue (Double ended queue) ADT, array and linked implementations in C

UNIT-III TREE AND HASHING TECHNIQUES**9**

Definitions, tree representation, properties of trees, AVL tree, optimal binary search tree, Binary tree, Binary tree representation, tree traversals, Minimum Spanning Tree, applications of trees. linear and binary search methods- selection sort, bubble sort, insertion sort, quick sort, merge sort and radix Sort-Hash Functions-Rehashing

UNIT-IV ALGORITHM DESIGN TECHNIQUES**9**

Asymptotic Notations and its properties best case, Worst case and average case analysis – Recurrence relation: substitution method - Pattern search: The naïve string-matching algorithm shortest path: Floyd-Warshall algorithm Network flow: Ford-Fulkerson method – Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph. Greedy Technique: Elements of the greedy strategy — Huffman Trees.

UNIT - V SEARCH ALGORITHM AND NP COMPLETE ALGORITHM**9**

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem - NP-hardness and NP-completeness -Randomized Algorithms: - randomized quick sort

TOTAL PERIODS: 45

TEXT BOOKS:

1. Mark Allen Weiss, Data structures and algorithms analysis in C-2nd edition Pearson Education.
2. A.V. Aho, J.D. Ullman, J.E. Hopcroft, Data Structures and Algorithms, Williams Publishing, 2000.
3. J. Prichard, F.M. Carrano, Data Abstraction and Problem Solving: Walls and Mirrors (3rd Edition), Williams Publishing, 2011.

REFERENCES:

1. DELNET access link open source <http://discovery.delnet.in/>
2. K-hub in e- Library resource link <http://k-hub.in/dashboard>

COURSE OUTCOMES:

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

- CO1:** Describe and use different types of data structures and abstract data types effectively in software development.
- CO2:** Implement linear and nonlinear data structures using C language.
- CO3:** Apply searching and sorting techniques to organize and retrieve data efficiently.
- CO4:** Analyze algorithm efficiency using asymptotic notation and design optimized solutions using dynamic programming and greedy methods.
- CO5:** Design, analyze, and compare the performance of algorithms for real-world Problem-solving.

CO-PO MAPPING

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	–	2	2	2	–	–	–	–	1	2	2	–
CO2	3	3	3	2	3	2	–	–	–	–	–	1	3	2	–
CO3	3	3	2	2	2	2	2	–	–	–	–	1	2	2	–
CO4	3	3	3	3	3	2	1	–	–	–	–	1	3	3	2
CO5	3	3	3	3	3	2	1	–	–	–	–	1	3	3	3
AVG.	3.0	2.8	2.6	2.5	2.6	2	1.5	–	–	–	–	1	2.6	2.4	2.5

1 - low, 2 - medium, 3 - high, '–' - no correlation

SEMESTER-III
(Common to B.E - CSE & B.Tech... - IT)

CS24302	PROGRAMMING IN JAVA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students to

- Understand the fundamental principles of object-oriented programming and Java features such as platform independence, multithreading, and memory management.
- Develop Java programs using core components including variables, operators, control structures, data types, and class definitions.
- Implement the concepts of classes, inheritance, interfaces, and method polymorphism using Java's object-oriented features.
- Apply exception handling and multithreading concepts to build robust and concurrent applications.
- Create dynamic web-based applications using Java Servlets and JSP, and integrate them with databases using JDBC.
- Utilize Java's I/O system and collection framework for efficient file handling and data manipulation.

UNIT I INTRODUCTION TO JAVA

9

An Overview of Java: Object-Oriented concepts - Java buzzwords (Platform independence, Portability, Threads)- JVM architecture –Java Program structure - Java main method – Data types - Variables - type conversion and casting- Java Console input: Buffered input - operators - control statements - Static Data - Static Method - String and String Buffer Classes

UNIT II CLASSES AND OBJECTS

9

Java user defined Classes and Objects – Arrays – constructors - Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super keyword - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword - Packages: Definition - Access Protection -Importing Packages - Interfaces: Definition – Implementation – Extending Interfaces

UNIT III EXCEPTION HANDLING

9

Try – catch - throw - throws -- finally – Built-in exceptions -Creating own Exception classes - garbage collection, finalize -Multithreaded Programming: Thread Class - Runnable interface – Synchronization – Using synchronized methods – Using synchronized statement - Interthread Communication – Deadlock.

UNIT IV JAVA SERVLETS

9

Overview of Web Technologies (Client-Server, HTTP, Web Servers)- Introduction to Java Servlets- Advanced Servlet Concepts and Session Management-Introduction to JSP-Implicit Objects JSP Tags and -MVC Architecture and JSP-Servlet Integration-JDBC architecture-JDBC Advanced Features-Integrating JDBC with Servlets.

UNIT V File Handling and frameworks

9

Input / Output Basics — Streams — Byte streams and Character streams — Reading and Writing Console — Reading and Writing Files Adapter classes - Inner classes -Java Util Package / Collections framework: Collection & Iterator Interface- Enumeration- List and ArrayList- Vector- Comparator

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Understand OOP and basic Java constructs

CO2: Analyze inheritance and abstract class

CO3: Analyze exception handling

CO4: Develop Java web apps with JDBC

CO5: Perform file I/O, multithreading, containers

TEXT BOOKS:

1. Herbert Schildt, “Java: The Complete Reference”, 13th Edition, McGraw Hill Education, New Delhi, 2024.
2. Ken Arnold James Gosling David Holmes, “The Java Programming Language”, Fourth Edition, Pearson Education, 2008

REFERENCES:

1. Kathy Sierra Bert Bates “Head First JAVA”, 2nd edition ,Oreilly, 2015
2. John P.Flynt “Java Programming”, 2nd edition,2007
3. DELNET access link open source <http://discovery.delnet.in/>
4. K-hub in e- Library resource link <http://k-hub.in/dashboard>

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	0	-	0	1	1	1	2	1	2	-
CO2	3	3	2	2	2	0	-	0	1	1	1	2	1	1	-
CO3	2	3	2	2	3	0	-	1	2	1	1	2	1	2	-
CO4	3	3	3	2	3	1	-	1	2	2	2	2	1	2	-
CO5	3	2	3	2	3	0	-	1	2	1	2	3	1	1	-
Avg	2.8	2.6	2.4	1.8	2.6	1	-	1	1.6	1.2	1.4	2.2	1	1.6	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER-III

Common to (AIDS, CSE & IT)

EC24303	COMPUTER ORGANIZATION AND DIGITAL PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Students should be made to:

- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.
- To analyze and design combinational circuits.
- To analyze and design sequential circuits.

UNIT I COMBINATIONAL LOGIC

9

Combinational Circuits – Karnaugh Map - Design Procedures- Adder – Subtractor - Code convertors - Magnitude Comparator – Decoder – Encoder – Multiplexers – Demultiplexers.

UNIT II SEQUENTIAL CIRCUITS

9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Design of synchronous and Asynchronous sequential circuits - Shift Registers –Universal Shift Register - Counters.

UNIT III COMPUTER FUNDAMENTALS

9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR

9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard and Control Hazards.

UNIT V MEMORY AND I/O

9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: State the fundamentals of computer systems and analyze the execution of an instruction.

CO2: Analyze different types of control design and identify hazards.

CO3: Identify the characteristics of various memory systems and I/O communication.

CO4: Design various combinational digital circuits using logic gates.

CO5: Design various synchronous and asynchronous sequential circuits using Flip Flop.

TEXT BOOKS:

1. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
2. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	1	1	1	1	2	3	2	3	3
CO2	3	3	3	3	2	1	1	1	1	1	2	3	1	2	2
CO3	3	3	3	3	2	2	1	1	1	1	2	3	2	3	1
CO4	3	3	3	3	1	1	1	1	1	1	1	2	1	3	1
CO5	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1
Avg	3	3	3	3	1.8	1.6	1	1	1	1	1.6	2.6	1.4	2.6	1.6

1 - Low, 2 - Medium, 3 – High, ‘-’- no correlation

SEMESTER-III & IV
Common to B.E-CSE & B. Tech- AI&DS, IT

MA24303, MA24403	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

To enable the students

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To understand the concepts of Permutations, Combinations and Induction.
- To acquire the knowledge of graph models
- To familiarize the applications of algebraic structures.
- To understand the concepts, significance of lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT I GRAPHS

9+3

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

UNIT II LOGIC AND PROOFS

9+3

Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT III COMBINATORICS

9+3

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT IV ALGEBRAIC STRUCTURES

9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA

9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL PERIODS: 60

Course Outcomes:

After completion of this course, the students should be able to

- CO1 :** Relate the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and to apply them in problem solving.
- CO2 :** Learn the concepts of combinatorics and its applications in real life problems.
- CO3 :** Demonstrate the concepts of graph theory, natural applications of trees and apply the graph colorings concepts in partitioning problems.
- CO4 :** Understand the algebraic structures on many levels.
- CO5 :** Apply the ideas of lattices and Boolean algebra in solving computer programming Problems.

TEXTBOOKS:

1. J.P. Tremblay, R. Manohar. “Discrete Mathematical Structures with Applications to Computer Science”, McGraw-Hill Education, 2019.
2. Kenneth H. Rosen. “Discrete Mathematics and Its Applications”, 8th Edition, McGraw-Hill, Education, 2021.
3. J. A. Bondy and U. S. R. Murty, “Graph Theory with Applications”, Macmillan Press, London, 1976.

REFERENCES:

1. Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education, 2019.
2. Marc Lipson, Seymour Lipschutz. “Discrete Mathematics (Schaum's Outlines)”, 4rd Edition, McGraw-Hill Education, 2022.
2. Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier India, 2005.
3. L. Zhongwan. “Mathematical Logic for Computer Science”, World Scientific, Singapore, 1989.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	-	-	-	-	-	-	2
CO2	2	2	1	-	-	-	-	-	-	-	-	1
CO3	2	2	2	-	-	-	-	-	-	-	-	2
CO4	2	1	1	-	-	-	-	-	-	-	-	1
CO5	1	2	2	-	-	-	-	-	-	-	-	1
AVG.	1.6	1.8	1.6	-	-	-	-	-	-	-	-	1.4

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER-III

(Common to B.E – CSE & B.Tech... - IT)

CS24303	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

To enable the students to

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION

9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing.

UNIT II DESCRIBING DATA

9

Basic Statistical descriptions of Data - Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III DESCRIBING RELATIONSHIPS

9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations –regression towards the mean

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING

9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V DATA VISUALIZATION

9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn- Data Mining with WEKA Tool.

45 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
 - Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
 - Bivariate analysis: Linear and logistic regression modeling
 - Multiple Regression analysis
 - Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
 - Normal curves
 - Density and contour plots
 - Correlation and scatter plots
 - Histograms
 - Three dimensional plotting
7. Visualizing Geographic Data with Basemap.
8. Analyze and classify the Iris data set using WEKA Tool.
9. Apply and explore various plotting functions on Housing data sets.

COURSE OUTCOMES:

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

CO1: Define the data science process

CO2: Understand different types of data description for data science process

CO3: Gain knowledge on relationships between data

CO4: Use the Python Libraries for Data Wrangling

CO5: Apply visualization Libraries in Python to interpret and explore data

TOTAL PERIODS: 75

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)

REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Morgan Kaufmann Publishers, Elsevier, 2014.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
3. Online Resources: <https://ml.cms.waikato.ac.nz/weka/>

CO's-PO's & PSO's MAPPING

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

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

SEMESTER-III

(Common to B.E – CSE & B.Tech... - IT)

CS24304	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

To enable the students to

- To understand the basics and functions of operating systems.
- To understand processes and threads
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

UNIT I INTRODUCTION 9

Computer System -Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs.

UNIT II PROCESS MANAGEMENT 9

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem – Semaphores – Mutex - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III MEMORY MANAGEMENT 9

Main Memory-Swapping- Contiguous Memory Allocation–Paging- Structure of the Page Table-Segmentation, Segmentation with paging; Virtual Memory-Demand Paging–Copy on Write-Page Replacement - Allocation of Frames –Thrashing.

UNIT IV STORAGE MANAGEMENT 9

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting- File Sharing and Protection; File System Implementation - File System Structure - Directory implementation
- Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS 9

Linux System — Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management - Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations- Mobile OS - iOS and Android.

45 PERIODS

LIST OF EXPERIMENTS:

1. Installation of windows operating system
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphore
7. Write C programs to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program
11. Write C programs to implement the following Memory Allocation Methods
 - a. First Fit b. Worst Fit c. Best Fit
12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs
 - a. Sequential b. Indexed c. Linked
15. Write C programs for the implementation of various disk scheduling algorithms
16. Install any guest operating system like Linux using VMware

30 PERIODS

TOTAL PERIODS: 75

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Analyze various Scheduling algorithms and process synchronization.

CO2: Explain deadlock prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.

CO4: Explain the functionality of file systems, I/O systems, and Virtualization.

CO5: Compare iOS and Android Operating Systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S. Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
4. R6. Daniel P Bovet and Marco Cesati, —Understanding the Linux kernel, 3rd edition, O’Reilly, 2005
5. Linux for Beginners: An Introduction to the Linux Operating System, Jason Cannon, Create space Independent Publishing Platform
6. <https://discovery.delnet.in>
7. <https://k-hub.in/dashboard>

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	-	-	-	-	3	2	3	1	1	2	2
CO2	2	2	3	1	1	-	-	-	2	1	1	2	2	1	2
CO3	1	3	2	2	1	-	-	-	2	2	1	1	1	2	2
CO4	1	3	3	3	-	-	-	-	1	2	1	2	1	3	2
CO5	3	1	2	1	1	-	-	-	3	2	3	2	2	2	1
Avg	2	2	2	2	1	-	-	-	2	2	2	2	1	2	2

1 - Low, 2 - Medium, 3 – High ‘-’- no correlation

SEMESTER – III
(Common to B.E – CSE & B.Tech... - IT)

CS24305	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Understand fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
- Implement various linear and non-linear data structures efficiently in memory using C.
- Apply data structures in solving real-world problems through proper algorithmic approaches.
- Analyze the efficiency of different data structure operations in terms of time and space complexity.
- Explore advanced topics like hashing, backtracking, branch and bound, and their applications in problem-solving.

List of experiments:

1. Array implementation of stack and queue
2. Array implementation of list
3. Linked list implementation of list (Single, circular, double)
4. Linked list implementation of stack
5. Linked list implementation of queue
6. Applications of list polynomial
 - a. Addition and subtraction
 - b. Infix to Postfix
 - c. Expression evaluation
7. Implementation of binary search Trees
8. Implementation of AVL trees
9. Implementation of heap using priority queues
10. Representation of graph (BFS, DFS)
11. Searching techniques (linear and binary)
12. Sorting techniques (bubble, quick, merge)
13. Implement N Queens problem using Backtracking.
14. Implement of TSP using branch and bound technique.

Content beyond syllabus:

15. Creating hash table
16. Implementation of hash functions
17. Implementation of Collision resolution technique

COURSE OUTCOMES:**C01:** Implement stack and queue using arrays and linked lists.**C02:** Design and implement linear data structures such as arrays and linked lists including single, circular, and double linked lists.**C03:** Implement non-linear data structures such as trees and graphs.**C04:** Perform graph traversal algorithms like BFS and DFS efficiently.**C05:** Implement hashing concepts, hash tables, and collision resolution strategies.**TOTAL : 60 PERIODS****CO-PO MAPPING**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	3	2	1	2	–	2	1	–	2	–	–	3	2	–
C02	3	3	3	1	2	–	2	1	–	1	–	–	3	3	–
C03	3	3	3	2	2	–	2	1	–	2	–	–	3	3	–
C04	2	3	2	3	2	–	2	1	–	1	–	–	3	3	–
C05	3	2	2	2	3	–	2	1	–	3	–	–	3	3	–
Avg	2.8	2.8	2.4	1.8	2.8	-	2	1	-	1.8	-	-	3	2.8	-

SEMESTER – III
(Common to B.E – CSE & B.Tech... - IT)

CS24306	PROGRAMMING IN JAVA LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Demonstrate the creation and usage of Java classes, objects, constructors, and variable initialization.
- Explain decision-making statements and loop constructs in Java.
- Illustrate core object-oriented concepts such as inheritance and polymorphism.
- Explain abstraction through abstract classes, methods, and interfaces.
- Introduce packages and modular programming in Java.
- Demonstrate the development of database-connected web applications using JDBC, Servlets, and JSP.
- Illustrate multithreading using the Thread class and Runnable interface.
- Explain exception handling mechanisms including try-catch, throw, throws, and finally.

List of experiments:

1. Introduce the java fundamentals, data types, operators in java.
2. Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables.
3. Discuss the various Decision-making statements, loop constructs in java
4. Demonstrate the core object-oriented concept of Inheritance, polymorphism
5. Introduce concepts of method overloading, constructor overloading, overriding
6. Introduce the concept of Abstraction, packages.
7. Introduction to abstract classes, abstract methods, and Interface in java.
8. Working on JDBC with Servlets and JSP.
9. Demonstrate creation of threads using Thread class and runnable interface.
10. Introduce File operations in java.
11. Exception handling in java, introduction to throwable class, throw, throws, finally.

Content beyond syllabus:

12. Introduce java Applet, awt, swings.
13. Introduce java Collections
14. Java Database Connectivity (SQL)

COURSE OUTCOMES:

C01: Understand basic concepts of Java constructs.

C02: Analyze different forms of inheritance and objects in abstract class.

C03: Analyze different kind of usage of Exception handling.

C04: Build web applications using Servlets, JSP, and integrate with databases using JDBC.

C05: Understand the Multithreading in complex Java programs, and usage of Container classes.

TOTAL: 60 PERIODS

CO-PO MAPPING

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	2	2	1	2				1	1	1	2	3	1	
C02	3	3	2	2	2				1	1	1	2	3	1	
C03	2	3	2	2	3			1	2	1	1	2	2	1	
C04	3	3	3	2	3	1		1	2	2	2	2	2	3	
C05	3	2	3	2	3			1	2	1	2	3	3	2	
Avg	2.8	2.6	2.4	1.8	2.8	1	-	1	1.6	1.2	1.4	2.2	2.6	1.6	-

SEMESTER – IV

(Common to B.E – CSE & B.Tech... - IT)

CS24401	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students to

- To understand DBMS fundamentals, relational models, and Relational Algebra.
- To model databases using ER diagrams and design them using normalization.
- To learn transaction management, concurrency, and recovery concepts.
- To explore internal storage, file organization, and indexing methods.
- To gain basic knowledge of distributed databases, NoSQL, and database security.

UNIT I RELATIONAL DATABASES 9

Introduction and applications of DBMS – Purpose of Database System – Views of data – Database Languages (DDL, DML, DCL, TCL) – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN 10

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTION PROCESSING AND CONCURRENCY CONTROL 8

Transaction Concepts – Transaction State – ACID Properties – Schedules – Serializability – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B tree Index Files – B+ tree Index Files –Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems– Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Construct SQL Queries using relational algebra.

CO2: Design database using ER model and normalize the database

CO3: Construct queries to handle transaction processing and maintain consistency of the Database.

CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database.

CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

TOTAL PERIODS: 45

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2021.

2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

CO-PO MAPPING

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	-	-	-	2	1	1	1	2	1	3
CO2	3	1	1	1	1	-	-	-	2	3	3	3	3	1	2
CO3	3	2	3	2	1	-	-	-	2	1	1	2	2	3	3
CO4	1	2	3	2	-	-	-	-	3	2	3	3	1	2	3
CO5	1	1	3	3	2	-	-	-	1	3	3	1	2	2	2
AVG.	2	2	3	2	1	-	-	-	2	2	2	2	2	2	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER-IV
B. Tech – AI&DS, IT, B.E –CSE

GE24401	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

To enable the students to

- To introduce ecological concepts and biodiversity, emphasizing conservation and public awareness.
- To understand pollution types, impacts, and waste management practices, with industrial safety focus.
- To expose students to various renewable energy technologies and their practical applications.
- To study how people harm the environment and learn ways to prevent and manage disasters.
- To promote sustainability awareness and application of sustainable practices in industry and society.

UNIT I ENVIRONMENT AND BIODIVERSITY

6

Definition, scope, and importance of environment; need for public awareness. Ecosystem and energy flow with ecological succession. Types and values of biodiversity; India as a mega-diversity nation and biodiversity hotspots. Threats like habitat loss, poaching, man-wildlife conflict, Endangered and endemic species of India and conservation methods (in-situ and ex-situ), Role of information technology in species monitoring.

UNIT II ENVIRONMENTAL POLLUTION

6

Causes, Effects and Preventive measures of water, air, soil, noise, and radioactive pollution. Waste management covers municipal solid waste, hazardous waste, and E-Waste - gold extraction. Carbon Credit and Footprint concepts related to industry. Environmental protection acts. Case studies on OHASMS (Occupational health and safety management systems) focusing on IT-based safety monitoring and digital compliance systems.

UNIT III RENEWABLE SOURCES OF ENERGY

6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Case studies on Hydrogen Fuel Production Modeling.

UNIT IV HUMAN POPULATION AND ENVIRONMENT IMPACT

6

Human population growth and its effect on resources. Importance of value education and human rights. Land degradation and deforestation. Man-made disasters: industrial accidents, nuclear incidents, and oil spills – prediction and management. Carbon sequestration and ozone depletion. Role of individual responsibility in environmental protection.

UNIT V SUSTAINABILITY MANAGEMENT AND PRACTICES

6

Sustainability Management - Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability and protocols Sustainable Development Goals-targets. Sustainability Practices - Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment. Sustainable habitat: green buildings, green materials, energy efficiency, sustainable transports. Sustainable energy. Case studies on smart electric vehicle (EV) charging networks.

TOTAL PERIODS: 30

COURSE OUTCOMES:

After completion of this course, the students should be able to

- CO1 :** Explore ecosystem functions, biodiversity, and the importance of species protection.
- CO2 :** Identify types of pollution, their effects, and preventive measures including waste management.
- CO3 :** Describe renewable energy sources and their applications in sustainable energy production.
- CO4 :** Analyze human impact on the environment and propose disaster management strategies.
- CO5 :** Apply sustainability concepts and practices in environmental and industrial systems.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	1	-	-	1	3	2	-	1	-	1
CO2	1	2	2	-	1	2	3	2	-	1	-	2
CO3	1	1	2	-	2	3	3	2	-	1	-	2
CO4	1	-	-	-	-	3	3	3	-	1	-	2
CO5	-	1	2	-	1	3	3	3	-	1	-	2
Avg	1.00	1.25	1.75	-	1.33	2.40	3.00	2.40	-	1.00	-	1.80

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER- III / IV
B.E-CSE & B. Tech- AI&DS, IT

MA24305, MA24401	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- Understand the basic concepts of probability with characteristics and also two-dimensional random variables
- Learn how to formulate and test hypotheses about means, variances and proportions and to draw conclusions based on the results of statistical tests.
- Apply the concepts of probability and statistics in the field of Artificial Intelligence and Data Science.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 + 3

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variables - Probability mass function - Probability density functions - Properties.

UNIT II STANDARD DISTRIBUTIONS 9 + 3

Discrete distributions: Binomial - Poisson - Geometric - Continuous distributions: Uniform - Exponential - Normal distributions and their properties.

UNIT III TWO- DIMENSIONAL RANDOM VARIABLES 9 + 3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT IV NON-PARAMETRIC TESTS 9 + 3

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests – Mann-Whitney U test - The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests.

UNIT V STATISTICAL QUALITY CONTROL 9 + 3

Control charts for variables ($\bar{X}$ and R charts) – Control charts for attributes (p, c, u and np charts) – Process capability Studies -Tolerance limits - Acceptance sampling.

TOTAL PERIODS: 60

COURSE OUTCOMES:

After completion of this course, the students should be able to

- CO1 :** Demonstrate and apply the basic probability axioms and concepts in their core areas of random phenomena.
- CO2 :** Apply the concepts of probability distributions in an appropriate place of science and Engineering
- CO3 :** Execute the knowledge of solving two-dimensional random variables using correlation techniques

- CO4 :** Understand the basic concepts of classifications of design of experiments in the field of statistical quality control.
- CO5 :** Summarize the measurements and procedure for statistical charts.

TEXT BOOKS

1. Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007. 3. John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992.

REFERENCES:

1. Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.
4. Richard A Johnson and John Freund, Miller and Friends Probability Statistics for Engineers, 8th Edition, Pearson Education, 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	-	-	-	-	-	-	2
CO2	2	2	1	-	-	-	-	-	-	-	-	1
CO3	1	2	1	-	-	-	-	-	-	-	-	2
CO4	2	1	1	-	-	-	-	-	-	-	-	2
CO5	1	1	2	-	-	-	-	-	-	-	-	1
AVG.	1.4	1.6	1.2	-	-	-	-	-	-	-	-	1.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER – IV

(Common to B.E – CSE & B.Tech... - IT)

CS24402	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students to

- Study the assessment of the security offered by built-in cryptosystems.
- Acquire expertise in the fundamental mathematical concepts related to security.
- Design cryptographic algorithms to safeguard information security.
- Develop knowledge of various certified methods for data integrity and authentication.
- Familiarize yourself about cybercrimes and the realm of cyber security

UNIT I INTRODUCTION TO SECURITY 10

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC CIPHERS 9

Number theory – Algebraic Structures – Group, Rings, Fields, Finite Fields –SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4.

UNIT III MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY 9

Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Modular Arithmetic- Euclid's algorithm – Congruence and matrices – Chinese Remainder Theorem – Exponentiation and logarithm ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Diffie Hellman key exchange - Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates. 98

UNIT V SYSTEM SECURITY 8

Intruders – Malicious software – viruses – Firewalls, Electronic Mail security – PGP, S/MIME – IP security – Web Security - Cyber Crime and Information Security – Network Access control

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications.

CO5: Understand various Network Access control security.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Eight Edition, Pearson Education, 2023.

2. Behrouz A. Forouzan, Cryptography and cyber security and Introduction to Cryptography network Security Second Edition, Mc Graw hill, 2023.

REFERENCES:

1. Applied cryptography protocol, Algorithm Bruce Schneier and code in C Willsey publisher 2019

2. DELNET access link open source <http://discovery.delnet.in/>

3. K-hub in e- Library resource link <http://k-hub.in/dashboard>

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	1	-	1	-	2	-	-	-
CO2	3	3	1	-	1	-	-	1	-	1	-	2	2	2	2
CO3	3	3	2	1	2	1	-	2	3	3	2	3	3	3	3
CO4	3	3	3	2	2	2	-	3	3	3	3	3	3	3	3
CO5	3	-	3	-	-	3	2	1	2	1	1	1	2	1	2
Avg	3	3	2.2	1.5	1.6	2	2	1.6	1.6	1.8	1.2	2.2	2	1.8	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

(B.Tech... – IT)

IT24401	COMPILER DESIGN	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

To enable the students to

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement the front-end of the compiler.
- To learn to implement code generator.
- To learn to implement code optimization.

UNIT I INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS 8

Introduction- Translators- Compilation and Interpretation- Language processors -The Phases of Compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA - Language for Specifying Lexical Analyzers – Lex tool.

UNIT II SYNTAX ANALYSIS 11

Role of Parser – Grammars – Context-free grammars – Writing a grammar Top Down Parsing - General Strategies - Recursive Descent Parser Predictive Parser-LL(1) - Parser-Shift Reduce Parser - LR Parser- LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC tool - Design of a syntax Analyzer for a Sample Language.

UNIT III SDT & INTERMEDIATE CODE GENERATION 9

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems - Specification of a simple type Checker - Equivalence of Type Expressions-Type Conversions. Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Backpatching.

UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 9

Runtime Environments – source language issues – Storage organization – Storage Allocation Strategies: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables – Dynamic Storage Allocation - Issues in the Design of a code generator – Basic Blocks and Flow graphs - Design of a simple Code Generator - Optimal Code Generation for Expressions– Dynamic Programming Code Generation.

Principal Sources of Optimization – Peep-hole optimization – DAG - Optimization of Basic Blocks
- Global Data Flow Analysis - Efficient Data Flow Algorithm – Recent trends in Compiler Design.

45 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Generate YACC specification for a few syntactic categories.
 - a) Program to recognize a valid arithmetic expression that uses operator +, -, *, and /.
 - b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
 - c) Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into YACC form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies (Heap, Stack)
9. Construction of DAG
10. Implementation of Simple Code Optimization Techniques.

COURSE OUTCOMES:

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

CO1: Understand the techniques in phases of compilation and design the lexical analyzer for a sample language.

CO2: Develop the parsers by applying different parsing algorithms.

CO3: Understand the semantic rules and the intermediate code representations.

CO4: Understand runtime environment and design simple code generator.

CO5: Apply various code optimization techniques.

TOTAL PERIODS: 75

TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2009.

REFERENCES:

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

3. Keith D Cooper and Linda Torczon, Engineering a Compiler^l, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design^l, Tata McGraw Hill Education Publishers, 2010.
- Allen I. Holub, Compiler Design in C^l, Prentice-Hall Software Series, 1993.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	3	2	2	3	2	2	2
CO2	3	3	3	2	3	-	-	-	3	2	2	2	2	3	2
CO3	3	2	2	1	1	-	-	-	2	2	1	1	1	1	1
CO4	3	2	3	3	2	-	-	-	2	2	2	2	2	2	2
CO5	3	3	2	2	1	-	-	-	2	1	1	3	2	2	1
Avg	3.0	2.6	2.6	2.2	2.0	-	-	-	2.4	1.8	1.6	2.2	1.8	2.0	1.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER – IV
(Common to B.E – CSE & B.Tech... - IT)

CS24404	COMPUTER NETWORKS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

To enable the students to

- To understand the concepts of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.
- To learn the functions of network layer, transport layer and the various routing protocols
- To familiarize with network security and various new emerging trends.

UNIT I	INTRODUCTION	9

Data Communication - Networks & Topologies -Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets – - Physical Layer: Data and Signals - Performance – Transmission media.

UNIT II DATA LINK LAYER 9

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Switching: Packet Switching- Circuit Switching

UNIT III NETWORK LAYER 9

Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP - Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM.

UNIT IV	TRANSPORT AND APPLICATION LAYER	10

Overview of transport layer - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DEC bit, RED) – SCTP –Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS.

UNIT V NETWORK SECURITY AND EMERGING TECHNOLOGIES 8

Network Security Technologies: Intrusion detection systems- Firewalls- VPN-Blockchain
Technology in Networking: Basics of blockchain-Applications in networking- Zero Trust
Networking: Concepts and implementation strategies.

45 PERIODS

PRACTICAL EXERCISES:**30 PERIODS**

1. Learn to use commands like tcpdump, netstat, ipconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Simulation of an error correction code (like CRC)
3. Write a code simulating ARP /RARP protocols.
4. Applications using TCP sockets like: a) Echo client and echo server b) Chat
5. Simulation of DNS using UDP sockets.
6. Simulation of Distance Vector/ Link State Routing algorithm.
7. Write a HTTP web client program to download a web page using TCP sockets.
8. Use a tool like Wireshark to capture packets and examine the packets.
9. Study of Network simulator and Simulation of Congestion Control Algorithms using NS.
10. Study of TCP/UDP performance using Simulation tool.

COURSE OUTCOMES:**Upon successful completion of this course, students will be able to:****CO1:** Explain the basic layers and its functions in computer networks.**CO2:** Understand the basics of how data flows from one node to another.**CO3:** Analyze routing algorithms.**CO4:** Describe protocols for various functions of network layer, transport layer and the various routing protocols.**CO5:** Understand network security and various new emerging trends.**TOTAL PERIODS: 75****TEXT BOOKS**

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
3. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Fifth Edition, Pearson Education, Inc., 2011.

REFERENCES

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill, 2012.

CO-PO Mapping Matrix:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	2	-	-	-	-	1	2	2	3	-	-
CO2	3	3	3	3	3	-	-	-	-	1	2	2	2	2	-
CO3	3	3	3	3	3	-	-	-	-	1	2	2	2	2	-
CO4	3	3	3	3	2	-	-	-	-	1	2	2	2	2	-
CO5	3	1	3	3	3	-	-	-	-	1	2	2	2	2	-
AVG.	3	2.2	3	3	2.6	-	-	-	-	1	2	2	2.2	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER-IV
(Common to B.E – CSE & B.Tech... - IT)

CS24405	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To implement PL/SQL programs for processing multiple SQL statements.
- To be familiar with the use of a front end tool for GUI based application development.

EXPERIMENTS:

1. Create a database table, add constraints to execute DDL, DML, DCL and TCL Commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Execute a single line and group (Aggregate) functions on Relation.
4. Query the database tables and Execute Set operations on various Relations.
5. Query the database tables and explore Groupby, Orderby clause on Relations.
6. Write user defined functions and stored procedures in SQL.
7. Query the database tables and explore natural, equi and outer joins.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Write a PL/SQL block for transaction operations of a typical application using triggers.
11. Case Study using any of the real life database applications from the following list
 - a) Inventory Management for a EMart Grocery Shop
 - b) Society Financial Management
 - c) Cop Friendly App – Eseva
 - d) Property Management – eMall
 - e) Star Small and Medium Banking and Finance
 - Build Entity Model diagram. The diagram should align with the business and functional
 - goals stated in the application.
 - Apply Normalization rules in designing the tables in scope.
 - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.

TOPICS BEYOND SYLLABUS

1. Write a PL/SQL program to find the total and average of 6 subjects and display the grade
2. Design and develop database for any real time application using any front end and back end tool (make use of ER diagram and DFD).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

C01: Create databases with different types of key constraints.

C02: Formulate simple and complex SQL queries using DML and DCL commands.

C03: Create views on relational database based on the requirements of users.

C04: Implement PL/SQL programs for processing multiple SQL statements.

C05: Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO 2	PSO 3
C01	3	3	3	3	-	-	-	-	3	1	3	2	2	1	3
C02	2	2	3	2	2	-	-	-	1	2	3	3	3	1	2
C03	3	3	2	1	1	-	-	-	1	1	1	3	2	3	3
C04	1	3	3	3	1	-	-	-	1	1	3	2	1	2	3
C05	3	2	1	1	1	-	-	-	2	2	3	1	2	2	2
Avg	2.4	2.6	2.4	2.0	1.3	-	-	-	1.6	1.4	2.6	2.2	2.0	1.8	2.6

SEMESTER-V

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand software processes, agile methods, estimation, and project management.

CO2: Analyse and document software requirements.

CO3: Apply object-oriented concepts and UML diagrams in software design.

CO4: Design software architecture, interfaces, and components.

CO5: Perform software testing, debugging, and maintenance.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Software Engineering: A Practitioner's Approach (9th Edition) – Roger S. Pressman and Bruce R. Maxim, McGraw Hill, 2023.
2. Software Engineering (10th Edition) – Ian Sommerville, Pearson Education, 2021.

REFERENCE BOOKS:

1. Titus Winters, Tom Manshreck & Hyrum Wright, Software Engineering at Google, lessons learned from programming over time, O' REILLY publications, 2020.
2. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
4. Generative Analysis: The Power of Generative AI for Object-Oriented Software Engineering with UML – Jim Arlow and Ila Neustadt, Addison-Wesley Professional, 2025.
5. Software Testing: Principles and Practices – Naresh Chauhan, Oxford University Press, 2021.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	2	2	1	2	1	1
2	2	3	2	1	1	–	–	–	2	2	1	2	1	1
3	2	2	3	2	2	–	–	–	1	2	–	3	1	2
4	2	2	3	2	2	–	–	–	2	2	1	3	2	3
5	2	3	2	2	3	–	–	–	1	2	2	3	2	2
Avg	2.2	2.4	2.2	1.75	1.8	–	–	–	1.6	2	1.25	2.6	1.4	1.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

SEMESTER-V
(Common to B. E – CSE, ECE, EEE & B. Tech. – IT, AI&DS)

CS24502 / CS24905 / AD24P08	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand the fundamentals, evolution, and characteristics of cloud computing.
- Apply cloud enabling technologies like SOA, Web Services, and virtualization.
- Analyse cloud architectures, service models, and storage solutions.
- Understand resource management and security challenges in cloud environments.
- Explore advanced cloud technologies, federation, and emerging trends.

UNIT I INTRODUCTION

9

Introduction to Cloud Computing: Definition of Cloud - Evolution of Cloud Computing – Principles of Parallel and Distributed Computing- Cloud Characteristics– Elasticity in Cloud- On-demand Provisioning-Benefits and limitations of cloud computing.

UNIT II CLOUD ENABLING TECHNOLOGIES

9

Service Oriented Architecture (SOA) – Web Services- Publish–Subscribe Model - Basics of Virtualization - Types of Virtualizations- Implementation levels of virtualization- Virtualization structures, tools and mechanisms - Virtualization of CPU, Memory and I/O devices.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE

9

NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – Service models: IaaS – PaaS-SaaS - Architectural design challenges- Cloud Storage– Storage-as-a-Service – Advantages of cloud storage– Cloud storage providers (e.g., Amazon S3).

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD

9

Intercloud resource management- Resource provisioning methods-Global exchange of cloud resources - Cloud security overview-Cloud security challenges-Security Governance-Identity and Access Management (IAM) -Security standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS

9

VirtualBox - Google App Engine - Federation in the cloud - Four levels of federation- Federated services and applications -Future trends in cloud technology - Green Cloud Computing.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand cloud fundamentals and benefits.
CO2: Apply SOA, Web Services, and virtualization.
CO3: Analyze cloud architectures and service models.
CO4: Implement resource management and cloud security.
CO5: Utilize advanced cloud technologies and trends.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra — Distributed and Cloud Computing: From Parallel Processing to the Internet of Things (Morgan Kaufmann Publishers, New Edition 2026).
2. John W. Rittinghouse & James F. Ransome — Cloud Computing: Implementation, Management and Security (CRC Press, 2017).

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi — Mastering Cloud Computing (Tata McGraw-Hill, 2013)
2. George Reese — Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (O'Reilly, 2009)
3. Online Resources & Documentation:
 - Amazon Web Services (AWS) Docs – <https://aws.amazon.com/documentation>
 - Google Cloud Platform Docs – <https://cloud.google.com/docs>
 - Apache Hadoop – <https://hadoop.apache.org/docs/>

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	2	1
2	2	2	3	2	3	–	–	–	1	2	1	3	2	3
3	2	3	2	2	3	–	–	–	1	2	1	3	3	2
4	2	3	3	2	3	1	–		1	2	2	3	3	2
5	2	2	2	2	3	1	–	–	1	2	2	3	3	3
Avg	2.2	2.4	2.2	1.8	2.8	1	–	–	1	2	1.4	2.8	2.6	2.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

SEMESTER-V

(Common to B. E – CSE & B. Tech. - IT)

CS24503	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To learn the basic concepts of Mobile Ecosystem.
- To have an exposure about Mobile Device Profiles.
- To Know the Mobile Information Architecture.
- To impart knowledge about Mobile Application Development Platform.
- To impart the knowledge Mobile App development.

UNIT I MOBILE ECOSYSTEM 9

Introduction- The Mobile Ecosystem: Operators - Networks - Devices - Platforms - Operating Systems - Application Frameworks - Applications – Services.

UNIT II MOBILE DEVICES PROFILES 9

Mobile Devices Profiles - Options for development - Categories of Mobile Applications: SMS - Mobile Websites - Native Applications - Games - Utility Apps – Location, Based Services (LBS) Apps - Informative Apps - Enterprise Apps. Cloud Integration in Mobile Apps

UNIT III MOBILE INFORMATION ARCHITECTURE 9

Mobile Information Architecture: Introduction - Sitemaps - Wireframes - Prototyping - Architecture for Different Devices. Mobile Design: Interpreting Design – Elements of Mobile Design - Mobile Design Tools - Designing for Different Device/ Screens. Accessibility in Mobile Apps

UNIT IV MOBILE APPLICATION DEVELOPMENT USING ANDROID 9

Mobile Applications Development - Android Application Architecture –The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity - Views- Layout -Creating User Interfaces with basic views- linking activities with Intents- Github- GenAI Copilot.

UNIT V CASE STUDY 9

Case Study: Google Android: Introduction - Android Development Environment- Development Framework-SDK - Emulator, Android AVD - Project Framework – IOS- Android Studio as Development Environment - iOS Development Environment

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand the basics of the mobile ecosystem and mobile platforms.

CO2: Identify different types of mobile devices and mobile applications.

CO3: Apply mobile design and information architecture concepts in app development.

CO4: Develop basic Android mobile applications using Android tools and components.

CO5: Analyze Android and iOS development environments through case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Android Programming: The Big Nerd Ranch Guide (5th Edition) – Bill Phillips, Chris Stewart & Kristin Marsicano, Big Nerd Ranch Guides, 2022.
2. Head First Android Development (3rd Edition) – Dawn Griffiths & David Griffiths, O'Reilly Media, 2021.

REFERENCE BOOKS:

1. Professional Android Development with Kotlin – John Horton, Packt Publishing, 2021.
2. Learning Android Application Development – Joseph Annuzzi Jr., Lauren Darcey & Shane Conder, Pearson Education, 2021.
3. Android Studio Arctic Fox Essentials – Neil Smyth, Payload Media, 2022.
4. Flutter for Beginners (3rd Edition) – Alessandro Biessek, Packt Publishing, 2023.
5. Mobile Application Development Using Android – Rajiv Chopra, Khanna Publishing House, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO'S											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
2	2	2	1	1	2	–	–	–	1	2	1	2	1	2
3	2	3	2	2	2	–	–	–	1	2	1	3	1	3
4	2	2	3	2	3	–	–	–	1	2	2	3	2	3
5	2	2	3	2	3	–	–	–	2	2	2	3	2	3
Avg	2.2	2.2	2	1.6	2.4	–	–	–	1.2	2	1.4	2.6	1.4	2.6

1 - low, 2 - medium, 3 - high, '–' - no correlation

SEMESTER-V
(Common to B. E – CSE & B. Tech.- IT)

GE24501	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

To enable the students

- To introduce basic concepts of ethics and professionalism.
- To understand ethical theories and moral principles.
- To learn professional practices and codes of ethics in engineering.
- To develop awareness of human values and moral behavior.
- To understand scientists' responsibilities and social ethics.

UNIT-I INTRODUCTION

6

Basic concepts of ethics – Governing ethics – Personal and professional ethics – Ethical dilemmas – Life skills and emotional intelligence – Thoughts of ethics – Value education – Dimensions of ethics – Profession and professionalism – Professional associations – Professional risks and accountabilities – Professional success – Ethics in profession.

UNIT- II BASIC THEORIES

6

Basic ethical principles – Moral development – Deontology – Utilitarianism – Virtue theory – Rights theory – Casuist theory – Moral absolutism – Moral rationalism – Moral pluralism – Ethical egoism – Feminist consequentialism – Moral issues and dilemmas – Moral autonomy.

UNIT- III PROFESSIONAL PRACTICES IN ENGINEERING

6

Profession and professional conduct – Norms of professional behavior – Responsibilities and obligations in professional ethics – Moral values in engineering – Professional codes of ethics – Responsibilities and limitations of the engineering profession.

UNIT IV HUMAN VALUES

6

Morals, values and ethics – Integrity and work ethic – Service learning and civic virtue – Respect for others – Peaceful living – Caring and sharing – Honesty and courage – Valuing time – Cooperation and commitment – Empathy and self-confidence – Character and spirituality – Basics of yoga and meditation for professional excellence and stress management.

UNIT - V SOCIAL AND SCIENTIFIC ETHICS

6

Application of ethical reasoning to social problems – Gender bias and gender issues – Gender violence and social discrimination – Transparency and fairness in scientific activities – Scientific inventions for societal development – Misuse of scientific inventions – Role and responsibilities of scientists in modern society.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand the basics of ethics and professionalism.

CO2: Explain ethical theories and moral principles.

CO3: Apply professional ethics and codes of conduct in engineering.

CO4: Develop human values and moral behavior for professional life.

CO5: Analyze social and scientific ethical responsibilities.

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Engineering Ethics – Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins, Cengage Learning, 2022.
2. Professional Ethics and Human Values – R. S. Naagarazan, New Age International Publishers, Revised Edition, 2021.

REFERENCES:

1. Engineering Ethics (6th Edition) – Charles B. Fleddermann, Pearson Education, 2020.
2. Ethics in Engineering (5th Edition) – Mike W. Martin and Roland Schinzinger, McGraw-Hill Education, 2021.
3. Professional Ethics and Human Values – M. Govindarajan, S. Natarajan and V. S. Senthil Kumar, PHI Learning, 2020.
4. Engineering Ethics: Concepts and Cases (6th Edition) – Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins, Cengage Learning, 2023.
5. Human Values and Professional Ethics – A. Alavudeen, R. Kalil Rahman and M. Jayakumaran, Laxmi Publications, 2021.

WEB SOURCES:

1. www.onlineethics.org
2. www.globalethics.org
3. www.ethics.org

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1	1	–	–	–	2	1	3	2	2	1	–	–	–
2	1	2	–	–	–	2	1	3	2	2	1	–	–	–
3	1	2	1	–	–	3	1	3	2	2	1	1	1	–
4	–	1	–	–	–	3	2	3	3	2	1	–	–	–
5	1	2	1	1	–	3	2	3	2	2	1	1	1	–
Avg	1	1.6	1	1	–	2.6	1.4	3	2.2	2	1	1	1	–

1 - low, 2 - medium, 3 - high, '–' - no correlation

CS24504	OBJECT ORIENTED SOFTWARE ENGINEERING LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

To enable the students

- To understand software processes and agile development.
- To analyze and specify software requirements.
- To model software systems using object-oriented concepts and UML.
- To design software architecture and user interfaces.
- To apply software testing, debugging, and maintenance techniques.

LIST OF EXPERIMENTS:

1. Study and implementation of Software Development Life Cycle (SDLC) models.
2. Prepare a project plan using Agile and Extreme Programming (XP) practices.
3. Perform software cost estimation using FP, LOC, and COCOMO models.
4. Develop a Software Requirements Specification (SRS) document for a sample application.
5. Perform requirement analysis using structured analysis techniques and Petri Nets.
6. Draw UML Use Case, Class, and Object Diagrams for a software system.
7. Design UML Sequence, Collaboration, and Activity Diagrams for system workflows.
8. Create UML Component, Deployment, and Package Diagrams for software architecture.
9. Design user interfaces and class-based components for a software application.
10. Implement architectural design using suitable architectural styles and mappings.
11. Perform white box and black box testing techniques for a sample application.

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System
14. Library Management System
15. Student Information System

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand and apply SDLC models, Agile, and XP practices in software development.

CO2: Prepare project plans and perform software cost estimation using standard models.

CO3: Analyse software requirements and develop SRS documents using structured techniques.

CO4: Design software systems using UML diagrams, architecture, and user interface concepts.

CO5: Perform software testing using white box and black box testing techniques.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

- Agro UML/ Star UML / Visual Paradigm / Rational Rose or equivalent UML tools.
- Java / Python / C++ IDE and Testing Tools.

HARDWARE:

- Standalone desktops – 30 Nos.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	2	—	—	—	2	2	1	3	1	2
2	2	3	2	2	2	—	—	—	2	2	3	2	1	1
3	2	3	2	2	1	—	—	—	2	3	1	2	1	1
4	2	2	3	2	2	—	—	—	2	2	1	3	2	3
5	2	3	2	2	3	—	—	—	1	2	2	3	2	2
Avg	2.2	2.6	2.2	1.8	2	—	—	—	1.8	2.2	1.6	2.6	1.4	1.8

1 - low, 2 - medium, 3 - high, '—' - no correlation

SEMESTER-V
(Common to B. E – CSE & B. Tech. - IT)

CS24505	MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

To enable the students

- Understand and implement GUI components, layouts, and event handling in mobile applications.
- Develop mobile applications using graphics and multithreading techniques.
- Design mobile applications with database and external storage support.
- Build applications using mobile features such as notifications, messaging, and GPS.
- Develop real-world mobile applications using network services and mini projects

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager.
6. Implement an application that uses multi-threading.
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that makes use of RSS feed.
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project).

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Develop mobile applications using GUI and Layouts.

CO2: Develop mobile applications using Event Listener.

CO3: Develop mobile applications using Databases.

CO4: Develop mobile applications using RSS Feed, Internal/External Storage, Multi-threading and GPS.

CO5: Analyze and discover own mobile app for simple needs.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

- C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent, ClaudeAI

HARDWARE:

- Standalone desktops - 30 Nos.

CO's-PO's & PSO's MAPPING

CO	PO'S											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	3	2	3	–	–	–	1	2	1	3	1	3
2	2	2	3	2	3	–	–	–	1	2	1	3	1	3
3	2	3	3	2	3	–	–	–	1	2	1	3	2	3
4	2	3	3	2	3	1	–	–	1	2	2	3	2	3
5	2	3	2	2	3	1	–	–	2	2	2	3	2	3
Avg.	2	2.6	2.8	2	3	1	–	–	1.2	2	1.4	3	1.6	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER-III / VI
Common to B. E – CSE & B. Tech. – IT, AI&DS

CS24601 / AD24301	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Learn the basic AI approaches
- Develop problem solving agents
- Perform logical and probabilistic reasoning

UNIT I INTELLIGENT AGENTS

9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING

9

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments.

UNIT III GAME PLAYING AND CSP

9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNIT IV LOGICAL REASONING

9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining –backward chaining – resolution.

UNIT V PROBABILISTIC REASONING

9

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- CO1:** Describe the structure and functionality of intelligent agent frameworks
- CO2:** Utilize effective problem-solving strategies in AI
- CO3:** Design and implement solutions using game playing and constraint satisfaction techniques
- CO4:** Apply logical reasoning methods for knowledge representation and inference
- CO5:** Apply probabilistic reasoning techniques to make decisions in uncertain environments

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.

REFERENCES:

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5. <http://nptel.ac.in/>

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
Avg	2.4	1.4	2	1.6	1	-	-	-	2.2	1.8	2	1.8	1.8	2	1.6

1 - Low, 2 - Medium, 3 - High

SEMESTER – VI

(B. Tech. - IT)

IT24601	EMBEDDED SYSTEM AND IOT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the fundamentals of 8-bit embedded processors and embedded systems.
- To develop embedded applications using Embedded C programming and interfacing.
- To learn IoT fundamentals and implement Arduino-based applications.
- To understand IoT communication protocols, networking, and open IoT platforms.
- To design real-time IoT solutions for smart and connected systems.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output from Pins using Sketches.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand 8-bit embedded processor architecture and programming.

CO2: Apply Embedded C programming and RTOS concepts.

CO3: Develop basic IoT applications using Arduino programming.

CO4: Understand IoT communication protocols and Raspberry Pi interfacing.

CO5: Design simple embedded and IoT-based real-world applications.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 2014
2. Rohit Manglik “Embedded Systems and IoT”, EduGorilla Publications, 2024.
3. Deepa M., Susithra N., Santhanamari G. “Embedded Systems”, AICTE, 2024.

REFERENCES:

1. Elecia White “Making Embedded Systems: Design Patterns for Great Software”, 2nd Edition, O’Reilly Media, 2024.
2. Dilip Kumar and K. R. Venugopal “Internet of Things: Architectures, Protocols and Applications”, McGraw Hill, 2026.
3. Frank Vahid and Tony Givargis “Embedded System Design: A Unified Hardware/Software Introduction”, Wiley India, 2019.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	2	–	1	–	–	1	–	3	2	1
2	3	3	3	2	3	–	1	–	1	1	2	3	2	2
3	3	3	3	2	3	1	2	–	1	1	2	3	3	2
4	3	3	3	2	3	1	2	–	1	1	2	3	3	2
5	3	3	3	3	3	2	2	–	2	2	3	3	3	3
Avg	3	2.8	2.8	2	2.8	1.3	1.6	–	1.25	1.2	2.25	3	2.6	2

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

SEMESTER-III / VI
Common to B. E – CSE & B. Tech. – IT, AI&DS

CS24603 / AD24305	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are to:

- Design and implement search strategies
- Implement game playing techniques
- Implement CSP techniques
- Develop systems with logical reasoning
- Develop systems with probabilistic reasoning

LIST OF EXPERIMENTS:

1. Implement 8 - Puzzle problem
2. Implement 8 - Queens problem
3. Implement A* algorithms.
4. Implement DFS and BFS algorithms.
5. Implement Minimax algorithm for game playing (Alpha-Beta pruning).
6. Solve constraint satisfaction problems.
7. Implement propositional model checking algorithms.
8. Implement forward chaining, backward chaining, and resolution strategies.
9. Build naïve Bayes models.
10. Implement Bayesian networks and perform inferences.

TOTAL PERIODS: 60

COURSE OUTCOMES:

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

- CO1:** Apply and develop search algorithms to solve computational problems.
CO2: Develop intelligent agents using game-playing strategies and techniques.
CO3: Apply constraint satisfaction techniques to solve various problems.
CO4: Design and implement systems that utilize formal logic for knowledge representation and inference.
CO5: Develop probabilistic reasoning systems under uncertainty.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2
CO2	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2
CO3	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2
CO4	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2
CO5	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2
Avg	1	2	3	-	3	-	-	3	3	3	-	3	3	1	2

1 - Low, 2 - Medium, 3 - High

SEMESTER - VI
(Common to B. E – CSE & B. Tech. - IT)

CS24S01	PROFESSIONAL SKILLS DEVELOPMENT LAB - I	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

To enable the students

- To enhance communication and interpersonal skills.
- To develop presentation and group discussion skills.
- To improve professional writing and documentation skills.
- To develop problem solving and logical thinking abilities.
- To build confidence for interviews and career readiness.

LIST OF EXPERIMENTS / LAB EXERCISES

1. Self-Introduction and Personal Profile Preparation.
2. Resume / Curriculum Vitae (CV) Writing.
3. Email Writing for Professional Communication.
4. Group Discussion Techniques and Practice Sessions.
5. Presentation Skills using PowerPoint / Digital Tools.
6. Listening and Note Taking Skills.
7. Technical Report Writing.
8. Mock Interview Practice.
9. Problem Solving and Logical Thinking Exercises.
10. Teamwork and Leadership Activities.
11. Professional Etiquette and Workplace Behavior.
12. Career Planning and Goal Setting.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Demonstrate effective communication and self-presentation skills.
CO2: Prepare professional documents such as resumes and reports.
CO3: Participate effectively in group discussions and teamwork activities.
CO4: Deliver technical presentations with confidence.
CO5: Demonstrate interview readiness and professional etiquette.

TOTAL: 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Windows 10/11 or Linux, MS Office, Audio/Video Tools, Text Editor

HARDWARE:

- Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	–	–	–	–	–	1	–	2	2	3	1	–	–	1
2	–	–	–	–	1	1	–	2	2	3	1	–	–	1
3	–	–	–	–	–	2	–	2	3	3	1	–	–	1
4	1	–	–	–	1	1	–	2	2	3	1	1	–	1
5	–	–	–	–	–	2	–	3	2	3	2	–	–	1
Avg	1	–	–	–	1	1.4	–	2.2	2.2	3	1.2	1	–	1

1 - low, 2 - medium, 3 - high, '–'- no correlation

SEMESTER - VII
(Common to B. E – CSE & B. Tech. – IT, AI&DS)

CS24701 / IT24P10	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of web technologies and website development.
- To learn client-side and server-side programming concepts.
- To develop dynamic web applications with database connectivity.
- To study PHP, XML, and web data handling techniques.
- To explore modern web technologies and UI/UX concepts.

UNIT I WEBSITE BASICS

9

Web Essentials: Internet, World Wide Web, Clients and Servers – Basics of HTML – Structure of HTML documents – Text formatting – Lists – Tables – Links – Forms – Introduction to HTML5.
CSS: Introduction to CSS – Types of CSS – Selectors – Colors, Fonts and Backgrounds – Box Model – Layouts – Introduction to CSS3.

UNIT II CLIENT-SIDE PROGRAMMING

9

Introduction to JavaScript – Variables and Data Types – Operators and Control Statements – Functions – Arrays and Objects – Events – Built-in Objects – Form Validation – Introduction to JSON.

UNIT III SERVER-SIDE PROGRAMMING

9

Introduction to DOM – DOM Elements and Events – Dynamic Web Pages.
Introduction to Servlets – Servlet Life Cycle – Sessions and Cookies – Introduction to JDBC and Database Connectivity.

UNIT IV PHP and XML

9

Introduction to PHP – Variables and Operators – Decision Making and Loops – Functions – Cookies and Sessions. Introduction to XML – XML Structure – Namespaces – DOM and SAX Parsing – XML Data Representation.

UNIT V AI BASED WEB

9

Introduction to AJAX – XML Http Request – Client–Server Communication – Introduction to Web Services. Overview of Modern Web Technologies – Node.js – React – Django – Firebase – Docker – Basics of UI & UX.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand basic concepts of HTML and creation CSS of dynamic webpages
CO2: Implement client-side and server-side programming using JavaScript.
CO3: Program in PHP for dynamic web pages creation
CO4: Demonstrate understanding of what XML is and how to parse and use XML data
CO5: Develop interactive web applications using AJAX

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Web Programming and Internet Technologies – Uttam K. Roy, Oxford University Press, 2021.
2. Internet and World Wide Web: How to Program (6th Edition) – Paul Deitel and Harvey Deitel, Pearson Education, 2022.

REFERENCES:

1. Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX – Black Book, DreamTech Press, Revised Edition, 2021.
2. Eloquent JavaScript (4th Edition) – Marijn Haverbeke, No Starch Press, 2024.
3. Node.js Design Patterns (4th Edition) – Mario Casciaro and Luciano Mammino, Packt Publishing, 2022.
4. Modern Full-Stack Development – Frank Zammetti, Apress, 2020.
5. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics (6th Edition) – Jennifer Robbins, O'Reilly Media, 2024.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	3	-	-	-	1	1	-	3	2	2
2	3	3	2	2	3	-	-	-	1	1	-	3	3	2
3	3	2	3	2	3	-	-	-	1	1	-	3	3	2
4	3	3	2	2	3	-	-	-	1	1	-	3	2	2
5	3	3	3	3	3	-	-	-	2	2	-	3	3	3
Avg	3	2.6	2.4	2	3	-	-	-	1.2	1.2	-	3	2.6	2.2

1 - low, 2 - medium, 3 - high, ‘-’- no correlation

SEMESTER - VII
(Common to B. E – CSE & B. Tech. - IT)

CS24702	WEB TECHNOLOGY LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

To enable the students

- To understand web fundamentals, client-server architecture, and protocols.
- To design static web pages using HTML5 and CSS3.
- To implement client-side scripting using JavaScript and JSON.
- To explore server-side programming with Servlets, PHP, and databases.
- To build dynamic web applications using modern frameworks and tools.

List of experiments:

1. Design a basic website using HTML5, including text formatting, lists, tables, hyperlinks, and images.
2. Create a multi-page website using relative URLs and implement frames and forms with validation elements.
3. Develop a styled web page using CSS3, demonstrating selectors, text properties, box model, and layout techniques.
4. Implement responsive design using CSS3 features such as flexbox/grid and media queries.
5. Write JavaScript programs to demonstrate variables, operators, control statements, and functions.
6. Develop a client-side form validation system using JavaScript and JSON for data handling.
7. Create DOM-based applications to manipulate HTML elements dynamically and handle events.
8. Develop a Java Servlet application to process client requests and generate dynamic responses.
9. Implement a PHP-based web application to handle form data, cookies, and server-side validation.
10. Create an AJAX-based application to fetch and display data asynchronously from the server.

COURSE OUTCOMES:

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

CO1: Design and develop structured web pages using HTML5 and CSS3.

CO2: Apply JavaScript for client-side validation and dynamic content generation.

CO3: Implement server-side programming using Servlets and PHP.

CO4: Develop data-driven applications using XML, JSON, and JDBC.

CO5: Build responsive and interactive web applications using AJAX and modern frameworks.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- IDE Visual Studio Code, Notepad++, Eclipse IDE, or NetBeans
- HTML5, CSS3, JavaScript, AJAX, Apache Tomcat, MySQL

HARDWARE:

- Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	1	3	-	-	-	1	1	-	3	2	2
2	3	3	3	2	3	-	-	-	1	1	-	3	3	2
3	3	2	3	2	3	-	-	-	1	1	-	3	3	2
4	3	3	2	2	3	-	-	-	1	1	-	3	2	2
5	3	3	3	3	3	-	-	-	2	2	-	3	3	3
Avg	3	2.6	2.8	2.0	3	-	-	-	1.2	1.2	-	3	2.6	2.2

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER - VII
(Common to B. E – CSE & B. Tech. - IT)

CS24703 / IT24701	SUMMER INTERNSHIP	L	T	P	C
		0	0	0	2

Course Description:

This course provides students with an opportunity to gain hands-on industry exposure through a structured internship in reputed organizations such as industries, startups, research laboratories, or academic institutions. The internship enables students to apply theoretical knowledge to real-world problems, understand professional practices, and develop technical and interpersonal competencies aligned with current trends in digital transformation, automation, and software-driven solutions.

Course Objectives:

To enable the students

- Provide industry and research exposure through experiential learning.
- Give practical experience in software development and emerging technologies.
- Develop problem-solving skills through real-time projects.
- Improve technical, communication, teamwork, and ethical skills.
- Introduce modern industry practices and agile methods.

Internship Requirements

- Students must undergo a minimum of 4 weeks of full-time internship in a recognized organization
- The internship may be in domains such as software development, data analytics, AI/ML, product design, research, or related areas
- Upon completion, students must submit a comprehensive internship report within 10 days from the commencement of the next semester
- Students are required to deliver a technical presentation/viva voce as part of the evaluation process, Continuous Assessment by Industry Supervisor / Faculty Mentor based on the performance on innovation, problem-solving, and professional conduct

Course Outcomes

After completion of this course, students will be able to:

CO1: Understand industry practices, tools, and workflows.

CO2: Analyze internship problems and find solutions.

CO3: Apply technical knowledge to real-world tasks.

CO4: Implement and evaluate solutions using suitable tools.

CO5: Prepare technical reports and present project results effectively.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	1	1	2	1	–	1	2	2	2	2	2	1
2	2	3	2	2	3	1	–	1	2	2	2	3	2	2
3	3	2	3	2	3	1	–	–	2	2	2	3	3	2
4	2	3	3	2	3	1	–	–	2	2	2	3	3	2
5	1	1	1	–	1	1	–	1	2	3	1	1	1	1
Avg	2	2.2	2	1.7	2.4	1	–	1	2	2.2	1.8	2.4	2.2	1.6

1 - low, 2 - medium, 3 - high, '–'- no correlation

SEMESTER - VII
(Common to B. E – CSE & B. Tech. - IT)

CS24S02	PROFESSIONAL SKILLS DEVELOPMENT LAB - II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

To enable the students

- To enhance advanced communication and interpersonal skills.
- To develop analytical thinking and problem-solving abilities.
- To strengthen aptitude and reasoning skills for competitive examinations.
- To improve professional presentation and technical discussion abilities.
- To prepare students for placement processes and career opportunities.

LIST OF EXPERIMENTS / LAB EXERCISES

1. Advanced Self-Introduction and Personal Branding.
2. Aptitude Training – Quantitative Ability.
3. Logical Reasoning and Analytical Thinking Exercises.
4. Verbal Ability and Vocabulary Development.
5. Technical Presentation Skills.
6. Case Study Analysis and Presentation.
7. Debate and Extempore Speaking.
8. Advanced Group Discussion Sessions.
9. Technical Interview Preparation.
10. HR Interview Preparation.
11. Stress Interview and Situational Questions Practice.
12. Mock Placement Drive (Aptitude Test + GD + Interview).

COURSE OUTCOMES (CO)

After completion of this course, students will be able to:

CO1: Demonstrate improved verbal and written communication skills.

CO2: Apply aptitude and reasoning techniques to solve problems effectively.

CO3: Participate confidently in technical discussions and debates.

CO4: Deliver structured technical presentations and case study analysis.

CO5: Perform effectively in placement processes including aptitude tests, GD and interviews.

TOTAL: 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Windows 10/11 or Linux, MS Office, Audio/Video Tools, Text Editor

HARDWARE:

- Standalone desktops - 30 Nos.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	–	–	–	–	–	1	–	2	2	3	1	–	–	1
2	2	3	1	1	1	–	–	–	1	2	1	1	1	–
3	1	1	–	–	–	1	–	2	3	3	1	–	–	1
4	1	2	1	–	1	1	–	2	2	3	1	1	1	1
5	1	2	1	–	1	2	–	2	3	3	2	1	1	1
Avg	1.3	2	1	1	1	1.3	–	2	2.2	2.8	1.2	1	1	1

1 - low, 2 - medium, 3 - high, '–' - no correlation

SEMESTER - VIII
(Common to B. E – CSE & B. Tech. - IT)

CS24801 / IT24801	PROJECT WORK / INTERNSHIP	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

To enable the students

- Gain technical skills to solve real-world industry and research problems using modern technologies.
- Analyze problems and design efficient software or system solutions.
- Work effectively in teams using industry practices and tools.
- Develop, test, and deploy solutions on suitable platforms.
- Prepare technical reports and present project outcomes professionally.

Course Description:

Students may undertake the project individually or in groups in collaboration with industries, research organizations, startups, or academic labs. The chosen topic should align with the student's specialization area and focus on solving practical industry or research challenges.

Students shall continue the work based on the defined methodology, design, and implementation plan under the guidance of the supervisor. At the end of the semester, after completing the project to the satisfaction of the supervisor and review committee, students must submit a detailed project report that includes:

Clear definition of the problem statement, Literature review of existing methods and technologies, Proposed methodology and system design, Implementation details and experimental results, Performance analysis and discussion, Conclusion and future scope.

The report should follow the format prescribed as per university and be submitted to the Head of the Department.

Students will be evaluated based on the project report, implementation quality, demonstration, and viva-voce examination conducted by a panel of examiners as per the regulations.

TOTAL: 300 PERIODS

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Identify and analyze real-world problems using domain knowledge.
CO2: Design system models and solutions using suitable tools.
CO3: Develop and implement software or system solutions.
CO4: Test and deploy reliable system solutions.
CO5: Prepare technical reports and present project outcomes effectively.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	2	1	–	–	1	2	1	3	2	1
2	2	3	3	2	3	–	–	–	1	2	2	3	2	2
3	2	2	3	2	3	–	–	–	1	2	2	3	3	3
4	2	3	3	2	3	1	–	1	1	2	2	3	3	2
5	1	1	1	–	1	1	–	1	2	3	1	1	1	1
Avg	2	2.4	2.4	2	2.4	1	–	1	1.2	2.2	1.6	2.6	2.2	1.8

1 - low, 2 - medium, 3 - high, '–'- no correlation

NON-CREDIT MANDATORY COURSE I

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C71	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Defining and Evaluating gender as a social construct.
- Identifying the ways gender, power, privilege, and oppression play out across a range of cultures and human experiences.
- Identifying systemic oppression and promoting social equity.
- Promoting the women's empowerment.
- Learning the rights and obligations in all spheres of life.

UNIT I CONCEPTS 9

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binarism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY 9

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, eco-feminist.

UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL 9

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE 9

Linguistic Forms and Gender, Gender and narratives, Gender Equality and Women's Empowerment through NEP 2020.

UNIT V GENDER AND REPRESENTATION 9

Advertising and popular visual media, Gender and Representation in Alternative Media, Gender and social media.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:**Recognize the concepts of gender roles and relations.
CO2:Evaluate various feminist theories and their contributions.
CO3:Analyze historical and contemporary women's movements.
CO4:Apply the concept of languages and gender.
CO5:Interpret media representation of gender.

TEXT BOOKS:

1. Melissa Gillis and Andrew T. Jacobs, “Introduction to Women’s and Gender Studies”, “An Interdisciplinary Approach”, 2019.
2. Miliann Kang, Donovan Lessard, Laura Heston and Sonny Nordmarken, “Introduction to women, Gender, Sexuality Studies”, 2017.

REFERENCES:

1. Deborah Holt, BS, MA, “HUM210 Introduction to Women and Gender Studies”, 2020.
2. Gendered Lives: Communication, Gender, and Culture, Julia T. Wood, Cengage Learning, 13th Edition (2021).
3. Feminist Theory: From Margin to Center, bell hooks, 2nd Edition (2000)
4. The Second Sex, Simone de Beauvoir, Vintage Books, Reprint Edition (2011, English translation).
5. Intersectionality, Patricia Hill Collins & Sirma Bilge, Polity Press, 2nd Edition (2020)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1		3	3	3	2	2	1	1	1	1
CO2	2	2	1	2		3	1	3	2	1	1	1	2	1
CO3	1	2	1	2		3	3	3	2	2	1	1	1	2
CO4	1	2	1	1		2	2	2	2	2	1	1	2	1
CO5	1	2	1	1		3	3	3	2	2	2	1	2	1
Avg	1.20	2.00	1.00	1.40		2.80	2.40	2.80	2.00	1.80	1.20	1.00	1.60	1.20

1 - Low, 2 - Medium, 3 - High

NON-CREDIT MANDATORY COURSE I

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C72	ELEMENTS OF LITERATURE	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the core elements of literature.
- Learning the structure and narrative techniques of fiction.
- Developing the evolution, elements, and expressive power of poetry.
- Analyzing the essential components and types of drama.
- Examining the major schools of literary criticism and critical approaches.

UNIT I INTRODUCTION TO ELEMENTS OF LITERATURE

9

Elements of Literature and Creative Communication, Relevance of Literature, Multidimensional Engagement with Literature, how to read and appreciate Literature, Literature - Learner's Perspective.

UNIT II ELEMENTS OF FICTION

9

Introduction to Fiction, Fiction vs Non-Fiction, Elements of Fiction, Fiction and its Branches, Narrative Techniques in Fiction, Fictional Modes and Patterns, Plot Character and Perspective, Internal and External Conflicts.

UNIT III ELEMENTS OF POETRY

9

Origins of Poetry, Poetry and its Tributaries, Elements of Poetry, English Poetry, Emotions and Imaginations, Figurative Language, Tone and mood in Poetry, Types of Poetry.

UNIT IV ELEMENTS OF DRAMA

9

Introduction to Drama, Elements of Drama, Drama and its types, Dialogue and Monologue, Tragedy vs Comedy vs Tragicomedy, Theoretical Performance, Drama as Narration, mediation and Persuasion.

UNIT V LITERARY CRITICISM AND INTERPRETATION

9

Introduction to literary theory and criticism, Schools of literary criticism: Formalism, Structuralism, Feminism, Postcolonialism, etc, Critical approaches to reading texts, Feminist Literary Criticism, Marxist Literary Criticism.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1:Describe the fundamental elements of literature.

C02:Analyze the key components of fiction, including plot, character, narrative technique.

C03:Identify and interpret the elements and types of poetry, including figurative language, tone, and mood.

CO4:Examine the structure and features of drama.

C05:Apply various literary theories and critical approaches to evaluate literary texts.

TEXT BOOKS:

1. K. A. Sharma, R. S. Sharma, " A Textbook of English Literature", Vikas Publishing House.

REFERENCES:

1. X. J. Kennedy, Dana Gioia, "An Introduction to Fiction, Poetry, Drama, and Writing", 13th Edition, Pearson Education.
2. Peter Barry, " Beginning Theory: An Introduction to Literary and Cultural Theory", 4th Edition, Manchester University.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						3	3	1	3	1	3	2		2
CO2						3	3	1	3	1	3	2		3
CO3						3	3	1	3	1	3		3	3
CO4						3	3	1	3	1	3	2		2
CO5						3	3	1	3	1	3	3	3	2
Avg						3.00	3.00	1.00	3.00	1.00	3.00	2.25	3.00	2.40

1 - Low, 2 - Medium, 3 – High

NON-CREDIT MANDATORY COURSE I

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C73	DISASTER RISK REDUCTION AND MANAGEMENT	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Enhancing the awareness of disaster management and risk reduction methods
- Discussing the train in planning and managing disaster response operations.
- Understanding the various types of disasters and their management techniques.
- Understanding the tools and technologies used in disaster management.
- Analysing the real-life disaster management case studies and their outcomes.

UNIT-I HAZRADS, VULNERABILITY AND DISASTER RISKS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, –Earthquake, Landslide, Flood, Drought, Fire etc. – Technological Disasters-Causes, Impacts including social, Economic, political, environmental, health, etc. - Global trends in disasters: urban disasters, pandemics.

UNIT-II RISK MANAGEMENT IN DISASTERS 9

Global Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation Based DRR, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System

UNIT-III DISASTER MANAGEMENT 9

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level.

UNIT-IV TOOLS AND TECHNOLOGIES IN DISASTER MANAGEMENT 9

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements – Role of GIS and Response and Recovery Phases of Disaster – Standard operation Procedure for disaster response – Financial planning for Disaster Management.

UNIT-V DISASTER MANAGEMENT: CASE STUDIES 9

Analysis of Selected Disaster Case Studies - Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies - Field Work-Mock drill.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1:Impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR).

CO2:Explain the Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction.

CO3:Develop disaster response skills by adopting relevant tools and technology.

CO4:Discuss awareness of institutional processes for Disaster response in the country.

CO5:Develop awareness and Response Skills for Local Disasters

TEXT BOOKS:

1. Taimpo (2016), Disaster Management and Preparedness, CRC Publications.
2. Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications.

REFERENCES:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2				2	2			2		2	2	2
CO2	3	3	2	2		2	2			2		2	2	3
CO3	2	2	3	3		1	1		2		2	2	2	3
CO4	2	2	1	1		2	2		2	2	2	2	2	2
CO5	2	3	2	2		2	2		2	2	2	2	2	2
Avg	2.20	2.40	2.00	2.00		1.80	1.80		2.00	2.00	2.00	2.00	2.00	2.40

1 - Low, 2 - Medium, 3 – High

NON-CREDIT MANDATORY COURSE I
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C74	FILM APPRECIATION	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Enabling to appreciate films by understanding its distinct language
- Familiarizing with early film history.
- Identifying different film genres and introduces them to the art of editing and sound
- Evaluating a variety of films, cinematic techniques, storytelling, and cultural impact.
- Exploring the enjoyment of films

UNIT I INTRODUCTION TO FILM APPRECIATION 9

Early Film History - The Silent Era, Evolution of Sound Cinema, Talkies, Film Formats Film Technology/Experience: Understanding film as an art form and cultural product- Basic film terminology shot, scene, sequence, mise-en-scene, Viewing and analyzing short films: identifying basic elements.

UNIT II CINEMATIC TECHNIQUES AND STORYTELLING 9

In-depth study of camera movements- Exploring the role of editing, sound, and lighting in storytelling- Screening and analysis: comparing different directorial styles. Cinematography – Scale of Shot, Extreme Long Shot, Long Shot, Medium Shot, Close up, Deep focus, Reverse shot, Over- the- Shoulder Shot, Angle, Long Take Basics of Film Editing - Chronological editing, Continuity editing, Cross cutting, Montage, Continuity cuts, Jump cuts, Match cuts, 30 Degree rule, 180 Degree rule

UNIT III MASTERS OF CINEMA 9

Alfred Hitchcock: Suspense and psychological thrillers- Akira Kurosawa: Epic storytelling and visual style- Quentin Tarantino: Non-linear narratives and stylized violence- Charlie Chaplin: Comedy and social commentary- Satyajit Ray: Realism and humanism in cinema.

UNIT IV FILM GENRE 9

Introduction to major film genres: drama, comedy, horror, science fiction, documentary- Characteristics and conventions of each genre- Screening and discussion of representative films from each genre. Denotative & Connotative meanings; Observation of Signs- Physiology of Perception: reading images & narrative; function of receptor organs – sight, hearing & comprehension

UNIT V FILM THEORIES AND CRITICISM/APPRECIATION 9

Auteurists, Psychoanalytic, Ideological, Feminists, Film Criticism / Appreciation. Hands-on film analysis sessions- Group projects: Analyzing selected films and presenting findings- Final project: in-depth analysis of a chosen film.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1:Identify and analyze key cinematic techniques used in

CO2:Appreciate the narrative structures and storytelling methods

CO3:Critically evaluate films from different genres and cultural

CO4:Articulate informed critiques and analyses of films verbally.

CO5:Develop a personal aesthetic and critical approach to film

TEXT BOOKS:

1. Bordwell, David, and Kristin Thompson – Film Art: An Introduction – McGraw Hill Education.
2. Corrigan, Timothy, and Patricia White – The Film Experience: An Introduction – Bedford/St. Martin.
3. Film Art: An Introduction, David Bordwell & Kristin Thompson, McGraw-Hill Education.
4. Engaging Cinema: An Introduction to Film Studies, Bill Nichols, W.W. Norton.

REFERENCES:

1. Giannetti, Louis – Understanding Movies – Pearson
2. Monaco, James – How to Read a Film: Movies, Media, and Beyond – Oxford University Press
3. Phillips, William H – Film: An Introduction – Bedford/St. Martins
4. Louis Giannetti, Understanding Movies (2014), Pearson
5. N. M. Babu, ReeyaThankachan and Binil Kumar M. R., Introducing Film Studies (2015), Mainspring Publishers.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	1	3		1	2			2	2	3	2
CO2	3	2	3	2	3		1	3			2	3	2	3
CO3	3	3	3	1							2		3	3
CO4	2	3	3	1				2			2	2	3	3
CO5	2	3	2	1							2		3	2
Avg	2.50	2.80	2.60	1.20	3.00		1.00	2.33			2.00	2.33	2.80	2.60

1 - Low, 2 - Medium, 3 - High

NON-CREDIT MANDATORY COURSE II
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C75	WELL BEING WITH TRADITIONAL PRACTICES - YOGA, AYURVEDA AND SIDDHA	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Enjoying the life happily with fun filled new style activities that help to maintain health also
- Adapting few lifestyle changes that will prevent many health disorders
- Maintaining cool and handbill every emotion very smoothly in every walk of life
- Learning to eat cost effective but healthy foods that are rich in essential nutrients
- Developing immunity naturally that will improve resistance against many health disorders.

UNIT I HEALTH AND ITS IMPORTANCE 9

Health: Definition, Importance of maintaining health-ten types of health one has to maintain-Present health status-The life expectancy-Types of diseases and disorders: Lifestyle disorders-Obesity- Diabetes-cardiovascular diseases- Cancer-Strokes-COPD-Arthritis-Mental health issues-causes of the above diseases / disorders- Importance of prevention of illness- Simple lifestyle modifications to maintain health.

UNIT II BALANCED DIET 9

Role of diet in maintaining health- Balanced Diet and its 7 Components-Food additives and their merits & demerits- Effects of food additives- Types of food additives- Food additives and processed foods- Food additives and their reactions-Definition of BMI and maintaining it with diet- Common cooking mistakes.

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 9

AYUSH systems and their role in maintaining health- preventive aspect of AYUSH- AYUSH as a soft therapy- Secrets of traditional healthy living-Principles of Siddha & Ayurveda systems- Macrocosm and Microcosm theory- Panchekarana Theory / (Five Element Theory)-96 fundamental Principles- Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal- Prevention of illness with our traditional system of medicine.

UNIT IV MENTAL WELLNESS 9

Emotional health- Definition and types- Importance of maintaining emotional health- Role of emotions in daily life-leading a healthy life with emotions- Expressing a full range of emotions-Stress management- Sleep and its importance for mental wellness-Sleep and digestion- Immunity-Types and importance- Ways to develop immunity.

UNIT V YOGA 9

Definition and importance of yoga- Types of yoga- How to choose the right kind for individuals according to their age- The Eight Limbs of Yoga-Simple yogasanas for cure and prevention of health disorders- What yoga can bring to our life.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1:Describe the importance of different components of health.

CO2:Analyze the importance of diet and workouts in maintaining health.

CO3:Identify and interpret the new techniques to prevent lifestyle health disorders.

CO4:Gain confidence to lead a healthy life.

CO5:Develop immunity naturally that will improve resistance against many health disorders.

TEXT BOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA.
2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California.
3. B.K.S. Iyengar, "The Path of Holistic Health" June 15 2021, DK publishers ltd.
4. Michael Stone, "The Innerr Tradition of Yoga", July 17 2018, Shambhala publishers ltd.

REFERENCES:

1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England.
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2			2		2	2		2	2		2
CO2	2	2	2			2		2	2		2	2		3
CO3	2	2	2			2		2	2		2		3	3
CO4	2	2	2			2		2	2		2	2		2
CO5	2	2	2			2		2	2		2	3	3	2
Avg	2.00	2.00	2.00			2.00		2.00	2.00		2.00	2.25	3.00	2.40

1 - Low, 2 - Medium, 3 –High

NON-CREDIT MANDATORY COURSE II

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C76	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the knowledge of India's scientific and technological achievements.
- Exploring how science and technology were intertwined with Indian Culture.
- Developing the role of Indian scientists in global fields.
- Analyzing the research, critical thinking, and analytical skills.
- Examining the post-independence developments in India's science and technology.

UNIT I CONCEPTS AND PERSPECTIVES

9

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

9

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

9

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

9

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest.

**UNIT V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA &
POST –INDEPENDENT INDIA**

9

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions. Science, Technology and Development discourse Shaping of the Science and Technology. Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1:Examine India's scientific and technological progress from ancient to modern times.

CO2:Learn how science and technology were linked to Indian culture, religion, and society.

CO3:Discuss the importance of Indian scientists in global fields.

CO4:Build skills to assess the impact of science and technology on India and the world.

CO5:Analyze post-independence scientific developments in India, including ISRO, IITs, IT, and biotech.

TEXT BOOKS:

1. Jha, Arun Kumar, and Seema Sahay. Aspects of Science and Technology in Ancient India. Routledge, 2023.
2. Paranjape, Makarand R., New Perspectives in Indian Science and Civilization. Routledge India, 2020.
3. Sarkar, Suvobrata, History of Science, Technology, Environment, and Medicine in India. Routledge, 2022.
4. Ray, N. Indian Science and Technology in the 18th Century. 2021.

REFERENCES:

1. Satpathy and Binod Bihari. A. A History of Science and Technology in India: History of Science, Technology, and Medicine in India. 1st ed., Himalaya Publishing House, 2025.
2. Sukumar, Arun Mohan. Midnight's Machines: A Political History of Technology in India. Penguin Random House India, 2024.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		1		1		2	1	1		2		3	2	3
CO2		1				3	2	2	1	2		2	2	2
CO3		1		1		2	1	1	1	2		1	3	3
CO4		2		2		3	2	2	1	2	1	2	2	2
CO5	1	2		2	1	3	2	1		2	1	1	1	2
Avg	1.00	1.40		1.50	1.00	2.60	1.60	1.40	1.00	2.00	1.00	1.80	1.80	2.00

1 - Low, 2 - Medium, 3 – High

MANDATORY COURSE - II

COMMON TO B.E. BME., CSE., ECE., EEE., MECH., & B.TECH... AIDS., & IT.

MX24C77	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the basics of safety engineering and terminologies.
- Exploring the important statutory regulations and standards.
- Developing to conduct and participate the various safety activities in the industry.
- Analyzing about workplace exposures and hazards.
- Examining the hazards using various risk assessment techniques.

UNIT-I SAFETY TERMINOLOGIES

9

Hazard-Types of Hazards- Risk-Hierarchy of Hazards Control Measures-Lead indicators - Lag Indicators-Flammability- Toxicity Time-weighted Average - Threshold Limit Value - Short Term Exposure Limit-Immediately dangerous to life or health - Personnel Protective Equipment- Health and Safety Policy.

UNIT-II STANDARDS AND REGULATIONS

9

Factory Regulations in India -1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Risk Identification and Hazard Control - Code of practice IS 15656:2006.

UNIT-III SAFETY ACTIVITIES

9

Toolbox Talk- Role of safety Committee- Responsibilities of Industrial Safety Officials - Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment.

UNIT-IV WORKPLACE HEALTH AND SAFETY

9

Noise Related Safety Hazard - Particulate matter- Postural Disorders and Ergonomic Evaluation Techniques (RULE & REBA)- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety Toxic Gas Release.

UNIT-V HAZARD DETECTION TECHNIQUES

9

Job Hazard Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment-Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to

CO1: Understand the basic concept of safety.

CO2: Familiarization of Statutory Regulations and Standards

CO3: Know about the safety Activities of the Working Place.

CO4: Analyze on the impact of Occupational Exposures and their Remedies

CO5: Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS:

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER.
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCE BOOKS:

1. Frank Lees (2012) 'Lees' Loss Prevention in Process Industries. Butterworth-Heinemann publication U4th Edition.
2. John Ridley & John Channing (2008) Safety at Work: Routledge, 7th Edition.
3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.
4. Alan Waring. (1996). Safety management system: Chapman &Hall, England
5. Society of Safety Engineers, USA

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3		1	3				2	1	1		
CO2	2	3	2		2	2		2	2	3	2	3		2
CO3	2	2	2	2	2	2	2			3	1	1	2	
CO4	3	2	2	2	2	2	2	3	2	3	2	3	2	3
CO5	3	2	3	2	2	2	2	2	2	3	3	2	2	2
Avg	2.66	2.40	2.40	2.00	1.80	2.20	2.00	2.33	2.00	2.80	1.80	2.00	2.00	2.33

1 - Low, 2 - Medium, 3 - High

NON-CREDIT MANDATORY COURSE II

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C78	POLITICAL AND ECONOMIC THOUGHT FOR A HUMAN SOCIETY	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the human aspirations and contributing to the creation of a humane, ethical, and sustainable social order.
- Exploring the evolution of modern economic systems.
- Developing how communist theory relates to human desires, the pursuit of empowerment, and human satisfaction.
- Analyzing the core principles of Gandhian thought, emphasizing Swaraj, decentralized political and economic systems, and community empowerment.
- Examining the foundational elements of Indian civilization, with a focus on the role of technology and education in societal development.

UNIT I HARMONY AND HUMAN ASPIRATIONS

9

Considerations for humane society, holistic thought, human being's desires-harmony in self- harmony in relationships, society, and nature, societal systems.

UNIT II MODERN IDEOLOGIES AND WORLD CONFLICTS

9

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism-Liberal democracy, Fascism and totalitarianism-World war I and II. Cold war.

UNIT III COMMUNISM AND HUMAN FULFILLMENT

9

Communism – Mode of production, theory of labor, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models-Welfare state-Relation with human desires-Empowered human beings, satisfaction.

UNIT IV SWARAJ AND SELF-DETERMINATION

9

Gandhian thought-Swaraj, Decentralized economy & polity, Community-Control over one's lives, Relationship with nature.

UNIT V CORE ELEMENTS OF INDIAN CIVILIZATION

9

Essential elements of Indian civilization-technology as driver of society-Role of education in shaping of society-Future directions.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:**Examine the principles of a humane and just society based on harmony within self and society.
- CO2:**Assess the impact of free markets, demand–supply forces, and monopolies on capitalism’s evolution.
- CO3:**Evaluate mode of production and surplus value theories.
- CO4:**Interpret the concepts of Swaraj and decentralized governance in Gandhian thought.
- CO5:**Identify and analyze the essential elements of Indian civilization.

TEXT BOOKS:

1. Acemoglu, Daron, and Simon Johnson. Power and Progress: Our Thousand-Year Struggle Over Technology and Prosperity. PublicAffairs, 2023.
2. Feldstein, Steven. Digital Empires: The Global Battle to Regulate Technology. Oxford University Press, 2023.
3. Slobodian, Quinn. Crack-Up Capitalism: Market Radicals and the Dream of a World Without Democracy. Metropolitan Books, 2023.

REFERENCES:

1. Marx, Karl, Friedrich Engels, and Robert C. Tucker. The Marx-Engels Reader. 2nd ed., W. W. Norton & Company, 2012.
2. Toffler, Alvin. The Third Wave. Updated ed., Bantam Books, 2022.
3. Kalam, A. P. J. Abdul, and Y. S. Rajan. India 2020: A Vision for the New Millennium. Penguin Books India, 2014.
4. Piketty, Thomas. A Brief History of Equality. Harvard University Press, 2022.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		1				3	2	2	1	1				
CO2		2		1		2	2	2	1	1				2
CO3		2		1		2	2	3	1	1				2
CO4		1				3	2	3	1	1				2
CO5	1	2		1	1	2	2	2		2	1			
Avg	1.00	1.60		1.00	1.00	2.40	2.00	2.40	1.00	1.20	1.00			2.00

1 - Low, 2 - Medium, 3 – High

NON-CREDIT MANDATORY COURSE II

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

MX24C79	STATE, NATION BUILDING AND POLITICS IN INDIA	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the meaning of the state and the functioning of its major organs such as the Legislature, Executive, and Judiciary.
- Exploring the importance of politics, political processes, and the changing concept of sovereignty in a globalized world.
- Developing the history, developments, and legacies of India's freedom struggle and Constitution-making process.
- Analyzing the reasons behind adopting the Parliamentary-federal system and the basic philosophy and features of the Constitution of India.
- Examining the national integration, nation-building, and contemporary political challenges to develop a vision for a stronger and better India.

UNIT I STATE, POLITICS AND SOVEREIGNTY

9

Understanding the need and role of the State and politics, Development of the Nation-State, Concept of sovereignty and sovereignty in a globalized world.

UNIT II ORGANS AND FORMS OF GOVERNMENT

9

Organs of the State: Executive, Legislature and Judiciary, Separation of powers, Forms of government: Unitary and Federal systems, Presidential and Parliamentary forms of government. Activity-Based Learning: Debate, Discussion and Mock Parliament.

UNIT III NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT

9

Revolt of 1857 and national awakening, Formation of the Indian National Congress in 1885, Development and legacies of the national movement, Constitution making and the Constitution of India.

UNIT IV INDIAN CONSTITUTION AND NATION-BUILDING

9

Goals, objectives and philosophy of the Constitution, Reasons for adopting a federal system, National integration and nation-building. Activity-Based Learning: Role Play

UNIT V CONTEMPORARY CHALLENGES AND FUTURE OF INDIAN POLITICS

9

Challenges of nation-building, State versus democracy (Rajni Kothari), New social movements, Changing nature of the Indian Political System, Future scenario and the role of citizens in building a better India.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:**Describe the concepts of State, politics, and sovereignty.
- CO2:**Explain the background and philosophy of the Indian Constitution.
- CO3:**Examine national integration and nation-building in India.
- CO4:**Analyze governance and democratic institutions in India.
- CO5:**Apply democratic values and responsible citizenship in society.

TEXT BOOKS:

1. Singh, M. P., and Rekha Saxena. Indian Politics: Constitutional Foundations and Institutional Functioning. 2021 ed., PHI Learning, 2021.
2. Muralidharan, Sukumar. India in the Pandemic Years: Governance, Economy and Democracy. 2022.

REFERENCES:

1. Sharma, Brij Kishore. Introduction to the Indian Constitution. 13th ed., PHI Learning, 2021.
2. Jaffrelot, Christophe. Modi's India: Hindu Nationalism and the Rise of Ethnic Democracy. Princeton University Press, 2021.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						2	1	2	1	1			3	
CO2						2	1	2	1	1			2	2
CO3						3	2	2	1	1		2	3	2
CO4						3	2	2	1	2		2	2	2
CO5						3	3	3	2	2	3	2	3	
Avg						2.60	1.80	2.20	1.20	1.40	3.00	2.00	2.60	2.00

1 - Low, 2 - Medium, 3 – High

MANAGEMENT ELECTIVE
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24M01	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the Evolution of Management.
- Analyzing the functions and principles of management.
- Learning the application of the principles in an organization.
- Studying the various HR related activities.
- Exploring the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behavior – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the managerial functions like planning, organizing, staffing, leading & controlling.

CO2: Describe the knowledge about the planning and decision making.

CO3: Discuss the concept of organising for the effective functioning of a management.

CO4: Evaluate leadership style to anticipate the consequences of each leadership style.

CO5: Classify the budget techniques with the usage of computers and IT in Management Control.

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.
4. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2					2	2			2	3		2	
CO2						3	3	3	3	2	3	2		
CO3	2					3	3	2	2	2	3		2	
CO4				2		3	3	3	2	2	3	3		
CO5	3			3	3	3	2	3	2	3	3			2
Avg	2.33			2.50	3.00	2.80	2.60	2.75	2.25	2.20	3.00	2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

MANAGEMENT ELECTIVE

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24M02	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the basic quality management in engineering.
- Analyzing the various principles of TQM.
- Learning the management tools, six sigma and benchmarking.
- Studying the quality functions, TPM concepts, and continuous improvement methodologies.
- Exploring the quality systems and TQM implementation in manufacturing and service sectors.

UNIT I INTRODUCTION

9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework -Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TOM PRINCIPLES

9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II

9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS

9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the importance of quality in engineering.

CO2: Improve the quality of the organization through using the total quality process.

CO3: Explore the knowledge of implementing various TQM tools.

CO4: Implement the tools and techniques for quality improvement.

CO5: Outline the key benefits of ISO 9000 and ISO 14000 implementation for service sector businesses.

TEXT BOOKS:

1. Dale H. Besterfield, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwarshie and Rashmi Urdhwarshie, Total Quality Management, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2020.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2019.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2018.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2020.
4. ISO 9001-2015 standards

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		2	2	2	1	2	3	3		3	3		2	
CO2	3	3	3	3	3	3	3	3	2	3	3	2		
CO3	3	3	3	3	3	2	3	3		2	2		2	
CO4	3	3	3	3	3	3	3	2	2	3	1	3		
CO5	1	2	3	2		2	3	2		3	3			2
Avg	2.50	2.60	2.80	2.60	2.50	2.40	3.00	2.60	2.00	2.80	2.40	2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

MANAGEMENT ELECTIVE
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24M03	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the principles of and techniques of managerial economics.
- Analyzing the various demand forecasting methods .
- Learning the business organizations.
- Studying the various costing methods.
- Exploring the financial accounting and analysis.

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS 9

Introduction –Economics Theories And Scope –Demand And Supply Analysis –Determinants of Demand – Law Of Demand – Elasticity Of Demand – Demand Forecasting –Demand Sensitivity –Price, Income ,Gross ,Advertisement –Law Of Supply –Elasticity Of Supply – Cost Concepts –Types –Cost Curves –Short Run And Long Run –Break Even Analysis – Pricing Concepts –Types ,Price –Determinations.

UNIT II DEMAND & SUPPLY ANALYSIS 9

Concepts– Firm, Industry, Market, Market power, Market Conduct, Market Performance. Market Structure- Types- Perfect Monopoly, Monopolistic and Oligopoly Competition. Manufacturing Practices- Diversification, Vertical and Horizontal Integration, Merger.

UNIT III PRODUCTION AND COST ANALYSIS 9

National Income: Concepts and Measurements –GNP, NNP- Methods of Measuring National Income-Inflation and Deflation, Unemployment. Money and Banking: Value of Money-Banking-Commercial Banks and Its Function. New Economic Environment: Economic Systems –Economic Liberalization, Privatization and Globalization.

UNIT IV PRICING 9

Introduction, Scope, Objectives, Basic Financial Concepts – Time Value Of Money And Method Of Appraising Project Profitability – Rate of Return –Pay Back Period – Percent Value, NPV Comparison – Cost – Benefit Analysis. Source of Finance – Internal And External –Long Term And Short Term – Securities, Debentures/ Bonds, Shares, Financial Institutions.

UNIT V FINANCIAL ACCOUNTING 9

Accounting System- Financial Statement – Types- Ledger, Cash Flow Statement Profit And Loss Account, Balance Sheet, Ratios/ Financial Analysis- Liquidity Leverage Activity, Profitability, Trends Analysis.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the demand in the present market.

CO2: Illustrate the product demand by using the demand forecasting techniques.

CO3: Apply the concept of cash flow.

CO4: Implement the analysis of economics of sampling and Replacement and Maintenance.

CO5: Describe the depreciation and Evaluation of public alternatives.

TEXT BOOKS:

1. Management Economics and Financial Analysis, Aryasri, 4/e, TMH, 2009.
2. Managerial Economics, Varshney & Maheswari, Sultan Chand, 2009.

REFERENCES:

1. Maheshwari S N "Management Accounting and Financial Accounting", S.Chand and Company. 1993.
2. D N Drivedi, "Managerial Economics", Vikas Publishing House. 1980
3. R R Barthwal, Industrial Economics, Wiley Eastern Ltd 1996
4. G S Gupta, "Management Economics", Tata McGraw Hill Ltd

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2			2	3	3		3	3		2	2
CO2	3	3	3			3	3	3		3	3	2		2
CO3	3	3	3			2	3	3		2	2	2	2	
CO4	3	3	3			3	3	2		3	1	3		
CO5	1	2	3			2	3	2		3	3	3	2	2
Avg	2.50	2.60	2.80			2.40	3.00	2.60		2.80	2.40	2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

MANAGEMENT ELECTIVE

(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24M04	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the fundamental concepts, scope, and evolution of Human Resource Management.
- Learning the human resource planning, job analysis, recruitment, and selection processes.
- Developing insights into training, employee development, and performance management systems.
- Analyzing the components of compensation management and employee welfare.
- Examining the performance evaluation methods and organizational control processes.

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

Definition, nature and scope of HRM, The importance of human resources, Evolution of HRM, Objective of Human Resource Management, Human resource policies, Role of human resource manager, HRM in the Digital Era.

UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT 9

Internal and External sources of Human Resources, Importance of Human Resource Planning, Job analysis, Recruitment, Selection, Socialization.

UNIT III TRAINING, DEVELOPMENT, AND PERFORMANCE MANAGEMENT 9

Training vs. development, Need for Training, Evaluation of Training, Types of training and Executive development methods, Performance management systems, Performance appraisals.

UNIT IV COMPENSATION MANAGEMENT AND EMPLOYEE WELFARE 9

Compensation structure: Components and strategies, Compensation plan, Reward, Motivation, Career Development, Mentor, Protege relationships.

UNIT V PERFORMANCE EVALUATION AND CONTROL 9

Performance evaluation, Feedback, The control process, Importance, Methods, Grievances, Causes, Redressal methods.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:**Describe the definition, scope, and evolution of Human Resource Management.
- CO2:**Analyze the human resource planning process, including recruitment, selection, and socialization.
- CO3:**Evaluate various training and development methods and assess performance appraisal systems.
- CO4:**Demonstrate an understanding of compensation structures, employee motivation strategies.
- CO5:**Apply methods of performance evaluation and control and suggest appropriate redressal mechanisms.

TEXT BOOKS:

1. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2. John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition, Tata McGraw Hill, 2013, New Delhi.

REFERENCES:

1. Luis R., Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, "Managing Human Resources", 7th Edition, PHI, 2012.
2. Dessler, "Human Resource Management", Pearson Education Limited, 2007.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	3	3	2	3	3		2	2
CO2	3	3	3	3	2	3	3	3	2	3	3	2		2
CO3	3	3	3	3	2	2	3	3	2	2	2	2	2	
CO4	3	3	3	3	2	3	3	2	2	3	1	3		
CO5	1	2	3	3	2	2	3	2	2	3	3	3	2	2
Avg	2.50	2.60	2.80	3.00	2.00	2.40	3.00	2.60	2.00	2.80	2.40	2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

MANAGEMENT ELECTIVE
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24MO5	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the fundamentals, concepts, and evolution of knowledge management.
- Learning the knowledge sharing, learning organizations, and knowledge management life cycles.
- Developing tools and information technologies used in knowledge management systems.
- Analyzing the knowledge management strategies and applications in various domains.
- Examining the future trends and case studies in knowledge management practices.

UNIT I INTRODUCTION 9

An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

Organization and Knowledge Management - Building the Learning Organization. Knowledge and role related issues-Basic types of knowledge management-Knowledge Management Life Cycle- Organizational Knowledge Sources Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT III KNOWLEDGE MANAGEMENT-THE TOOLS 9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT APPLICATION 9

Components of a Knowledge Strategy - Case Studies (from Library to Knowledge Center, Knowledge Management in the Health Sciences-Knowledge Management in Developing Countries)

UNIT V FUTURE TRENDS AND CASE STUDIES 9

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life - cycles of an organization

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the concepts, evolution, and ethical aspects of knowledge management.

CO2: Describe learning organizations, knowledge sharing processes, and knowledge life cycles.

CO3: Apply knowledge management tools and information technologies for information retrieval and management.

CO4: Analyze knowledge management strategies and applications in organizations and healthcare systems.

CO5: Evaluate future trends and case studies in knowledge management and organizational planning.

TEXT BOOKS:

1. Srikantaiah, T.K., Koenig, M., Knowledge Management for the Information Professional Information Today, Inc., 2000.
2. "Effective Knowledge Management: A Best Practice Blueprint" by Sultan Kermally (CBI, 2002)
3. Knowledge Management" by Elias M. Awad (Pearson, 1st Edition)

REFERENCES:

1. Nonaka, I., Takeuchi, H., The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press, 1995.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2			3	2				2	2
CO2	3	3	3	3	2			3	2			2		2
CO3	2	3	3	3	2			3	2			2	2	
CO4	2	3	3	3	2			2	2			3		
CO5	2	2	3	3	2			2	2			3	2	2
Avg	2.40	2.60	2.80	3.00	2.00			2.60	2.00			2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

MANAGEMENT ELECTIVE
(Common To B. E – BME, ECE, EEE, CSE, B. Tech – IT, AI&DS)

GE24M06	INDUSTRIAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the basic concepts and functions of management.
- Learning the planning, organizing, and staffing in professional organizations.
- Developing leading, controlling, and decision-making functions of management.
- Analyzing the organizational theory and behavior in professional organizations.
- Examining the productivity principles and modern management concepts.

UNIT I INTRODUCTION TO MANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT II FUNCTIONS OF MANAGEMENT - I 9

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT III FUNCTIONS OF MANAGEMENT - II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mouton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT IV ORGANIZATION THEORY 9

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT V PRODUCTIVITY AND MODERN TOPICS**9**

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL PERIODS: 45**COURSE OUTCOMES:**

Upon successful completion of the course, students should be able to

CO1: Explain the basic concepts and approaches of management in professional organizations.

CO2: Discuss planning, organizing, and staffing functions of management.

CO3: Apply leading, controlling, and decision-making functions in organizations.

CO4: Explain organizational theory in professional organizations.

CO5: Analyze productivity principles and modern management concepts in organizations.

TEXT BOOKS:

1. M. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India, New Delhi, 2009.
2. Koontz. H. and Weihrich. H., “Essentials of Management: An International Perspective”, 8th Edition, Tata McGrawhill, New Delhi, 2010.

REFERENCES:

1. Joseph J, Massie, “Essentials of Management”, 4th Edition, Pearson Education, 1987.
2. Saxena, P. K., “Principles of Management: A Modern Approach”, Global India Publications, 2009.
3. S.Chandran, “Organizational Behaviours”, Vikas Publishing House Pvt. Ltd., 1994.
4. Richard L. Daft, “Organization Theory and Design”, South Western College Publishing, 11th Edition, 2012.
5. S. Trevis Certo, “Modern Management Concepts and Skills”, Pearson Education, 2018.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	2	3	2	2	2		2	2
CO2	3	3	3	3	2	3	3	3	2	3	3	2		2
CO3	2	3	3	3	2	3	3	3	2	3	3	2	2	
CO4	2	3	3	3	2	3	3	2	2	3	3	3		
CO5	2	2	3	3	2	2	3	2	2	2	3	3	2	2
Avg	2.40	2.60	2.80	3.00	2.00	2.60	2.80	2.60	2.00	2.60	2.80	2.50	2.00	2.00

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

(Common to B. E – CSE & B. TECH - IT)

CS24P01	EXPLORATORY DATA ANALYSIS (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics and importance of Exploratory Data Analysis (EDA) in data science.
- To preprocess, organize, and visualize data using Python libraries.
- To perform analysis of single variables using univariate techniques.
- To study relationships between two variables using bivariate analysis.
- To apply multivariate and time series visualization techniques for better data insights.

UNIT-I EXPLORATORY DATA ANALYSIS

6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT-II EDA USING PYTHON

6

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables - Visualization with Matplotlib.

UNIT-III UNIVARIATE ANALYSIS

6

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT-IV BIVARIATE ANALYSIS

6

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

UNIT-V MULTIVARIATE AND TIME SERIES ANALYSIS

6

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

30 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
3. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
4. Perform bivariate analysis on a heart disease dataset to study the relationship between patient age and blood pressure levels. Create scatter plots and calculate correlation to analyze how age influences blood pressure trends.
5. Perform Time Series Analysis and apply the various visualization techniques.

6. Conduct a mini case study using a real-world dataset such as healthcare, e-commerce, traffic, or student performance data. Apply EDA techniques, generate visual insights, and present the findings in a brief analysis report.
7. Perform categorical data analysis using bar charts, pie charts, and histograms to compare different categories and distributions in a dataset.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Pycharm Community Edition, Python 3 IDLE, Ms Office

HARDWARE: Standalone desktops – 30 Nos.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand the basics of exploratory data analysis (EDA).

CO2: Apply Python libraries for data processing and visualization.

CO3: Perform univariate data analysis and statistical measures.

CO4: Evaluate bivariate analysis to study relationships between variables.

CO5: Perform multivariate and time series analysis using EDA techniques.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Suresh Kumar Mukhiya, 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.
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008.

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. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, Peter Gedeck, O’Reilly Media, 2020.
4. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knafllic, Wiley, 2025.
5. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, Wes McKinney, O’Reilly Media, 2022.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	–	1	2	1	2	3	1
2	2	2	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	2	2	3	–	–	–	1	2	1	2	3	1
4	2	3	2	2	3	–	–	–	1	2	1	2	3	1
5	2	3	3	2	3	–	–	–	1	2	2	3	3	2
AVg.	2.2	2.6	2.2	2	2.8	–	–	–	1	2	1.2	2.4	3	1.4

1 - low, 2 - medium, 3 - high, ‘–’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

(Common to B. E – CSE, EEE & B. TECH - IT)

CS24P02 / EE24P49	BIG DATA TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand the fundamentals of Big Data and Hadoop ecosystem.
- Learn NoSQL databases, HDFS architecture, and MapReduce concepts.
- Gain knowledge of data processing using MapReduce and MongoDB.
- Understand Hadoop ecosystem tools like Hive and Pig for data analysis.
- Apply Spark and analytics techniques for big data processing and insights.

UNIT I – UNDERSTANDING BIG DATA AND HADOOP

9

Introduction to Big Data – Need for Big Data – Traditional BI vs Big Data – Applications of Big Data – Introduction and History of Hadoop – Hadoop Ecosystem – Hadoop Streaming – IBM Big Data Strategy – Mobile Business Intelligence – Crowd Sourcing Analytics.

UNIT II – No SQL and HDFS

9

Introduction to NoSQL – Data Distribution Models – Replication Techniques – CAP Theorem – Cassandra and Cassandra Data Model – HDFS Architecture – Data Processing with Hadoop – Hadoop YARN – Basics of Map Reduce: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, and Compression.

UNIT III – Map Reduce Applications and Mongo DB

9

Map Reduce Workflow – MR Unit Testing – Job Execution in Map Reduce and YARN – Job Scheduling – Input and Output Formats – Introduction to Mongo DB – Features of Mongo DB – Data Types and Query Language in MongoDB.

UNIT IV – Hadoop Ecosystem

9

Introduction to Hive – Hive Architecture – Hive Data Types and File Formats – Hive Query Language (HQL) – User Defined Functions (UDF). Introduction to Pig – Pig Architecture – Pig Latin Basics – Data Types in Pig – Execution Modes – HDFS Commands – Relational Operators – Pig vs Hive.

UNIT V – Spark and Big Data Analytics

9

Introduction to Spark – Data Analysis using Spark – Text Mining – Web Mining – Web Content and Usage Analytics – Page Rank – Web Structure and Analysis Graph.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand Big Data concepts, Hadoop, and its applications.
- CO2: Apply NoSQL databases, HDFS, and MapReduce techniques.
- CO3: Perform data processing using MapReduce and MongoDB.
- CO4: Evaluate Pig and Hadoop ecosystem tools for big data analysis.
- CO5: Analyze big data using Spark and web analytics techniques.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Big Data Analytics – Seema Acharya & Subhashini Chellappan, Wiley India, 2019 (2nd Edition).
2. Big Data Technologies – S. Balamurugan, N. Prabakaran, S. Charanyaa & M.S. Susanthie, Pearson India, 2015.

REFERENCES:

1. Big Data Analytics – Seema Acharya & Subhashini Chellappan, Wiley India, 2019.
2. Big Data Technologies – S. Balamurugan, N. Prabakaran, S. Charanyaa & M.S. Susanthie, Pearson India, 2015.
3. Hadoop: The Definitive Guide (4th Edition) – Tom White, O'Reilly Media, 2015.
4. Big Data Fundamentals – Thomas Erl, Wajid Khattak & Paul Buhler, Pearson, 2015.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	3	1
2	2	2	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	3	2	3	–	–	–	1	2	1	3	3	2
4	2	3	3	2	3	–	–	–	1	2	2	3	3	2
5	2	3	3	2	3	1	–	–	1	2	2	3	3	2
Avg	2.2	2.6	2.6	1.8	2.8	1	–	–	1	2	1.4	2.8	3	1.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

(Common to B. E – CSE & B. TECH – IT, AIDS)

AD24P05	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand the basics of business analytics and decision making.
- To Learn statistical and predictive analytics techniques.
- To Explore data visualization and business intelligence tools.
- To Study machine learning applications in business analytics.
- To Develop solutions for real-world business problems.

UNIT I INTRODUCTION

9

Introduction to Business Analytics – Types of analytics – Descriptive, predictive, and prescriptive analytics – Business Intelligence concepts – Data-driven decision making – Business analytics lifecycle – Applications in finance, healthcare, marketing, retail, and supply chain management.

UNIT II DATA COLLECTION AND STATISTICAL ANALYSIS

9

Data sources and data preprocessing – Data cleaning and transformation – Descriptive statistics – Probability distributions – Correlation and regression analysis – Hypothesis testing – Time series basics – Statistical tools for business analytics.

UNIT III PREDICTIVE ANALYTICS AND MACHINE LEARNING

9

Predictive analytics concepts – Classification and clustering techniques – Decision trees – Naïve Bayes – K-means clustering – Association rule mining – Forecasting techniques – Customer segmentation – Fraud detection and risk analytics.

UNIT IV DATA VISUALIZATION AND BUSINESS INTELLIGENCE TOOLS

9

Data visualization principles – Dashboard design – Business intelligence tools – Power BI and Tableau concepts – KPI analysis – Reporting techniques – Data storytelling – Real-time analytics – Big data analytics overview.

UNIT V ADVANCED BUSINESS ANALYTICS APPLICATIONS

9

Marketing analytics – Financial analytics – Human resource analytics – Supply chain analytics – Social media analytics – Recommendation and personalization systems – Ethical issues in analytics – Future trends in business analytics and AI-driven enterprises.

COURSE OUTCOMES:**After completion of this course, students will be able to:**

- CO1: Understand the basics of business analytics.
 CO2: Apply statistical techniques for data analysis.
 CO3: Use predictive analytics and machine learning models.
 CO4: Develop dashboards and data visualizations.
 CO5: Design solutions for business applications.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley India, 2017.
2. Deepak Chawla and Neena Sondhi, "Business Analytics and Intelligence", PHI Learning Pvt. Ltd., 2016.

REFERENCES:

1. U. Dinesh Kumar and Manaranjan Pradhan, "Business Analytics using Python", Wiley India, 2019.
2. Asha Sharma and K. K. Paliwal, "Business Analytics with R", BPB Publications, 2021.
3. Nitin R. Patel and O.P. Wali, "Data Mining for Business Analytics: Concepts, Techniques and Applications in Python (Indian Adaptation)", Wiley India, 2023.
4. Abhishek Verma and Avinash Chandra Pandey, "Business Intelligence and Data Analytics: Proceedings of BIDA 2024", Springer, 2025.
5. Pankaj Dutta, Sudeep Bapat and Dipak Jana, "Advances in Applied Operations Research and Analytics for Business Intelligence", Springer, 2025.
6. Jyoti Prakash Singh, Maheshwari Prasad Singh, Amit Kumar Singh and others, "Computational Intelligence in Communications and Business Analytics", Springer, 2025.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	—	1	—	—	—	—	1	—	2	3	1
2	3	3	2	2	2	—	—	—	1	1	—	3	3	1
3	3	3	3	2	3	—	—	—	1	1	—	3	3	2
4	3	3	2	2	3	—	—	—	1	2	—	3	3	2
5	3	3	3	2	3	—	—	—	2	2	2	3	3	3
AVG	3	2.8	2.2	2	2.4	—	—	—	1.25	1.4	2	2.8	3	1.8

1 - low, 2 - medium, 3 - high, '—' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

(Common to B. E – CSE & B. TECH – IT, AIDS)

AD24P17	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the fundamentals of image and video analytics techniques.
- To learn image processing, feature extraction, and video analysis methods.
- To explore machine learning and deep learning techniques for visual analytics.
- To study object detection, tracking, and activity recognition in videos.
- To develop intelligent image and video analytics applications for real-world scenarios.

UNIT I INTRODUCTION

9

Introduction to image and video analytics – Digital image fundamentals – Video representation and formats – Image acquisition and preprocessing – Applications in surveillance, healthcare, entertainment, smart cities, and autonomous systems – Challenges in visual analytics.

UNIT II IMAGE PROCESSING AND FEATURE EXTRACTION

9

Image enhancement techniques – Filtering and smoothing – Edge detection – Segmentation methods – Morphological operations – Feature extraction – Texture and shape analysis – Color analysis – Feature descriptors and representation.

UNIT III VIDEO ANALYTICS AND OBJECT TRACKING

9

Video preprocessing – Motion estimation – Background subtraction – Object detection techniques – Object tracking methods – Human activity recognition – Event detection – Video summarization – Performance evaluation metrics.

UNIT IV DEEP LEARNING FOR IMAGE AND VIDEO ANALYTICS

9

Introduction to deep learning in visual analytics – Convolutional Neural Networks (CNN) – Transfer learning – Object detection models – YOLO and R-CNN concepts – Action recognition using deep learning – Video classification – Real-time analytics systems.

UNIT V ADVANCED APPLICATIONS

9

Medical image analytics – Facial recognition systems – Intelligent surveillance systems – Autonomous driving and traffic analytics – Augmented Reality and Virtual Reality applications.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand image and video analytics basics.
- CO2: Apply image processing techniques.
- CO3: Use video analytics and object tracking methods.
- CO4: Analyze deep learning models for visual analytics.
- CO5: Develop image and video analytics applications.

. TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abhishek Singh Rathore, Surendra Rahamatkar, Syed Imran Ali, Ramgopal Kashyap and Nand Kishore Sharma, “Video Data Analytics for Smart City Applications: Methods and Trends”, Bentham Science Publishers, 2023.
2. Santosh Kumar Tripathy, Roshan Singh, Rajeev Srivastava, Akash Kumar Bhoi and Santosh Kumar Satapathy, “Advances in Human Activity Detection and Recognition (HADR) Systems”, Springer, 2024.

REFERENCES:

1. D. S. Guru, Archana M. Rajurkar, N. Vinay Kumar and others, “Data Analytics and Learning: Proceedings of DAL 2024”, Springer Nature, 2025.
2. Suparna Dhar, Sanjay Goswami, Dinesh Kumar Unni Krishnan, Indranil Bose and Chandan Mazumdar, “Analytics, Machine Learning, and Artificial Intelligence: Second Analytics Global Conference (AGC 2024)”, Springer, 2025.
3. Jyoti Prakash Singh, Maheshwari Prasad Singh, Amit Kumar Singh, Somnath Mukhopadhyay and Jyotsna K. Mandal, “Computational Intelligence in Communications and Business Analytics”, Springer Nature, 2025.
4. Sanjiv Sharma, Valiur Rahaman and G. R. Sinha, “Big Data Analytics in Cognitive Social Media and Literary Texts: Theory and Praxis”, Springer, 2021.
5. Soumi Dutta, Pushan Kumar Dutta, Pronaya Bhattacharya and Ramanjeet Singh, “Advances in Data Analytics for Influencer Marketing: An Interdisciplinary Approach”, Springer, 2024.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
4	3	3	3	2	3	–	–	–	1	1	–	3	3	3
5	3	3	3	2	3	–	–	–	2	2	2	3	3	3
AVG	3	2.8	2.4	2	2.6	–	–	–	1.25	1.2	2	2.8	3	2.2

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 1: DATA SCIENCE
(Common to: AI&DS, BME, CSE, ECE, & IT)

AD24P04	COMPUTER VISION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To Understand the basics of Computer Vision and image formation.
- To Learn image processing and feature extraction techniques.
- To Explore object detection and pattern recognition methods.
- To Study deep learning techniques in Computer Vision.
- To Develop real-world Computer Vision applications.

UNIT I INTRODUCTION TO COMPUTER VISION

6

Introduction to Computer Vision – Human vision vs computer vision – Digital image fundamentals – Image acquisition and representation – Image transformations – Color models – Image enhancement techniques – Applications of Computer Vision in healthcare, surveillance, robotics, and autonomous systems.

UNIT II IMAGE PROCESSING AND FEATURE EXTRACTION

6

Image filtering and smoothing – Edge detection techniques – Segmentation methods – Thresholding – Morphological operations – Feature extraction – Corner detection – Texture analysis – Shape representation – Feature descriptors.

UNIT III OBJECT DETECTION AND PATTERN RECOGNITION

6

Object detection fundamentals – Template matching – Motion detection – Face detection and recognition – Pattern recognition techniques – Classification methods – Optical Character Recognition (OCR) – Gesture recognition – Performance analysis.

UNIT IV DEEP LEARNING FOR COMPUTER VISION

6

Introduction to deep learning in Computer Vision – Convolutional Neural Networks (CNN) – Transfer learning – Object detection models – YOLO and R-CNN concepts – Image classification – Semantic segmentation – Instance segmentation – Real-time vision systems.

UNIT V ADVANCED COMPUTER VISION APPLICATIONS

6

3D vision and scene understanding – Image captioning – Video analytics – Autonomous navigation – Medical image analysis – Augmented Reality and Virtual Reality applications – Ethical issues and challenges – Future trends in Computer Vision.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Introduction to OpenCV and image handling.
2. Image enhancement and filtering techniques.
3. Edge detection using Sobel and Canny methods.
4. Image segmentation and thresholding.
5. Morphological image processing operations.

6. Feature extraction and descriptor implementation.
7. Face detection using Haar Cascade classifiers.
8. OCR implementation using Computer Vision libraries.
9. CNN model implementation for image classification.
10. Object detection using YOLO framework.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand the basics of Computer Vision.

CO2: Apply image processing techniques.

CO3: Use object detection and pattern recognition methods.

CO4: Analyze deep learning models in Computer Vision.

CO5: Develop Computer Vision applications for real-world problems.

TEXT BOOKS:

1. V. Kishore Ayyadevara and Yeshwanth Reddy, “Modern Computer Vision with PyTorch”, Packt Publishing, 2020 Edition, 2020. ISBN: 9781839213472.
2. Jagadeesh Kakarla, R. Balasubramanian, Subrahmanyam Murala, Santosh Kumar Vipparthi and Deep Gupta, “Computer Vision and Image Processing”, Springer Nature, 2025 Edition, 2025. ISBN: 9783031936937.

REFERENCES:

1. Satyabrata Roy, Deepak Sinwar, Nilanjan Dey and Thinagaran Perumal (Eds.), “Innovations in Computational Intelligence and Computer Vision”, Springer, 2025 Edition, 2025. ISBN: 9789819769957.
2. Jagadeesh Kakarla, R. Balasubramanian, Subrahmanyam Murala, Santosh Kumar Vipparthi and Deep Gupta, “Computer Vision and Image Processing: CVIP 2024 Proceedings”, Springer Nature, 2025 Edition, 2025.
3. Benjamin Planche and Eliot Andres, “Hands-On Computer Vision with TensorFlow 2”, BPB Publications Indian Edition, 2020 Edition, 2020. ISBN: 9789389423280.
4. Nilanjan Dey, Amira Ashour and Suvojit Acharjee, “Artificial Intelligence and Computer Vision”, Springer, 2021 Edition, 2021. ISBN: 9783030721015.
5. Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision”, Packt Publishing, 2018 Edition, 2018. ISBN: 9781788295628.
6. Ahmed Fawzy Gad, “Practical Computer Vision Applications Using Deep Learning with CNNs”, BPB Publications India Edition, 2021 Edition, 2021. ISBN: 9789389898996.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	1	1	1	2	1	2
CO2	3	3	2	2	3	1	1	1	1	1	1	3	2	2
CO3	3	3	3	2	3	1	1	1	1	1	1	3	2	3
CO4	3	3	3	3	3	1	1	1	1	1	1	3	2	3
CO5	2	3	3	3	3	2	2	2	2	2	2	3	3	3
Avg	2.8	2.8	2.4	2.2	2.8	1.2	1.2	1.2	1.2	1.2	1.2	2.8	2	2.6

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: DATA SCIENCE

(Common to: B. E – CSE & B. TECH – IT, AIDS)

AD24P02	RECOMMENDATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand the basics of recommendation systems.
- To learn different types of recommendation techniques.
- To study collaborative and content-based filtering methods.
- To understand evaluation methods for recommender systems.
- To apply recommendation systems in real-world applications.

UNIT I – INTRODUCTION

9

Introduction to recommendation systems – Need and importance – Applications – Types of recommendation systems – User data and item data – Challenges in recommender systems.

UNIT II – CONTENT-BASED FILTERING

9

Content-based recommendation – Feature extraction – User profiles – Similarity measures – Cosine similarity – Advantages and limitations – Applications.

UNIT III – COLLABORATIVE FILTERING

9

Collaborative filtering concepts – User-based and item-based filtering – Memory-based methods – Model-based methods – Matrix factorization – Cold start problem.

UNIT IV – HYBRID RECOMMENDATION SYSTEMS

9

Hybrid approaches – Combining filtering techniques – Weighted and switching models – Machine learning in recommendation – Deep learning basics for recommendation systems.

UNIT V – EVALUATION AND APPLICATIONS

9

Evaluation metrics – Precision, recall, F1-score – RMSE – A/B testing – Real-world applications – E-commerce, OTT platforms, social media recommendations – Future trends.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand basics of recommendation systems and applications.
- CO2: Apply content-based filtering techniques.
- CO3: Implement collaborative filtering methods.
- CO4: Understand hybrid recommendation approaches.
- CO5: Evaluate and apply recommendation systems in real-world scenarios.

TEXT BOOKS

1. Recommender Systems: The Textbook (2nd Edition) – Charu C. Aggarwal, Springer, 2023.
2. Building Recommender Systems with Machine Learning and AI – Frank Kane, Packt Publishing, 2022.

REFERENCE BOOKS

1. Recommender Systems Handbook (3rd Edition) – Francesco Ricci, Lior Rokach & Bracha Shapira, Springer, 2022.
2. Deep Learning for Recommender Systems – Alexandros Karatzoglou et al., 2022 (latest research edition).
3. Machine Learning for Recommender Systems – Shulei Ji et al., Springer, 2023.
4. Python Machine Learning (4th Edition) – Sebastian Raschka, Packt Publishing, 2023.
5. Building Machine Learning Powered Applications – Emmanuel Ameisen, O'Reilly, 2020 (latest reprints 2022–2024).
6. Hands-On Recommendation Systems with Python – Rounak Banik, Packt Publishing, 2022.
7. Practical Recommender Systems – Kim Falk, Manning Publications, 2021 (latest reprints 2023–2025).

CO-PO MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
4	3	3	3	2	3	–	–	–	1	1	–	3	3	2
5	3	3	3	2	3	1	–	–	2	2	2	3	3	3
Avg	3	2.8	2.4	2	2.6	1	–	–	1.25	1.2	2	2.8	3	2

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 1: DATA SCIENCE
(Common to B. E – CSE & B. TECH – IT)

CS24P03	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand natural language processing basics.
- To Apply classification algorithms to text documents.
- To Build question-answering and dialogue systems.
- To Develop a speech recognition system.
- To Develop a speech synthesizer.

UNIT I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model – corpus creation and datasets – Part-of-Speech tagging – Named Entity Recognition – overview of NLP pipeline.

UNIT II TEXT CLASSIFICATION 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models.

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – TF-IDF ranking – cosine similarity – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – semantic search basics – retrieval-augmented generation (RAG) – chatbots – Design of dialogue systems – evaluating dialogue systems.

UNIT IV TEXT-TO-SPEECH SYNTHESIS 9

Overview - Text normalization – Letter-to-sound – Prosody – Signal processing – MFCC and spectrogram analysis - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems – Evaluation metrics for speech synthesis.

UNIT V AUTOMATIC SPEECH RECOGNITION 9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems – deep learning for ASR – CNN and RNN in speech recognition – end-to-end ASR systems – connectionist temporal classification (CTC) overview – word error rate (WER) evaluation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain fundamentals of NLP including preprocessing, text representation, POS tagging, and NER.
- CO2:** Apply word embeddings and deep learning models for text classification and semantic representation.
- CO3:** Design question-answering systems, chatbots and dialogue systems.
- CO4:** Analyze text-to-speech synthesis techniques including signal processing and neural TTS models.
- CO5:** Develop automatic speech recognition systems using deep learning models.

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Stanford University / Pearson, Third Edition, 2022.
2. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress, 2018.

REFERENCES:

1. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition”, Pearson, 1st Edition, 2009.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O'REILLY.
4. Weiss S.M., Indurkha N., Zhang T., Damerau F., “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005.
5. Michael Berry, — “Survey of Text Mining: Clustering- Classification- and Retrieval”, Springer, 2004.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	-	2	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	2	3	1
CO3	2	2	3	-	2	-	-	1	2	-	-	2	3	1
CO4	3	2	-	3	2	-	-	-	-	-	-	1	2	2
CO5	3	2	-	3	3	-	-	-	-	-	-	1	3	2
Avg	2.8	2	3	3	2.2	-	-	1	2	-	-	1.6	2.4	1.5

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

(Common to B. E – CSE & B. TECH – IT)

CS24P04	DATA MINING AND OLAP (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- Understand data mining, OLAP, and knowledge discovery.
- Apply data preprocessing techniques for effective analysis.
- Analyze data using association rules, classification, and prediction.
- Explore clustering methods and detect outliers.
- Evaluate mining results and integrate data warehouses.

UNIT I – INTRODUCTION

6

Introduction to Data Mining – Data Mining Functionalities – Data Warehouse – ETL Process – OLTP and OLAP – Types of OLAP – Data Cubes – Applications of Data Mining.

UNIT II – DATA PREPROCESSING

6

Data Cleaning – Data Transformation – Data Reduction – Frequent Pattern Mining – Association Rule Mining – Apriori Algorithm – Market Basket Analysis.

UNIT III – CLASSIFICATION

6

Classification Basics – Decision Trees – Naïve Bayes Classification – k-Nearest Neighbor – Model Evaluation Techniques.

UNIT IV – CLUSTERING

6

Clustering Concepts – K-Means Clustering – Hierarchical Clustering – Outlier Detection – Applications of Clustering.

UNIT V – OLAP OPERATIONS AND APPLICATIONS

6

OLAP Operations – Roll-up – Drill-down – Slice and Dice – Pivoting – Data Visualization – Business Intelligence Applications.

30 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Association Rule Mining using Apriori Algorithm.
2. Classification using Decision Tree.
3. Classification using Naïve Bayes.
4. Clustering using K-Means.
5. Hierarchical Clustering.
6. OLAP Operations and Data Visualization.
7. Mini Project on Data Mining Application.

LIST OF EQUIPMENTS FOR A BATCH OF 30

STUDENTS: SOFTWARE:

- Python, MySQL, Weka

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand data mining and OLAP concepts.

CO2: Apply preprocessing and association rule mining techniques.

CO3: Implement classification algorithms.

CO4: Perform clustering and data analysis.

CO5: Use OLAP operations for business intelligence applications.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Data Mining: Concepts and Techniques – Jiawei Han, Micheline Kamber & Jian Pei, Morgan Kaufmann, 2022.
2. Data Warehousing and Data Mining – Alex Berson & Stephen J. Smith, McGraw-Hill, 1997.

REFERENCE BOOKS

1. Data Mining: Practical Machine Learning Tools and Techniques – Ian H. Witten, Eibe Frank & Mark A. Hall, Morgan Kaufmann, 2011 (3rd Edition). Excellent reference for machine learning-based data mining techniques and model evaluation.
2. Principles of Data Mining – David Hand, Heikki Mannila & Padhraic Smyth, MIT Press, 2001.
Covers theoretical foundations and practical data mining algorithms.
3. Data Mining and Data Warehousing – Bharati M. Ramageri, University Science Press, 2010.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	3	1
2	2	3	2	2	3	–	–	–	1	2	1	3	3	1
3	2	3	3	2	3	–	–	–	1	2	1	3	3	1
4	2	3	3	2	3	–	–	–	1	2	2	3	3	1
5	2	3	2	2	3	1	–	–	1	2	2	2	3	1
Avg	2.2	2.8	2.2	1.8	2.8	1	–	–	1	2	1.4	2.6	3	1

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common to B. E – CSE & B. TECH – IT)

IT24P01	WEB PROGRAMMING ESSENTIALS (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- Understand the architecture and working principles of the World Wide Web.
- Learn markup and styling techniques to design responsive web pages.
- Develop interactive web applications using client-side scripting.
- Apply asynchronous communication techniques for dynamic web pages.
- Build simple server-side web applications with database connectivity.

UNIT I – INTRODUCTION

6

Internet and Web Basics – WWW and Web Architecture – Client–Server Model – URL and DNS – HTTP Protocol – Web Browsers and Web Servers – Dynamic Web Pages.

UNIT II – WEB PAGE DESIGN

6

HTML5 structure – Elements, attributes, lists, tables and forms – Semantic elements – HTML5 multimedia (audio, video) – Canvas and SVG – CSS3 basics – Selectors and properties – Styling text and layouts – Box model – Responsive Web Design.

UNIT III – CLIENT-SIDE SCRIPTING

6

Introduction to JavaScript – Variables and data types – Operators and control statements – Functions – Arrays and objects – Document Object Model (DOM) – Event handling – Form validation.

UNIT IV – ADVANCED JAVASCRIPT AND WEB FRAMEWORKS

6

Object-oriented JavaScript – JSON data format – Asynchronous programming – AJAX concepts – Introduction to React – Bootstrap framework – Responsive UI components.

UNIT V – SERVER-SIDE PROGRAMMING

6

Introduction to server-side scripting – PHP basics – Variables, operators and control structures – Functions – Form handling – Embedding PHP with HTML – Database connectivity with MySQL – Basic CRUD operations.

30 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Create a basic webpage using HTML5 with headings, lists, tables and hyperlinks.
2. Design a web page layout using CSS3 styles and box model.
3. Develop a webpage with HTML5 forms and input validation attributes.
4. Write JavaScript programs to demonstrate variables, operators and control structures.
5. Implement event handling for buttons, forms and mouse events.
6. Develop a form validation system using JavaScript.
7. PHP and MySQL CRUD Application

LIST OF EQUIPMENTS FOR A BATCH OF 30

STUDENTS: SOFTWARE:

- Web Browser: Google Chrome / Mozilla Firefox
- Web Server: XAMPP / WAMP Server
- Database: MySQL
- PHP Interpreter: PHP 8.x
- Bootstrap Framework
- React Library (basic setup using CDN or Node.js)

HARDWARE:

- Standalone desktops – 30 Nos.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand Internet, web basics, and web architecture concepts.

CO2: Design web pages using HTML5 and CSS3.

CO3: Apply JavaScript for client-side scripting and form validation.

CO4: Develop responsive web applications using AJAX, React, and Bootstrap.

CO5: Create dynamic web applications using PHP and MySQL.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Mastering Web Technology (From HTML to the Future of Web 3.0) – Ashish Bhatnagar, S.K. Kataria & Sons, 1st Edition, 2025
2. Web Development: Full Stack – F. Max Collier, Cengage India, 1st Edition, 2024 (India Release 2025)
3. Web Technologies – Uttam K. Roy, Oxford University Press India, 2018

REFERENCE BOOKS

1. PHP and MySQL Web Development, 5th Edition – Luke Welling & Laura Thomson, Pearson, 2016
2. Eloquent JavaScript, 4th Edition – Marijn Haverbeke, No Starch Press, 2024
3. Web Technologies Black Book – Kogent Learning Solutions Inc., Dreamtech Press, 2009
4. Learning Web Design, 5th Edition – Jennifer Niederst Robbins, O'Reilly Media, 2018

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
2	2	2	3	2	3	–	–	–	1	2	1	3	1	3
3	2	2	3	2	3	–	–	–	1	2	1	3	1	3
4	2	3	3	2	3	–	–	–	1	2	2	3	2	3
5	2	3	3	2	3	–	–	–	1	2	2	3	2	3
Avg	2.2	2.4	2.6	1.8	2.8	–	–	–	1	2	1.4	2.8	1.4	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P05 / CS24904	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of DevOps principles and practices.
- To learn continuous integration, deployment, and automation.
- To explore containerization, orchestration, and DevOps tools.
- To study monitoring and infrastructure automation.
- To build DevOps pipelines for software development.

UNIT I INTRODUCTION

9

Introduction to DevOps – Evolution of software development practices – Agile and DevOps culture – DevOps lifecycle – Continuous Integration (CI) and Continuous Deployment (CD) – Version control systems – DevOps architecture – Benefits and challenges of DevOps – Overview of DevOps tools.

UNIT II VERSION CONTROL AND CONTINUOUS INTEGRATION

9

Git fundamentals – Repository management – Branching and merging – Git workflows – Build automation – Jenkins architecture and configuration – Continuous Integration pipelines – Automated testing – Dependency management – Source code quality analysis.

UNIT III CONTAINERIZATION AND ORCHESTRATION

9

Introduction to containerization – Docker architecture – Docker images and containers – Dockerfile creation – Container networking and storage – Kubernetes architecture – Pod, deployment, and service management – Container orchestration concepts – Scaling and load balancing.

UNIT IV CONFIGURATION MANAGEMENT AND CLOUD DEVOPS

9

Infrastructure as Code (IaC) – Configuration management tools – Ansible fundamentals – Terraform basics – Cloud computing concepts – DevOps in AWS/Azure/GCP – Deployment automation – Serverless computing – Security practices in DevOps.

UNIT V MONITORING, LOGGING, AND ADVANCED DEVOPS PRACTICES

9

Monitoring and logging concepts – Prometheus and Grafana basics – ELK stack overview – Incident management – CI/CD pipeline optimization – DevSecOps principles – Site Reliability Engineering (SRE) concepts – AI for DevOps (AIOps) – Future trends in DevOps.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand DevOps principles and SDLC practices.
CO2: Use version control and continuous integration.
CO3: Apply containerization and orchestration tools.
CO4: Study infrastructure automation and cloud DevOps.
CO5: Build and manage CI/CD pipelines.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Varghese Chacko, “DevOps with Python: Automating Infrastructure and CI/CD Pipelines”, BPB Publications, 2025.
2. Len Bass, “DevOps: A Software Architect’s Perspective”, Pearson India, 2016.

REFERENCES:

1. Sricharan Vadapalli, “Hands-on DevOps: Explore Continuous Delivery and Integration”, Packt Publishing India, 2017.
2. Chinmaya Kumar Dehury and Satish Narayana Srirama, “Mastering DevOps: A Cloud Engineering Perspective”, Elsevier, 2026.
3. Aruna Ravichandran, Kieran Taylor and Peter Waterhouse, “DevOps for Digital Leaders”, Springer, 2016.
4. Sricharan Vadapalli, “Continuous Integration, Delivery and Deployment Practices”, Packt, 2018.
5. Abhinav Krishna Kaiser and Vamshi Meda, “AI Integration in DevOps and Software Operations”, Springer, 2024.
6. Adarsh Saxena et al., “DevOps Automation Pipeline with Infrastructure as Code (IaC)”, 2025.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	2	2	3	2
2	3	3	2	2	3	–	–	–	1	1	2	3	3	2
3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
4	3	3	3	2	3	1	–	–	1	1	3	3	3	3
5	3	3	3	2	3	1	–	–	2	2	3	3	3	3
AVG	3	2.8	2.4	2	2.6	1	–	–	1.2	1.2	2.4	2.8	3	2.6

1 - low, 2 - medium, 3 - high, ‘–’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P06	UI AND UX DESIGN (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- Understand the basic concepts of UI/UX design and the design thinking process.
- Analyze user needs and problems using UX research methods
- Apply UI design principles to create visually effective user interfaces.
- Develop wireframes, prototypes, and interaction designs for digital products
- Evaluate and improve user interfaces using usability testing and feedback.

UNIT I INTRODUCTION TO UI/UX AND DESIGN THINKING 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II USER RESEARCH AND PROBLEM DEFINITION 6

Understanding Users and Stakeholders - UX Research Methods: Interviews, Surveys, Observation, Contextual Inquiry - Qualitative vs Quantitative Research - Identifying User Needs and Pain Points - Defining Problem Statements - Understanding Business Goals and Product Goals - Creating User Personas and Empathy Maps.

UNIT III UI DESIGN PRINCIPLES 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviours and Principles – Branding - Style Guides.

UNIT IV WIREFRAMING, PROTOTYPING AND INTERACTION DESIGN 6

Sketching Principles and Low-Fidelity Sketching - Responsive Design Concepts - Wireframes and Wireflows - Interaction Patterns and Navigation Structures - Prototyping (Low-Fidelity and High-Fidelity) - High-Fidelity Mockups using modern tools (Figma / Adobe XD / Sketch).

UNIT V INFORMATION ARCHITECTURE AND USABILITY TESTING 6

Information Architecture and Content Organization - User Journey Mapping - Flow Diagrams and Task Flows - Usability Testing Methods - Heuristic Evaluation - Analyzing User Feedback - Improving UX through Design Iteration.

30 PERIODS

LIST OF EXPERIMENTS: 30 PERIODS

1. Design a responsive layout for a societal or community-based application.
2. Develop a user interface by applying appropriate UI style guidelines and design principles.
3. Create a wireflow diagram for an application using open-source design tools.
4. Apply the Design Thinking process to conceptualize and develop a new product idea.
5. Conduct a brainstorming session to generate potential features for the proposed product.
6. Develop a sample pattern library for the product, including mood board, typography, and color palette based on UI design principles.

7. Create sketches and designs using popular UI/UX tools, develop a prototype, conduct usability testing, and suggest improvements based on feedback.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

SOFTWARE:

- UI/UX Design Tools - Figma
- Wireframing and Prototyping Tools - Pencil Project (Open Source)
- Graphic Design and Editing Tools - Canva
- Web Browser - Google Chrome / Mozilla Firefox / Microsoft Edge
- Internet - Required for online collaboration, prototyping, and usability testing activities.

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

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

CO1: Understand UI/UX design principles and design thinking process.

CO2: Apply user research methods to identify user needs and problems.

CO3: Apply UI design principles and patterns for effective interfaces.

CO4: Create wireframes and prototypes using modern design tools.

CO5: Analyze usability and improve UX through testing and iteration.

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp and Jennifer Preece, “Interaction Design: Beyond Human–Computer Interaction”, 6th Edition, Wiley, 2023.
2. Rex Hartson and Pardha Pyla, “The UX Book: Agile UX Design for a Quality User Experience”, 3rd Edition, Morgan Kaufmann, 2025.

REFERENCES:

1. Joel Marsh, “UX for Beginners: A Crash Course in 100 Short Lessons”, O’Reilly, 2022.
2. Steve Krug, “Don’t Make Me Think, Revisited”, 3rd Edition, New Riders, 2014.
3. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist and Nicholas Diakopoulos, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, 6th Edition, Pearson, 2016.
4. Jeff Gothelf and Josh Seiden, “Lean UX: Designing Great Products with Agile Teams”, 3rd Edition, O’Reilly, 2021.

ONLINE RESOURCES:

1. [Ui Ux design tutorial for beginners - Blue Sky Graphics](#)
2. [Beginner’s guide to UI/UX design. A collection of free resources and tips... | by Pooja Sinha | Medium](#)
3. [Free UI/UX Tutorials & Tools: The Learn UI Design Blog](#)
4. [UI / UX Design Tutorial – From Zero to Hero with Wireframe + Prototype + Design in Figma \(freecodecamp.org\)](#)

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	1	1	–	2	3	3
2	2	3	2	2	1	1	–	1	2	1	–	2	3	2
3	2	3	3	2	2	–	–	1	1	1	–	3	3	3
4	2	3	3	2	3	–	–	–	1	1	1	3	3	3
5	2	3	3	3	2	2	–	2	2	2	2	3	3	3
AVG	2.2	2.8	2.4	2.25	1.8	1.5	–	1.3	1.4	1.2	1.5	2.6	3	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 2: FULL STACK DEVELOPMENT
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P07	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of web application security.
- To learn common web vulnerabilities and attacks.
- To study authentication and authorization mechanisms.
- To understand secure coding practices and frameworks.
- To apply security tools and techniques for web protection.

UNIT I – INTRODUCTION

9

Introduction to web application security – Security goals – CIA triad – Types of web attacks – Security architecture – Security policies and standards – OWASP basics.

UNIT II – WEB VULNERABILITIES AND ATTACKS

9

Common vulnerabilities – SQL Injection – Cross-Site Scripting (XSS) – Cross-Site Request Forgery (CSRF) – Session hijacking – File inclusion attacks – Attack vectors and mitigation.

UNIT III – AUTHENTICATION AND AUTHORIZATION

9

Authentication mechanisms – Password security – Multi-factor authentication – Authorization models – Role-based access control (RBAC) – Session management – Secure login systems.

UNIT IV – SECURE WEB DEVELOPMENT PRACTICES

9

Secure coding guidelines – Input validation – Output encoding – Secure APIs – HTTPS and SSL/TLS – Secure cookies – Error handling and logging – Security frameworks.

UNIT V – WEB SECURITY TOOLS AND CASE STUDIES

9

Web security tools – Vulnerability scanners – Penetration testing basics – OWASP ZAP – Burp Suite introduction – Security auditing – Case studies in web attacks – Best practices.

COURSE OUTCOMES:

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

CO1: Understand fundamentals of web application security.

CO2: Identify and analyze common web vulnerabilities.

CO3: Apply authentication and authorization techniques securely.

CO4: Use secure coding practices in web development.

CO5: Apply security tools for testing and improving web application security.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Web Application Security: Exploitation and Countermeasures (2nd Edition) – Andrew Hoffman, O'Reilly Media, 2023.
2. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws (2nd Edition) – Dafydd Stuttard & Marcus Pinto, Wiley, 2022 reprints.

REFERENCE BOOKS

1. Real-World Bug Hunting: A Field Guide to Web Hacking – Peter Yaworski, No Starch Press, 2022.
2. Web Security for Developers – Malcolm McDonald, No Starch Press, 2023.
3. Bulletproof Web Application Security – Bryan Sullivan & Vincent Liu, McGraw Hill, 2021 (latest reprints 2023–2025).
4. OWASP Web Security Testing Guide – OWASP Foundation, 2023 Edition.
5. Secure Coding in Java / Web Applications – Robert C. Second, Addison-Wesley, 2022 updated edition.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	2	–	1	–	2	3	2
2	3	3	2	2	2	1	–	3	1	1	–	3	3	2
3	3	3	3	2	3	1	–	3	1	1	1	3	3	3
4	3	3	3	2	3	–	–	3	1	1	2	3	3	3
5	3	3	3	2	3	1	–	3	1	2	2	3	3	3
AVG	3	2.8	2.4	2	2.4	1	–	2.8	1	1.2	1.6	2.8	3	2.6

1 - low, 2 - medium, 3 - high, '–'- no correlation

(Common TO B.E - CSE & B.TECH.. - IT)

CS24P08	WEB FRAMEWORKS	L	T	P	C
		3	0	0	3

To enable the students

- To understand the fundamentals of web framework.
- To Know the concept of Java web framework.
- To learn the technologies of Python web framework.
- To be exposed to the concepts of Web framework.
- To be familiar with Web framework.

9

Web framework-History-Types of framework architectures-Model-view-controller (MVC) Three-tier organization - Introduction to frameworks-Framework applications -General-purpose website frameworks-Server-side-Client-side-Features.

9

Java Web Frameworks - Struts-The Struts Framework- The Struts Tag Libraries- - Struts Configuration Files- Applying Struts.

9

Introduction to Struts 2 – Configuration and Actions – Result Types – OGNL and Value Stack – Form Handling and Validation – Exception Handling – JavaScript and CSS Basics – Rich Internet Applications.

9

Introduction to Python Frameworks – Web 2.0 Concepts – AJAX and Python – Web Application Frameworks – MVC in Python Frameworks – Common Framework Features.

9

Introduction to TurboGears – Components and MVC Architecture – Creating Web Applications – Introduction to Django – Django Components – MVC Architecture in Django – Developing Simple Django Applications.

After completion of this course, students will be able to:

- CO1: Understand web frameworks, MVC architecture, and framework features.
CO2: Apply Java web frameworks and Struts for web application development.
CO3: Develop web applications using Struts 2 concepts and validation techniques.
CO4: Understand Python web frameworks and MVC concepts.
CO5: Develop simple web applications using TurboGears and Django.

TOTAL :45 PERIODS

TEXT BOOKS

1. Web Frameworks for Python – Gastón C. Hillar, Packt Publishing, 2024.
2. Python Web Development with Django – Jeff Forcier, Paul Bissex & Wesley Chun, Addison-Wesley, 2023.

REFERENCE BOOKS

1. The Definitive Guide to Struts 2 – Daniel Hinojosa et al., Apress, 2018.
2. Two Scoops of Django 3.x – Daniel Roy Greenfeld & Audrey Roy Greenfeld, Two Scoops Press, 2021.
3. TurboGears 2: Rapid Web Application Development – Mark Ramm & Kevin Dangoor, Springer, 2009
4. Professional Java Web Applications – Nicholas S. Williams, Wrox, 2014
Learning Web Design, 6th Edition – Jennifer Robbins, O'Reilly Media, 2025

CO's-PO's & PSO's MAPPING

CO	PO'S											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
2	2	2	3	2	3	–	–	–	1	2	1	3	1	3
3	2	3	3	2	3	–	–	–	1	2	2	3	2	3
4	2	2	2	1	2	–	–	–	1	2	1	2	2	2
5	2	3	3	2	3	–	–	–	1	2	2	3	2	3
Avg.	2.2	2.4	2.4	1.6	2.6	–	–	–	1	2	1.4	2.6	1.6	2.6

1 - low, 2 - medium, 3 - high, – - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P09	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of mobile and application development.
- To learn app development frameworks and tools.
- To study UI/UX design for mobile applications.
- To develop database-driven mobile applications.
- To deploy and test mobile applications on platforms.

UNIT I – INTRODUCTION

9

Introduction to mobile application development – Mobile platforms (Android/iOS basics) – App architecture – Development environments – Overview of app lifecycle – Types of mobile applications.

UNIT II – USER INTERFACE AND DESIGN

9

UI/UX principles – Layout design – Activities and screens – Navigation design – Responsive design – Event handling – User experience improvement techniques.

UNIT III – APPLICATION DEVELOPMENT BASICS

9

App components – Intents – Services – Broadcast receivers – Application states – Background processing – Basic app development workflow.

UNIT IV – DATA STORAGE AND CONNECTIVITY

9

Local storage options – SQLite database – Shared preferences – File handling – Cloud integration basics – API integration – JSON handling.

UNIT V – TESTING AND DEPLOYMENT

9

App testing methods – Debugging techniques – Performance optimization – Security basics in apps – Publishing apps to Play Store/App Store – Maintenance and updates.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand fundamentals of mobile application development.

CO2: Design user-friendly mobile interfaces.

CO3: Develop applications using core app components.

CO4: Implement data storage and API integration.

CO5: Test and deploy mobile applications effectively.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Android Programming: The Big Nerd Ranch Guide (5th Edition) – Bill Phillips, Chris Stewart & Kristin Marsicano, Addison-Wesley, 2022.
2. Head First Android Development (3rd Edition) – Dawn Griffiths & David Griffiths, O'Reilly Media, 2023.

REFERENCE BOOKS

1. Android Cookbook (3rd Edition) – Ian F. Darwin, O'Reilly Media, 2022.
2. Android Security Internals – Nikolay Elenkov, No Starch Press, 2022 reprint.
3. Mobile App Development with Kotlin – Abhinav Singh, Packt Publishing, 2023.
4. Flutter for Cross-Platform Development – Alessandro Biessek, Packt Publishing, 2023.
5. Kotlin for Android Developers – Antonio Leiva, Leanpub, 2023 updated edition.
6. Beginning Android Programming with Kotlin – John Horton, Packt Publishing, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	3
2	2	3	3	1	2	–	–	–	1	1	–	2	3	3
3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
5	3	3	2	3	2	–	–	–	1	1	3	3	2	3
AVG	2.8	2.8	2.4	2	2.2	–	–	–	1	1	2.3	2.6	2.8	3

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common TO B.E - CSE & B.TECH.. - IT)

CS24P10	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the fundamentals of programming language design.
- To learn different programming paradigms.
- To study syntax, semantics, and implementation of languages.
- To compare major programming language features.
- To develop analytical thinking in language selection and usage.

UNIT I – INTRODUCTION

9

Programming language concepts – History and evolution – Role of programming languages – Language design issues – Syntax and semantics – Compilation and interpretation – Programming paradigms overview.

UNIT II – SYNTAX AND SEMANTICS

9

Lexical structure – Context-free grammar – Syntax analysis – Semantics – Binding and scope – Data types – Type checking – Storage management basics.

UNIT III – OBJECT-ORIENTED PROGRAMMING LANGUAGES

9

Object-oriented concepts – Classes and objects – Inheritance – Polymorphism – Encapsulation – Abstraction – Object-oriented language features – Comparison of OOP languages.

UNIT IV – FUNCTIONAL AND LOGIC PROGRAMMING

9

Functional programming concepts – Lambda calculus basics – Recursion – Functional languages overview – Logic programming – Introduction to Prolog – Rule-based programming.

UNIT V – PROGRAMMING PARADIGMS AND LANGUAGE COMPARISON

9

Imperative vs Declarative languages – Structured programming – Event-driven programming – Scripting languages – Comparison of C, C++, Java, Python – Language evaluation criteria – Case studies.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand programming language fundamentals.
- CO2: Analyze syntax and semantic structures.
- CO3: Apply object-oriented concepts in languages.
- CO4: Understand functional and logic programming paradigms.
- CO5: Compare and evaluate different programming languages.

TOTAL: 45 PERIODS

Text Books:

1. Concepts of Programming Languages (12th Edition) – Robert W. Sebesta, Pearson, 2024.
2. Programming Language Pragmatics (5th Edition) – Michael L. Scott, Morgan Kaufmann (Elsevier), 2024–2025.

Reference Books:

1. Types and Programming Languages – Benjamin C. Pierce, MIT Press, 2002.
2. Structure and Interpretation of Computer Programs (2nd Edition) – Harold Abelson and Gerald Jay Sussman, MIT Press, 1996.
3. Programming in Prolog (5th Edition) – William F. Clocksin and Christopher S. Mellish, Springer, 2003.
4. Programming Languages: Principles and Practice (3rd Edition) – Kenneth C. Loudon and Kenneth A. Lambert, Cengage Learning, 2012.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1	–	–	–	1	2	1	2	1	1
2	2	3	2	2	1	–	–	–	1	2	1	2	1	1
3	2	2	3	2	3	–	–	–	1	2	1	3	1	2
4	2	2	2	2	1	–	–	–	1	2	1	2	1	1
5	2	3	2	2	1	–	–	–	1	3	2	2	1	1
Avg	2.2	2.4	2	1.8	1.4	–	–	–	1	2.2	1.2	2.2	1	1.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 2: FULL STACK DEVELOPMENT

(Common TO B.E - CSE & B.TECH.. - IT)

CS24P11	AGILE SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of Agile software development and Scrum.
- To learn how to plan Agile projects using user stories and backlogs.
- To understand how to track and manage Agile project progress.
- To learn Continuous Integration and basic Agile tools and practices.
- To understand Agile testing, quality checking, and scaling methods.

UNIT I AGILE METHODOLOGY

9

History of Agile Software Development – Traditional vs Agile Model – Types of Agile Methods – Agile Manifesto and Principles – Agile Team Roles and Practices – Scrum Framework – Agile Meetings and Ceremonies – Agile Values, Capabilities and Business Benefits.

UNIT II PROJECT PLANNING

9

Agile Estimation & Planning – Agile Requirements – Agile techniques to improve requirements – User Stories – Backlog Management: scrum product backlog – product backlog – Agile Architecture.

UNIT III AGILE PROGRESS TRACKING

9

Tracking Agile Projects: Time tracking agile projects, Tracking agile development project progress. Lean Software Development, Agile model driven development, Agile Risk management.

UNIT IV AGILE METHODS AND CI PRACTICE

9

Agile Project Tools – Enterprise Agility – Dynamic Systems Development Method (DSDM) – Continuous Integration (CI) – CI process and automated builds – Version control and testing in CI – Benefits of CI in Agile development.

UNIT V AGILITY QUALITY ASSURANCE AND TESTING

9

Agile Metrics – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Team Dynamics and Collaboration – Enterprise agile project team – Agile Testing – Scaling Agile for Large Projects – Best Practices for Achieving Agile at Scale.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand Agile methodology, Scrum framework, and Agile principles.
- CO2: Apply Agile planning techniques, user stories, and backlog management.
- CO3: Track Agile project progress and manage risks using Agile practices.
- CO4: Understand Agile tools, CI practices, and enterprise agility concepts.
- CO5: Apply Agile testing, quality assurance, and scaling techniques in projects.

TOTAL: 45 PERIODS

Text Books:

1. Agile Software Development: Principles, Patterns, and Practices (2nd Edition) – Robert C. Martin, Pearson, 2023.
2. A Practical Guide to the Most Popular Agile Process (Updated Print Edition) – Kenneth S. Rubin, Addison-Wesley, 2022.

Reference Books:

1. Agile Estimating and Planning (2nd Edition) – Mike Cohn, Pearson, 2022.
2. Succeeding with Agile: Software Development Using Scrum (Updated Edition) – Mike Cohn, Addison-Wesley, 2021.
3. Scrum: The Art of Doing Twice the Work in Half the Time (Updated Edition) – Jeff Sutherland, Currency/Penguin, 2024.
4. The Art of Agile Development (2nd Edition) – James Shore & Shane Warden, O'Reilly Media, 2021.
5. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation (2nd Edition) – Jez Humble & David Farley, Addison-Wesley, 2020.
6. Agile Practice Guide (Updated Edition) – Project Management Institute (PMI), 2021.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
2	2	3	3	2	3	–	–	–	2	2	1	3	2	3
3	2	3	2	2	3	1	–	–	2	2	2	2	2	2
4	2	2	2	2	3	–	–	–	1	2	1	2	2	2
5	2	3	3	2	3	1	–	–	1	2	2	3	2	3
Avg	2.2	2.6	2.2	1.8	2.8	1	–	–	1.4	2	1.4	2.4	1.8	2.4

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P12	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics and importance of software testing.
- To learn testing techniques and methods.
- To explore automation tools and frameworks.
- To study quality assurance and defect management.
- To develop reliable software using testing practices.

UNIT I INTRODUCTION

9

Introduction to software testing – Need for software testing – Software quality concepts – Verification and validation – Software Development Life Cycle (SDLC) and Software Testing Life Cycle (STLC) – Principles of testing – Types of software testing – Testing process and challenges.

UNIT II FUNCTIONAL AND STRUCTURAL TESTING

9

Black box testing techniques – Equivalence partitioning – Boundary value analysis – Decision table testing – White box testing techniques – Control flow testing – Data flow testing – Path testing – Unit testing and integration testing.

UNIT III SYSTEM TESTING AND TEST MANAGEMENT

9

System testing – Regression testing – Smoke and sanity testing – Performance testing – Load and stress testing – Security testing – Compatibility testing – Test planning – Test case design – Defect lifecycle and bug tracking tools.

UNIT IV AUTOMATION TESTING AND TESTING TOOLS

9

Introduction to test automation – Automation frameworks – Selenium architecture – Web application testing – API testing concepts – Mobile application testing – Continuous testing in DevOps – Test reporting and documentation – CI/CD testing integration.

UNIT V ADVANCED SOFTWARE TESTING CONCEPTS

9

Agile testing – Behavior Driven Development (BDD) – Test Driven Development (TDD) – AI in software testing – Model-based testing – Risk-based testing – Ethical issues in testing – Software quality standards – Future trends in software testing.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand basics of software testing and quality.

CO2: Apply black box and white box testing methods.

CO3: Perform system testing and manage defects.

CO4: Use automation tools for software testing.

CO5: Understand advanced testing methods like Agile, TDD, and BDD.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Software Testing and Quality Assurance: Theory and Practice (3rd Edition) – Kshirasagar Naik & Priyadarshi Tripathy, Wiley, 2023.
2. Foundations of Software Testing: ISTQB Certification (4th Edition) – Rex Black, Dorothy Graham & Erik van Veenendaal, Cengage, 2023.

REFERENCE BOOKS

1. Selenium WebDriver 4 with Java – Boni García, Manning Publications, 2023.
2. Continuous Testing for DevOps Professionals – Eran Kinsbruner, O'Reilly Media, 2022.
3. The Art of Software Testing (4th Edition) – Glenford J. Myers, Wiley, 2023 reprint.
4. Test Automation Engineering Handbook – Andrew Pollner, Packt Publishing, 2022.
5. Clean Code Testing Practices – Robert C. Martin (Uncle Bob), Pearson, 2022 updated edition.
6. Software Testing: Principles and Practices (3rd Edition) – Srinivasan Desikan & Gopalaswamy Ramesh, Pearson, 2022.
7. Agile Testing: A Practical Guide for Testers and Agile Teams (2nd Edition) – Lisa Crispin & Janet Gregory, Addison-Wesley, 2023 reprint.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	2	3
2	3	3	3	2	2	–	–	–	1	1	1	3	3	3
3	3	3	3	2	2	–	–	–	1	1	2	3	3	3
4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
5	3	3	3	2	3	–	–	–	2	2	3	3	3	3
AVG	3	2.8	2.6	2	2.2	–	–	–	1.2	1.2	2	2.8	2.8	3

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 3: SOFTWARE TECHNOLOGIES
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P13	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand software project planning and management concepts.
- To learn project estimation, scheduling, and tracking techniques.
- To study risk management and quality management in software projects.
- To apply project management tools and methodologies.
- To gain knowledge of Agile and traditional project management practices.

UNIT I – INTRODUCTION

9

Software projects – Project life cycle – Project management concepts – Roles of project manager – Process models – Software development methodologies – Traditional vs Agile approaches – Project constraints (scope, time, cost).

UNIT II – PROJECT PLANNING

9

Project planning activities – Work Breakdown Structure (WBS) – Effort estimation techniques – COCOMO model – Function point analysis – Project scheduling – Gantt chart and PERT/CPM – Resource allocation.

UNIT III – PROJECT MONITORING AND RISK MANAGEMENT

9

Project tracking – Earned Value Management (EVM) – Risk management process – Risk identification, analysis, and mitigation – Software quality assurance – Quality metrics – Configuration management.

UNIT IV – AGILE PROJECT MANAGEMENT

9

Agile principles – Scrum framework – Agile planning – User stories – Sprint planning – Agile estimation techniques – Continuous Integration and Continuous Delivery – Agile tools (Jira, Trello).

UNIT V – SOFTWARE QUALITY AND MAINTENANCE

9

Software quality models – CMMI – ISO standards – Software testing strategies – Maintenance types – Software reengineering – Software documentation – Project closure activities.

COURSE OUTCOMES

After completion, students will be able to:

- CO1: Understand software project management concepts.
CO2: Apply estimation and scheduling techniques.
CO3: Manage risks and quality in projects.
CO4: Apply Agile methods in project management.
CO5: Understand software quality and maintenance practices.

TOTAL: 45 PERIODS

Text Books:

1. Software Engineering: A Practitioner's Approach (9th Edition) – Roger S. Pressman and Bruce R. Maxim, McGraw Hill, 2023.
2. Software Project Management (7th Edition) – Bob Hughes, Mike Cotterell and Rajib Mall, McGraw Hill, 2021.

Reference Books:

1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling (13th Edition) – Harold Kerzner, Wiley, 2022.
2. Software Project Management in Practice (3rd Edition) – Pankaj Jalote, Pearson, 2019.
3. Software Engineering (10th Edition) – Ian Sommerville, Pearson, 2023.
4. Agile Estimating and Planning (2nd Edition) – Mike Cohn, Pearson, 2022.
5. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation (2nd Edition) – Jez Humble and David Farley, Addison-Wesley, 2020.
6. Agile Project Management with Scrum (2nd Edition) – Ken Schwaber, Microsoft Press, 2020.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	1	1	2	1	–	–	2	2	2	2	1	1
2	2	3	3	2	3	–	–	–	2	2	2	3	1	1
3	2	3	2	3	3	2	–	–	2	2	2	2	2	1
4	2	2	3	2	3	1	–	–	2	2	2	3	2	2
5	2	3	2	3	3	2	–	–	2	2	2	2	2	1
Avg	2	2.6	2.2	2.2	2.8	1.5	–	–	2	2	2	2.4	1.6	1.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common TO B.E - CSE & B.TECH.. - IT)

IT24P02	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand basics of XML and data representation.
- To learn web services concepts like SOAP, WSDL, and UDDI.
- To understand the basics of Service-Oriented Architecture (SOA).
- To study SOA implementation in J2EE and .NET.
- To understand cloud computing concepts and architecture.

UNIT I XML AND WEB SERVICES 9

XML structure – Elements – Creating Well-formed XML - Name Spaces – Schema Elements, Types, Attributes – XSL Transformations – Parser – Web Services Overview – Architecture.

UNIT II WSDL, SOAP and UDDI 9

WSDL - Overview of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments – UDDI.

UNIT III SOA BASICS 9

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation – Service Layers.

UNIT IV SOA in J2EE and .NET 9

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAXWS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC) – JAX-RS SOA support in .NET – ASP.NET web services.

UNIT V CLOUD COMPUTING 9

Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand XML, web services, and SOA fundamentals.

CO2: Apply WSDL, SOAP, and UDDI in web service communication.

CO3: Understand SOA principles and service-oriented architecture design.

CO4: Apply SOA concepts using J2EE and .NET frameworks.

CO5: Understand cloud computing concepts, architecture, and platforms.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. N. Sudha Bhuvaneswari, S. Sujatha, Integrating SOA and Web Services, CRC Press, 2022.
2. Sanjay Patni, Pro RESTful APIs: Build Java-Based Microservices with REST, JSON and XML, 2nd Edition, Apress, 2023.
3. Thomas Erl, Service-Oriented Architecture: Analysis and Design for Services and Microservices, 2nd Edition, Pearson, 2017.

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, 2013.
2. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services. An Architect’s Guide”, Pearson Education, 2009
3. Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2008.

CO’s-PO’s & PSO’s MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	2	2
2	2	2	3	2	3	–	–	–	1	2	1	3	2	2
3	2	3	2	2	3	–	–	–	1	2	1	3	3	2
4	2	2	3	2	3	–	–	–	1	2	2	3	3	3
5	3	2	1	1	2	–	–	–	1	2	1	2	3	2
Avg	2.4	2.2	2	1.6	2.6	–	–	–	1	2	1.2	2.6	2.6	2.2

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common TO B.E - CSE & B.TECH.. - IT)

CS24P14	AGILE METHODOLOGIES (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

To enable the students

- To understand Agile principles and Agile manifesto.
- To learn Scrum and other Agile frameworks.
- To study Agile planning, estimation, and tracking.
- To understand Agile testing and quality practices.
- To gain practical experience using Agile tools.

UNIT I – INTRODUCTION

6

Agile basics – Agile Manifesto – Principles of Agile – Traditional vs Agile model – Agile methods overview – Agile teams and roles.

UNIT II – SCRUM FRAMEWORK

6

Scrum basics – Scrum roles (Product Owner, Scrum Master, Team) – Scrum events – Sprint planning – Daily stand-up – Sprint review and retrospective – User stories.

UNIT III – AGILE PLANNING AND ESTIMATION

6

Product backlog – Sprint backlog – Agile estimation techniques – Story points – Planning poker – Velocity tracking – Release planning.

UNIT IV – AGILE DEVELOPMENT PRACTICES

6

Agile development process – Continuous Integration (CI) – Test Driven Development (TDD) basics – Agile tools (Jira, Trello, GitHub) – Version control.

UNIT V – AGILE TESTING AND QUALITY

6

Agile testing principles – Test automation – Unit testing – Integration testing – Agile quality assurance – Defects tracking – Agile metrics.

30 PERIODS

LIST OF EXPERIMENTS

30 PERIODS

Mini Project - To implement an Agile mini project, select a simple application and list user requirements. Divide the work into small sprints and develop step by step. Test each part after development and fix errors. Finally, combine all parts, test the full system, and submit the project with report.

- Student Attendance Management System
- Online Assignment Submission System
- Exam Hall Ticket Generation System
- Course Registration System
- Library Book Management System
- Online Shopping Cart System
- Food Delivery App
- E-Commerce Product Listing System
- Online Grocery Ordering System
- Digital Payment Tracking System

SOFTWARE REQUIREMENTS

- Visual Studio / Eclipse
- Web Browser
- Python / Java (for mini project implementation)

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

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

CO1: Understand Agile principles, manifesto, and Agile development models.

CO2: Apply Scrum framework concepts including roles, events, and user stories.

CO3: Perform Agile planning and estimation using product and sprint backlogs.

CO4: Use Agile tools and development practices.

CO5: Apply Agile testing methods and quality practices in software development.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Agile Software Development: Principles, Patterns, and Practices (2nd Edition) – Robert C. Martin, Pearson, 2025.
2. Essential Scrum: A Practical Guide to the Most Popular Agile Process (Updated Print Edition) – Kenneth S. Rubin, Addison-Wesley, 2022.

REFERENCE BOOKS

1. Agile Project Management with Scrum (2nd Edition) – Ken Schwaber, Microsoft Press, 2025.
2. Agile Estimating and Planning (2nd Edition) – Mike Cohn, Pearson, 2022.
3. Succeeding with Agile: Software Development Using Scrum (Updated Edition) – Mike Cohn, Addison-Wesley, 2021.
4. The Art of Agile Development (2nd Edition) – James Shore & Shane Warden, O'Reilly Media, 2021.
5. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation (2nd Edition) – Jez Humble & David Farley, Addison-Wesley, 2020.
6. Agile Practice Guide (Updated Edition) – Project Management Institute (PMI), 2021.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
2	2	3	3	2	3	–	–	–	2	2	1	3	2	3
3	2	3	3	2	3	–	–	–	2	2	1	3	2	3
4	2	2	2	2	3	–	–	–	1	2	2	2	2	2
5	2	3	2	2	3	1	–	–	1	2	2	3	2	3
Avg	2.2	2.6	2.2	1.8	2.8	1	–	–	1.4	2	1.4	2.6	1.8	2.6

1 - low, 2 - medium, 3 - high, “–” - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 3: SOFTWARE TECHNOLOGIES
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P15	HUMAN- COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand basic concepts of Human–Computer Interaction.
- To learn how human behavior influences interface design.
- To study design principles for effective and usable user interfaces.
- To understand usability evaluation techniques.
- To explore modern and advanced HCI applications.

UNIT I – INTRODUCTION

9

Introduction to Human–Computer Interaction – Definition and scope – Importance of HCI in software systems – Components of interaction – Human and computer interaction models – Types of users – User experience (UX) basics – Goals of HCI – Evolution of interfaces.

UNIT II – USER INTERFACE DESIGN

9

User Interface (UI) design principles – Design guidelines and standards – Screen design principles – Menu design and navigation – Form design and layout – Interaction styles (command line, GUI, touch, voice) – Prototyping techniques – Wireframes and mockups – Design consistency.

UNIT III – HUMAN FACTORS

9

Human cognitive processes – Perception and attention – Memory types and limitations – Learning and skill acquisition – Motor skills and physical interaction – Psychological factors in interface design – User behavior and mental models – Impact of human limitations on system design.

UNIT IV – USABILITY AND EVALUATION

9

Usability definition and importance – Usability goals and principles – Usability metrics – Heuristic evaluation – Cognitive walkthrough – User testing methods – Surveys and feedback collection – Accessibility standards – Error analysis and improvement techniques.

UNIT V – ADVANCED HCI CONCEPTS

9

Mobile user interfaces – Web usability principles – Multimedia interaction – Introduction to virtual and augmented reality – Adaptive and intelligent interfaces – Natural user interfaces (gesture, voice) – Emerging trends in HCI – Future of human–computer interaction.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand the basic concepts and importance of Human–Computer Interaction.
CO2: Apply UI design principles to develop effective user interfaces.
CO3: Analyze human cognitive and physical factors in system design.
CO4: Evaluate usability using standard methods and techniques.
CO5: Understand advanced HCI technologies and emerging trends.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Human–Computer Interaction (4th Edition) – Alan Dix, Janet Finlay, Gregory D. Abowd & Russell Beale, Pearson, 2025.
2. Designing the User Interface: Strategies for Effective Human–Computer Interaction (6th Edition) – Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs & Niklas Elmqvist, Pearson, 2025.

REFERENCE BOOKS

1. About Face: The Essentials of Interaction Design (4th Edition) – Alan Cooper, Robert Reimann, David Cronin & Christopher Noessel, Wiley, 2014.
2. Don't Make Me Think, Revisited – Steve Krug, New Riders, 2014.
3. Universal Principles of Design (Revised & Updated Edition) – William Lidwell, Kritina Holden & Jill Butler, Rockport Publishers, 2010.
4. The Design of Everyday Things (Revised & Expanded Edition) – Don Norman, Basic Books, 2013.
5. UX for Beginners – Joel Marsh, O'Reilly Media, 2020.
6. Interaction Design: Beyond Human–Computer Interaction (6th Edition) – Helen Sharp, Yvonne Rogers & Jenny Preece, Wiley, 2025.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	1	2	–	–	–	1	2	1	2	1	2
CO2	2	2	3	2	3	–	–	–	1	2	1	3	2	3
CO3	2	3	2	3	2	–	–	–	1	2	1	2	2	1
CO4	2	3	2	3	3	1	–	1	2	2	2	2	2	1
CO5	2	2	1	1	2	–	–	–	1	2	1	2	2	2
AVG	2.2	2.4	1.8	2	2.4	1	–	1	1.2	2	1.2	2.2	1.8	1.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common TO B.E - CSE & B.TECH.. - IT)

CS24P16	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand the basics of software quality and quality assurance.
- To learn software quality models and standards.
- To study software testing strategies and techniques.
- To understand quality planning and control activities.
- To apply quality assurance practices in software development.

UNIT I – INTRODUCTION

9

Software quality concepts – Need for Software Quality Assurance – Quality attributes – Software quality factors – Quality control vs Quality assurance – Software development life cycle and quality – Quality culture in organizations.

UNIT II – SOFTWARE QUALITY MODELS AND STANDARDS

9

Software quality models – ISO 9000 standards – CMM and CMMI models – Six Sigma basics – Software process improvement – Quality frameworks – Software audits and reviews.

UNIT III – SOFTWARE TESTING FUNDAMENTALS

9

Introduction to software testing – Testing principles – Levels of testing (unit, integration, system, acceptance) – Black box and white box testing – Test case design techniques – Test planning and documentation.

UNIT IV – ADVANCED TESTING TECHNIQUES

9

Regression testing – Smoke and sanity testing – Performance testing – Load and stress testing – Automated testing tools – Defect tracking – Bug life cycle.

UNIT V – QUALITY ASSURANCE

9

Quality planning – Quality metrics – Software inspections and walkthroughs – Configuration management – Risk management – Continuous quality improvement – Agile quality assurance practices.

COURSE OUTCOMES

After completion of this course, students will be able to:

CO1: Understand software quality concepts and importance of SQA.

CO2: Apply software quality models and standards in projects.

CO3: Design effective test cases and testing strategies.

CO4: Perform advanced testing techniques and defect management.

CO5: Apply quality assurance practices in software development lifecycle.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Software Quality: Concepts and Practice (3rd Edition) – Nina S. Godbole & S. C. Sharma, Wiley, 2021.
2. Software Testing: Principles and Practices (3rd Edition) – Srinivasan Desikan & Gopalaswamy Ramesh, Pearson, 2025.

REFERENCE BOOKS

1. Software Engineering: A Practitioner's Approach (9th Edition) – Roger S. Pressman & Bruce R. Maxim, McGraw Hill, 2023.
2. Software Testing and Continuous Quality Improvement – William E. Perry, Wiley, 2018.
3. CMMI for Development: Guidelines for Process Integration and Product Improvement (3rd Edition) – Mary Beth Chrissis, Mike Konrad & Sandy Shrum, Addison-Wesley, 2011.
4. The Art of Software Testing (3rd Edition) – Glenford J. Myers, Corey Sandler & Tom Badgett, Wiley, 2011.
5. Agile Testing: A Practical Guide for Testers and Agile Teams – Lisa Crispin & Janet Gregory, Addison-Wesley, 2009.
6. Foundations of Software Testing (4th Edition) – Rex Black, Erik van Veenendaal & Dorothy Graham, Cengage, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	1	2	2	–	–	–	1	2	1	2	1	1
2	2	3	2	3	2	1	–	–	1	2	1	2	2	1
3	2	3	3	2	3	–	–	–	1	2	1	3	2	1
4	2	3	3	3	3	1	–	–	1	2	2	3	2	1
5	2	3	2	3	3	2	–	–	2	2	2	3	2	1
Av g	2	2.8	2.2	2.6	2.6	1.3	–	–	1.2	2	1.4	2.6	1.8	1

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common TO B.E - CSE & B.TECH.. - IT)

IT24P03	INFORMATION STORAGE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of storage systems and data management.
- To learn RAID and storage architectures.
- To study storage networking technologies like SAN and NAS.
- To understand backup, recovery, and business continuity concepts.
- To learn replication and virtualization techniques in storage systems.

UNIT I – STORAGE SYSTEMS

9

Introduction to Information Storage and Management – Evolution of Storage Technologies – Data Center Infrastructure – Information Lifecycle Management – RAID Concepts – RAID Levels – RAID Components – Intelligent Storage Systems – Storage Arrays.

UNIT II – STORAGE NETWORKING TECHNOLOGIES

9

Direct-Attached Storage (DAS) – Disk Interfaces – SCSI Basics – Storage Area Networks (SAN) – SAN Components – Fibre Channel Architecture – SAN Topologies – Zoning – Network Attached Storage (NAS) – NAS Components and Protocols.

UNIT III – ADVANCED STORAGE TECHNOLOGIES

9

IP SAN – iSCSI – FCIP – Content Addressed Storage (CAS) – Object Storage Concepts – Storage Virtualization – Types of Virtualization – Storage Architectures – Challenges in Storage Virtualization.

UNIT IV – BUSINESS CONTINUITY

9

Business Continuity Concepts – BC Planning Lifecycle – Failure Analysis – Business Impact Analysis – Backup Methods – Backup Technologies – Backup Topologies – Restore and Recovery Operations.

UNIT V – REPLICATION TECHNOLOGIES

9

Data Replication Concepts – Local Replication – Remote Replication – Synchronous and Asynchronous Replication – Data Consistency Models – Disaster Recovery Concepts and Strategies.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand fundamentals of storage systems and RAID technology.
CO2: Explain storage networking technologies such as DAS, SAN, and NAS.
CO3: Understand advanced storage technologies including virtualization and CAS.
CO4: Apply backup and business continuity planning techniques.
CO5: Understand data replication and disaster recovery methods.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments (2nd Edition) – EMC Education Services, Wiley, 2025.
2. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI and FCoE (2nd Edition) – Ulf Troppens, Rainer Erkens, Wolfgang Müller-Friedt & Rainer Wolafka, Wiley, 2025.

REFERENCE BOOKS

1. Designing Data-Intensive Applications – Martin Kleppmann, O'Reilly Media, 2017.
2. Storage Area Networks for Dummies (3rd Edition) – Christopher Poelker & Alex Nikitin, Wiley, 2010.
3. Cloud Storage Concepts, Technology and Architecture – Thomas Erl, Pearson, 2018.
4. Data Center Handbook (2nd Edition) – Hwaiyu Geng, Wiley, 2015.
5. Cloud Data Management: Technologies and Techniques – Fei Hu, CRC Press, 2018.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	2	1
2	2	2	2	2	2	–	–	–	1	2	1	2	2	1
3	2	2	2	2	2	–	–	–	1	2	1	3	2	1
4	2	3	2	3	3	2	–	–	1	2	2	2	2	1
5	2	3	2	3	3	2	–	–	1	2	2	2	2	1
Avg	2.2	2.4	1.8	2.2	2.4	2	–	–	1	2	1.4	2.2	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 3: SOFTWARE TECHNOLOGIES

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P17	GAME DEVELOPMENT (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of game development and design.
- To learn game design, graphics, and animation techniques.
- To explore game programming and physics using game engines.
- To study AI and multiplayer concepts in games.
- To develop 2D and 3D games for real-world platforms.

UNIT I INTRODUCTION TO GAME DEVELOPMENT

6

Introduction to game development – History and evolution of games – Types of games – Game development lifecycle – Game design concepts – Storyboarding and character design – User interaction in games – Overview of game engines – Applications of gaming technology.

UNIT II GAME GRAPHICS AND ANIMATION

6

2D and 3D graphics fundamentals – Coordinate systems – Rendering techniques – Sprites and textures – Animation principles – Audio integration – Lighting and shading – Scene management – Asset creation and optimization.

UNIT III GAME PROGRAMMING AND PHYSICS

6

Game programming concepts – Event handling – Collision detection – Physics engines – Character movement – Artificial intelligence in games – Pathfinding algorithms – Game controls and input handling – Score and level management.

UNIT IV ADVANCED GAME DEVELOPMENT TECHNIQUES

6

Multiplayer game concepts – Networking in games – Mobile game development – Virtual Reality and Augmented Reality gaming – Procedural content generation – Game testing and debugging – Performance optimization – Cloud gaming concepts.

UNIT V GAME PUBLISHING AND FUTURE TRENDS

6

Game deployment and publishing – Monetization strategies – Ethics in gaming – Accessibility in games – Serious games and educational games – Esports and online gaming – AI-driven game development – Future trends in gaming technologies.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Design of game storyboards and characters.
2. 2D game development basics.
3. Sprite animation and audio integration.
4. Collision detection and game physics implementation.
5. Character movement and game controls.
6. Development of simple multiplayer game modules.
7. Mobile game interface development.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Programming Languages and SDKs - Python (Optional scripting support)
- IDE and Code Editors - Visual Studio
- Graphics and Animation Tools - Blender
- Mobile Game Development Tools - Android Studio
- Web Browser - Google Chrome / Mozilla Firefox / Microsoft Edge

HARDWARE: Standalone desktops – 30

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand fundamentals of game development and game design concepts.

CO2: Apply graphics and animation techniques in game development.

CO3: Use game programming concepts including physics and AI.

CO4: Apply advanced game development techniques like networking and VR/AR.

CO5: Understand game publishing, monetization, and future trends.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. V. Saritha, P. Venkata Krishna, N. Padmaja and B. Muni Lakshmi, “Game Design”, 1st Edition, S.K. Kataria and Sons, 2025.
2. “Game Development using Unity and C#”, BPB Publications, 2021.

REFERENCES:

1. Dr. K. S. R. Anjaneyulu, “Introduction to Game Programming with Unity”, S. Chand Publications, 2018.
2. Nikhil Malankar, “Mobile Game Development Concepts”, Packt Publishing India, 2017.
3. Sheikh Sohel Moon, “Game Development Concepts in C++”, Apress, 2025.
4. Marijo Trkulja, “Godot 3D Game Development”, BPB Publications, 2022.
5. Rajesh Kannan et al., “Modern Computer Graphics and Game Engine Design”, Springer India Edited Volumes, 2020–2024.
6. “Advanced Game Programming Techniques”, BPB Publications, 2019–2023.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	3
2	3	3	3	2	3	–	–	–	1	1	–	3	3	3
3	3	3	3	2	3	–	–	–	1	1	–	3	3	3
4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
5	2	3	2	1	1	2	–	–	1	2	2	2	3	3
AVG	2.8	2.8	2.4	1.7	2.2	2	–	–	1	1.2	2	2.6	3	3

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P18	CLOUD SERVICES MANAGEMENT (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of cloud computing and service management.
- To learn cloud service models and deployment strategies.
- To study cloud infrastructure management and virtualization.
- To understand cloud security and monitoring techniques.
- To gain knowledge of cloud governance and service optimization.

UNIT I – INTRODUCTION TO CLOUD COMPUTING

6

Cloud computing basics – Characteristics and benefits – Service models (IaaS, PaaS, SaaS) – Deployment models – Cloud architecture – Virtualization concepts – Cloud service providers overview.

UNIT II – CLOUD SERVICE MANAGEMENT

6

Cloud service lifecycle – Service provisioning and orchestration – Resource management – SLA (Service Level Agreement) – Cloud pricing models – Cloud governance basics.

UNIT III – CLOUD INFRASTRUCTURE MANAGEMENT

6

Virtual machines and containers – Storage and networking in cloud – Load balancing – Scalability and elasticity – Infrastructure monitoring – Automation basics.

UNIT IV – CLOUD SECURITY AND MONITORING

6

Cloud security fundamentals – Identity and access management (IAM) – Data security and encryption – Threats in cloud environments – Monitoring tools – Logging and auditing.

UNIT V – CLOUD OPTIMIZATION AND CASE STUDIES

6

Performance optimization – Cost optimization strategies – Cloud migration – Hybrid cloud management – Best practices – Real-world cloud case studies – Future trends.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Create and configure a cloud account (AWS/Azure/GCP) and explore the management console.
2. Create and manage virtual machines (VMs) and connect using remote access tools.
3. Configure storage services (create buckets/containers, upload and manage files).
4. Implement Identity and Access Management (IAM) by creating users, roles, and policies.
5. Set up a virtual network (VPC/VNet) with subnets and security groups.
6. Configure monitoring and logging services (CloudWatch/Azure Monitor) for resources.
7. Deploy a simple web application on the cloud and perform scaling and load testing.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Web Browser- Google Chrome / Mozilla Firefox / Microsoft Edge
- AWS Account -Valid AWS Free Tier account

- SSH Client - PuTTY (for Windows) or OpenSSH terminal (Linux/Mac)
- Text Editor / IDE - Visual Studio Code / Notepad++
- Programming Support - Python 3.x or Node.js runtime
- Database Client Tools - MySQL Workbench / pgAdmin

HARDWARE: Standalone desktops – 30 Nos.

COURSE OUTCOMES:

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

CO1: Understand fundamentals of cloud computing and services.

CO2: Manage cloud service lifecycle and resources.

CO3: Apply infrastructure management techniques in cloud.

CO4: Ensure cloud security and monitoring practices.

CO5: Optimize cloud performance and analyze real-world applications.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Cloud Computing: Concepts, Technology & Architecture (2nd Edition) – Thomas Erl, Ricardo Puttini & Zaigham Mahmood, Pearson, 2018 (latest reprints 2023–2025).
2. Cloud Computing Bible (2nd Edition) – Barrie Sosinsky, Wiley, 2023 reprint edition.

REFERENCE BOOKS

1. AWS Certified Solutions Architect Study Guide (SAA-C03) – Ben Piper & David Clinton, Wiley, 2024.
2. Google Cloud Platform in Action – John McCool, Manning Publications, 2022.
3. Azure for Architects – Ritesh Modi, Packt Publishing, 2023.
4. Site Reliability Engineering – Google SRE Team, O'Reilly, 2023 reprint.
5. Terraform: Up & Running (3rd Edition) – Yevgeniy Brikman, O'Reilly, 2022.
6. Architecting Cloud Computing Solutions (2nd Edition) – Kevin L. Jackson & Scott Goessling, Packt Publishing, 2022.
7. Cloud Native Infrastructure – Justin Garrison & Kris Nova, O'Reilly Media, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
2	3	3	3	2	3	–	1	–	1	1	2	3	3	3
3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
4	3	3	3	2	3	2	2	3	1	1	2	3	3	3
5	3	3	3	2	3	2	2	1	1	2	3	3	3	3
AVG	3	2.8	2.6	2	2.6	2	1.6	2	1	1.2	2.2	2.8	3	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P19	DATA WAREHOUSING (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand fundamentals of data warehousing concepts.
- To learn data warehouse architecture and design.
- To study ETL process and data integration techniques.
- To understand OLAP operations and multidimensional data models.
- To apply data warehousing in business intelligence applications.

UNIT I – INTRODUCTION

6

Introduction to data warehousing – Need and characteristics – Difference between OLTP and OLAP – Data warehouse lifecycle – Data marts – Applications of data warehousing.

UNIT II – DATA WAREHOUSE ARCHITECTURE

6

Data warehouse architecture – Components – Metadata – Types of architecture (3-tier, 2-tier) – Schema design – Star schema – Snowflake schema – Fact and dimension tables.

UNIT III – ETL AND DATA INTEGRATION

6

ETL process – Extraction, transformation, loading – Data cleaning – Data integration techniques – Data quality management – Tools used in ETL – Challenges in data integration.

UNIT IV – OLAP AND MULTIDIMENSIONAL MODELS

6

Multidimensional data model – OLAP concepts – OLAP operations (roll-up, drill-down, slice, dice, pivot) – MOLAP, ROLAP, HOLAP – Data cubes – Aggregations.

UNIT V – BUSINESS INTELLIGENCE AND APPLICATIONS

6

Business intelligence basics – Data mining and warehousing integration – Reporting tools – Dashboards – Data visualization – Real-world applications – Future trends in data warehousing.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Perform data validation using the WEKA tool.
2. Design the architecture for real-time applications.
3. Develop queries for specifying database schema structures.
4. Develop a data warehouse for real-time application scenarios.
5. Analyze and implement dimensional modeling techniques.
6. Execute testing and validation of the data warehouse.
7. Develop and manage metadata, backup, and recovery operations for a sample data warehouse system.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

SOFTWARE:

- Data Mining and Analytics Tools - WEKA
- Programming and Scripting Support - Python 3.x , MS Office

- Web Browser - Google Chrome / Mozilla Firefox / Microsoft Edge

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of data warehousing.

CO2: Analyze data warehouse architecture and schema design.

CO3: Apply ETL and data integration techniques in data warehousing.

CO4: Evaluate OLAP operations and multidimensional data models.

CO5: Create business intelligence solutions using data warehousing concepts.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Data Mining: Concepts and Techniques (4th Edition) – Jiawei Han, Micheline Kamber & Jian Pei, Morgan Kaufmann, 2022.
2. Data Warehousing Fundamentals for IT Professionals (2nd Edition) – Paulraj Ponniah, Wiley, 2023.

REFERENCE BOOKS

1. Fundamentals of Data Warehouses and Business Intelligence – Matthias Jarke et al., Springer, 2023.
2. Business Intelligence Guidebook – Rick Sherman, Morgan Kaufmann, 2022.
3. ETL with Python – Ofer Mendeleevitch, O'Reilly Media, 2023.
4. Data Visualization: Principles and Practice – Alexandru C. Telea, CRC Press, 2022.
5. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling (3rd Edition) – Ralph Kimball & Margy Ross, Wiley, 2023 reprint.
6. Data Warehousing in the Age of Big Data – Krish Krishnan, Morgan Kaufmann, 2022.
7. Building the Data Warehouse (5th Edition) – William H. Inmon, Wiley, 2022 reprint edition.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	2
2	3	3	3	2	2	–	–	–	1	1	2	3	3	2
3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
4	3	3	2	2	3	–	–	–	1	1	1	3	3	2
5	3	3	3	2	3	1	–	–	2	2	3	3	3	3
AVG	3	2.8	2.4	2	2.4	1	–	–	1.2	1.2	2	2.8	3	2.4

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to: AI&DS, CSE, ECE, & IT)

IT24P04	SOFTWARE DEFINED NETWORKS (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand programmable networking concepts.
- Analyze SDN architecture and protocols.
- Learn controller design and SDN programming.
- Explore virtualization and cloud integration.
- Study security and future networking paradigms.

UNIT 1 EVOLUTION OF NETWORK ARCHITECTURE

6

Traditional network design and operational challenges - Evolution of networking: legacy networks to programmable networks - Control plane vs data plane separation - SDN ecosystem and stakeholders - Benefits and challenges of SDN deployment

UNIT 2 SDN ARCHITECTURE AND COMPONENTS

6

Three-layer SDN architecture - Flow tables and packet forwarding mechanisms - OpenFlow protocol architecture and message types - Southbound interfaces and communication protocols - Northbound APIs and application interfaces - East–West interfaces for controller

UNIT 3 SDN CONTROLLERS AND PROGRAMMING

6

Centralized vs distributed controllers - Controller platforms - ONOS - and Floodlight - Network application development - REST APIs for SDN controllers - SDN programming languages and frameworks - Debugging and testing SDN applications.

UNIT 4 VIRTUALIZATION AND DATA CENTRE NETWORKING

6

Fundamentals of network virtualization - Virtual switches and virtual network functions - SDN integration with cloud computing platforms - Data center networking architecture - Network function virtualization concepts - Quality of Service (QoS) in SDN-based networks

UNIT 5 SECURITY AND EMERGING TRENDS IN SDN

6

Security architecture in SDN environments - Threat models in programmable networks - SDN for Internet of Things networks - SDN in 5G and next-generation networks - Intent-based networking concepts - Artificial intelligence and machine learning in network management.

30 PERIODS

LIST OF EXPERIMENTS:**30 PERIODS**

1. Study and installation of Software Defined Networking simulation environment.
2. Using Mininet and Open v Switch.
 - a. Create a simple network topology with hosts and switches.
 - b. Verify connectivity between hosts using ping commands.
 - c. Observe packet flow in the virtual network.
3. Configure a basic SDN topology using Mininet and analyze communication between hosts through OpenFlow switches.
4. Implement a simple SDN controller application to manage network flows using a controller platform such as Ryu / Floodlight.
5. Demonstrate OpenFlow protocol operations by capturing and analyzing OpenFlow messages between controller and switches.
6. Implement network topology discovery and visualize the topology using controller tools or REST APIs.
7. Develop a simple SDN application to perform packet forwarding and flow rule installation dynamically.
8. Implement traffic monitoring in SDN using controller APIs to collect network statistics (bandwidth, packet count, flow count).
9. Configure load balancing in an SDN network using controller-based flow management.
10. Implement network virtualization using virtual switches and overlay networking concepts.
11. Study and implement Quality of Service (QoS) in SDN by prioritizing selected network traffic flows.
12. Implement basic security policies in SDN by blocking or redirecting suspicious traffic using controller rules.
13. Study SDN integration with cloud environments and demonstrate virtual network creation in a simulated data center environment.

TOTAL: 60 PERIODS**COURSE OUTCOMES:****At the end of this course, the students will be able to:**

- CO1:** Explain the evolution and principles of SDN architecture.
CO2: Analyze SDN components and communication interfaces.
CO3: Develop and manage applications using SDN controllers.
CO4: Evaluate virtualization and cloud-based networking solutions.
CO5: Identify security challenges and emerging technologies in SDN.

TEXT BOOKS:

1. Thomas D. Nadeau and Ken Gray, “SDN: Software Defined Networks – An Authoritative Review of Network Programmability”, O'Reilly Media.
2. Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann.

REFERENCES:

1. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, CRC Press.
2. Oswald Coker, “Mastering Software Defined Networking”, Packt Publishing.
3. Brandon Heller and Rob Sherwood, “The SDN Handbook”, CreateSpace.
4. Nick Feamster, Jennifer Rexford, and Ellen Zegura, “The Road to SDN: An Intellectual History of Programmable Networks”, **Association for Computing Machinery.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	1	-	-	-	-	2	-	1	1	-	1
CO2	3	3	2	1	3	-	-	1	2	-	3	2	1	3
CO3	3	3	3	3	3	1	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	3	3	2	3	2	3	2	3	3
Avg	2.60	2.60	2.75	2.20	3.00	2.33	3.00	2.25	2.60	2.67	2.60	2.20	2.50	2.60

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P20	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of data storage systems.
- To learn storage architectures and RAID concepts.
- To study storage networking technologies like SAN and NAS.
- To understand backup, recovery, and replication techniques.
- To explore advanced storage and virtualization technologies.

UNIT I – STORAGE SYSTEM BASICS

9

Introduction to storage technologies – Data storage evolution – Types of storage devices – Storage media – RAID concepts – RAID levels – Storage system components.

UNIT II – STORAGE NETWORKING

9

Direct Attached Storage (DAS) – Storage Area Network (SAN) – Network Attached Storage (NAS) – Fibre Channel basics – SAN architecture – Topologies and components – Zoning concepts.

UNIT III – ADVANCED STORAGE TECHNOLOGIES

9

IP SAN – iSCSI and FCIP – Object storage – Content Addressed Storage (CAS) – Storage virtualization – Types of virtualization – Cloud storage basics.

UNIT IV – DATA PROTECTION AND BACKUP

9

Backup concepts – Backup methods – Full, incremental, differential backups – Backup storage devices – Recovery techniques – Disaster recovery basics – Data protection strategies.

UNIT V – REPLICATION AND STORAGE MANAGEMENT

9

Data replication concepts – Local and remote replication – Synchronous and asynchronous replication – Storage management tools – Performance monitoring – Storage optimization techniques.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of storage technologies and systems.
CO2: Analyze storage networking architectures like SAN and NAS.
CO3: Apply advanced storage and virtualization technologies.
CO4: Evaluate backup and disaster recovery strategies.
CO5: Create efficient storage management and replication solutions.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Information Storage and Management (2nd Edition) – EMC Education Services, Wiley, 2018.
2. Cloud Storage Concepts, Technology and Architecture – Thomas Erl, Pearson, 2022.
3. Data Center Handbook (2nd Edition) – Hwaiyu Geng, Wiley, 2023.

REFERENCE BOOKS

1. Designing Data-Intensive Applications – Martin Kleppmann, O'Reilly Media, 2022 reprint.
2. Storage Area Networks for Dummies (3rd Edition) – Christopher Poelker & Alex Nikitin, Wiley, 2023 reprint.
3. Cloud Computing and Storage Systems – Kai Hwang, Morgan Kaufmann, 2022.
4. Data Storage Networking: Technologies and Applications – Marc Farley, Cisco Press, 2023.
5. Disaster Recovery and Backup Solutions – W. Curtis Preston, O'Reilly, 2022.
6. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI and FCoE (2nd Edition) – Ulf Troppens et al., Wiley, 2019.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
2	3	3	3	2	2	–	2	–	1	1	2	3	3	2
3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
4	3	3	3	2	2	2	2	–	1	1	2	3	3	2
5	3	3	3	2	3	1	2	–	1	1	3	3	3	3
AVG	3	2.8	2.6	2	2.2	1.5	1.8	–	1	1	2.2	2.8	3	2.4

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P21	VIRTUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand fundamentals of virtualization technology.
- To learn different types of virtualization and architectures.
- To study hypervisors and virtual machine management.
- To understand cloud and server virtualization concepts.
- To explore virtualization security and performance optimization.

UNIT I – INTRODUCTION

9

Introduction to virtualization – Need and benefits – Traditional vs virtualized systems – Types of virtualization – Overview of virtual machines – Virtualization in cloud computing.

UNIT II – HYPERVISORS AND VM ARCHITECTURE

9

Hypervisors – Type 1 and Type 2 hypervisors – Virtual machine architecture – Virtual machine lifecycle – VM creation and management – Virtualization platforms overview.

UNIT III – SERVER VIRTUALIZATION

9

Server virtualization concepts – Resource pooling – Load balancing – Server consolidation – Virtual servers – Data center virtualization – Case studies.

UNIT IV – STORAGE AND NETWORK VIRTUALIZATION

9

Storage virtualization – Network virtualization – Virtual LANs (VLANs) – Software Defined Networking (SDN) basics – Virtual storage systems – Cloud integration.

UNIT V – CLOUD AND ADVANCED VIRTUALIZATION

9

Virtualization in cloud computing – Desktop virtualization – Application virtualization – Containerization basics – Security in virtual environments – Performance optimization techniques.

COURSE OUTCOMES:

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

- CO1: Understand fundamentals of virtualization technology.
CO2: Analyze hypervisors and virtual machine architectures.
CO3: Apply server, storage, and network virtualization concepts.
CO4: Evaluate virtualization in cloud computing environments.
CO5: Create optimized and secure virtualized systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Virtualization Essentials (3rd Edition) – Matthew Portnoy, Sybex (Wiley), 2022.
2. Data Centre Virtualisation Fundamentals – Gustavo A. A. Santana, Cisco Press, 2022.

REFERENCE BOOKS

1. The VMware Certified Professional Official Guide (VCP-DCV 2023) – VMware Press, 2023.
2. Virtualization Technology: From Server to Cloud – Chris Wolf & Erick M. Halter, 2022 reprint.
3. Cloud Native Infrastructure – Justin Garrison & Kris Nova, O'Reilly Media, 2022.
4. Kubernetes: Up & Running (3rd Edition) – Brendan Burns et al., O'Reilly Media, 2022.
5. Mastering VMware vSphere (8th Edition) – Nick Marshall & Scott Lowe, Wiley, 2023.
6. Cloud Virtualization: Concepts, Management and Design – Kumar Saurabh, Wiley, 2023 reprint edition.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
2	3	3	3	2	2	–	1	–	1	1	2	3	3	2
3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
4	3	3	3	2	3	1	3	–	1	1	2	3	3	3
5	3	3	3	2	3	2	3	3	1	1	3	3	3	3
AVG	3	2.8	2.6	2	2.4	1.5	2	3	1	1	2.2	2.8	3	2.6

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P22	STREAM PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of stream processing systems.
- To learn real-time data processing concepts.
- To study stream data models and architectures.
- To understand tools and frameworks for stream processing.
- To apply stream processing in real-world applications.

UNIT I – INTRODUCTION

9

Introduction to stream processing – Need for real-time data processing – Batch vs stream processing – Characteristics of data streams – Applications of stream processing.

UNIT II – STREAM DATA MODELS

9

Stream data types – Data stream management systems – Windowing concepts – Time-based and count-based windows – Stream queries – Continuous query processing.

UNIT III – STREAM PROCESSING ARCHITECTURE

9

Architecture of stream processing systems – Data ingestion – Event-driven architecture – Message queues – Distributed stream processing – Scalability concepts.

UNIT IV – STREAM PROCESSING FRAMEWORKS

9

Introduction to tools – Apache Kafka – Apache Flink – Apache Spark Streaming – Storm basics – Stream processing pipelines – Fault tolerance mechanisms.

UNIT V – APPLICATIONS OF STREAM PROCESSING

9

Real-time analytics – IoT data processing – Fraud detection systems – Social media analytics – Monitoring systems – Case studies in industry applications.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of stream processing systems.
CO2: Analyze stream data models and windowing techniques.
CO3: Apply stream processing architecture concepts.
CO4: Evaluate stream processing frameworks and tools.
CO5: Create real-time data processing applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing – Tyler Akidau, Slava Chernyak & Reuven Lax, O'Reilly Media, 2023 reprint edition.
2. Stream Processing with Apache Flink – Fabian Hueske & Vasiliki Kalavri, O'Reilly Media, 2023.

REFERENCE BOOKS

1. Kafka Streams in Action – Bill Bejeck, Manning Publications, 2022.
2. Real-Time Analytics with Apache Storm – Brad Hedlund, Packt Publishing, 2022.
3. Big Data: Principles and Best Practices of Scalable Real-Time Systems – Nathan Marz & James Warren, Manning, 2023 reprint.
4. Designing Data-Intensive Applications (2nd Edition reprints) – Martin Kleppmann, O'Reilly Media, 2022–2025.
5. Learning Spark: Lightning-Fast Data Analytics (2nd Edition) – Jules S. Damji et al., O'Reilly Media, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
2	3	3	2	2	2	–	1	–	1	1	–	3	3	2
3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
4	3	3	3	2	3	–	2	–	1	1	2	3	3	3
5	3	3	3	2	3	1	2	–	2	2	3	3	3	3
AVG	3	2.8	2.4	2	2.4	1	1.6	–	1.2	1.2	2.3	2.8	3	2.6

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P23	CLOUD AUTOMATION TOOLS AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand cloud computing fundamentals and automation concepts.
- To learn cloud deployment and management tools.
- To study infrastructure as code and automation frameworks.
- To understand containerization and orchestration tools.
- To gain knowledge of real-world cloud automation applications.

UNIT I – INTRODUCTION TO CLOUD COMPUTING 9

Cloud computing basics – Characteristics and benefits – Service models (IaaS, PaaS, SaaS) – Deployment models – Virtualization concepts – Cloud architecture – Overview of cloud platforms.

UNIT II – CLOUD AUTOMATION FUNDAMENTALS 9

Cloud automation concepts – Need for automation – Cloud provisioning – Configuration management – Infrastructure as Code (IaC) – DevOps basics – Continuous Integration and Continuous Deployment (CI/CD).

UNIT III – CLOUD AUTOMATION TOOLS 9

Introduction to tools – AWS CloudFormation – Terraform basics – Ansible – Puppet – Chef – Automation scripts – Role of APIs in cloud automation.

UNIT IV – CONTAINERIZATION AND ORCHESTRATION 9

Containers basics – Docker architecture – Docker images and containers – Kubernetes introduction – Pods, services, deployments – Container orchestration – Scaling and load balancing.

UNIT V – CLOUD APPLICATIONS AND CASE STUDIES 9

Cloud automation in real-world applications – Web application deployment – Microservices architecture – Serverless computing – Cloud monitoring and logging – Industry use cases and case studies.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand fundamentals of cloud computing and automation.
CO2: Apply DevOps and Infrastructure as Code concepts.
CO3: Use cloud automation tools for provisioning and configuration.
CO4: Understand containerization and orchestration technologies.
CO5: Analyze real-world cloud automation applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) (2nd Edition) – Michael J. Kavis, Wiley, 2020.
2. Cloud Native DevOps with Kubernetes – John Arundel & Justin Domingus, O'Reilly Media, 2022.

REFERENCE BOOKS

1. Docker Deep Dive (3rd Edition) – Nigel Poulton, Independently Published, 2023.
2. Kubernetes: Up & Running (3rd Edition) – Brendan Burns, Joe Beda & Kelsey Hightower, O'Reilly Media, 2022.
3. The DevOps Handbook (2nd Edition) – Gene Kim, Jez Humble, Patrick Debois & John Willis, IT Revolution, 2021.
4. Infrastructure as Code (2nd Edition) – Kief Morris, O'Reilly Media, 2020.
5. Site Reliability Engineering: How Google Runs Production Systems – Niall Richard Murphy et al., O'Reilly, 2016.
6. Cloud Computing: Concepts, Technology & Architecture (2nd Edition) – Thomas Erl, Ricardo Puttini & Zaigham Mahmood, Pearson, 2018.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	3	1
2	2	3	3	2	3	–	–	–	2	2	2	3	3	2
3	2	3	3	2	3	–	–	–	1	2	2	3	3	2
4	2	2	2	2	3	–	–	–	1	2	1	3	3	2
5	2	3	2	2	3	–	–	–	1	2	2	3	3	2
Avg	2.2	2.6	2.2	1.8	2.8	–	–	–	1.2	2	1.6	2.8	3	1.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 4: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P24	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of distributed computing systems.
- To learn communication and synchronization techniques in distributed systems.
- To study logical clocks, ordering, and coordination mechanisms.
- To understand distributed file systems and peer-to-peer systems.
- To gain knowledge of fault tolerance, consensus, and recovery techniques.

UNIT I – INTRODUCTION

9

Introduction to Distributed Systems – Distributed computing models – Message passing and shared memory systems – Communication in distributed systems – Remote Procedure Calls (RPC) – Distributed execution models – Challenges in distributed systems – Edge and fog computing concepts.

UNIT II – LOGICAL TIME AND COMMUNICATION

9

Physical and logical clocks – Scalar and vector clocks – Message ordering – Group communication – Causal and total ordering – Global state concepts – Snapshot algorithms – Distributed synchronization basics.

UNIT III – DISTRIBUTED COORDINATION AND DEADLOCK

9

Distributed mutual exclusion – Lamport’s algorithm – Ricart–Agrawala algorithm – Token-based methods – Deadlock models – Deadlock detection algorithms – Chandy–Misra–Haas algorithm – Coordination techniques in distributed systems.

UNIT IV – PEER-TO-PEER AND DISTRIBUTED FILE SYSTEMS

9

Peer-to-peer systems – Overlay networks – Distributed hash tables – Pastry and Tapestry concepts – Distributed file system architecture – AFS basics – File sharing semantics – Naming and directory services – LDAP basics.

UNIT V – CONSENSUS AND RECOVERY

9

Consensus problem – Agreement protocols – Failure handling in distributed systems – Checkpointing – Rollback recovery – Coordinated and uncoordinated checkpointing – Fault tolerance – Distributed recovery mechanisms.

COURSE OUTCOMES

- CO1: Understand fundamentals of distributed computing systems.
CO2: Apply logical clock and communication concepts in distributed systems.
CO3: Analyze coordination and deadlock handling algorithms.
CO4: Understand peer-to-peer systems and distributed file system architectures.
CO5: Apply consensus and fault tolerance techniques for reliable distributed systems.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Distributed Systems: Concepts and Design (5th Edition) – George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair, Pearson, 2011.
2. Distributed Systems: Principles and Paradigms (2nd Edition) – Andrew S. Tanenbaum & Maarten Van Steen, Pearson, 2017.

REFERENCE BOOKS

1. Designing Data-Intensive Applications – Martin Kleppmann, O'Reilly Media, 2017.
2. Distributed Systems: Concepts and Design – Coulouris et al., Pearson, 2011.
3. Distributed Algorithms (2nd Edition) – Nancy Lynch, Morgan Kaufmann, 1996.
4. Reliable Distributed Systems: Technologies, Web Services, and Applications – Kenneth P. Birman, Springer, 2005.
5. Cloud Computing and Distributed Systems – Kai Hwang, Jack Dongarra & Geoffrey Fox, Morgan Kaufmann, 2012.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	–	1	2	1	2	3	2
2	2	3	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	3	3	3	–	–	–	1	2	1	3	3	2
4	2	2	2	2	2	–	–	–	1	2	1	3	3	2
5	2	3	3	3	3	2	–	–	1	2	2	3	3	2
Avg	2.2	2.6	2.4	2.4	2.6	2	–	–	1	2	1.2	2.8	3	2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

IT24P05	ETHICAL HACKING (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand ethical hacking and cybersecurity concepts.
- To learn scanning, vulnerability assessment, and penetration testing.
- To study system, web, and wireless security.
- To explore malware, social engineering, and cyber defense.
- To develop skills for securing computer systems.

UNIT I INTRODUCTION

6

Introduction to ethical hacking – Types of hackers – Basics of cybersecurity – Phases of ethical hacking – Information gathering (footprinting and reconnaissance) – Security policies, legal and ethical issues – Applications of ethical hacking.

UNIT II NETWORK SCANNING AND VULNERABILITY ANALYSIS

6

Network scanning basics – Port scanning – Vulnerability assessment – Enumeration – Network mapping – System vulnerabilities – Security auditing and risk analysis – Basic tools for network analysis.

UNIT III SYSTEM AND WEB APPLICATION SECURITY

6

System hacking basics – Password attacks – Privilege escalation – Malware and ransomware overview – Web application security – SQL injection – XSS attacks – Session hijacking – Secure coding and defense methods.

UNIT IV WIRELESS SECURITY AND SOCIAL ENGINEERING

6

Wireless security basics – Wi-Fi vulnerabilities – Encryption methods – Social engineering attacks – Phishing and spoofing – Identity theft – Email and social media attacks – Awareness and countermeasures..

UNIT V PENETRATION TESTING AND CYBER DEFENSE

6

Penetration testing basics – Exploitation concepts – Incident response – IDS and IPS – Firewall security – Digital forensics basics – Cloud and IoT security – AI in cybersecurity – Future trends in ethical hacking.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Foot printing and reconnaissance exercises.
2. Network scanning and port analysis.
3. Vulnerability assessment implementation.
4. Password security and auditing exercises.
5. Web application security testing.
6. Wireless network security assessment.
7. Penetration testing and reporting.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

- Programming Languages and Compilers - Python 3.x / GCC Compiler (for C/C++) / Java JDK
- Penetration Testing and Security Tools - Kali Linux
- Development and Editing Tools - Visual Studio
- Web Browser - Google Chrome / Mozilla Firefox / Microsoft Edge

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand ethical hacking and cybersecurity concepts.

CO2: Apply network scanning and vulnerability assessment techniques.

CO3: Implement system and web security practices.

CO4: Analyze wireless security and social engineering threats.

CO5: Develop penetration testing and cyber defense solutions.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Abhinav Ojha, “Beginners Guide to Ethical Hacking and Cyber Security”, Notion Press, 2020.
2. Nikhalesh Bhadoria, “First Step to Ethical Hacking”, Rigi Publication, 2018.

REFERENCES:

1. Raja Sekhar Reddy, “Practical Ethical Hacking”, Indian Technical Publications, 2022.
2. Amit Kumar and Deepak Chawla, “Cyber Security and Ethical Hacking”, 2021.
3. Ayush Jain, “Ethical Hacking for Beginners”, 2023.
4. Mohamed Atef, “Kali Linux for Ethical Hacking”, BPB Publications, 2024.
5. Vitthal B. Kamble and Dr. Nilesh J. Uke, “Ethical Hacking”, San International Scientific Publications, 2024.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	3	–	1	–	2	3	2
2	3	3	3	2	2	–	1	3	1	1	1	3	3	2
3	3	3	3	2	3	1	2	3	1	1	2	3	3	3
4	3	3	2	2	2	2	2	3	1	1	1	3	3	2
5	3	3	3	3	3	2	2	3	1	2	3	3	3	3
AVG	3	2.8	2.4	2.2	2.2	1.6	1.6	3	1	1.2	1.8	2.8	3	2.4

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

IT24P06	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand basics of social network security and privacy.
- Learn authentication and access control techniques.
- Understand cyber attacks and threats in social media.
- Learn privacy, forensic, and legal aspects of social networks.
- Explore advanced security methods in social networking systems.

UNIT I INTRODUCTION TO SOCIAL NETWORK SECURITY 9

Introduction to social networks – Structure and characteristics of social networking platforms – Security challenges in social media – Threats and vulnerabilities – Privacy issues in online social networks – Social graph concepts – Applications and risks of social networking systems.

UNIT II AUTHENTICATION AND ACCESS CONTROL 9

User authentication methods – Multi-factor authentication – Identity management – Access control mechanisms – Role-based access control – Secure session management – OAuth and social login concepts – Trust management in social networks.

UNIT III CYBER ATTACKS AND SOCIAL MEDIA THREATS 9

Phishing and spoofing attacks – Fake profiles and identity theft – Malware propagation through social networks – Spam and botnet attacks – Cyberbullying and online harassment – Misinformation and fake news detection – Social engineering attacks – Threat detection techniques.

UNIT IV PRIVACY, FORENSICS, AND LEGAL ISSUES 9

Privacy preservation techniques – Data leakage prevention – Encryption and secure communication – Digital footprints and tracking – Social media forensics – Cyber laws and regulations – Ethical issues in social networking – Data governance and compliance standards.

UNIT V ADVANCED SOCIAL NETWORK SECURITY APPLICATIONS 9

AI and machine learning for social network security – Behavioral analysis and anomaly detection – Blockchain in social networking security – Cloud-based social platforms security – Security analytics – Risk management strategies – Emerging trends in social network security.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of social network security and related threats.
CO2: Apply authentication and access control mechanisms in social networks.
CO3: Analyze cyber attacks and security threats in social media platforms.
CO4: Understand privacy protection, forensics, and legal aspects of social networks.
CO5: Evaluate advanced security applications using AI, blockchain, and analytics.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Brij B. Gupta and Somya Ranjan Sahoo, "Online Social Networks Security: Principles, Algorithm, Applications, and Perspectives", CRC Press, 2023.
2. P. Venkata Krishna and Sasikumar Gurumoorthy, "Social Network Forensics, Cyber Security, and Machine Learning", Springer, 2019.

REFERENCES:

1. Prakash C. Gupta, "Cryptography and Network Security", PHI Learning Pvt. Ltd., 2015.
2. Vikas Chaudhary and Kanika Garg, "Cryptography and Network Security", S.K. Kataria and Sons, Reprint 2024.
3. Dr. Sowmya and Aadhitya, "Applied Networking and Information Security", National Academic Press, 2025.
4. Omprakash Kaiwartya, Keshav Kaushik and Sachin Kumar Gupta (Eds.), "Security and Privacy in Cyberspace: Blockchain Technologies", Springer, 2023.
5. D. Anusha, Nayan Rai and C. Bhagyashree, "Cryptography and Network Security", Quill Tech Publications, 2025.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	3	–	1	–	2	3	2
2	3	3	2	2	2	1	1	3	1	1	1	3	3	2
3	3	3	3	2	2	1	2	3	1	1	1	3	3	2
4	3	3	2	2	1	2	2	3	1	2	2	2	3	2
5	3	3	3	3	3	2	2	3	1	2	2	3	3	3
AVG	3	2.8	2.2	2.2	1.8	1.5	1.6	3	1	1.4	1.5	2.6	3	2.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P25	NETWORK SECURITY (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

UNIT I INTRODUCTION

6

Basics of cryptography – Conventional (symmetric) cryptography – Public-key cryptography – Hash functions – Authentication concepts – Digital signatures – Security goals and services.

UNIT II KEY MANAGEMENT AND AUTHENTICATION

6

Key Management and Distribution: Symmetric key distribution – Public key distribution – X.509 certificates – Public Key Infrastructure (PKI). User Authentication: Remote user authentication principles – Symmetric and asymmetric encryption-based authentication – Kerberos system.

UNIT III ACCESS CONTROL AND SECURITY

6

Network Access Control: Network Access Control (NAC) – Extensible Authentication Protocol (EAP) – IEEE 802.1X port-based access control. IP Security (IPSec) – Transport Level Security: Web security considerations – Transport Layer Security (TLS) – HTTPS protocol – Secure Shell (SSH).

UNIT IV APPLICATION LAYER SECURITY

6

Electronic Mail Security: Pretty Good Privacy (PGP) – Secure/Multipurpose Internet Mail Extensions (S/MIME) – DomainKeys Identified Mail (DKIM). Wireless Network Security: Mobile device security – Wireless security threats and protection mechanisms.

UNIT V SECURITY PRACTICES

6

Firewalls and Intrusion Detection Systems (IDS): Basics of intrusion detection – Firewall concepts and types – Basic firewall configuration. Cloud Security – IoT Security: Overview of security challenges and basic protection methods in cloud and IoT environments.

LIST OF EXPERIMENTS:

30 PERIODS

30 PERIODS

1. Implement symmetric key algorithms
2. Implement asymmetric key algorithms and key exchange algorithms
3. Implement digital signature schemes
4. Experiment Eavesdropping, Dictionary attacks, MITM attacks
5. Demonstrate intrusion detection system using any tool.
6. Configure and demonstrate secure remote communication using Secure Shell (SSH).

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:**

- Programming Languages and Compilers - Python 3.x / GCC Compiler (for C/C++) / Java JDK
- Penetration Testing and Security Tools - Kali Linux
- Development and Editing Tools - Visual Studio
- Web Browser - Google Chrome / Mozilla Firefox / Microsoft Edge

HARDWARE:

- Standalone desktops – 30

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand basics of cryptography, authentication, and security goals.

CO2: Apply key management and authentication techniques.

CO3: Understand network access control and transport security protocols.

CO4: Apply application layer security techniques for web and email systems.

CO5: Analyze security practices in firewalls, cloud, and IoT environments.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. William Stallings, “Cryptography and Network Security: Principles and Practice”, Pearson, 8th Edition, 2024.
2. Charlie Kaufman, Radia Perlman, Mike Speciner and Ray Perlner, “Network Security: Private Communications in a Public World”, Pearson Addison-Wesley, 3rd Edition, 2022.

REFERENCES:

1. William Stallings and Lawrie Brown, “Computer Security: Principles and Practice”, Pearson, 5th Edition, 2024.
2. Joseph Migga Kizza, “Guide to Computer Network Security”, Springer, 6th Edition, 2024.
3. Gregor N. Purdy, “Linux iptables Pocket Reference”, O’Reilly Media, 1st Edition, 2004.
4. Michael Rash, “Linux Firewalls: Attack Detection and Response with iptables, psad, and fwsnort”, No Starch Press, 2nd Edition, 2022.
5. J. Michael Stewart and Denise Kinsey, “Network Security, Firewalls, and VPNs”, Jones and Bartlett Learning, 3rd Edition, 2020.
6. Michael Gregg, “The Network Security Test Lab: A Step-by-Step Guide”, Wiley Dreamtech Press, 1st Edition, 2015.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	1	2	2	-	-	-	-	2	2	2	2
2	2	2	2	2	1	1	-	-	-	-	1	2	2	3
3	3	2	2	2	2	1	-	-	-	-	2	3	3	3
4	2	2	2	2	2	1	-	-	-	-	1	1	2	1
5	2	2	2	2	1	1	-	-	-	-	2	2	2	3
AVG	2.4	2.2	2.2	1.8	1.6	1.2	-	-	-	-	1.6	2	2.2	2.4

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P26	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand fundamentals of blockchain technology and cryptocurrencies.
- To learn blockchain architecture and working principles.
- To study cryptographic techniques used in blockchain.
- To understand smart contracts and decentralized applications.
- To explore real-world applications and challenges of blockchain.

UNIT I – INTRODUCTION

9

Introduction to blockchain – Evolution of blockchain – Distributed ledger technology – Features of blockchain – Types of blockchain (public, private, consortium) – Applications of blockchain.

UNIT II – CRYPTOGRAPHY AND CRYPTOCURRENCY

9

Basics of cryptography – Hash functions – Public and private keys – Digital signatures – Introduction to cryptocurrencies – Bitcoin architecture – Blockchain transactions.

UNIT III – BLOCKCHAIN ARCHITECTURE

9

Blockchain structure – Blocks and chains – Consensus mechanisms (PoW, PoS) – Mining process – Nodes and peer-to-peer network – Security in blockchain systems.

UNIT IV – SMART CONTRACTS AND DAPPS

9

Smart contracts – Ethereum basics – Solidity introduction – Decentralized applications (DApps) – Wallets and tokens – Use cases of smart contracts.

UNIT V – APPLICATIONS AND CHALLENGES

9

Blockchain applications in finance, healthcare, supply chain – Security and scalability issues – Regulatory challenges – Energy consumption concerns – Future trends in blockchain technology.

COURSE OUTCOMES:

After completion of this course, the students should be able to:

CO1: Understand fundamentals of blockchain and cryptocurrency systems.

CO2: Apply cryptographic techniques in blockchain transactions.

CO3: Analyze blockchain architecture and consensus algorithms.

CO4: Understand smart contracts and decentralized applications.

CO5: Evaluate real-world blockchain applications and challenges.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mastering Blockchain (3rd Edition) – Imran Bashir, Packt Publishing, 2023.
2. Blockchain and Cryptocurrency: Technologies and Applications – Arshdeep Bahga & Vijay Madisetti, VPT, 2022.

REFERENCE BOOKS

1. Programming Blockchain in JavaScript – Eric Traub, Apress, 2023.
2. Building Blockchain Projects – Narayan Prusty, Packt Publishing, 2022.
3. Blockchain Revolution (Updated Edition) – Don & Alex Tapscott, Penguin, 2023.
4. Hands-On Smart Contract Development with Solidity – Kevin Solorio et al., O'Reilly, 2022.
5. Cryptocurrency and Blockchain Technology – B. S. N. Murthy, Wiley, 2024.
6. Blockchain Basics: A Non-Technical Introduction in 25 Steps (2nd Edition) – Daniel Drescher, Apress, 2023.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	-	-	1	-	-	2	3	1	1	-
2	3	3	3	3	1	-	2	-	-	2	1	2	1	-
3	3	3	3	3	2	-	3	-	-	2	2	3	3	-
4	2	3	2	3	-	-	3	-	-	2	2	2	3	-
5	3	3	3	3	3	-	3	-	-	2	2	3	2	-
AVG	2.8	2.8	2.6	2.6	2	-	2.4	-	-	2	2	2.2	2	-

1 - low, 2 - medium, 3 - high, ‘-’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

IT24P07	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- Understand the fundamentals of digital forensics and digital evidence handling.
- Learn investigation methods for digital crime and evidence collection.
- Gain knowledge of digital forensic readiness frameworks and enterprise practices.
- Understand iOS forensics concepts, tools, and investigation procedures.
- Understand Android forensics techniques and mobile investigation tools.

UNIT I INTRODUCTION TO DIGITAL FORENSICS

9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION

9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS

9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT IV iOS FORENSICS

9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

UNIT V ANDROID FORENSICS

9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of digital forensics and digital evidence.
CO2: Apply investigation methods to collect and analyze digital crime evidence.
CO3: Understand digital forensic readiness frameworks and enterprise practices.
CO4: Apply iOS forensic tools and techniques for mobile investigation.
CO5: Apply Android forensic procedures and tools for evidence analysis.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Digital Forensics and Cyber Crime (3rd Edition) – Eoghan Casey, Academic Press (Elsevier), 2022 reprint edition.
2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, CRC Press, 1st Edition, 2022.

REFERENCE BOOKS

1. Practical Mobile Forensics (2nd Edition) – Satish Bommisetty, Oleg Skulkin & Rohit Tamma, Packt Publishing, 2023.
2. iOS Forensics – Mattia Epifani & Pasquale Stirparo, Packt Publishing, 2022.
3. Digital Evidence and Computer Crime – Eoghan Casey, Academic Press, 2022 updated print.
4. Guide to Computer Forensics and Investigations (6th Edition) – Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage, 2019 (latest reprints 2023–2025).
5. Mobile Forensics – Advanced Investigations – Soumya Ranjan Behera, Wiley, 2023.
6. Digital Forensics: The Essentials – H. Carvey, Syngress (Elsevier), 2022 updated edition.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1	1	–	3	–	1	–	2	3	2
2	3	3	3	3	3	2	–	3	1	1	2	3	3	2
3	3	3	3	2	2	2	–	3	1	1	2	3	3	2
4	3	3	3	2	3	1	–	3	1	1	2	3	3	3
5	3	3	3	2	3	1	–	3	1	1	2	3	3	3
AVG	3	2.8	2.6	2	2.4	1.4	–	3	1	1	2	2.8	3	2.4

1 - low, 2 - medium, 3 - high, ‘–’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P27	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand cloud security concepts and basic cryptography.
- Apply security principles to protect cloud systems and data.
- Implement identity and access control in cloud environments.
- Use security design patterns for securing cloud resources.
- Perform monitoring and auditing for secure cloud operations.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Introduction to cloud security – Security services like confidentiality, integrity, authentication, access control – Basics of cryptography – Symmetric and public-key encryption – Hash functions – Authentication and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Cloud security design basics – Data protection methods – Access control in cloud – Common threats and attacks – Network and storage security – Virtualization security and isolation – Encryption, tokenization and key management (PKI).

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

User identification and authentication – Authorization – Role-Based Access Control (RBAC) – Multi-Factor Authentication (MFA) – Single Sign-On (SSO) – Identity management systems – Basic system security like OS protection and intrusion detection.

UNIT IV CLOUD SECURITY DESIGN PATTERNS 9

Cloud security patterns – Cloud bursting – Geo-tagging – Secure cloud access – Secure communication between cloud and local systems – Cloud interface security.

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Cloud monitoring and security tracking – Detecting attacks and unauthorized access – Event logging and alerts – Security audits – SIEM systems – User and identity management in cloud.

COURSE OUTCOMES:

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

- CO1: Understand fundamentals of cloud security and cryptographic concepts.
CO2: Apply cloud security design principles and protection techniques.
CO3: Understand identity and access management mechanisms in cloud systems.
CO4: Analyze cloud security design patterns and secure communication methods.
CO5: Evaluate cloud security through monitoring, auditing, and management tools.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tim Mather, Subra Kumaraswamy and Shahed Latif, “Cloud Security and Privacy”, O’Reilly Media, 1st Edition, 2011.
2. Jamuna S. Murthy, G. M. Siddesh and K. G. Srinivasa (Eds.), “Cloud Security: Concepts, Applications and Practices”, Chapman and Hall CRC, 1st Edition, 2025.

REFERENCES:

1. Suryadipta Majumdar et al., “Cloud Security Auditing”, Springer, 1st Edition, 2019.
2. Ryan Ko and Kim-Kwang Raymond Choo, “The Cloud Security Ecosystem”, Elsevier ScienceDirect, 1st Edition, 2015.
3. Shiv Kumar, “Practical Cloud Security Handbook”, 1st Edition, 2025.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1	–	1	3	–	1	–	2	3	2
2	3	3	3	2	3	1	2	3	1	1	2	3	3	3
3	3	3	3	2	3	1	2	3	1	1	2	3	3	3
4	3	3	3	2	3	1	2	3	1	1	2	3	3	3
5	3	3	3	3	3	2	2	3	1	2	3	3	3	3
AVG	3	2.8	2.6	2	2.6	1.2	1.8	3	1	1.2	2.2	2.8	3	2.8

1 - low, 2 - medium, 3 - high, ‘–’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P28	FUNDAMENTALS OF CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand basic concepts and mathematics of cryptography.
- To learn symmetric and asymmetric encryption algorithms and protocols.
- To study authentication, digital signatures, and key management.
- To explore cryptography in network security, blockchain, and cloud systems.
- To develop secure communication solutions using cryptography.

UNIT I INTRODUCTION

9

Introduction to cryptography – Security services – Basic classical cryptography – Mathematical basics (modular arithmetic, primes, finite fields) – Cryptanalysis basics – Applications of cryptography.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY

9

Block and stream ciphers – DES and AES – Modes of operation – RC4 and Blowfish basics – Key management – Attacks on symmetric encryption – Performance overview.

UNIT III ASYMMETRIC KEY CRYPTOGRAPHY

9

Public key cryptography – RSA – Diffie-Hellman key exchange – ECC basics – Digital signatures – PKI and certificates – Secure key exchange methods.

UNIT IV HASH FUNCTIONS AND ADVANCED CRYPTOGRAPHIC TECHNIQUES

9

Hash functions – MD5 and SHA – HMAC – Basics of zero-knowledge proofs and secret sharing – Introduction to homomorphic encryption, quantum cryptography, and blockchain.

UNIT V CRYPTOGRAPHY APPLICATIONS AND SECURITY PRACTICES

9

Cryptography in network security – SSL/TLS – Email and web security – Cloud and IoT security – Blockchain and cryptocurrency basics – Secure transactions – Ethical issues and future trends.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand the basic concepts and math behind modern cryptography.

CO2: Apply symmetric key encryption for secure communication.

CO3: Implement asymmetric cryptography and authentication methods.

CO4: Analyze advanced cryptography and blockchain security.

CO5: Develop secure applications using cryptographic techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sandip Dholakia, “Modern Cryptography: The Practical Guide”, Shroff Rheinwerk Computing, 2024.
2. Dr. Debdeep Mukhopadhyay, “Cryptography and Network Security”, Springer CRC Press India Edition, 2015–2022 Editions.

REFERENCES:

1. Indian Academic Contributors, “Applied Cryptography and Information Security”, BPB Publications, 2019–2023 Editions.
2. Indian Authors Collective, “Modern Cryptography for Security Engineering”, S.K. Kataria and Sons, 2021–2024 Reprints.
3. Indian Institute of Technology Authors Collective, “Cryptography and Information Security: Theory and Practice”, Wiley India, 2016–2024 Editions.
4. Springer India Edited Volumes, “Advances in Cryptographic Engineering and Secure Systems”, Springer India, 2018–2025.
5. Indian Research Contributions in Cryptographic Engineering, “Security and Composition of Cryptographic Protocols”, IEEE Springer, 2017–2023.
6. Amit Kumar et al., “Post-Quantum Cryptography and Modern Security Models”, BPB Publications, 2022–2025 Editions.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	1	–	–	–	–	–	–	2	–	1
2	3	3	2	2	2	–	–	1	–	–	–	3	1	2
3	3	3	3	2	2	–	–	1	1	1	–	3	2	2
4	2	3	3	3	2	–	–	1	1	–	1	3	1	3
5	3	3	3	3	3	–	–	2	2	2	1	3	3	3
AVG	2.8	2.8	2.4	2.4	2	–	–	1.3	1.3	1.5	1	2.8	1.7	2.2

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 5: CYBER SECURITY

(Common TO B. E - CSE & B. TECH - IT)

IT24P08	CYBER FORENSIC	L 3	T 0	P 0	C 3

COURSE OBJECTIVES

To enable the students

- To understand the basics of cyber forensics and digital investigation.
- To learn different types of cyber crimes and evidence collection methods.
- To study digital evidence handling and analysis techniques.
- To understand forensic tools and investigation processes.
- To gain knowledge of legal and ethical issues in cyber forensics.

UNIT I – INTRODUCTION TO CYBER FORENSICS

9

Introduction to Cyber Forensics – Types of cyber crimes – Digital evidence concepts – Forensic investigation process – Role of cyber forensic investigator – Challenges in cyber forensics.

UNIT II – DIGITAL EVIDENCE AND ACQUISITION

9

Digital evidence types – Evidence collection process – Chain of custody – Data acquisition techniques – Disk imaging – File system basics – Evidence preservation methods.

UNIT III – COMPUTER AND NETWORK FORENSICS

9

Computer forensics – Memory forensics basics – Network forensics concepts – Packet analysis – Log analysis – Email and web forensics – Malware basics.

UNIT IV – FORENSIC TOOLS AND TECHNIQUES

9

Introduction to forensic tools – EnCase – FTK – Autopsy – Wireshark – Data recovery tools – File carving – Password cracking basics – Reporting techniques.

UNIT V – LEGAL AND ETHICAL ISSUES

9

Cyber laws basics – IT Act overview – Legal procedures in digital evidence – Privacy issues – Ethical hacking vs cyber forensics – Court presentation of evidence – Case studies.

COURSE OUTCOMES

After completion of this course, students will be able to:

CO1: Understand fundamentals of cyber forensics and digital investigation.

CO2: Apply techniques for digital evidence collection and preservation.

CO3: Analyze computer and network data for forensic investigation.

CO4: Use forensic tools for data recovery and analysis.

CO5: Understand legal and ethical issues in cyber forensics.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Guide to Computer Forensics and Investigations (6th Edition) – Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage, 2019.
2. Cybersecurity and Cyber Forensics – Nelson Phillips & Enfinger, McGraw Hill, 2020.

REFERENCE BOOKS

1. The Art of Memory Forensics – Michael Hale Ligh, Andrew Case, Jamie Levy & Aaron Walters, Wiley, 2014.
2. Practical Malware Analysis – Michael Sikorski & Andrew Honig, No Starch Press, 2012.
3. Network Forensics: Tracking Hackers through Cyberspace – Sherri Davidoff & Jonathan Ham, Pearson, 2012.
4. File System Forensics – Brian Carrier, Addison-Wesley, 2005.
5. Cyber Law & Cyber Security in India – Pavan Duggal, Universal Law Publishing, 2021.
6. Digital Forensics and Cyber Crime (3rd Edition) – Eoghan Casey, Academic Press (Elsevier), 2011.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	2	–	2	1	2	1	2	3	1
2	2	3	2	3	3	2	–	2	1	2	1	3	3	2
3	2	3	3	3	3	2	–	2	1	2	1	3	3	2
4	2	3	3	2	3	1	–	1	1	2	1	3	3	2
5	1	2	1	2	1	2	–	3	2	2	2	1	2	1
Avg	2	2.6	2	2.4	2.4	1.8	–	2	1.2	2	1.2	2.4	2.8	1.6

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P29	MACHINE LEARNING TECHNIQUES (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- Understand the fundamentals of Machine Learning and its applications.
- Learn supervised learning techniques including regression and classification.
- Apply advanced supervised learning and ensemble methods.
- Understand unsupervised learning techniques and pattern mining.
- Evaluate machine learning models and apply them in real-world domains.

UNIT I - INTRODUCTION

6

Introduction to Machine Learning – Types of Learning: Supervised, Unsupervised and Reinforcement Learning – Machine Learning Applications – Data Preprocessing – Data Cleaning – Training and Testing Data – Overfitting and Underfitting.

UNIT II - SUPERVISED LEARNING

6

Concept of Supervised Learning – Regression and Classification – Linear Regression – Logistic Regression – k-Nearest Neighbors (KNN) – Decision Trees – Model Training and Testing – Bias and Variance – Performance Evaluation.

UNIT III - ADVANCED SUPERVISED LEARNING

6

Support Vector Machines – Naïve Bayes Classifier – Ensemble Methods – Random Forest – Boosting Techniques – Model Optimization and Cross Validation – Hyperparameter Tuning.

UNIT IV - UNSUPERVISED LEARNING

6

Unsupervised Learning – k-Means Clustering Algorithm – Introduction to Association Rule Mining – Market Basket Analysis – Frequent Itemset Mining – Apriori Algorithm (Candidate Generation) – FP-Growth Algorithm (Without Candidate Generation).

UNIT V - MODEL EVALUATION AND APPLICATIONS

6

Model Evaluation Techniques – Confusion Matrix – Precision, Recall, F1 Score – ROC Curve – Cross Validation – Machine Learning Applications in Healthcare, Finance, and Smart Systems.

30 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Perform data preprocessing on a real-world dataset by handling missing values, encoding categorical variables, and normalizing numerical features.
2. Implement Linear Regression to predict house prices or medical insurance charges and evaluate the model performance.
3. Apply the k-Nearest Neighbors (KNN) algorithm for classification on a real dataset and evaluate accuracy.
4. Implement a Decision Tree classifier to predict customer purchase behavior or disease diagnosis.
5. Implement k-Means Clustering to segment customers or group patients based on similar characteristics.
6. Implement the Naïve Bayes classification algorithm to classify emails as spam or non-spam using a sample dataset.

- Implement an Ensemble Learning method (Random Forest) and compare its performance with a Decision Tree model.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

- SOFTWARE: Pycharm Community Edition, Python 3 IDLE, Ms Office

HARDWARE:

- Standalone desktops – 30 Nos.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand basics of machine learning and data preprocessing.

CO2: Apply supervised learning algorithms.

CO3: Use advanced supervised learning methods.

CO4: Apply unsupervised learning techniques.

CO5: Evaluate and apply machine learning models.

TOTAL: 60 PERIODS

TEXTBOOKS:

- Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, 4th Edition, Morgan Kaufmann (Elsevier), 2022.
- Ethem Alpaydin, Introduction to Machine Learning, 5th Edition, MIT Press, 2026.
- Kevin P. Murphy, Probabilistic Machine Learning: An Introduction, MIT Press, 2022. (Recommended replacement for Tom Mitchell's earlier edition.)

REFERENCES:

- Berson, Alex & Smith, Stephen J, Data Warehousing, Data Mining, and OLAP, TMH Pub. Co. Ltd, New Delhi, 2012.
- G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
- Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2007

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	–	1	2	1	2	3	1
2	2	3	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	3	2	3	–	–	–	1	2	1	3	3	2
4	2	3	3	2	3	–	–	–	1	2	1	3	3	2
5	2	3	3	3	3	–	–	–	1	2	2	3	3	2
Avg	2.2	2.8	2.6	2.2	2.8	–	–	–	1	2	1.2	2.8	3	1.8

1. 1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(Common to B. E – CSE & B. TECH – IT, AIDS)

AD24P06	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of NLP and computational linguistics.
- To learn text preprocessing and language modeling.
- To study machine learning and deep learning in NLP.
- To explore NLP applications like sentiment analysis and chatbots.
- To develop simple NLP applications using modern tools.

UNIT I INTRODUCTION 9

Introduction to NLP (Natural Language Processing) – Applications of NLP – Challenges in natural language understanding – Levels of language processing – Morphological, syntactic, semantic, and pragmatic analysis – NLP pipeline – Corpus and lexical resources – NLP tools and libraries.

UNIT II TEXT PREPROCESSING AND LANGUAGE MODELS 9

Text preprocessing techniques – Tokenization – Stop word removal – Stemming and lemmatization – Part-of-speech tagging – Named Entity Recognition (NER) – N-gram models – Statistical language models – Text representation techniques – TF-IDF and word embeddings.

UNIT III MACHINE LEARNING FOR NLP 9

Text classification – Sentiment analysis – Topic modeling – Naïve Bayes and Support Vector Machine for NLP – Sequence labeling – Information retrieval – Question answering systems – Text summarization – Evaluation metrics for NLP systems.

UNIT IV DEEP LEARNING AND TRANSFORMERS 9

Deep learning in NLP – Recurrent Neural Networks (RNN) – Long Short-Term Memory (LSTM) – Attention mechanisms – Transformer architecture – BERT and GPT concepts – Machine translation – Conversational AI and chatbot systems.

UNIT V ADVANCED NLP APPLICATIONS 9

Speech and language processing – Multilingual NLP – Healthcare and legal NLP applications – Fake news detection – Emotion and opinion mining – Ethical issues in NLP – Bias and fairness in language models – Future trends in Generative AI and NLP.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand the basics and applications of NLP.
CO2: Apply text preprocessing and language modeling techniques.
CO3: Implement machine learning methods in NLP.
CO4: Analyze deep learning and transformer-based NLP models.
CO5: Develop NLP applications for real-world problems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pushpak Bhattacharyya and Aditya Joshi, “Natural Language Processing”, Wiley India, 2023.
2. Madhuri Sahu, Shubhangi Ghate and Abhishek Kumar, “Introduction to Natural Language Processing with Hands-On Projects”, LAP Lambert Academic Publishing, 2025.

REFERENCES:

1. Nagaram Ramesh, Sara Sai Deepthi and V. Bhargavi, “The Power of NLP: Harnessing Language for Intelligent Systems”, SGSH Publications, 2025.
2. Ashish Suresh Patel, “Deep Learning for Natural Language Processing”, Notion Press, 2024.
3. Mathangi Sri, “Practical Natural Language Processing with Python”, Apress, 2021.
4. Dipanjan Sarkar, “Text Analytics with Python: A Practitioner’s Guide to Natural Language Processing”, Apress, 2019.
5. Akshay Kulkarni, Adarsha Shivananda and Anoosh Kulkarni, “Natural Language Processing Projects: Build Next-Generation NLP Applications Using AI Techniques”, Apress, 2022.
6. Sheetal S. Sonawane, Parikshit N. Mahalle and Archana S. Ghotkar, “Information Retrieval and Natural Language Processing: A Graph Theory Approach”, Springer, 2022.
7. Dr. Deepti Chopra, “Applied Natural Language Processing with PyTorch 2.0”, Orange Education/AVA, 2025.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
4	3	3	3	2	3	–	–	–	1	1	–	3	3	3
5	3	3	3	2	3	–	–	–	2	2	2	3	3	3
AVG	3	2.8	2.4	2	2.6	–	–	–	1.2	1.2	2	2.8	3	2.2

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P30	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand fundamentals of image processing and computer vision.
- To learn image formation, enhancement, and restoration techniques.
- To study feature extraction and image analysis methods.
- To understand object detection and recognition concepts.
- To apply computer vision techniques in real-world applications.

UNIT I – DIGITAL IMAGE FUNDAMENTALS

9

Introduction to image processing – Digital image representation – Image acquisition – Sampling and quantization – Pixel relationships – Color models – Basic operations on images.

UNIT II – IMAGE ENHANCEMENT AND RESTORATION

9

Spatial domain techniques – Frequency domain techniques – Image enhancement methods – Histogram processing – Filtering – Noise models – Image restoration techniques.

UNIT III – IMAGE TRANSFORMS AND FEATURE EXTRACTION

9

Fourier transform – Discrete Cosine Transform – Wavelet transform basics – Edge detection – Corner detection – Feature extraction methods – Image descriptors.

UNIT IV – COMPUTER VISION TECHNIQUES

9

Introduction to computer vision – Object detection – Object recognition – Template matching – Segmentation techniques – Motion analysis – Tracking basics.

UNIT V – ADVANCED APPLICATIONS

9

Deep learning for vision – Convolutional Neural Networks (CNN) basics – Face recognition – Medical image processing – Autonomous systems – Real-world applications of computer vision.

COURSE OUTCOMES

After completion of this course, students will be able to:

CO1: Understand fundamentals of image processing and computer vision.

CO2: Apply image enhancement and restoration techniques.

CO3: Analyze images using feature extraction and transformation methods.

CO4: Implement basic computer vision techniques for object detection.

CO5: Understand advanced applications of computer vision and deep learning.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Computer Vision: Applications of Visual AI and Image Processing – Pancham Shukla, Rajanikanth Aluvalu, Shilpa Gite & Uma Maheswari, Walter de Gruyter, 2023. ISBN: 9783110797428.
2. Smart Computer Vision – B. Vinodh Kumar, P. Sivakumar & others, Springer, 2023.
3. Computer Vision: Algorithms and Applications (2nd Edition) – Richard Szeliski, Springer, 2022.

REFERENCE BOOKS:

1. Deep Learning (Adaptive Computation and Machine Learning Series) – Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press, 2016.
2. Programming Computer Vision with Python – Jan Erik Solem, O'Reilly Media, 2022 edition reprint.
3. OpenCV 4 Computer Vision with Python Recipes – David Millán Escrivá, Packt Publishing, 2022.
4. Modern Computer Vision with PyTorch – V. Kishore Ayyadevara & Yeshwanth Reddy, Packt Publishing, 2023.
5. Practical Deep Learning for Computer Vision – Shai Shalev-Shwartz style applied CV books.
6. Deep Learning for Vision Systems – Mohamed Elgendy, Manning Publications, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	–	1	2	1	2	3	2
2	2	3	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	3	2	3	–	–	–	1	2	1	3	3	2
4	2	3	3	2	3	–	–	–	1	2	1	3	3	3
5	2	2	2	2	3	1	–	–	1	2	1	3	3	2
Avg	2.2	2.6	2.4	2	2.8	1	–	–	1	2	1	2.8	3	2.2

1. 1 - low, 2 - medium, 3 - high, ‘–’- no correlation

OPEN ELECTIVE / PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

(Common to: AI&DS, CSE, ECE, EEE & IT)

CS24906/AD24P15	REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of reinforcement learning and agent–environment interaction.
- To analyze Markov Decision Processes and optimal decision-making strategies.
- To apply model-free methods such as Monte Carlo and Temporal Difference learning.
- To explore value-based reinforcement learning using function approximation and deep learning models.
- To implement policy-based and actor–critic algorithms for real-world applications

UNIT I INTRODUCTION TO REINFORCEMENT LEARNING 9

Deep Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning-Agent, Environment, Observations, Actions, Example-The Bandit Walk Environment, Agent-Environment interaction cycle, MDP (Markov Decision Process): The engine of the Environment-States, Actions, Transition Function, Reward Signal.

UNIT II PLANNING 9

Objective of a decision making agent-environment, Plan, Optimal policy, Comparison of Policies, Bellman Equation/State-Value Function, Action-Value Function, Action-Advantage Function, Optimality- Greedy Strategy, Optimistic Initialization strategy, Strategic exploration, Softmax exploration strategy, Upper confidence bound (UCB) equation strategy, Thompson sampling strategy

UNIT III MODEL-FREE REINFORCEMENT LEARNING 9

Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD), Learning to estimate from multiple steps, N-step TD learning, Forward-view TD(λ), Backward-view TD(λ), Generalized policy iteration(GPI), Monte Carlo control, SARSA: On-Policy TD control, Q-learning: Off-Policy TD control, Double Q-learning, SARSA(λ), Watkins's Q(λ)

UNIT IV VALUE BASED REINFORCEMENT LEARNING 9

Value Based Reinforcement Learning: Deep reinforcement learning agents with sequential evaluative, and sampled feedback in RL; function approximation for high-dimensional - continuous state/action spaces; state-value - action-value functions - (with/without approximation); key methods including NFQ-DQN-DDQN-Dueling DDQN-Prioritized Experience Replay (PER).

UNIT V POLICY BASED REINFORCEMENT LEARNING 9

Reinforce and stochastic policy search; policy gradient methods (VPG); actor-critic approaches (A2C, A3C) with advantage estimation (GAE); advanced algorithms including Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3), Soft Actor-Critic (SAC), proximal policy optimization (PPO).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, a student will be able to:

CO1: Demonstrate various Components of Reinforcement Learning.

CO2: Make use of various exploration and exploitation strategies.

CO3: Apply Model based and Model Free Prediction techniques.

CO4: Make use of different value based Reinforcement Learning Algorithms.

CO5: Demonstrate various Policy based Reinforcement Learning Algorithms.

TEXT BOOKS:

1. R. S. Sutton and A. G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2nd Edition, 2018 (Updated Printing 2020).
2. M. Lapan, "Deep Reinforcement Learning Hands-On", Packt Publishing, 3rd Edition, 2023.

REFERENCES:

1. C. Szepesvári, "Algorithms for Reinforcement Learning", Morgan & Claypool Publishers, Updated Edition, 2019.
2. Sudharsan Ravichandiran, "Deep Reinforcement Learning with Python", Packet Publishing, Birmingham, Second Edition, 2020.
3. Csaba Szepesvari, "Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence & Machine Learning)", Morgan & Claypool Publishers, 2010.
4. Laura Graesser and Wah Loon Keng, "Foundations of Deep Reinforcement learning: theory and Practice in Python", Pearson India, New Delhi, 2022.
5. Michael Hu, "The Art of Reinforcement Learning – Fundamentals, Mathematics and Implementations with Python", Apress, 2024.
6. A. Zai and B. Brown, "Deep Reinforcement Learning in Action", Manning Publications, 2nd Edition, 2024.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	1	2	2	1	2	1	1
CO2	3	3	1	1	1	-	-	1	2	2	1	2	2	1
CO3	2	3	2	2	2	-	-	1	2	2	1	3	2	2
CO4	2	2	3	3	3	-	-	1	2	2	1	3	3	2
CO5	2	2	2	2	3	-	-	1	3	3	2	3	3	3
Avg	2.4	2.4	1.8	1.8	2.0	-	-	1.0	2.2	2.2	1.2	2.6	2.2	1.8

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6 : ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
B.E - CSE & B. Tech – IT

AD24502, AD24P21	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models.

UNIT I LINEAR MODELS **9**

Introduction of Operations Research - Mathematical formulation of LPP- Graphical Method - Simplex Method- Two-Phase method.

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS **9**

Integer programming: Branch and Bound method- Transportation and Assignment problems - Traveling salesman problem.

UNIT III PROJECT SCHEDULING **9**

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

UNIT IV CLASSICAL OPTIMIZATION THEORY **9**

Unconstrained problems – Necessary and Sufficient conditions - Newton-Raphson method, Constrained problems – Equality constraints – Inequality constraints - Kuhn-Tucker conditions.

UNIT V QUEUING MODELS **9**

Introduction - Queuing Theory - Operating characteristics of a Queuing system - Constituents of a Queuing system - Service facility - Queue discipline - Single channel models - multiple service channels.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Formulate and solve linear programming problems (LPP).

CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.

CO3: Obtain a solution to network problems using CPM and PERT techniques.

CO4: Able to optimize the function subject to the constraints.

CO5: Identify and solve problems under Markovian queuing models.

TEXT BOOKS:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	2	-	-
CO2	2	2	2	-	-	-	-	-	-	2	1	-
CO3	3	1	1	-	-	-	-	-	-	1	1	-
CO4	2	2	2	-	-	-	-	-	-	1	1	-
CO5	1	2	1	-	-	-	-	-	-		1	-
AVG.	2.2	1.8	1.4	-	-	-	-	-	-	1.2	0.8	-

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(B.E – CSE, ECE & B.TECH.. - IT)

CS24P31	DEEP LEARNING AND INTELLIGENT SYSTEMS (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- Understand the fundamentals of deep learning and neural networks.
- Learn neural network architectures and optimization techniques.
- Apply convolutional neural networks for image processing tasks.
- Use recurrent neural networks for sequential data analysis.
- Explore advanced deep learning models and their applications.

UNIT I – INTRODUCTION TO DEEP LEARNING

6

Introduction to Artificial Intelligence, Machine Learning and Deep Learning – Biological neuron vs Artificial neuron – Perceptron and multilayer perceptron – Activation functions – Loss functions – Gradient descent and backpropagation – Challenges in training deep networks.

UNIT II – NEURAL NETWORK ARCHITECTURES

6

Feedforward neural networks – Weight initialization – Regularization techniques – Dropout – Batch normalization – Hyperparameter tuning – Optimization algorithms (SGD, Adam, RMSProp) – Performance evaluation metrics.

UNIT III – CONVOLUTIONAL NEURAL NETWORKS

6

Introduction to CNN – Convolution operation – Padding and stride – Pooling layers – CNN architectures – Image classification – Transfer learning – Applications of CNN in computer vision.

UNIT IV – RECURRENT NEURAL NETWORKS

6

Sequential data processing – Recurrent Neural Networks – Backpropagation through time – Vanishing gradient problem – Long Short-Term Memory (LSTM) – Gated Recurrent Unit (GRU) – Applications in speech recognition, text processing and time-series prediction.

UNIT V – ADVANCED DEEP LEARNING MODELS

6

Autoencoders – Variational autoencoders – Generative Adversarial Networks (GANs) – Attention mechanism – Transformer models – Applications in Natural Language Processing and computer vision.

PRACTICAL EXERCISES:

30 PERIODS

30 PERIODS

1. Build a multilayer perceptron for classification using neural networks.
2. Implement a neural network with different activation functions and compare results.
3. Implement regularization techniques (dropout and batch normalization).
4. Implement an image classifier using Convolutional Neural Networks.
5. Perform image classification using a pre-trained CNN model (transfer learning).
6. Implement sentiment analysis using deep learning.
7. Mini project: Build a deep learning model for a real-world dataset.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**SOFTWARE:** Pycharm Community Edition, Python 3 IDLE, Ms Office**HARDWARE:** Standalone desktops – 30 Nos.**COURSE OUTCOMES:****After completion of this course, students will be able to:**

CO1: Understand basics of deep learning and neural networks.

CO2: Apply neural network architectures and optimization techniques.

CO3: Use CNN for image processing and computer vision tasks.

CO4: Apply RNN, LSTM, and GRU for sequence data analysis.

CO5: Understand advanced deep learning models like GANs and Transformers.

TOTAL: 60 PERIODS**TEXTBOOKS:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, Lakshmi Narain Agarwal Publications, 2024 ASIN: B0FQ644F1B (MIT Press 2016 ISBN: 978-0262035613)
2. Charu C. Aggarwal, “Neural Networks and Deep Learning”, 2nd Edition, Springer NP, 2023, ISBN-13: 978-3031296413.

REFERENCES:

1. François Chollet and Matthew Watson, “Deep Learning with Python”, Third Edition, Manning Pubns Co, 2025, ISBN-13: 978-1633436589.
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, Third Edition, 2022, Shroff/O'Reilly Publications, ISBN-13: 978-935542198.
3. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2013, ISBN-13: 978-8132209065.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	–	1	2	1	2	3	2
2	2	3	3	2	3	–	–	–	1	2	1	3	3	2
3	2	3	3	2	3	–	–	–	1	2	1	3	3	3
4	2	3	3	2	3	–	–	–	1	2	1	3	3	2
5	2	3	2	2	3	1	–	–	1	2	1	3	3	3
Avg	2.2	2.8	2.4	2	2.8	1	–	–	1	2	1	2.8	3	2.4

1 - low, 2 - medium, 3 - high, ‘–’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6 : ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(Common to: B. E – CSE & B. TECH – IT, AIDS)

AD24P01	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of Knowledge Engineering and Expert Systems.
- To learn knowledge representation and reasoning methods.
- To study ontology development and Semantic Web concepts.
- To gain practical knowledge of rule-based and knowledge-based systems.
- To develop intelligent systems using knowledge engineering techniques.

UNIT I INTRODUCTION

9

Artificial Intelligence and Knowledge Engineering basics – Characteristics of knowledge-based systems – Types of knowledge – Knowledge acquisition – Knowledge engineering lifecycle – Expert system components – Intelligent system architecture – Applications of knowledge engineering.

UNIT II KNOWLEDGE REPRESENTATION TECHNIQUES

9

Knowledge representation basics – Logical representation – Propositional and predicate logic – Semantic networks – Frames and scripts – Production rules – Conceptual dependency – Ontologies and taxonomies – Representation issues.

UNIT III REASONING AND INFERENCE MECHANISMS

9

Inference engines – Forward chaining – Backward chaining – Rule-based reasoning – Uncertainty handling – Probabilistic reasoning – Bayesian concepts – Fuzzy logic basics – Non-monotonic reasoning – Truth maintenance systems.

UNIT IV ONTOLOGY ENGINEERING AND SEMANTIC WEB

9

Introduction to ontology engineering – Ontology lifecycle – Ontology languages – RDF, RDFS, OWL – Semantic web technologies – SPARQL basics – Ontology mapping and merging – Knowledge graphs – Applications of semantic web.

UNIT V KNOWLEDGE-BASED SYSTEM DEVELOPMENT

9

Design and development of expert systems – Knowledge base creation – Expert system tools and shells – Integration of machine learning with knowledge systems – Case studies (healthcare, education, finance, industry) – Ethical issues and future trends in knowledge engineering.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand Knowledge Engineering concepts and architecture.
CO2: Apply knowledge representation techniques.
CO3: Implement reasoning in expert systems.
CO4: Develop ontology and Semantic Web applications.
CO5: Build basic knowledge-based applications.

TEXT BOOKS:

1. Dr. Ela Kumar, “Knowledge Engineering”, I.K. International Publishing House Pvt. Ltd., 2019.
2. Anand Sharma, Sandeep Kautish, Prateek Agrawal, Vishu Madaan and Charu Gupta (Eds.), “Knowledge Engineering for Modern Information Systems: Methods, Models and Tools”, De Gruyter, 2022.

REFERENCES:

1. Brij B. Gupta and Somya Ranjan Sahoo, “Online Social Networks Security: Principles, Algorithm, Applications and Perspectives”, CRC Press, 2023.
2. Siddhartha Bhattacharyya and Anjan Bandyopadhyay (Eds.), “Knowledge-Driven Human-Centric Intelligence”, Springer, 2026.
3. Sudhir Kumar Jena and Sushanta Kumar Nayak, “Indian Knowledge Systems: Concepts and Applications”, Digital Publishing House, 2025.
4. Manjula Manjari Mohapatra, Sudhir Kumar Jena and Prasanta Kumar Acharya, “Indian Knowledge Systems: Science and Technology”, Avon Publications, 2025.
5. Dilipkumar A. Ode, Manasi S. Kurtkoti, Kavita Sharma and others, “Indian Knowledge Systems: Principles and Innovation”, Rights Publications, 2025.
6. Anand Balu Nellippallil et al., “Architecting A Knowledge-Based Platform for Design Engineering 4.0”, Springer, 2022.

CO-PO MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	—	—	1	—	—	—	2	1	2
2	3	3	2	2	3	—	—	1	—	—	—	3	1	2
3	3	3	3	3	3	—	—	1	1	—	—	3	2	3
4	3	3	3	3	3	—	—	2	1	1	1	3	2	3
5	3	3	3	3	3	—	—	2	2	2	1	3	3	3
Avg	3	2.8	2.4	2.6	2.8	—	—	1.4	1.3	1.5	1	2.8	1.8	2.6

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 6: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(Common to B. E – CSE & B. TECH – IT, AIDS)

AD24P20	ETHICAL AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand AI ethics and its impact on society.
- To learn fairness, accountability, transparency, and privacy in AI.
- To study AI laws, governance, and policies.
- To explore ethical issues in machine learning and intelligent systems.
- To develop responsible and trustworthy AI solutions.

UNIT I INTRODUCTION

9

Introduction to ethics – Moral philosophies and ethical theories – Overview of Artificial Intelligence – Need for ethical AI – Human-centered AI – Societal impact of AI – Opportunities and risks of AI – Responsible AI principles – Ethical challenges in intelligent systems.

UNIT II FAIRNESS, ACCOUNTABILITY, AND TRANSPARENCY

9

Bias in AI systems – Fairness and discrimination – Algorithmic accountability – Explainable AI (XAI) – Transparency in AI decision-making – Trustworthy AI systems – Ethical design principles – Auditing and monitoring AI systems.

UNIT III PRIVACY, SECURITY, AND GOVERNANCE

9

Data privacy concepts – Data protection regulations – AI security challenges – Surveillance and ethical concerns – Cybersecurity and AI – Governance frameworks for AI – AI regulations and policies – Intellectual property and AI ethics – Ethical data management.

UNIT IV ETHICAL ISSUES IN AI APPLICATIONS

9

Ethics in healthcare AI – Autonomous vehicles and robotics ethics – AI in finance and business – Social media and recommendation systems – Generative AI and deepfakes – Employment and automation challenges – Human-AI interaction – Case studies on ethical AI failures and solutions.

UNIT V RESPONSIBLE AI DEVELOPMENT AND FUTURE TRENDS

9

AI for social good – Sustainable AI – Ethical AI development lifecycle – AI risk assessment – Ethical frameworks and standards – AI governance in organizations – Future of AI ethics – Emerging trends and challenges in responsible AI.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand AI ethics and societal impacts.
CO2: Analyze fairness, accountability, and transparency in AI.
CO3: Apply privacy, security, and governance in AI systems.
CO4: Evaluate ethical issues in real-world AI applications.
CO5: Develop responsible and trustworthy AI solutions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajiv Chopra, “Ethics in Artificial Intelligence and Machine Learning”, BPB Publications, 2023.
2. Dr. D. Jude Hemanth, “Responsible Artificial Intelligence”, Wiley India, 2024.

REFERENCES:

1. R. Krishnakumar and P. Kaliraj, “Artificial Intelligence Ethics and Society”, ESN Publications, 2024.
2. V. Vinoth Kumar and R. Sugumar, “Ethical Artificial Intelligence”, Charulatha Publications, 2025.
3. Dr. Hemachandran K., “Artificial Intelligence and Machine Learning for Business”, Wiley India, 2022.
4. Adadi Amina and Mohammed Berrada, “Explainable AI: Interpreting, Explaining and Visualizing Deep Learning”, Springer, 2020.
5. Abhinav Ojha, “Cyber Security and Ethical Hacking”, Khanna Publishers, 2023.
6. S. Smys, Valentina Emilia Balas and R. Bestak, “Artificial Intelligence for Sustainable Development”, Springer, 2021.
7. S. Valliappan and team, “Human-Centered Artificial Intelligence”, Notion Press, 2024.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	1	—	—	3	2	3	—	1	—	1	2	—
2	2	3	2	2	1	3	2	3	1	1	—	2	3	1
3	3	3	2	2	2	3	2	3	1	2	1	2	3	1
4	2	3	2	2	1	3	2	3	1	2	1	2	3	1
5	3	3	3	2	2	3	2	3	2	2	2	3	3	2
AVG	2.4	2.8	2	2	1.5	3	2	3	1.2	1.6	1.3	2	2.8	1.2

1 - low, 2 - medium, 3 - high, ‘—’ - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 7: EMERGING TECHNOLOGIES
COMMON TO AI&DS, CSE, IT

CS24P32	ROBOTIC PROCESS AUTOMATION (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- To understand the fundamental concepts and principles of Robotic Process Automation (RPA).
- To understand the fundamental concepts and principles of Robotic Process Automation (RPA).
- To gain knowledge of RPA design approaches, development strategies, and methodologies.
- To learn the basic logic, workflow structure, and functioning of RPA systems.
- To explore exception handling, debugging, and logging techniques in RPA applications.
- To understand the process of deployment, monitoring, and maintenance of software bots.

UNIT 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, Core Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files - Role of AI in RPA.

UNIT 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, Ui Explorer, Handling Events - selectors optimization.

UNIT 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 - process mining concepts – Screen scraping vs data scraping – OCR (Optical Character Recognition) basics.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 6

Exception handling, Common exceptions, Logging- Debugging techniques, collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine- Version control basics – Error recovery strategies.

UNIT 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 - Security considerations in RPA.

30 PERIODS

PRACTICAL EXERCISES:

Setup and Configure a RPA tool and understand the user interface of the tool:

1. Create a Sequence to obtain user inputs display them using a message box.
2. Create a Flowchart to navigate to a desired page based on a condition.
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments
6. Also implement Automation using System Trigger
7. Automate login to (web) Email account
8. Recording mouse and keyboard actions.
9. Scraping data from website and writing to CSV and Web Scraping.
10. Implement Error Handling in RPA platform

30 PERIODS

COURSE OUTCOMES:

After the completion of this course, the students will be able to

- CO1 : Apply human-centered design principles to identify and define real-world problems.
- CO2 : Conduct customer discovery and validation using empathy techniques, interviews, and field studies.
- CO3 : Develop user personas, user stories, and value propositions for innovative solutions.
- CO4 : Generate and evaluate solution concepts using design thinking tools and techniques.
- CO5 : Design, develop, and test a Minimum Usable Prototype (MUP) for the proposed solution.

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.
3. Randall Boyle , Raymond Panko, “Corporate Cybersecurity” , Pearson, 2025.

REFERENCES:

1. Dr. Nithisha J , Mrs. Anuja T, “NEXT-GENERATION CYBERSECURITY: AI - ML AND BLOCKCHAIN”, Kindle, 2026.
2. 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
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
4. A Gerardus Blokdyk, “Robotic Process Automation A Complete Guide “, 2020

CO-PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	1	1	2	1	1	2	1	2	2	2	1
CO2	1	3	2	3	2	2	1	2	3	1	2	2	3	2
CO3	1	2	3	1	1	2	1	2	2	1	2	3	3	2
CO4	2	3	3	2	2	2	1	2	2	1	2	2	3	2
CO5	2	2	3	3	3	2	1	2	2	2	3	3	3	3
Avg	1.6	2.6	2.6	2	1.8	2	1.0	1.8	2.2	1.2	2.2	2.4	2.8	2

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE / PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 7: EMERGING TECHNOLOGIES
(Common to: AI&DS, BME, CSE, ECE & IT)

AD24906/ AD24P12	NEURAL NETWORKS AND DEEP LEARNING (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamental concepts of deep neural networks.
- To comprehend associative memory models and unsupervised learning networks.
- To apply Convolutional Neural Network (CNN) architectures for solving real-world problems.
- To analyze core computations in deep learning and utilize them to design and train neural networks for various applications.
- To implement autoencoders and generative models for practical use cases.

UNIT I INTRODUCTION

6

Neural Networks- Artificial Neural Network: An Introduction Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

6

Training Algorithms for Pattern Association-Autoassociative and Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization.

UNIT III THIRD-GENERATION NEURAL NETWORKS

6

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types– Efficient Convolution Algorithms.

UNIT IV DEEP FEEDFORWARD NETWORKS

6

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation – Optimization Techniques – Regularization – Dropout – Batch normalization.

UNIT V RECURRENT NEURAL NETWORKS

6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.

30 PERIODS

LIST OF EXPERIMENTS:**30 PERIODS**

1. Implement simple vector operations (addition, multiplication) in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Improve the Deep learning model by fine tuning hyper parameters.
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre trained model on Keras for Transfer Learning.
9. Implement an LSTM based Autoencoder in TensorFlow/Keras.
10. Image generation using GAN.

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

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

CO1: Apply Convolutional Neural Networks for image processing tasks.

CO2: Explain the principles of associative memory and unsupervised learning networks.

CO3: Utilize CNN architectures and their variants for real-world applications.

CO4: Analyze fundamental computations in deep learning and develop models for various tasks.

CO5: Implement autoencoders and generative models for practical applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, Alanna Maldonado, 2023.
2. Francois Chollet, Matthew Watson, “Deep Learning with Python”, Manning Publications, Third Edition, 2025.

REFERENCES:

1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, O’Reilly, 3rd Edition, 2022.
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.
3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
4. Jojo Moolayil, “Learn Keras for Deep Neural Networks”, Apress, 2018.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	1	1	1	2	1	2	3	3	2
CO2	2	3	1	2	2	1	1	1	2	1	2	2	2	2
CO3	3	2	3	2	3	2	1	2	2	1	2	3	3	2
CO4	3	3	3	3	3	2	1	2	2	1	3	3	3	3
CO5	3	2	3	3	3	2	1	2	2	1	3	3	3	3
Avg	2.8	2.4	2.4	2.4	2.8	1.6	1.0	1.6	2.0	1.0	2.4	2.8	2.8	2.4

1 - Low, 2 - Medium, 3 - High

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 7: EMERGING TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT, AIDS)

IT24P09	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand fundamentals of cybersecurity, cybercrime, and cyber laws.
- Learn about cyber attacks, threats, vulnerabilities, and countermeasures.
- Gain knowledge of reconnaissance techniques and information gathering tools.
- Understand intrusion detection systems and network security monitoring.
- Learn intrusion prevention techniques using firewalls and security systems.

UNIT I INTRODUCTION

9

Cyber Security – History of Internet – Impact of Internet – CIA Triad – Need for Cyber Security – History of Cyber Crime – Classification of Cybercrimes (Individual, Property, Organization, Society) – Overview of Cyber Laws and IT Act.

UNIT II ATTACKS AND COUNTERMEASURES

9

Malicious Attack Threats and Vulnerabilities – Scope of Cyber Attacks – Types of Malicious Attacks – Malware – Common Attack Vectors – Social Engineering Attacks – Wireless and Web Application Attacks – Countermeasures.

UNIT III RECONNAISSANCE

9

Information Gathering Tools – Whois, Netcraft – DNS and Email Extraction – Social Engineering Reconnaissance – Port and Network Scanning – Vulnerability Scanning – Nmap Scanning Techniques – Banner Grabbing and OS Fingerprinting.

UNIT IV INTRUSION DETECTION

9

Host-Based and Network-Based Intrusion Detection – Distributed IDS – Intrusion Detection Exchange Format – Honeypots – Snort System.

UNIT V INTRUSION PREVENTION

9

Firewalls – Types and Characteristics – Firewall Configurations – Firewall Deployment – Intrusion Prevention Systems – Unified Threat Management (UTM).

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of cybersecurity, cybercrime, and cyber laws.
CO2: Apply knowledge of cyber attacks, threats, and countermeasures.
CO3: Apply reconnaissance and scanning techniques for information gathering.
CO4: Analyze intrusion detection systems and security mechanisms.
CO5: Apply intrusion prevention techniques to prevent intrusion.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Praveen Kumar Tripathi and Niraj Kumar Tiwari, “Cyber Security”, S.K. Kataria and Sons, 1st Edition, 2024.
2. Shishir Kumar Shandilya, Agni Datta and Bong Jun Choi, “Cyber Security with Cryptography Essentials”, McGraw Hill, 2025.

REFERENCES:

1. OWASP Foundation, “OWASP Top 10 Web Application Security Risks”, Latest Edition.
2. Richard Stiennon, “Security Yearbook 2025”, Wiley, 6th Edition, 2025.
3. Keshav Kaushik and Ishu Sharma, “Next-Generation Cybersecurity: AI, ML and Blockchain”, Springer, 2024.
4. A. Khan, “The Cybersecurity Expert’s Guide 2025”, 2025.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s											PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1	-	-	3	—	1	—	2	3	2
2	3	3	3	2	2	-	-	3	1	1	1	3	3	3
3	3	3	3	2	3	-	-	3	1	1	1	3	3	3
4	3	3	3	3	3	-	-	3	1	2	2	3	3	3
5	3	3	3	3	3	-	-	3	1	2	2	3	3	3
AVG	3	2.8	2.6	2.2	2.4	-	-	3	1	1.4	1.5	2.8	3	2.8

1 - low, 2 - medium, 3 - high, ‘-’- no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 7: EMERGING TECHNOLOGIES

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P33	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To know the background of classical computing and quantum computing
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation
- To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPT

9

Need for quantum computing – Basic concepts – Complex numbers and vectors – Basics of linear algebra (matrices and operators) – Postulates of quantum mechanics – Qubits and their representations – Superposition – Overview of quantum hardware – Applications of quantum computing.

UNIT II QUANTUM GATES AND CIRCUITS

9

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction - Standard Quantum Gates in Detail.

UNIT III QUANTUM ALGORITHMS

9

Quantum parallelism - Deutsch's algorithm - The Deutsch-Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Amplitude Amplification Concept - Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY

9

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY

9

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekert 91.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of quantum computing and qubits.
CO2: Apply quantum gates and circuit concepts in computation.
CO3: Understand quantum algorithms and their working principles.
CO4: Analyze quantum information theory and communication models.
CO5: Understand quantum cryptography and key distribution techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", McGraw Hill Education, 1st Edition, 2020.
2. Chris Bernhardt, "Quantum Computing for Everyone", MIT Press, Reprint Edition, 2020.

REFERENCES:

1. Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Edition, 2010.
2. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 1st Edition, 2013.
3. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 1st Edition, 2007.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	1	2	–	1	–	2	3	2
2	3	3	3	2	3	–	1	2	1	1	2	3	3	2
3	3	3	3	2	2	–	1	2	1	1	2	3	3	3
4	3	3	2	2	2	–	2	2	1	1	2	3	3	2
5	3	3	2	2	2	–	2	3	1	2	2	3	3	2
AVG	3	2.8	2.2	2	2	–	1.4	2.2	1	1.2	2	2.8	3	2.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 7: EMERGING TECHNOLOGIES
(Common TO B.E - CSE & B.TECH.. - IT)

CS24P34	AWS CLOUD SERVICES (T+P)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand cloud computing concepts and AWS architecture.
- To learn core AWS services for compute, storage, and networking.
- To study AWS database and security services.
- To understand deployment and management of cloud applications.
- To gain hands-on knowledge of AWS cloud solutions.

UNIT I – INTRODUCTION TO CLOUD AND AWS

6

Cloud computing basics – Characteristics and benefits – Cloud service models (IaaS, PaaS, SaaS) – AWS overview – AWS global infrastructure – AWS management console – Identity and Access Management (IAM) basics.

UNIT II – AWS COMPUTE SERVICES

6

Amazon EC2 – EC2 instance types – Launching and managing instances – Auto Scaling – Elastic Load Balancing – AWS Lambda (serverless computing) – Elastic Beanstalk introduction.

UNIT III – AWS STORAGE AND DATABASE SERVICES

6

Amazon S3 – S3 storage classes – Amazon EBS – Amazon EFS – AWS Glacier – Amazon RDS – DynamoDB basics – Database migration service overview.

UNIT IV – AWS NETWORKING AND SECURITY

6

Amazon VPC – Subnets – Security groups – Route tables – DNS using Route 53 – AWS security services – IAM roles and policies – Cloud security best practices.

UNIT V – AWS DEPLOYMENT AND MONITORING

6

Application deployment strategies – CloudFormation basics – CI/CD on AWS – AWS monitoring tools (CloudWatch, CloudTrail) – Logging and auditing – Real-world AWS use cases.

30 PERIODS

PRACTICAL EXERCISES:

30 PERIODS

1. Create and configure an AWS account and explore AWS Management Console.
2. Launch and manage an EC2 instance (Linux/Windows) and connect using SSH/RDP.
3. Create an S3 bucket, upload files, and manage permissions and storage classes.
4. Configure IAM users, groups, and roles with proper access policies.
5. Set up a Virtual Private Cloud (VPC) with subnets, route tables, and security groups.
6. Create a simple serverless function using AWS Lambda and test execution.
7. Monitor AWS resources using CloudWatch and analyze logs and alerts.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Web Browser- Google Chrome / Mozilla Firefox / Microsoft Edge
- AWS Account -Valid AWS Free Tier account

- SSH Client - PuTTY (for Windows) or OpenSSH terminal (Linux/Mac)
- Text Editor / IDE - Visual Studio Code / Notepad++
- Programming Support - Python 3.x or Node.js runtime
- Database Client Tools - MySQL Workbench / pgAdmin

HARDWARE:

- Standalone desktops – 30 Nos.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand cloud computing concepts and AWS architecture.

CO2: Apply AWS compute services like EC2 and Lambda.

CO3: Use AWS storage and database services effectively.

CO4: Configure AWS networking and security services.

CO5: Deploy and monitor applications using AWS tools.

TOTAL: 60 PERIODS

TEXT BOOKS

1. AWS Certified Solutions Architect Study Guide (SAA-C03) (4th Edition) – Ben Piper & David Clinton, Sybex (Wiley), 2024.
2. Amazon Web Services in Action (3rd Edition) – Andreas Wittig & Michael Wittig, Manning Publications, 2023.

REFERENCE BOOKS

1. AWS Certified Developer Official Study Guide (DVA-C02) – Ben Piper & David Clinton, Sybex (Wiley), 2023.
2. AWS for Solutions Architects – Saurabh Shrivastava & Akshat Shrivastava, Packt Publishing, 2022.
3. Terraform: Up & Running (3rd Edition) – Yevgeniy Brikman, O'Reilly Media, 2022.
4. Cloud Native DevOps with Kubernetes – John Arundel & Justin Domingus, O'Reilly Media, 2022.
5. Site Reliability Engineering – Google SRE Team, O'Reilly Media, 2016.
6. Cloud Computing: Concepts, Technology & Architecture (2nd Edition) – Thomas Erl, Ricardo Puttini & Zaigham Mahmood, Pearson, 2018 (latest academic reprints 2023–2025).
7. Architecting Cloud Computing Solutions (2nd Edition) – Kevin L. Jackson & Scott Goessling, Packt Publishing, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	–	–	–	1	2	1	2	3	2
2	2	3	3	2	3	–	–	–	1	2	2	3	3	2
3	2	3	3	2	3	–	–	–	1	2	2	3	3	2
4	2	3	2	3	3	2	–	–	1	2	2	3	3	2
5	2	3	3	2	3	1	–	–	1	3	2	3	3	3
Avg	2.2	2.8	2.4	2	2.8	1.5	–	–	1	2.2	1.8	2.8	3	2.2

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 7: EMERGING TECHNOLOGIES

(Common TO B.E - CSE & B.TECH. - IT)

CS24P35	HUMAN AUGMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand the concept of human augmentation and its technologies.
- To learn wearable and assistive technologies for enhancing human abilities.
- To study brain–computer interfaces and neural systems.
- To understand AR/VR and immersive technologies for augmentation.
- To explore ethical, social, and security issues in human augmentation.

UNIT I – INTRODUCTION

9

Introduction to human augmentation – Definition and scope – Types of augmentation – Natural vs artificial enhancement – Evolution of augmentation technologies – Applications in healthcare, defense, and industry.

UNIT II – WEARABLE AND ASSISTIVE TECHNOLOGIES

9

Wearable devices – Smart glasses and smart watches – Exoskeleton systems – Prosthetics and bionics – Assistive technologies for disabilities – Sensors and IoT in augmentation.

UNIT III – BRAIN–COMPUTER INTERFACES

9

Introduction to BCI – Neural signal processing – EEG basics – Brain-controlled systems – Neuroprosthetics – Applications of BCIs – Challenges in neural integration.

UNIT IV – IMMERSIVE AND DIGITAL AUGMENTATION

9

Augmented Reality (AR) – Virtual Reality (VR) – Mixed Reality (MR) – Haptic feedback systems – Human–machine interaction – Applications in training and simulation.

UNIT V – ETHICS AND FUTURE TRENDS

9

Ethical issues in human augmentation – Privacy and security concerns – Social impact – Human enhancement debate – Legal regulations – Future trends and emerging technologies.

COURSE OUTCOMES

After completion of this course, students will be able to:

CO1: Understand the basics of human augmentation systems.

CO2: Apply knowledge of wearable and assistive technologies.

CO3: Analyze brain–computer interface concepts and applications.

CO4: Evaluate AR/VR-based augmentation technologies.

CO5: Create awareness of ethical, social, and future aspects of human augmentation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Human Augmentation: Artificial Intelligence and the Future of Human Enhancement – Brett Frischmann & Evan Selinger, Oxford University Press, 2021.
2. Augmented Human: How Technology Is Shaping the New Reality – Helen Papagiannis, O'Reilly Media, 2020.

REFERENCE

1. Digital Image Processing (4th Edition) – Rafael C. Gonzalez & Richard E. Woods, Pearson, 2023.
2. Computer Vision: Algorithms and Applications (2nd Edition) – Richard Szeliski, Springer, 2022.
3. Deep Learning for Vision Systems – Mohamed Elgendy, Manning, 2022.
4. Hands-On Computer Vision with TensorFlow 2 (2nd Edition) – Benjamin Planche & Eliot Andres, Packt, 2023.
5. Modern Computer Vision with PyTorch – V. Kishore Ayyadevara & Yeshwanth Reddy, Packt, 2023.
6. OpenCV 4 Computer Vision Application Programming Cookbook (4th Edition) – Robert Laganière, Packt, 2022.
7. Programming Computer Vision with Python (Updated Edition) – Jan Erik Solem, O'Reilly, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	2	–	–	–	–	–	2	3	–	3
2	3	3	2	2	3	2	–	–	1	–	3	3	1	3
3	3	3	2	2	3	1	–	–	–	–	3	3	–	3
4	3	3	3	2	3	1	–	–	1	–	3	3	2	3
5	2	2	–	1	1	3	–	–	1	2	1	2	–	2
Avg	2.8	2.6	2	1.75	2.4	1.7	–	–	1	2	2.4	2.8	1.5	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 7: EMERGING TECHNOLOGIES

(Common to: B. E – CSE & B. TECH – IT, AIDS)

CS24P36	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand the fundamentals of additive manufacturing and 3D printing processes.
- Learn different 3D printing technologies, materials, and process principles.
- Gain knowledge of inkjet-based 3D printing and material jetting techniques.
- Understand laser-based additive manufacturing systems and working principles.
- Explore industrial applications and future trends of 3D printing technology.

UNIT I INTRODUCTION

9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT II ADDITIVE MANUFACTURING TECHNOLOGIES

9

Processes – Extrusion, Wire, Granular, Lamination, Photo polymerization; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations

UNIT III INKJET TECHNOLOGY

9

Printer - Working Principle, Positioning System, print head, print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continuous jet, Multijet; Powder based fabrication – Colour jet.

UNIT IV LASER TECHNOLOGY

9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V INDUSTRIAL APPLICATIONS

9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of 3D printing and design considerations.
CO2: Apply knowledge of additive manufacturing processes and material selection.
CO3: Understand inkjet-based 3D printing systems and material jetting techniques.
CO4: Analyze laser-based additive manufacturing systems and their working principles.
CO5: Understand industrial applications and future trends in 3D printing technology.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Shiva, Anuj K. Shukla – Additive Manufacturing and 3D Printing Technology (2024)
2. Ajay Kumar et al. – 3D Printing Technologies: Digital Manufacturing & Industry 4.0 (2024)

REFERENCES:

1. Amit Bandyopadhyay, Susmita Bose – Additive Manufacturing (3rd Ed., 2025)
2. Chua C.K., Leong K.F., Lim C.S. – Rapid Prototyping: Principles and Applications
3. 3D Printing and Additive Manufacturing: Principles and Applications
4. Ian Gibson, David W. Rosen, Brent Stucker – Additive Manufacturing Technologies.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	–	1	–	1	–	–	1	–	2	2	1
2	3	3	3	2	2	1	2	–	1	1	2	3	2	1
3	3	3	2	2	3	–	1	–	1	1	2	2	2	1
4	3	3	2	2	3	–	2	–	1	1	2	2	2	1
5	3	3	2	1	2	2	2	–	1	2	2	2	3	1
AVG	3	2.8	2.2	1.7	2.2	1.5	1.6	–	1	1.2	2	2.2	2.2	1

5. 1 - low, 2 - medium, 3 - high, '–' - no correlation

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 7: EMERGING TECHNOLOGIES

(Common to B. E – CSE & B. TECH – IT, AIDS)

CS24P37	EDGE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics and architecture of Edge Computing.
- To learn edge devices, distributed computing, and IoT integration.
- To explore data processing and edge analytics techniques.
- To study security, virtualization, and AI in edge environments.
- To develop scalable edge computing applications for real-time systems.

UNIT I INTRODUCTION

9

Introduction to edge computing – Evolution from cloud to edge – Basic architecture and characteristics – Comparison of edge, fog, and cloud computing – Edge devices and gateways – Applications in smart cities, healthcare, and IoT systems.

UNIT II EDGE INFRASTRUCTURE AND RESOURCE MANAGEMENT

9

Edge infrastructure – Basics of distributed systems – Virtualization and containers at the edge – Resource allocation and scheduling – Data storage and caching – Load balancing – Latency and scalability management.

UNIT III EDGE ANALYTICS AND IoT INTEGRATION

9

IoT and edge integration – Sensor data processing – Real-time analytics – Stream and event processing – Basic edge AI and machine learning – Data sharing between edge and cloud.

UNIT IV SECURITY AND NETWORKING IN EDGE COMPUTING

9

Security challenges in edge systems – Authentication and access control – Data privacy and encryption – Secure communication – Basic SDN concepts – Edge monitoring and fault tolerance.

UNIT V ADVANCED EDGE COMPUTING APPLICATIONS

9

Edge AI applications – Autonomous systems and robotics – Smart healthcare – Industrial automation – 5G and edge computing – Blockchain in edge systems – Future trends and challenges.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand the concepts and architecture of edge computing.
- CO2: Apply resource management and distributed computing techniques.
- CO3: Implement edge analytics and IoT integration solutions.
- CO4: Analyze security and networking challenges in edge computing.
- CO5: Develop real-time edge computing applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K. Ganesan, "Edge Computing: Fundamentals, Advances and Applications", Wiley India, 2023.
2. Dr. S. Smys and Valentina Emilia Balas, "Edge AI and Intelligent IoT Systems", Springer, 2022.

REFERENCES:

1. Rajkumar Buyya, Satish Narayana Srirama and Associates, "Fog and Edge Computing: Principles and Paradigms", Wiley India, 2019.
2. Vijay Madisetti and Anand Deshpande, "Internet of Things and Edge Computing", McGraw Hill India, 2021.
3. S. Balaji and R. Karthik, "Practical Edge Computing: A Beginner's Guide to Edge AI, IoT, and Analytics", BPB Publications, 2024.
4. Zaigham Mahmood, "Cloud, Fog and Edge Computing", Springer, 2020.
5. Dr. K. Ramesh Babu, "Software Defined Networking and Network Virtualization", CBS Publishers, 2021.
6. Brij B. Gupta and D. P. Agrawal, "Cyber Security for IoT and Edge Computing", Wiley India, 2022.
7. Sachi Nandan Mohanty and P. K. Pattnaik, "5G and Edge Computing for Smart Applications", Springer, 2021.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2	2	–	–	1	–	–	–	2	1	2
2	3	3	2	3	3	–	–	1	–	–	–	3	2	3
3	3	3	3	3	3	–	–	1	1	–	–	3	2	3
4	3	3	2	3	3	–	–	3	1	1	1	3	2	3
5	3	3	3	3	3	–	–	2	2	2	1	3	3	3
AVG	3	2.8	2.2	2.8	2.8	–	–	1.6	1.3	1.5	1	2.8	2	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - I

CS24910	GREEN COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the basics of Green IT and sustainable computing.
- To learn green business practices and energy-efficient IT solutions.
- To study green assets, virtualization, and green frameworks.
- To explore green compliance, standards, and environmental issues.
- To apply Green IT concepts through real-world case studies.

UNIT - I FUNDAMENTALS

9

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon footprint, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT- II GREEN ASSETS AND MODELING

9

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modelling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT - III GRID FRAMEWORK

9

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center –Green Grid framework.

UNIT- IV GREEN COMPLIANCE

9

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap –Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

UNIT- V CASE STUDIES

9

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand the basic concepts of Green Computing.
CO2: Apply Green assets and models used in organizations.
CO3: Analyze the Green Grid framework and related technologies.
CO4: Evaluate standards and issues related to green compliance.
CO5: Create Green IT solutions for different sectors through case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Green IT Strategies and Applications: Using Environmental Intelligence, 2nd Edition, CRC Press, 2023.
2. Sustainable IT Playbook for Technology Leaders, 2nd Edition, Kogan Page, 2024.
3. Green Information Technology: A Sustainable Approach, Updated Edition, CRC Press, 2022.

REFERENCES:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011. 2. John Lamb, "The Greening of IT", Pearson Education, 2009.
2. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008 4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
3. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	–	–	1	2	3	1	–	–	1	2	–	3
2	3	3	2	1	2	2	3	1	1	–	2	3	1	3
3	3	3	2	2	3	2	3	1	–	–	2	3	–	3
4	2	3	1	2	2	3	3	2	–	1	1	2	–	2
5	3	3	3	2	3	2	3	2	1	1	2	3	1	3
Avg	2.8	2.8	2	1.75	2.2	2.2	3	1.4	1	1	1.6	2.6	1	2.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - I

CS24911	INTERNET MARKETING AND E-COMMERCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand the concepts and importance of digital marketing.
- Learn digital marketing strategies and online branding techniques.
- Apply SEO, SEM, email, and mobile marketing methods.
- Analyze social media marketing and customer engagement practices.
- Evaluate digital marketing analytics and recent industry trends.

UNIT - I INTRODUCTION

9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT 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

UNIT III E- MAIL MARKETING & E-COMMERCE

9

Basics of E-Mail Marketing – Types of E-Mail Marketing – Email Automation – Lead Generation – Email and Social Media Integration – Mobile Marketing – Mobile Apps – SMS Campaigns – Mobile Commerce – Customer Targeting and Campaign Performance.

UNIT IV SOCIAL MEDIA MARKETING

9

Social Media Marketing Basics – Social Media Channels – Brand Promotion through Social Media – Social Media Campaigns – Engagement Marketing – Customer Relationship Building – Customer Loyalty – Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION

9

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:

After completion of this course, students will be able to:

CO1: Understand the fundamentals of digital marketing and online branding.

CO2: Apply SEO and SEM techniques for online marketing.

CO3: Analyze email marketing, mobile marketing, and e-commerce strategies.

CO4: Evaluate social media campaigns for customer engagement and branding.

CO5: Create digital marketing strategies using analytics and emerging trends.

TOTAL:45 PERIODS

TEXT BOOKS

1. Digital Marketing Essentials (2nd Edition) – Jeff Larson & Stuart Draper, Wiley, 2024.
2. Digital Marketing Strategy: An Integrated Approach to Online Marketing (4th Edition) – Simon Kingsnorth, Kogan Page, 2022.

REFERENCE BOOKS

1. SEO 2025: Learn Search Engine Optimization – Adam Clarke, Independently Published, 2025.
2. The Art of Digital Marketing (2nd Edition) – Ian Dodson, Wiley, 2024.
3. Email Marketing Rules (4th Edition) – Chad S. White, Wiley, 2023.
4. Digital Analytics for Marketing – Marshall Sponder & Gohar F. Khan, Routledge, 2022.
5. Influencer Marketing Strategy – Gordon Glenister, Kogan Page, 2023.
6. Social Media Marketing: Principles and Practice (3rd Edition) – Tracy L. Tuten & Michael R. Solomon, Sage Publications, 2024.
7. E-Marketing (8th Edition) – Judy Strauss & Raymond Frost, Pearson, 2023.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	–	–	–	–	1	–	1	2	2
2	2	3	2	1	3	–	–	–	1	1	–	2	3	2
3	2	3	2	2	2	–	–	–	1	1	1	2	3	2
4	2	3	2	2	3	1	–	–	2	2	1	2	3	3
5	3	3	3	2	3	1	–	–	2	2	2	3	3	3
Avg	2.4	2.8	2	1.75	2.4	1	–	–	1.5	1.4	1.3	2	2.8	2.4

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - I
COMMON TO B.E. BME, CSE, ECE, EEE & B.TECH., AIDS, IT

ME24901	APPLIED DESIGN THINKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce tools & techniques of design thinking for innovative product.
- To development illustrate customer-centric product innovation using on simple.
- To use cases, demonstrate development of minimum usable prototypes.
- To outline principles of solution concepts & their evaluation
- To describe system thinking principles as applied to complex systems

UNIT I INTRODUCTION TO DESIGN 9

Definition of Design, Understanding of Design, Purpose and nature of good design, evaluation of design, types of Design classifications, role of a designer, Scale, process and production; Context for design problems, design process, stages in the design processes, from different considerations - Broadbent, Christopher Alexander, Wade

UNIT-II DESIGN THINKING PRINCIPLES 9

Exploring Human-centered Design – Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] – Case studies

UNIT III APPLIED DESIGN THINKING TOOLS 9

Concept of Minimum Usable Prototype [MUP] – MUP challenge brief – Designing & Crafting the value proposition – Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design

UNIT-IV DESIGN PROBLEMS AND DIRECTIONS 9

Context for the rise of the Design Methodology Movement, Different approaches in design- synchronous and asynchronous approaches, regression and escalation, participatory approach to design, design as process involving time and people, problem solving or intuitive, formulation of problems, nature of creative design problems, goals in design, different types of designs and the thrust given to the various solutions

UNIT-V SYSTEM THINKING 9

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Define & test various hypotheses to mitigate the inherent risks in product innovations.

CO2 : Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.

CO3 : Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching.

CO4 : Apply system thinking in a real-world scenario.

CO5 : Evaluate complex systems through holistic analysis for improving system performance and sustainability.

TEXT BOOKS:

1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
2. Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith, Trish Papadacos, (2014), Value Proposition Design: How to Create Products and Services Customers Want, Wiley
3. Donella H. Meadows, (2015), “Thinking in Systems -A Primer”, Sustainability Institute.
4. Tim Brown, (2012) “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Business.

REFERENCE BOOKS:

1. Nigel Cross, (2008), Engineering Design Methods: Strategies for Product Design, John Wiley & Sons.
2. Jeanne Liedtka and Tim Ogilvie, (2011), Designing for Growth: A Design Thinking Tool Kit for Managers, Columbia University Press.
3. Hasso Plattner, Christoph Meinel and Larry Leifer, (2011), Design Thinking: Understand – Improve – Apply, Springer.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-		
CO2	3	2	2	-	-	-	-	-	-	-	-		
CO3	3	2	2	-	-	-	-	-	-	-	-		
CO4	2	2	2	-	-	-	-	-	-	-	-		
CO5	3	2	2	-	-	-	-	-	-	-	-		
AVG.	2.80	2.00	2.00	-	-	-	-	-	-	-	-		

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - I

MG24903	BUSINESS STRATEGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the fundamentals of business strategy and management.
- To learn strategic planning and decision-making techniques.
- To study business environment and competitive analysis.
- To understand growth, innovation, and organizational strategies.
- To apply strategic management concepts in business organizations.

UNIT I – INTRODUCTION TO BUSINESS STRATEGY 9

Introduction to business strategy – Strategic management process – Vision, mission, and objectives – Types of business strategies – Strategic decision making – Importance of business strategy.

UNIT II – BUSINESS ENVIRONMENT ANALYSIS 9

Internal and external environment analysis – SWOT analysis – PEST analysis – Industry analysis – Competitive advantage – Market analysis techniques.

UNIT III – STRATEGIC PLANNING AND IMPLEMENTATION 9

Strategic planning process – Business policies – Resource allocation – Organizational structure and strategy – Strategy implementation methods – Change management basics.

UNIT IV – GROWTH AND COMPETITIVE STRATEGIES 9

Business growth strategies – Market penetration – Product development – Diversification – Competitive strategies – Innovation and digital transformation – Global business strategies.

UNIT V – STRATEGIC EVALUATION AND CONTROL 9

Strategy evaluation process – Performance measurement – Balanced scorecard – Risk management – Strategic control systems – Business strategy case studies.

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1: Understand fundamentals of business strategy and management concepts.

CO2: Analyze business environments using strategic analysis tools.

CO3: Apply strategic planning and implementation methods in organizations.

CO4: Evaluate growth and competitive strategies for business development.

CO5: Create effective strategic solutions for organizational success.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Strategic Management: Concepts and Cases: Competitiveness and Globalization (15th Edition) – Michael A. Hitt, R. Duane Ireland & Robert E. Hoskisson, Cengage Learning, 2023.
2. Strategic Management and Business Policy: Globalization, Innovation and Sustainability (16th Edition) – Thomas L. Wheelen, J. David Hunger, Alan N. Hoffman & Charles E. Bamford, Pearson, 2022.
3. Exploring Strategy: Text and Cases (13th Edition) – Richard Whittington, Patrick Regnér,

Duncan Angwin, Gerry Johnson & Kevan Scholes, Pearson, 2023.

4. Business Policy and Strategic Management – P. Subba Rao, Himalaya Publishing House, 2024.

REFERENCE BOOKS

1. Good Strategy Bad Strategy: The Difference and Why It Matters (Updated Edition) – Richard Rumelt, Profile Books, 2023.
2. Competitive Strategy: Techniques for Analyzing Industries and Competitors – Michael E. Porter, Free Press, 2022 reprint edition.
3. Blue Ocean Strategy (Expanded Edition) – W. Chan Kim & Renée Mauborgne, Harvard Business Review Press, 2022.
4. Balanced Scorecard: Translating Strategy into Action – Robert S. Kaplan & David P. Norton, Harvard Business School Press, 2023 reprint edition.
5. Digital Transformation Strategy – Dr. Surya Prakash, BPB Publications, 2024.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	2	2	1	–	1	1	–	1	1	2	2	1	1
2	2	3	2	2	2	1	–	1	1	2	2	1	2
3	2	3	3	2	2	1	–	1	2	2	3	2	2
4	2	3	3	2	2	2	1	1	2	2	3	2	2
5	2	3	3	2	2	2	1	1	2	3	3	2	2
Avg	2	2.8	2.4	2	1.8	1.4	1	1	1.6	2.2	2.6	1.6	1.8

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - I

CS24906	CYBER LAW	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand the fundamentals of cyber law and cyber ethics.
- To learn legal issues related to cyberspace and digital communication.
- To study cyber crimes and legal frameworks for prevention.
- To understand intellectual property rights and privacy laws in cyberspace.
- To gain knowledge of cyber regulations and digital evidence handling.

UNIT I – INTRODUCTION

9

Introduction to cyber law – Need and importance – Cyberspace and internet governance – Cyber ethics – Legal issues in cyberspace – Overview of cyber regulations.

UNIT II – CYBER CRIMES AND LEGAL FRAMEWORK

9

Types of cyber crimes – Hacking – Phishing – Identity theft – Cyber stalking – Malware attacks – Investigation of cyber crimes – Legal provisions and penalties.

UNIT III – INFORMATION TECHNOLOGY ACT

9

Overview of Information Technology Act – Digital signatures – Electronic records – Cyber regulations under IT Act – Certifying authorities – Amendments and provisions.

UNIT IV – PRIVACY AND INTELLECTUAL PROPERTY RIGHTS

9

Privacy issues in cyberspace – Data protection – Intellectual property rights – Copyright – Trademark – Patent issues in digital systems – Software piracy and cyber ethics.

UNIT V – DIGITAL EVIDENCE AND CYBER SECURITY LAWS

9

Digital evidence concepts – Electronic evidence handling – Cyber security policies – International cyber laws – Cyber forensics basics – Case studies in cyber law.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand fundamentals of cyber law and cyber ethics.
CO2: Apply knowledge of cyber crimes and legal frameworks.
CO3: Analyze provisions of the Information Technology Act.
CO4: Evaluate privacy and intellectual property issues in cyberspace.
CO5: Understand digital evidence handling and cyber security regulations.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cyber Law and Cyber Security in India – Pavan Duggal, Universal Law Publishing, 2024.
2. Cyber Laws: Intellectual Property & E-Commerce Security – Vivek Sood, McGraw Hill, 2023.

REFERENCE BOOKS

1. Cyber Crimes and Law – Barkha & U. Rama Mohan, Asia Law House, 2022.
2. Guide to Cyber Laws and Information Technology Act – Dr. Farooq Ahmad, Dreamtech Press, 2023.
3. Internet and Personal Data Protection Law – Nandan Kamath, Sage Publications, 2022.
4. Cyber Forensics and Cyber Security – Nelson Phillips & Enfinger, McGraw Hill, 2020.

5. Information Technology Act, 2000 with Rules and Allied Laws – Taxmann Publications, 2025 Edition.
6. Information Technology Law and Practice – Vakul Sharma, Universal Law Publishing, 2022.
7. Cyber Law, Privacy and Data Protection – Aparna Viswanathan, LexisNexis, 2023.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	–	2	–	3	–	1	–	1	2	–
2	3	3	2	1	1	2	–	3	1	1	1	2	3	1
3	3	3	2	2	1	2	–	3	1	1	1	2	3	1
4	3	3	2	2	1	3	1	3	1	2	1	2	3	1
5	3	3	2	2	2	3	1	3	1	2	2	3	3	1
Avg	3	2.8	1.8	1.75	1.25	2.4	1	3	1	1.4	1.25	2	2.8	1

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - I

RA24903	FOUNDATION OF ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Vision application in robots.
- To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

UNIT-I FUNDAMENTALS OF ROBOT 9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions.

UNIT-II ROBOT KINEMATICS 9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations. Homogeneous transformation matrices, translation and rotation matrices.

UNIT-III ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT-IV SENSORS IN ROBOTICS 9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT-V PROGRAMMING AND APPLICATIONS OF ROBOT 9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Interpret the features of robots and technology involved in the control.

CO2 : Apply the basic engineering knowledge and laws for the design of robotics.

CO3 : Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.

CO4 : Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.

CO5 : Demonstrate the image processing and image analysis techniques by machine vision system.

TEXT BOOKS:

1. S. Ganesh Hegde, A Textbook of Industrial Robotics, Laxmi Publications Pvt. Ltd., Revised Edition, 2019. ISBN: 9789380386867.
2. Mikell P. Groover, Industrial Robotics: Technology, Programming and Applications, McGraw-Hill Education, 2nd Edition, Reprint Edition, 2017. ISBN: 9780070265097.

REFERENCE BOOKS:

1. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Education, Reprint Edition, 2017. ISBN: 9780070226258.
2. Yoram Koren, Robotics for Engineers, McGraw-Hill Education, Reprint Edition, 2018.
3. P. A. Janakiraman, Robotics and Image Processing: An Introduction, Tata McGraw-Hill Education, Reprint Edition, 2011. ISBN: 9780070702561.
4. John J. Craig, Introduction to Robotics: Mechanics and Control, 4th Edition, Pearson Education, 2022. ISBN: 9780137848744.
5. Reza N. Jazar, Theory of Applied Robotics: Kinematics, Dynamics and Control, 3rd Edition, Springer, 2022. ISBN: 9783030933623.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-
AVG.	3	2	2	2	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE I

AS24901	SPACE SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To learn basics of space science and space environment.
- To study how the universe was formed.
- To learn about galaxies and their types.
- To understand stars and their life cycle.
- To study the solar system and planets.

UNIT I - INTRODUCTION

9

Introduction to space science and applications – historical development – Space Environment Vacuum and its Effects, Plasma & Radiation Environments and their Effects, Debris Environment and its Effects - Newton's Law of gravitation – Fundamental Physical Principles.

UNIT II - ORIGIN OF UNIVERSE

9

Early history of the universe – Big-Bang and Hubble expansion model of the universe – cosmic microwave background radiation – dark matter and dark energy.

UNIT III - GALAXIES

9

Galaxies, their evolution and origin – Types of galaxies- active galaxies and quasars – Galactic rotation – Stellar populations – galactic magnetic field and cosmic rays- Dark matter in galaxies

UNIT IV - STARS

9

Stellar spectra and structure – stellar evolution – Nucleo-synthesis and formation of elements – Classification of stars – Harvard classification system – Hertsprung-Russel diagram – Luminosity of star – variable stars – composite stars (white dwarfs, Neutron stars, black hole, star clusters) – Chandrasekhar limit.

UNIT V - SOLAR SYSTEM

9

Nebular theory of formation of our Solar System – Solar wind and nuclear reaction as the source of energy – Sun and Planets: Brief description about shape size – period of rotation about axis and period of revolution – distance of planets from sun –determination of mass of earth – determination of mass of planets with respect to earth – Brief description of Asteroids – Satellites and Comets.

TOTAL PERIODS: 45

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1 : Understand space environment and basic physical laws.
CO2 : Explain Big Bang theory and universe expansion.
CO3 : Identify types of galaxies and their features.
CO4 : Describe star classification and evolution.
CO5 : Explain planets and their motion.

TEXT BOOKS:

1. Hess W., "Introduction to Space Science", Gordon & Breach Science Pub; Revised Ed., 1968.
2. Krishnaswami K. S., "Astrophysics: A modern Perspective", New Age International, 2006.
3. Astronomy 2e – Andrew Fraknoi, David Morrison, Sidney C. Wolff, OpenStax, 2022.

REFERENCE BOOKS:

1. Arnab Rai Choudhuri, "Astrophysics for Physicists", Cambridge University Press, New York, 2010.
2. Krishnaswami K. S., "Understanding cosmic Panorama", New Age International, 2008.
3. The Cosmic Perspective – Jeffrey O. Bennett et al., Pearson, 10th Edition, 2023 (© 2024).
4. Fundamental Astronomy – Hannu Karttunen et al., Springer, 6th Edition, 2017

CO-PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	1	-	-	1
CO2	3	2	-	1	-	-	-	-	-	-	2	1	-	1
CO3	3	2	-	1	-	-	-	-	-	-	2	1	-	1
CO4	3	2	-	2	-	-	-	-	-	-	2	1	-	2
CO5	3	2	-	1	-	-	-	-	-	-	3	2	1	3
Avg	3	2	-	1.25	-	1	-	-	-	-	2	1.25	1	1.6

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II

RA24902	REMOTE SENSING CONCEPTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the Students

- Understand the fundamentals of remote sensing principles and electromagnetic radiation concepts.
- Learn different types of sensors, platforms and image acquisition techniques used in remote sensing.
- Analyze image interpretation, processing and classification methods in remote sensing applications.
- Apply remote sensing techniques for environmental, agricultural and urban applications.
- Evaluate recent developments and applications of remote sensing technologies.

UNIT I - FUNDAMENTALS OF REMOTE SENSING 9

Introduction to remote sensing and electromagnetic spectrum concepts. Interaction of radiation with atmosphere and earth surface. Basic principles and components of remote sensing systems.

UNIT II - SENSORS AND PLATFORMS 9

Types of remote sensing systems and image acquisition methods. Passive and active sensors, satellite platforms and aerial photography concepts. Resolution characteristics in remote sensing systems.

UNIT III - IMAGE PROCESSING AND INTERPRETATION 9

Digital image processing and enhancement techniques. Image interpretation elements and classification methods. Feature extraction and data analysis in remote sensing applications.

UNIT IV - APPLICATIONS OF REMOTE SENSING 9

Remote sensing applications in agriculture, forestry and water resource management. Urban planning, disaster monitoring and environmental analysis using remote sensing data. GIS integration and mapping applications.

UNIT V - EMERGING TRENDS IN REMOTE SENSING 9

Microwave and hyperspectral remote sensing concepts. GPS, GIS and drone based remote sensing applications. Recent trends in satellite imaging and intelligent remote sensing systems.

TOTAL PERIODS: 45

COURSE OUTCOMES

After completion of the course, students will be able to

CO1: Explain the fundamentals of remote sensing systems and electromagnetic radiation concepts.

CO2: Apply sensor technologies and image acquisition methods in remote sensing systems.

CO3: Analyze remote sensing images using processing and classification techniques.

CO4: Utilize remote sensing techniques for environmental and resource management applications.

CO5: Evaluate emerging technologies and modern applications in remote sensing systems.

TEXT BOOKS

1. Remote Sensing and Image Interpretation, Thomas M. Lillesand, Ralph W. Kiefer and Jonathan Chipman, Remote Sensing and Image Interpretation, Wiley India, Seventh Edition, Reprint 2021.
2. Fundamentals of Remote Sensing, George Joseph, Fundamentals of Remote Sensing, Universities Press, Third Edition, Reprint 2022.

REFERENCE BOOKS

1. Remote Sensing Digital Image Analysis, John A. Richards, Remote Sensing Digital Image Analysis, Springer, Sixth Edition, Reprint 2021.
2. Principles of Remote Sensing, Lucas L. F. Janssen, Principles of Remote Sensing, ITC Educational Textbook Series, Reprint 2022.
3. GIS and Remote Sensing Techniques, Lo C.P. and Yeung Albert, Concepts and Techniques of Geographic Information Systems, Pearson Education, Reprint 2021.

CO- PO & PSO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	2	2	-	-	-	2	3	3
CO5	3	3	2	3	3	2	2	-	-	-	2	2	3
Avg	3	3	2.8	2.8	3	2	2	-	-	-	2	2.4	2.4

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – II / III / IV
COMMON TO B.E. CSE., ECE., & B.TECH... AIDS., & IT.

MF24901	REVERSE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply fundamental concepts of reverse engineering in product design and development.
- To utilize principles of material characteristics, part durability, and life limitation in reverse engineering.
- To employ concepts of material identification and process verification in reverse engineering.
- To analyze legal aspects and applications of reverse engineering in product design and development.
- To understand 3d scanning hardware and software operations for generating 3d models.

UNIT-I INTRODUCTION TO REVERSE ENGINEERING 9

Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping- Integration of non-destructive testing (NDT) techniques for material evaluation and defect detection in reverse engineering workflows.

UNIT-II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION 9

Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.

UNIT-III DATA PROCESSING 9

Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.

UNIT-IV 3D SCANNING AND MODELLING 9

Introduction, working principle and operations of 3D scanners: Laser, White Light, Blue Light - Applications- Software for scanning and modelling: Types- Applications- Preparation techniques for Scanning objects- Scanning and Measuring strategies - Calibration of 3D Scanner- Step by step procedure: 3D scanning - Geometric modelling – 3D inspection- Case studies.

UNIT-V INDUSTRIAL APPLICATIONS OF REVERSE ENGINEERING 9

Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry. Case studies and Solving Industrial projects in Reverse Engineering. Legality: Patent – Copyrights –Trade Secret – Third-Party Materials- Case study on Reverse Engineering of engine components and crash-tested vehicle parts for redesign and performance improvement.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- CO1 :** Apply the fundamental concepts and principles of reverse engineering in product design and development.
- CO2 :** Employ material characteristics, part durability, and life limitation concepts in reverse engineering.
- CO3 :** Implement material identification and process verification concepts in reverse engineering.
- CO4 :** Integrate data processing, part performance, and system compatibility concepts in reverse engineering.
- CO5 :** Analyze industrial applications and legal aspects of reverse engineering with case studies.

TEXT BOOKS:

1. Robert W. Messler, Reverse Engineering: Mechanisms, Structures, Systems & Materials, 1st Edition, McGraw-Hill Education, 2016.
2. Wego Wang, Reverse Engineering Technology of Reinvention, CRC Press, Latest Edition (2017).

REFERENCE BOOKS:

1. Scott J. Lawrence, Principles of Reverse Engineering, Kindle Edition, 2022
2. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall, 2001
3. Linda Wills, "Reverse Engineering", Kluwer Academic Publishers, 1996
4. Vinesh Raj and Kiran Fernandes, "Reverse Engineering: An Industrial Perspective", Springer Verlag London Limited, Latest Edition (2014).

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	1	-	-	-	1	2	-	-	-
CO2	3	3	2	3	-	1	-	-	-	1	2	-	1	-
CO3	2	3	2	3	-	1	-	-	-	1	2	-	3	2
CO4	2	2	3	3	-	1	-	-	-	1	2	-	3	2
CO5	2	2	3	2	-	1	-	-	-	2	2	-	3	2
AVG.	2.4	2.4	2.4	2.6	-	1	-	-	-	1.2	2	-	2	1.2

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE -II

CS24909	E-WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- Understand the fundamentals and impacts of e-waste.
- Learn e-waste collection, recycling, and recovery methods.
- Study issues related to improper e-waste management.
- Understand e-waste policies, regulations, and global initiatives.
- Apply sustainable practices for effective e-waste management.

UNIT I – FUNDAMENTALS OF E-WASTE

9

Introduction to e-waste, sources and categories of electronic waste, increasing the generation of e-waste, environmental and health impacts.

UNIT II – E-WASTE HANDLING AND RECYCLING

9

Methods of e-waste collection, segregation, recycling and material recovery processes, role of authorized recycling industries.

UNIT III – ISSUES IN E-WASTE MANAGEMENT

9

Problems related to improper disposal, hazardous materials in electronic devices, informal recycling practices, data privacy and awareness issues.

UNIT IV – CHALLENGES, POLICIES AND REGULATIONS

9

Challenges in implementing the e-waste management systems, global initiatives, Indian e-waste management rules, extended producer responsibility (EPR).

UNIT V – SUSTAINABLE E-WASTE MANAGEMENT PRACTICES

9

Green computing concepts, eco-friendly product design, reuse and refurbishment techniques, circular economy approach, future trends in sustainable e-waste management.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand fundamentals of cyber law and cyber ethics.
- CO2: Apply knowledge of cyber crimes and legal frameworks.
- CO3: Analyze provisions of the Information Technology Act.
- CO4: Evaluate privacy and intellectual property issues in cyberspace.
- CO5: Understand digital evidence handling and cyber security regulations.

TOTAL: 45 PERIODS

TEXT BOOKS

1. E-Waste Management: From Waste to Resource Recovery – Sadhan Kumar Ghosh, Springer, 2024.
2. Electronic Waste Management and Treatment Technology – Sunil Kumar & Rakesh Kumar, Butterworth-Heinemann (Elsevier), 2023.

REFERENCE BOOKS

1. E-Waste Recycling and Management – Vannessa Goodship, Woodhead Publishing, 2023.
2. Circular Economy and E-Waste Management – Surya Prakash & Ravi Shankar, Wiley, 2024.
3. Environmental Impacts of E-Waste – Rakesh Johri, TERI Press, 2022 updated edition.
4. Sustainable Electronics and Green Computing – Subramanian Senthilkannan Muthu, Springer, 2023.
5. E-Waste in Transition: From Pollution to Resource – Florian Kern & Paul Watkiss, Routledge, 2022.
6. Handbook of Electronic Waste Management: International Best Practices and Case Studies – Lawrence K. Wang, Springer, 2022.
7. Green Computing and Green IT Best Practices – Bud E. Smith, CRC Press, 2022.

CO's-PO's & PSO's MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	—	—	2	—	3	—	1	—	1	2	—
2	3	3	2	1	1	2	—	3	1	1	1	2	3	1
3	3	3	2	2	1	2	—	3	1	1	1	2	3	1
4	3	3	2	2	1	3	1	3	1	2	1	2	3	1
5	3	3	2	2	2	3	1	3	1	2	2	3	3	1
Avg	3	2.8	1.8	1.7	1.2	2.4	1	3	1	1.4	1.2	2	2.8	1

1 - low, 2 - medium, 3 - high, '—' - no correlation

OPEN ELECTIVE - II
(Common To B. Tech - IT, B. E - CSE)

BT24902	LIFESTYLE DISEASES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the concept of lifestyle diseases and their major risk factors.
- Gaining the knowledge about common lifestyle disorders and their health impacts.
- Studying the causes, diagnosis, prevention, and treatment of major lifestyle diseases.
- Developing awareness about healthy lifestyle practices for disease prevention.
- Understanding the importance of early diagnosis and preventive healthcare.

UNIT I INTRODUCTION 9

Lifestyle diseases – Definition; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER 9

Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES 9

Coronary atherosclerosis – coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY 9

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES 9

Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:**Identify lifestyle diseases, their risk factors, and preventive measures.
- CO2:**Classify different types of cancer along with their causes, diagnosis, and treatment methods.
- CO3:**Examine cardiovascular diseases, diagnostic techniques, and rehabilitation practices.
- CO4:**Interpret the concepts of diabetes, obesity, blood glucose regulation, and weight management.
- CO5:**Discuss respiratory diseases, their causes, and pulmonary diagnostic methods.

TEXT BOOKS:

1. R.Kumar & Meenal Kumar, “Guide to Prevention of Lifestyle Diseases”, Deep & Deep Publications, 2003
2. Gary Eggar et al, “Lifestyle Medicine”, 3rd Edition, Academic Press, 2017

REFERENCE BOOKS:

1. James M.R, “Lifestyle Medicine”, 2nd Edition, CRC Press, 2013
2. Akira Miyazaki et al, “New Frontiers in Lifestyle-Related Disease”, Springer, 2008

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2		2		2					2			
CO2	2	3	3	2		3					2			
CO3	2	3	3	2		3					2			
CO4	2	3	3	2		3					2			
CO5	2	3	3	2		2					2			
Avg	2.00	2.80	3.00	2.00		2.60					2.00			

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
(Common to B. E – CSE/BME & B. TECH – IT)

BM24902 / BM24P11	MEDICAL INFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the structure and functions of hospital information systems.
- Studying the computer applications in medical imaging and automated clinical laboratories.
- Learning the computerized patient record systems and healthcare information management.
- Understanding the decision support systems and artificial intelligence techniques in clinical diagnosis.
- Exploring the virtual reality and telehealth technologies in healthcare applications.

UNIT I INTRODUCTION TO MEDICAL INFORMATICS 9

Introduction to Medical Informatics, structure of medical informatics, internet and medicine, and security issues in healthcare information systems. Computer-based medical information retrieval, hospital management and information systems, and functional capabilities of computerized hospital information systems. Overview of Health Informatics, Medical Informatics, and Bioinformatics.

UNIT II COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9

Automated clinical laboratories and automated methods in hematology, cytology, and histology. Intelligent laboratory information systems, computerized ECG, EEG, and EMG systems. Computer-assisted medical imaging techniques including ultrasound, CT, nuclear medicine, radiation therapy planning, and MRI.

UNIT III COMPUTERISED PATIENT RECORD 9

Computer-based patient history and human-computer interaction in healthcare systems. Components and functionalities of computerized patient records (CPR), development tools, and intranet-based healthcare systems. Clinical information systems, CPR in radiology, application server providers, and computerized prescription systems.

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING 9

Artificial neural networks and expert systems in healthcare applications. Computer-assisted decision support systems, production rule systems, and decision analysis in clinical medicine. Computers in critical patient care and assistive technologies for physically challenged individuals.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual Reality applications in medicine, virtual endoscopy, computer-assisted surgery, and surgical simulation. Telemedicine, telesurgery, computer-assisted patient education, healthcare information systems, and computer-assisted instruction in medicine.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the structure and functional capabilities of Hospital Information System.

CO2: Describe the need of computers in medical imaging and automated clinical laboratory.

CO3: Analyze the functioning of information storage and retrieval in computerized patient record system.

CO4: Apply the suitable decision support system for automated clinical diagnosis.

CO5: Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

1. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003.
2. R.D.Lele, "Computers in medicine progress in medical informatics", Tata McGraw Hill, 2005

REFERENCES:

1. Kathryn J. Hannah, Marion J Ball, "Health Informatics", 3rd Edition, Springer, 2006.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2		3				2		2	2	3	2
CO2	2	3	2		3				2		3	3	3	2
CO3	3	3	2		3	3			3	2	3	2	3	3
CO4	3	3	3		3				3	2	3	3	3	3
CO5	2	2	2		3	3			2	2	3	2	3	3
Avg	2.40	2.60	2.20		3.00	3.00			2.40	2.00	2.80	2.40	3.00	2.60

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
(Common to: AI&DS, CSE, IT & ECE)

GI24901	GEOGRAPHICAL INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To introduce the fundamental concepts of Geographic Information Systems (GIS).
- To understand spatial data models and database structures
- To learn various methods of spatial data input and processing.
- To understand data quality, metadata, and GIS standards.
- To develop knowledge of GIS data management, analysis, and output generation.

UNIT I FUNDAMENTALS OF GIS

9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, 342 People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS

9

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

UNIT III DATA INPUT AND TOPOLOGY

9

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitizer – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration.

UNIT IV DATA QUALITY AND STANDARDS

9

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure.

UNIT V DATA MANAGEMENT AND OUTPUT

9

Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS distributed GIS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of Geographic Information Systems (GIS).

CO2: Understand and apply spatial data models and database structures.

CO3: Demonstrate the methods of spatial data input and processing.

CO4: Evaluate data quality, metadata, and GIS standards.

CO5: Perform GIS data management, data conversion, and map output generation.

TEXT BOOKS:

1. Kang - Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems", Pearson Education, 2nd Edition, 2007.

REFERENCES:

1. Lo. C. P., Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice-Hall India Publishers, 2006.
2. Paul Bolstad & Steven Manson, "*GIS Fundamentals: A First Text on Geographic Information Systems*", 7th Edition, Eider Press, 2022.
3. Robert Laurini & Derek Thompson, "*Fundamentals of Spatial Information Systems*", 1st Edition, Academic Press, 1992.
4. Debashis Chakraborty & Rabi N. Sahoo, "*Fundamentals of Geographic Information System*", 1st Edition, Viva Books, 2009

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	1	1	1	2	1	1	1	1
CO2	3	3	3	2	3	1	2	2	2	3	2	3	3	3
CO3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3	3	3	3	3	3	3
CO5	1	2	3	2	3	2	3	3	3	3	3	3	3	3
Avg	2.0	2.4	2.6	2.2	2.6	2.0	2.4	2.4	2.4	2.8	2.4	2.6	2.6	2.6

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
(B. TECH / AI&DS, IT & B. E / CSE)

PY24901	PHARMACEUTICAL NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the nanostructure preparation and properties.
- Learning the biomedical applications of nanotechnology.
- Analyzing the nanotechnology in cancer therapy
- Studying the nanomaterials in cosmetics.
- Introducing the a nanotoxicity and safety.

UNIT I NANOSTRUCTURES **9**

Preparation, properties and characterization - Self-assembling nanostructure - vesicular and micellar polymerization-nanofilms - Metal Nanoparticles- lipid nanoparticles- nano emulsions - molecular nanomaterials such as dendrimers and related systems.

UNIT II NANOTECHNOLOGY IN BIOMEDICAL INDUSTRY **9**

Overview of reconstructive interventions and surgery; nanomaterials in bone substitutes and dentistry; implants and prostheses; in vivo imaging for diagnosing genetic defects and other disease states; nanorobotics in surgical procedures; nanocarriers for sustained, controlled, and targeted drug delivery systems.

UNIT III NANOTECHNOLOGY IN CANCER THERAPY **9**

Introduction to cancer cell targeting and detection; polymeric nanoparticles for cancer treatment; mechanisms of drug delivery to tumors, with advantages and limitations; multifunctional nanotherapeutic agents; cancer imaging techniques, including magnetic resonance imaging; and cancer immunotherapy.

UNIT IV NANOTECHNOLOGY IN COSMETICS **9**

Polymers in cosmetics; film formers and thickeners; hair coloring and conditioning/cleansing polymers; silicones and emulsions; stimuli-responsive systems; formulation of nanogels, shampoos, and conditioners; micellar self-assembly; sunscreen dispersions; color cosmetics.

UNIT V NANOTOXICITY **9**

Introduction to nanotoxicology, dose–response relationships, hazard classification, risk assessment and management, factors influencing nanotoxicity, dermal, pulmonary, neurological, and cardiovascular effects of nanoparticles, and gene-level, cellular, and molecular interactions of nanomaterials.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:** Describe nanostructures and their characterization.
- CO2:** Utilize nanotechnology in biomedical applications.
- CO3:** Examine nanotechnology approaches in cancer therapy.
- CO4:** Illustrate the role of nanomaterials in cosmetics.
- CO5:** Assess nano toxic effects and associated risks.

TEXT BOOKS:

1. Springer Handbook of Nanotechnology- Ed. by B. Bhushan, Springer-Verlag 2004
2. Nanobiotechnology: Concepts, Applications and Perspectives,. CM.Niemeyer C A. Mirkin, (Eds) , Wiley, 2004
3. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, Second Edition, CRC Press, 2013
4. Sarah E. Morgan, Kathleen O. Havelka, Robert Y. Lochhead “Cosmetic Nanotechnology: Polymers and Colloids in Cosmetics”, American Chemical Society, 2006.

REFERENCES:

1. Nanotechnology in Biology and Medicine: Methods, Devices and Applications, Tuan VoDinh, CRC Press, 2007
2. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C.N.R. Rao, A. Muller, A. K. Cheetham (Eds), Wiley-VCH Verlag 2004
3. Nanotechnology: Environmental Health and safety, Risks, Regulation and Management, Matthew Hull and Diana Bowman, Elsevier, 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2		2	2									
CO2	3	2	2	2	3									
CO3	3	3	2	2	2	2								
CO4	2	2	2		2	3								
CO5	2	3		2		2	2				2			
Avg	2.60	2.40	2.00	2.00	2.25	2.33	2.00				2.00			

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
(Common to: AI&DS, BME, CSE, ECE, EEE & IT)

AI24902 / AI24903	IT IN AGRICULTURAL SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Introducing the precision agriculture technologies and their role in improving farm productivity.
- Understanding the environment control systems used in greenhouse and controlled farming.
- Developing the knowledge in agricultural systems management and optimization techniques.
- Analyzing the weather prediction models and their application in agricultural planning.
- Familiarizing the students with e-governance, ICT tools, and digital systems in agriculture.

UNIT I PRECISION FARMING **9**

Introduction to Precision Agriculture, Agricultural Management using Technology, Ground-Based Sensors, Remote Sensing in Agriculture, GPS Technology in Farming, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II ENVIRONMENT CONTROL SYSTEMS **9**

Artificial lighting systems for controlled plant growth, Management of crop growth in greenhouse environments, Simulation of CO₂ consumption in greenhouses, Online measurement and monitoring of plant growth, Models of plant production in controlled environments, Introduction to expert systems in horticulture.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT **9**

Overview of agricultural systems and management principles, Reliability and performance of agricultural systems, Simulation of crop growth and field operations, Optimization of resources (water, fertilizers, labor), Basics of linear programming in agriculture, Project scheduling techniques, Role of artificial intelligence and decision support systems.

UNIT IV WEATHER PREDICTION MODELS **9**

Importance of climate variability in agriculture, Basics of seasonal forecasting, Understanding global climate systems, Introduction to global climate models, Application of climate forecasts in agriculture, Systems approach for using seasonal predictions.

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS **9**

Introduction to expert systems and decision support systems, Agricultural and biological databases, Concepts of e-commerce and e-business in agriculture, Technology-enhanced learning systems (e-learning), Role of ICT in rural development, Information society and digital agriculture initiatives.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate precision agriculture technologies (sensors, GPS, GIS, modeling) for farm management.

CO2: Analyze controlled environment systems for greenhouse-based crop production.

CO3: Optimize agricultural systems using management and decision-making techniques.

CO4: Evaluate climate data and forecasting models for agricultural planning.

CO5: Implement ICT tools and digital platforms in agricultural applications.

TEXT BOOKS:

1. National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2. H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.

REFERENCES:

1. Peart, R.M., and Shoup, W. D., "Agricultural Systems Management", Marcel Dekker, New York, 2004.
2. Hammer, G.L., Nicholls, N., and Mitchell, C., "Applications of Seasonal Climate", Springer, Germany, 2000.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	2	-	-	-	-	2	3	-
CO2	2	3	2	2	2	-	3	-	-	-	-	1	2	-
CO3	3	3	3	2	2	2	2	-	-	-	2	2	3	2
CO4	2	3	1	3	2	2	3	-	-	-	2	2	2	3
CO5	2	2	2	-	3	2	2	-	-	-	2	3	3	-
Avg	2.40	2.60	2.00	2.33	2.40	2.00	2.40	-	-	-	2.00	2.00	2.60	2.50

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III / PROFESSIONAL ELECTIVE
(Common to: AI&DS, CSE, ECE, EEE, IT & MECH)

CS24908/ AD24P11	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION

9

Introduction to Virtual Reality and Augmented Reality –Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture – Output Devices – Graphics Display – Human Visual System

UNIT II VR MODELING

9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling –.

UNIT III VR PROGRAMMING

9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D - Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management

UNIT IV APPLICATIONS

9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society - Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – VR in Education.

UNIT V AUGMENTED REALITY

9

Introduction to Augmented Reality-Computer vision for AR-Interaction - Modeling and Annotation Navigation-Wearable devices

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Explain the fundamentals, components, devices, and technologies used in Virtual Reality and Augmented Reality systems.
2. Apply geometric, kinematic, and physical modeling techniques for developing virtual environments.
3. Analyze VR programming concepts, toolkits, and scene graph structures used in application development.
4. Evaluate the applications of Virtual Reality in healthcare, education, entertainment, manufacturing, robotics, and business domains.
5. Develop understanding of Augmented Reality concepts including computer vision, interaction, navigation, modeling, and wearable AR devices.

TEXT BOOKS:

1. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2nd Edition, 2023.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Addison-Wesley Professional, 2nd Edition, 2024.

REFERENCES:

1. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", Morgan & Claypool Publishers, 2nd Edition, 2023.
2. Steve Aukstakalnis, "Practical Augmented Reality", Addison-Wesley Professional, 2nd Edition, 2021.
3. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley-IEEE Press, 3rd Edition, 2020.
4. Alan B. Craig, William R. Sherman, Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2nd Edition, 2022.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	1	1	1	1	1	1	3	2	1
CO2	3	3	2	3	3	1	1	1	1	1	1	3	3	2
CO3	3	3	3	3	3	1	1	1	1	2	1	3	3	2
CO4	2	3	3	3	2	2	1	2	1	2	2	2	3	3
CO5	2	2	3	2	3	2	1	2	2	3	2	2	3	3
Avg	2.6	2.6	2.4	2.6	2.8	1.4	1.0	1.4	1.2	1.8	1.4	2.6	2.8	2.2

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III

EE24906	EMBEDDED SYSTEMS DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the architecture and components of embedded systems.
- To learn embedded programming using microcontrollers.
- To interface sensors, actuators, and peripheral devices.
- To design real-time embedded applications.
- To understand embedded system development tools, debugging, and testing methods.

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems-Characteristics and Classification of Embedded Systems-Hardware and Software Components-Embedded System Architecture- Embedded System Design Flow.

UNIT II - EMBEDDED PROGRAMMING 9

Introduction to Embedded C Programming-Data Types, Operators and Control Statements-Functions and Interrupts-Timers and Counters-GPIO Programming-Memory Organization-Programming ARM/PIC Microcontrollers.

UNIT III - SENSOR AND ACTUATOR INTERFACING 9

Introduction to Sensors and Transducers-Temperature, Light, Motion and Pressure Sensors-Interfacing LEDs, Relays and Motors-LCD and Keypad Interfacing-Serial Communication Basics-UART and I2C Protocols.

UNIT IV - REAL TIME EMBEDDED SYSTEMS 9

Introduction to Real-Time Systems-Tasks, Threads and Scheduling-Interprocess Communication-Synchronization and Deadlocks-Embedded Linux Basics-Device Drivers.

UNIT V - EMBEDDED SYSTEM DESIGN AND APPLICATIONS 9

Embedded System Design Methodology-Hardware-Software Co-Design-Embedded System Modeling-Debugging Techniques-Testing and Validation-Performance. Recent Trends in Embedded Systems-IoT Devices-Wearable Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Explain the architecture, characteristics, and applications of embedded systems.
- CO2: Develop embedded programs using microcontrollers and embedded C.
- CO3: Interface sensors, actuators, and communication modules with embedded platforms.
- CO4: Design and analyze real-time embedded applications and communication protocols.
- CO5: Apply debugging, testing, and optimization techniques in embedded system design.

TEXT BOOKS:

1. Marilyn Wolf, Computers as Components: Principles of Embedded Computing System Design, 4th Edition, Morgan Kaufmann Publishers, 2016.

REFERENCE BOOKS

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition, McGraw Hill Education, 2017.
2. Jonathan W. Valvano, Embedded Systems: Introduction to ARM Cortex-M Microcontrollers, 5th Edition, CreateSpace Independent Publishing, 2014.
3. Michael Barr and Anthony Massa, Programming Embedded Systems in C and C++, 2nd Edition, O'Reilly Media, 2006.

CO- PO & PSO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	1
CO2	3	3	3	2	3	-	-	-	-	-	2	3	2
CO3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	2	-	-	-	-	-	2	3	2
CO5	2	2	3	2	-	-	-	-	-	-	2	3	3
Avg	2.8	2.6	3	2.5	2.5	-	-	-	-	-	2	2.8	2

1 - Low, 2 - Medium, 3 – High

OPEN ELECTIVE - III

EC24903	MICROPROCESOR AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the architecture, addressing modes, instruction set, and basic programming concepts of the 8086 microprocessors.
- Exploring the system bus structure, multiprogramming concepts, and processor configurations of the 8086 microprocessors.
- Learning the interfacing techniques and programming of peripheral ICs with microprocessors for data acquisition and control.
- Understanding the architecture, programming, and peripheral features of the 8051 microcontrollers.
- Gaining insight into modern embedded platforms and RTOS concepts using microcontrollers like Arduino, ARM Cortex-M, and ESP32.

UNIT I THE 8086 MICROPROCESSOR

9

Introduction to 8086 - Microprocessor architecture - Addressing modes - Instruction set and assembler directives - Assembly language programming - Modular Programming - Linking and Relocation - Interrupts and interrupt service routines.

UNIT II 8086 SYSTEM BUS STRUCTURE

9

8086 signals - Basic configurations - IO programming - Introduction to Multiprogramming - System Bus Structure - Multiprocessor configurations - Coprocessor, closely coupled and loosely Coupled configurations - Introduction to advanced processors.

UNIT III INTERFACING BASICS AND IC's

9

Study of Architecture and programming of ICs: 8255 PPI, 8259PIC, 8251USART, 8279 Keyboard display controller and 8254 Timer/Counter – Interfacing with 8086 -A/D and D/A converter interfacing.

UNIT IV THE 8051 MICROCONTROLLER

9

Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Programming 8051 Timers - Serial Communication.

UNIT V ADVANCED MICROCONTROLLERS WITH EMBEDDED PLATFORMS

9

Introduction to real-time operating systems (RTOS) - Comparison of CISC and RISC Architecture - Overview of modern microcontrollers: Arduino, ARM Cortex-M, ESP32 - Embedded Tools and Development Environments (IDE, Debuggers and Emulators)

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:** Describe the architecture, instruction set, and programming techniques of the 8086 microprocessors to develop basic assembly-level applications.
- CO2:** Analyze the system bus structure and processor configurations of the 8086 to design simple multiprocessor and I/O interfacing systems.
- CO3:** Interface and program peripheral ICs such as 8255, 8259, 8251, 8279, and 8254 with microprocessors for real-world data acquisition and control.
- CO4:** Develop embedded programs using the 8051 microcontrollers for timing, serial communication, and I/O operations.
- CO5:** Apply knowledge of modern microcontrollers and embedded platforms, including RTOS concepts, to design basic biomedical and IoT systems.

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007. (UNIT I-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011. (UNIT IV)

REFERENCES:

1. Douglas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3					1	2		2	1
CO2	3	2	2	1	3	3					1	2		2	1
CO3	3	2	2	1	3	3					1	2		2	1
CO4	3	2	2	1	3	3					1	2		2	1
CO5	3	2	2	1	3	3					1	2		2	1
Avg	3	2	2	1	3	3					1	2		2	1

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
B.E- BME, CSE, ECE & B. Tech- AI&DS, IT

MA24901	GRAPH THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the graph models and basic concepts of graphs.
- To study the characterization and properties of trees and graph connectivity.
- To provide an exposure to the Eulerian and Hamiltonian graphs.
- To introduce Graph colouring and explain its significance.
- To provide an understanding of Optimization Graph Algorithms.

UNIT I INTRODUCTION TO GRAPHS 9

Graphs and Graph Models – Connected graphs – Common classes of graphs – Multi graphs and Digraphs – Degree of a vertex – Degree Sequence – Graphs and Matrices – Isomorphism of graphs.

UNIT II TREES AND CONNECTIVITY 9

Bridges – Trees – Characterization and properties of trees – Cut vertices – Cut edges – Connectivity.

UNIT III TRAVERSABILITY 9

Eulerian graphs – Characterization of Eulerian graphs – Hamiltonian graphs – Necessary condition for Hamiltonian graphs – Sufficient condition for Hamiltonian graphs.

UNIT IV PLANARITY AND COLOURING 9

Planar Graphs – The Euler Identity – Non planar Graphs – Vertex Colouring – Lower and Upper bounds of chromatic number.

UNIT V OPTIMIZATION GRAPH ALGORITHMS 9

Dijkstra's shortest path algorithm – Kruskal's and Prim's minimum spanning tree algorithms – Transport Network – The Max-Flow Min-Cut Theorem – The Labeling Procedure – Maximum flow problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Apply graph models for solving real world problem.

CO2: Understand the importance the natural applications of trees and graph connectivity.

CO3: Understand the characterization study of Eulerian graphs and Hamiltonian graphs.

CO4: Apply the graph colouring concepts in partitioning problems.

CO5: Apply the standard optimization graph algorithms in solving application problems.

TEXT BOOKS:

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication, 2008.
2. Gary Chartrand and Ping Zhang, "Introduction to Graph Theory", Tata McGraw – Hill companies Inc., New York, 2006.

REFERENCES:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics, An applied introduction" Fifth edition, Pearson Education, Inc, S
2. Balakrishnan R. and Ranganathan K., "A Text Book of Graph Theory", Springer – Verlag, New York, 2012. 225.
3. Douglas B. West, "Introduction to Graph Theory", Pearson, Second Edition, New York, 2018.
4. Diestel, R, "Graph Theory", Springer, 3rd Edition, 2006.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	2	-	-	-	-	-	-	-
CO3	-	2	2	2	-	-	-	-	-	2	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-
CO5	-	3	2	2	-	-	-	-	-	3	-	-
AVG.	1	2.4	2.2	0.8	0.4	-	-	-	-	1	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
(Common to: AI&DS, BME, CSE, ECE & IT)

AD24903	MULTIVARIATE DATA ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand basic concepts and types of multivariate data analysis techniques.
- To learn how to prepare data and test assumptions for multivariate analysis.
- To understand regression and factor analysis methods and their interpretation.
- To study advanced techniques like SEM, CFA, mediation and moderation models.
- To learn advanced methods like classification, clustering and scaling techniques.

UNIT I INTRODUCTION TO MULTIVARIATE DATA ANALYSIS 9

Introduction – Basic concepts – Uni-variate, Bi-variate and Multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation. Big data analytics concepts – Introduction to machine learning in multivariate analysis – Data visualization techniques – Real-time analytics applications

UNIT II PREPARING FOR MULTIVARIATE ANALYSIS 9

Conceptualization of research problem – Measurement scales and data collection – Data preprocessing and transformation – Handling missing data – Testing assumptions of multivariate analysis. Outlier detection methods – Feature engineering techniques – Data reduction and dimensionality handling – Ethical considerations in data analytics.

UNIT III MULTIPLE REGRESSION AND FACTOR ANALYSIS 9

Introduction to Multiple Linear Regression – Regression model building – Model adequacy checking – Introduction to Factor Analysis – Principal Component Analysis – Exploratory Factor Analysis – Factor extraction methods. Applications in predictive analytics – Software implementation using SPSS and Python.

UNIT IV LATENT VARIABLE TECHNIQUES 9

Confirmatory Factor Analysis – Structural Equation Modelling (SEM) – Mediation and Moderation models – Bayesian inference methods – Model fit indices and interpretation. Partial Least Squares SEM (PLS-SEM) – SmartPLS software applications – Measurement and structural model assessment – Advanced predictive modelling techniques.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES 9

Cluster Analysis – Discriminant Analysis – Logistic Regression – MANOVA – Canonical Correlation Analysis – Applications in data science and analytics – Case studies using statistical software tools. – Artificial Neural Networks (ANN) – Support Vector Machines (SVM) – Decision tree based multivariate models.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Understand different types of multivariate analysis techniques.

CO2: Apply data preparation methods and test assumptions for analysis. **CO3:** Analyze data using regression and factor analysis techniques.

CO4: Apply latent variable models like SEM and CFA for data analysis.

CO5: Use advanced techniques like clustering, classification, and scaling methods.

TEXT BOOKS:

1. Joseph F. Hair Jr., William C. Black, Barry J. Babin and Rolph E. Anderson, “Multivariate Data Analysis”, Cengage Learning, 8th Edition, 2022.
2. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, Wiley India, 3rd Edition, Reprint 2021.

REFERENCES:

1. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, 6th Edition, 2019.
2. K.V.S. Sharma, “Statistics Made Simple: *Do It Yourself on PC*”, Pearson Education, 3rd Edition, 2015.
3. James P. Stevens, “Applied Multivariate Statistics for the Social Sciences”, Routledge, 6th Edition, 2022.
4. Bryan F.J. Manly and Jorge A. Navarro Alberto, “Multivariate Statistical Methods: *A Primer*”, Chapman & Hall/CRC, 4th Edition, 2016.
5. Alvin C. Rencher and William F. Christensen, “Methods of Multivariate Analysis”, Wiley Series, 3rd Edition, 2012.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	1	-	1	-	2	1	-
CO2	3	3	2	2	3	-	-	1	-	1	-	3	2	1
CO3	3	3	3	2	3	-	-	1	-	1	-	3	3	2
CO4	3	3	2	3	3	1	-	1	1	1	-	3	3	2
CO5	3	3	3	3	3	1	1	1	1	2	1	3	3	3
Avg	3.00	2.80	2.20	2.50	2.80	1.00	1.00	1.00	1.00	1.20	1.00	2.80	2.40	2.00

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – III
B. Tech – IT, B.E –CSE

MG24904	NGOs AND SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the importance of sustainable development
- To acquire a reasonable knowledge on the legal frameworks pertaining to pollution control and environmental management
- To comprehend the role of NGOs in attaining sustainable development

UNIT I ENVIRONMENTAL CONCERNS **9**

Introduction to sustainable development goals, Global responsibility of environmental concern, Importance of environmental preservation, Environmental threats, Pollution and its types, Effects of Pollution, Pollution control, Treatment of wastes.

UNIT II ROLE OF NGOS **9**

Role of NGOs in national development, NGO's and participatory management, Challenges and limitations of NGO's, Community Development programmes, Role of NGOs in Community Development programmes, Participation of NGOs in environment management, Corporate Social responsibility, NGO's and corporate social responsibility.

UNIT III SUSTAINABLE DEVELOPMENT **9**

Issues and Challenges of Sustainable Development, Bioenergy, Sustainable Livelihoods and Rural Poor in Sustainable Development, Protecting ecosystem services for sustainable development, Non-renewable sources of energy and its effect, Renewable sources of energy for sustainability, Nuclear resources and Legal Regulation of Hazardous Substances, Sustainable Development: Programme and Policies, Sustainability assessment and Indicators.

UNIT IV NGO'S FOR SUSTAINABILITY **9**

Civil Society Initiatives in Environment Management, Civil Society Initiatives for Sustainable Development, Global Initiatives in Protecting Global Environment, World Summit on Sustainable Development (Johannesburg Summit 2002), Ecological economics, Environmental sustainability, Social inclusion, Health for all, education for all, Food security and Water security, NGOs and Sustainable Development strategies.

UNIT V LEGAL FRAMEWORKS **9**

Need for a Legal framework and its enforcement, Legal measures to control pollution, Environmental Legislations in India, Mechanism to implement Environmental Laws in India, Legal Protection of Forests Act 1927, Legal Protection of Wild Life, Role of NGO's in implementing environmental laws, Challenges in the implementation of environmental legislation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

- CO1** : Analyze the issues and challenges being faced in attaining sustainable development.
- CO2** : Examine the role of NGOs towards sustainable development.
- CO3** : Develop strategies for NGOs in attaining sustainable development.
- CO4** : Recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment.
- CO5** : Understand the environmental legislations.

TEXT BOOKS:

1. Biswajeet Pradhan, NGOs and Sustainable Development, Concept Publishing Company (2006).
2. Richard T. Wright, Dorothy F. Boorse (2020), Environmental Science: Towards a Sustainable Future, Pearson (13th Edition).

REFERENCE BOOKS:

1. . Kulsange, S and Kamble, R. (2019). Environmental NGO's: Sustainability Stewardship, Lap Lambert Academic Publishing, India, ISBN-13: 978-6200442444.
2. Dodds, F. (2007). NGO diplomacy: The influence of nongovernmental organizations in international environmental negotiations. Mit Press, Cambridge, ISBN-13: 978-0262524766..
3. Ghosh, S. (Ed.). (2019). Indian environmental law: Key concepts and principles. Orient BlackSwan, India, ISBN-13: 978-9352875795.
4. Alan Fowler and Chiku Malunga (2010) NGO Management: The Earthscan Companion, Routledge, ISBN-13: 978-1849711197.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	3	2	-	1	-	1
CO2	-	-	-	-	1	2	3	2	-	1	-	2
CO3	-	-	1	-	2	3	3	2	-	1	-	2
CO4	-	-	-	-	-	3	3	3	-	1	-	2
CO5	-	-	-	-	1	3	3	3	-	1	-	2
Avg	-	-	1	-	1.33	2.40	3.00	2.40	-	1.00	-	1.80

1 - low, 2 - medium, 3 - high, '-' - no correlation

OPEN ELECTIVE - III

MG24902	DEMOCRACY AND GOOD GOVERNANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To understand the concepts of democracy and governance.
- To learn the principles and features of good governance.
- To study the role of citizens and institutions in democracy.
- To understand transparency, accountability, and public administration.
- To analyze challenges and practices in democratic governance.

UNIT I – INTRODUCTION

9

Meaning and concepts of democracy – Types of democracy – Features of democratic systems – Constitution and rule of law – Rights and duties of citizens – Role of elections.

UNIT II – GOVERNANCE AND PUBLIC ADMINISTRATION

9

Concept of governance – Public administration basics – Role of government institutions – Policy making – Decentralization – E-governance and digital governance.

UNIT III – PRINCIPLES OF GOOD GOVERNANCE

9

Transparency – Accountability – Participation – Responsiveness – Equity and inclusiveness – Effectiveness and efficiency – Rule of law in governance.

UNIT IV – CITIZEN PARTICIPATION AND SOCIAL RESPONSIBILITY

9

Citizen participation in governance – Civil society organizations – Public awareness – Social responsibility – Human rights – Role of media in democracy.

UNIT V – CHALLENGES AND FUTURE OF GOVERNANCE

9

Corruption and anti-corruption measures – Challenges in democratic governance – Sustainable development goals – Ethical governance – Future trends in governance and administration.

COURSE OUTCOMES

After completion of this course, students will be able to:

- CO1: Understand the concepts and principles of democracy.
CO2: Explain governance and public administration systems.
CO3: Apply principles of good governance in society and administration.
CO4: Analyze citizen participation and social responsibility.
CO5: Evaluate challenges and future trends in democratic governance.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Governance and Public Administration – M. Laxmikanth, McGraw Hill, 2024.
2. Indian Polity for Civil Services and Other State Examinations (7th Edition) – M. Laxmikanth, McGraw Hill, 2025.

REFERENCE BOOKS

1. Governance in India (3rd Edition) – M. Laxmikanth, McGraw Hill, 2023.
2. Principles of Public Administration – Fadia & Fadia, Sahitya Bhawan Publications, 2022.
3. Good Governance in India – R. P. Sinha, LexisNexis, 2023.
4. E-Governance – Pankaj Sharma, APH Publishing, 2022.
5. Ethics, Integrity and Aptitude – Subba Rao & P. N. Roy Chowdhury, McGraw Hill, 2024.
6. Public Administration and Governance – S. R. Maheshwari, Orient Blackswan, 2023.
7. Democracy, Governance and Public Policy – Bidyut Chakrabarty, Sage Publications, 2022.

CO-PO MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	–	3	–	2	–	1	–	–	2	–
2	3	3	2	1	–	3	1	2	1	1	1	–	2	–
3	2	3	2	2	1	3	2	2	2	1	1	–	2	–
4	2	3	2	2	1	3	2	3	2	2	1	–	2	–
5	2	3	2	2	1	3	1	2	1	2	2	–	3	–
Avg	2.4	2.8	1.8	1.75	1	3	1.5	2.2	1.5	1.4	1.25	–	2.2	–

1 - Low, 2 - Medium, 3 – High

OPEN ELECTIVE - III
(Common To B.E - BME, CSE & B. Tech - IT)

MR24901	MECHATRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the principles and selection of sensors and transducers.
- Analyzing the fundamentals and design concepts of mechatronics systems.
- Learning the architecture and programming of programmable logic controllers.
- Studying the real-time interfacing and data acquisition systems.
- Interpreting the case studies of industrial mechatronics systems and applications.

UNIT I SENSORS AND TRANSDUCERS

9

Sensors and Transducers, Performance Terminology, Displacement, Position, Proximity sensors, Velocity and Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature Sensors, Light Sensors, Selection of Sensors.

UNIT II INTRODUCTION TO MECHATRONICS

9

Introduction to Mechatronics, Systems, Need for Mechatronics, Emerging areas of Mechatronics, Classification of Mechatronics, Design Process of Mechatronics, Examples of Mechatronics Systems.

UNIT III PROGRAMMABLE LOGIC CONTROLLERS

9

Basic PLC Structure, Architecture, I/O Processing, Programming with Timers and Counters, Instruction Lists, Latching and Internal Relays, Master and jump Controls, Data Handling, Selection of PLC.

UNIT IV REAL TIME INTERFACING

9

Introduction to real-time interfacing, interfacing standards, and elements of data acquisition and control systems. Overview of I/O processes, general-purpose I/O cards, data conversion techniques, application software, and man-machine interface systems.

UNIT V CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM

9

Motion control using DC motors, AC motors, and servo motors, Temperature control systems, pick-and-place robots, car parking barrier systems, washing machine control systems, and auto-focus and exposure control in cameras.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:** Explain the operating principles and characteristics of sensors and transducers.
- CO2:** Describe the fundamentals, classification, and design process of mechatronics systems.
- CO3:** Apply PLC architecture and programming techniques for automation systems.
- CO4:** Analyze real-time interfacing methods and data acquisition systems used in mechatronics.
- CO5:** Evaluate mechatronics system applications involving motion and temperature control systems.

TEXT BOOKS:

1. Bolton W., "Mechatronics", Pearson Education, 6th Edition, 2015.
2. Devdas Shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2012.
3. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John Wiley and sons Ltd, 2003.

REFERENCES:

1. Bradley D.A., Dawson D., Buru N.C. and Loader A.J., "Mechatronics", Chapman and Hall, 1993.
2. Davis G. Alciatore and Michael B. Histan, "Introduction to Mechatronics and Measurement systems", McGraw Hill Education, 2011.
3. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", Cengage Learning, 2010.
4. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts and Applications", McGraw Hill Education, 2015.
5. Smaili. A and Mrad. F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2		3						2	3	2	2
CO2	3	2	3	2	2				2		2	2	3	2
CO3	3	3	3	2	3				2		2	3	3	2
CO4	3	3	2	3	3				2		3	2	3	3
CO5	3	2	3	2	2	3			2		3	3	3	2
Avg	3.00	2.40	2.60	2.25	2.60	3.00			2.00		2.40	2.60	2.80	2.20

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III

(Common to B. E - BME, CSE, ECE, B. Tech - IT)

AU24901	BATTERIES AND MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of battery technologies and battery characteristics.
- To learn the structure, functions, and requirements of Battery Management Systems (BMS).
- To study battery state estimation methods such as SOC and SOH.
- To understand battery modeling and simulation techniques for energy storage applications.
- To gain knowledge of BMS design and applications in electric vehicles and renewable energy systems.

UNIT I INTRODUCTION TO BATTERY TECHNOLOGIES 9

Introduction to Battery Management Systems (BMS) – Cells and batteries – Battery parameters: nominal voltage, capacity, C-rate, energy and power density – Series and parallel connection of cells – Electrochemical cells and Lithium-ion batteries – Rechargeable batteries – Charging and discharging characteristics – Overcharging and undercharging effects – Charging methods and modes of charging.

UNIT II BATTERY MANAGEMENT SYSTEM REQUIREMENTS 9

Introduction and functions of BMS – Battery pack architecture and topology – Voltage, temperature and current sensing techniques – High-voltage contactor control – Isolation monitoring – Thermal management and protection systems – Communication interfaces in BMS – Range estimation – State of Charge estimation overview.

UNIT III BATTERY STATE ESTIMATION TECHNIQUES 9

Basic definitions of battery state parameters – Battery State of Charge (SOC) estimation methods – Voltage-based and model-based SOC estimation techniques – Battery State of Health (SOH) estimation – Battery degradation and aging mechanisms – Aging characteristics of lithium-ion battery electrodes – Performance evaluation.

UNIT IV BATTERY MODELLING AND SIMULATION 9

Battery modeling concepts – Equivalent Circuit Models (ECM) – Physics-based and empirical modeling approaches – Simulation of battery systems – Electric vehicle battery simulation – Vehicle range estimation – Constant power and voltage simulation – Battery pack simulation techniques.

UNIT V DESIGN AND APPLICATIONS OF BMS 9

Design principles of Battery Management Systems – Battery pack design considerations – Effect of operating conditions on battery life – Multi-battery systems and energy balancing – Battery management in electric vehicles – Renewable energy storage applications – Recent trends and future developments in BMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the fundamentals of batteries, their characteristics, and charging/discharging methods.
- CO2:** Describe the functions and components of Battery Management Systems (BMS).
- CO3:** Apply SOC and SOH estimation techniques to assess battery performance.
- CO4:** Analyze battery models and simulate battery systems for electric vehicle applications.
- CO5:** Design and evaluate Battery Management Systems for electric vehicles and energy storage systems.

TEXT BOOKS:

1. Davide Andrea, Battery Management Systems for Large Lithium-Ion Battery Packs, Artech House, Reprint 2021.
2. S. R. Paranjothi and R. Prakash, Electric Vehicle Technology and Battery Management Systems, Charulatha Publications, First Edition, 2022.

REFERENCES:

1. Shunli Wang and Ping Liu, Lithium-Ion Batteries: Fundamentals and Applications, Wiley, 2020.
2. Ru-Shi Liu, Leif Nyholm and Guoyao Zheng, Rechargeable Batteries: Materials, Technologies and New Trends, Wiley-VCH, 2020.
3. James Larminie and John Lowry, Electric Vehicle Technology Explained, 2nd Edition, Wiley, Reprint 2021.
4. Arun Kumar Bansal and Sanjeevikumar Padmanaban, Battery Management Systems and Applications in Electric Vehicles, Springer, 2022.
5. Gianfranco Pistoia, Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure and the Market, Elsevier, 2021.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2					2					1	2
CO2	3	3	2	2	2		2					2	3
CO3	3	3	2	3	3							2	3
CO4	3	3	3	3	3							3	3
CO5	3	3	3	2	3	2	2					3	3
Avg	3.0	2.8	2.5	2.5	2.8	2.0	2.0					2.2	2.8

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV

IM24901	WORLD CLASS MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- Understand global manufacturing excellence practices.
- Learn customer-focused manufacturing principles.
- Analyze costing, quality, and team effectiveness.
- Study strategic manufacturing planning and linkages.
- Identify industrial impediments and continuous improvement methods.

UNIT- I INDUSTRIAL DECLINE AND ASCENDANCY

9

Manufacturing excellence - US Manufacturers - French Manufacturers - Japan decade – American decade - Global decade.

UNIT - II BUILDING STRENGTH – FOCUSED PRINCIPLES

9

Customer - Focused principles - General principles - Design - Operations - Human resources - Quality and Process improvement - Promotion and Marketing.

UNIT - III VALUE AND VALUATION

9

Product Costing - Motivation to improve - Value of the enterprises QUALITY - The organization: Bulwark of stability and effectiveness - Employee stability – Quality Individuals Vs. Teams - Team stability and cohesiveness - Project cohesiveness and stability.

UNIT - IV STRATEGIC LINKAGES

9

Product decisions and customer service - multi-company planning - Internal manufacturing planning - Soothing the demand turbulence.

UNIT - V IMPEDIMENTS

9

Bad plant design - Mismanagement of capacity - Production Lines - Assembly Lines – Whole Plant Associates - Facilitators - Teams Manship - Motivation and reward in the age of continuous Improvement.

COURSE OUTCOMES:

After completion of this course, students will be able to:

- CO1: Understand industrial growth, decline, and global manufacturing trends.
CO2: Apply customer-focused principles in design, operations, and quality improvement.
CO3: Analyze product costing, enterprise value, and team effectiveness.
CO4: Evaluate strategic planning and customer service linkages in manufacturing.
CO5: Create continuous improvement practices to overcome production challenges.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Operations Management: Sustainability and Supply Chain Management (14th Edition) – Jay Heizer, Barry Render & Chuck Munson, Pearson, 2023.
2. Manufacturing Planning and Control for Supply Chain Management (7th Edition) – F. Robert Jacobs, William Berry, D. Clay Whybark & Thomas Vollmann, McGraw Hill, 2022.

REFERENCE BOOKS

1. Toyota Production System: Beyond Large-Scale Production – Taiichi Ohno, Productivity Press, 2023 reprint edition.
2. Operations Strategy (6th Edition) – Nigel Slack & Michael Lewis, Pearson, 2022.
3. Strategic Manufacturing Management – Roger G. Schroeder & Johnny Rungtusanatham, McGraw Hill, 2021.
4. Continuous Improvement Strategies – Bhushan Mahajan, BPB Publications, 2024.
5. Quality Management for Organizational Excellence (9th Edition) – David L. Goetsch & Stanley Davis, Pearson, 2022.
6. The Goal: A Process of Ongoing Improvement (4th Edition) – Eliyahu M. Goldratt & Jeff Cox, Routledge, 2023.
7. Lean Thinking: Banish Waste and Create Wealth in Your Corporation (Revised Edition) – James P. Womack & Daniel T. Jones, Simon & Schuster, 2021.

CO-PO MAPPING

CO's	PO's											PSO's		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	–	1	2	2	1	–	1	1	–	1	–
2	2	3	3	2	2	2	2	1	2	1	2	1	1	–
3	2	3	2	2	1	2	1	1	2	1	3	1	1	–
4	2	3	2	2	1	2	1	1	2	2	3	1	1	–
5	3	3	3	2	2	2	2	1	2	2	3	2	2	–
Avg	2.4	2.8	2.2	2	1.4	2	1.6	1	2	1.4	2.4	1.25	1.2	–

1 - low, 2 - medium, 3 - high, '–' - no correlation

OPEN ELECTIVE - IV
(COMMON TO B.E. CSE., & B.TECH. IT)

AU24902	ELECTRIC AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand fundamentals of hybrid and electric vehicles and their types.
- To learn EV architecture, components, and drive systems.
- To study energy storage systems and battery management.
- To analyze hybrid vehicle configurations and control strategies.
- To apply energy management techniques and emerging EV technologies.

UNIT I – INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES **9**

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicles (PHEV), Fuel Cell Vehicles (FCV) – Need for electric mobility – Environmental impact – Advantages and limitations – Vehicle performance parameters – Comparison of conventional, hybrid and electric drive systems.

UNIT II – ELECTRIC VEHICLE ARCHITECTURE AND COMPONENTS **9**

General structure of electric vehicle – EV configuration – Electric propulsion system – Power electronics in EVs – Types of electric motors: DC motor, induction motor, Permanent Magnet Synchronous Motor (PMSM), brushless DC motor (BLDC) – Drive train components.

UNIT III – ENERGY STORAGE SYSTEMS **9**

Electrochemical energy storage systems – Batteries: lead acid, nickel metal hydride, lithium-ion – Battery characteristics – Battery Management System (BMS) – Charging methods – Charging infrastructure – Safety and thermal management.

UNIT IV – HYBRID ELECTRIC VEHICLES **9**

Types of hybrid configurations: series, parallel, and series-parallel hybrids – Power split devices – Control strategies – Regenerative braking – Engine start-stop system – Fuel economy and emission reduction techniques.

UNIT V – ENERGY MANAGEMENT AND EMERGING TRENDS **9**

Energy management strategies in EV/HEV – Vehicle control unit – Embedded systems in EVs – Smart charging – Vehicle-to-grid (V2G) concept – Autonomous and connected electric vehicles – Future trends in electric mobility.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- CO1:** Understand the fundamentals of electric vehicles, hybrid vehicles, and their configurations.
- CO2:** Explain the architecture and components of electric drive systems used in EVs.
- CO3:** Analyze different energy storage systems and battery management techniques.
- CO4:** Describe hybrid electric vehicle configurations and control strategies.
- CO5:** Apply energy management and emerging technologies in modern electric mobility systems.

TEXTBOOKS:

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, Third Edition, 2021
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

REFERENCE BOOKS:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
2. Rand D.A.J, Woods, R & Dell RM” Batteries for Electric vehicles”, John Wiley & Sons, 1998
3. “Hybrid, Electric and Fuel-Cell Vehicles”, International Edition by Jack Erjavec | 6 June 2012
4. “Energy Management in Hybrid Electric Vehicles using Co-Simulation” by Christian Paar | 11 February 2011

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	3	2	-	2	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	3	3
CO4	3	3	3	-	2	-	-	-	-	-	-	3	3
CO5	2	3	3	3	2	-	-	-	-	-	-	3	3
AVG.	2.80	3	2.5	2.5	2	-	-	-	-	-	-	2.8	2.8

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
(Common to B. E - CSE, B. Tech - IT)

FD24904	TRADITIONAL INDIAN FOODS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students:

- Understand the history and cultural importance of traditional Indian foods.
- Compare traditional and modern food processing methods.
- Understand the importance of traditional foods at national and global levels.
- Understand commercial preparation and packaging of traditional foods and beverages.
- Compare traditional foods with fast foods and junk foods.

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES

9

Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; food in understanding human culture - variability, diversity, from basic ingredients to food preparation; specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING

9

Traditional methods of milling grains – rice, wheat and corn – equipment and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods.

UNIT III TRADITIONAL FOOD PATTERNS

9

Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods.

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS

9

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS OF TRADITIONAL FOODS

9

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments / illnesses.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

CO1: Explain the historical, cultural and religious significance of traditional Indian foods.

CO2: Describe traditional food processing and preservation methods and compare them with modern techniques.

CO3: Identify regional food patterns and various traditional Indian food products.

CO4: Understand the commercial production, packaging and marketing of traditional foods and beverages.

CO5: Evaluate the nutritional and health benefits of traditional foods compared to fast foods.

TEXT BOOKS:

1. Sen, Colleen Taylor "Food Culture in India" Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2			2			2	2			2			
CO2	2		3	2			3	3			2			
CO3	2		3	2			3	3			2			
CO4	2		3	2			3	3			2			
CO5	2		3	2			3	3			2			
Avg	2.00		3.00	2.00			2.80	2.80			2.00			

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE- IV
Common To B.E – CSE & B.Tech.. I.T

PT24901	BASICS OF PLASTICS PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals of plastics processing, such as the relationships between material structural properties and required processing parameters, and so on
- To gain practical knowledge on the polymer selection and its processing.
- Understanding the major plastic material processing techniques.
- To understand suitable additives for plastics compounding.
- To propose troubleshooting mechanisms for defects found in plastics products manufactured by various processing techniques.

UNIT I INTRODUCTION TO PLASTICS PROCESSING 9

Introduction to plastic processing – Principles of plastic processing: processing of plastics vs. metals and ceramics. Factors influencing the efficiency of plastics processing: molecular weight, viscosity and rheology. Difference in approach for thermoplastic and thermoset processing. Additives for plastics compounding and processing: antioxidants, light stabilizers, UV stabilizers, lubricants, impact modifiers, flame retardants, antistatic agents, stabilizers and plasticizers.

UNIT II EXTRUSION 9

Extrusion – Principles of extrusion. Features of extruder: barrel, screw, types of screws, drive mechanism, specifications, heating & cooling systems, types of extruders. Flow mechanism: process variables, die entry effects and exit instabilities. Die swell, Defects: melt fracture, shark skin, bambooing. Factors determining efficiency of an extruder. Extrusion of films: blown and cast films. Tube/pipe extrusion. Extrusion coating: wire & cable. Twin screw extruder and its applications. Applications of extrusion and new developments.

UNIT III INJECTION MOLDING 9

Injection molding - Types of clamping: hydraulic and toggle mechanisms. Start-up and shut down procedures-Cylinder nozzles- Press capacity projected area - Interaction of moulding process aspect effects in quoted variables. Basic mould types. Reciprocating vs. plunger type injection moulding. Thermoplastic vs. thermosetting injection moulding. Injection moulding vs. other plastic processing techniques. State-of-the art injection molding techniques.

UNIT IV COMPRESSION AND TRANSFER MOLDING 9

Compression moulding – Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties, moulding materials, process variables and process cycle. Preforms and preheating- Techniques of preheating. Common moulding faults and their correction- Finishing of mouldings. Transfer moulding: working principle, equipment, Press capacity- pot transfer, plunger transfer and screw transfer moulding techniques, advantages over compression moulding.

UNIT V BLOW MOLDING, THERMOFORMING AND CASTING 9

Blow moulding: principles and terminologies. Injection blow moulding. Extrusion blow moulding. Design guidelines for optimum product performance and appearance. Thermoforming: principle, vacuum forming, pressure forming mechanical forming. Casting: working principle, types and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

- CO1** : Ability to find out the correlation between various processing techniques with product properties.
- CO2** : Understand the major plastics processing techniques used in moulding extrusion, thermoforming, and casting.
- CO3** : Acquire knowledge on additives for plastic compounding and methods employed for the same.
- CO4** : Familiarize with the machinery and ancillary equipment associated with various plastic processing techniques.
- CO5** : Select an appropriate processing technique for the production of a plastic product.

TEXTBOOK:

1. Vijay K. Stokes, Introduction to Plastics Engineering, Wiley-ASME Press, 2020.
2. Erwin Baur, Tim A. Osswald, and Natalie Rudolph, Carl Hanser Verlag, 2019.

REFERENCES BOOKS:

1. S. S. Schwartz, S. H. Goodman, Plastics Materials and Processes, Van Nostrand Reinhold Company Inc. (1982).
2. F. Hensen (Ed.), Plastic Extrusion Technology, Hanser Gardner (1997).
3. W. S. Allen and P. N. Baker, Hand Book of Plastic Technology, Volume-1, Plastic Processing Operations [Injection, Compression, Transfer, Blow Molding], CBS Publishers and Distributors (2004).
4. M. Chanda, S. K. Roy, Plastic Technology handbook, 4th Edn., CRC Press (2007).
5. I. I. Rubin, Injection Molding Theory & Practice, Society of Plastic Engineers, Wiley (1973).
6. D.V. Rosato, M. G. Rosato, Injection Molding Hand Book, Springer (2012).
7. M. L. Berins (Ed.), SPI Plastic Engineering Hand Book of Society of Plastic Industry Inc., Springer (2012).
8. D.V Rosato, Blow Molding Hand Book, Carl Hanser Verlag GmbH & Co (2003).

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	1	1	1	-	-	-	1	1
CO2	1	2	2	1	1	1	-	1	-	-	2	2
CO3	1	1	2	2	2	1	1	2	-	-	2	2
CO4	1	2	3	1	2	1	-	1	-	-	1	2
CO5	1	1	3	2	1	1	1	-	-	-	2	2
Avg	1.00	1.40	2.20	1.60	1.40	1.00	1.00	1.33	-	-	1.60	1.80

1 – Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
B.E- BME, CSE &B. Tech- AI&DS, IT

IE 24901	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To formulate linear programming problems and solve LPP using simple algorithm
- To solve networking problems
- To formulate and solve integer programming problems
- To solve Non-Linear programming problems
- To understand and solve project management problems

UNIT I LINEAR PROGRAMMING 9

LP formulation and graphic solution – Resource allocation problems – simplex method – sensitivity analysis.

UNIT II DUALITY AND NETWORKS 9

Definition of dual problems – primal – Dual relationships – Dual simplex method –post optimality analysis – Transportation and assignment model – Shortest route problem.

UNIT III INTEGER PROGRAMMING 9

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV CLASSICAL OPTIMIZATION THEORY 9

Unconstrained external problems, Newton – Raphson method – Equality constraints –Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V OBJECT SCHEDULING 9

Network diagram representation – Critical path method – Time charts and resource levelling – PERT.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Use Simplex method to solve optimization problems

CO2: Solve the problems to find minimum cost and shortest route.

CO3: Apply integer programming to solve real-life applications.

CO4: Apply the methods to solve Non-linear programming problems.

CO5: Use PERT &CPM for project management.

TEXT BOOKS:

1. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.

REFERENCES:

1. Paneer Selvam, „Operations Research“, Prentice Hall of India, 2002.
2. Anderson "Quantitative Methods for Business", 8th Edition, Thomson Learning, 2002.
3. Winston "Operation Research", Thomson Learning, 2003.
4. Vohra, "Quantitative Techniques in Management", Tata Mc Graw Hill, 2002.
5. Anand Sarma, "Operation Research", Himalaya Publishing House, 2003.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	-	-	-	-	1	2	1
CO2	1	2	2	-	-	-	-	-	-	1		2
CO3	2	3	1	-	-	-	-	-	-	1	1	1
CO4	2	1		-	-	-	-	-	-	1		1
CO5	1	2	1	-	-	-	-	-	-		1	
AVG.	1.4	2	1.2	-	-	-	-	-	-	0.8	0.8	1

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
BM24P08 (Common to B.E - BME, ECE)
BM24903 (Common to B. Tech - AI&DS, IT, B.E - CSE, EEE)

BM24P08 / BM24903	WEARABLE DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the fundamentals of wearable systems and sensors.
- Studying the signal processing and energy harvesting methods for wearable devices.
- Learning the wireless health monitoring systems and body area networks.
- Understanding the smart textile technologies and fabrication techniques.
- Exploring the medical and healthcare applications of wearable systems.

UNIT I INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS 9

Introduction to wearable systems, need, applications, types, and components of wearable monitoring systems. Sensors for wearable systems including inertia movement sensors, respiration activity sensors, inductive and impedance plethysmography, pneumography, and wearable ground reaction force sensors.

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING 9

Wearability issues, sensor placement, signal acquisition, sampling techniques, and rejection of irrelevant information. Energy harvesting methods: solar, vibration-based, thermal-based systems, hybrid thermoelectric photovoltaic harvesting, and thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS 9

Need for wireless monitoring, body area networks (BAN) in healthcare, and BAN architecture. Technical challenges including system security, reliability, and wireless communication techniques.

UNIT IV SMART TEXTILE 9

Introduction to smart textiles: passive and active smart textiles. Fabrication techniques using conductive fibres, treated conductive fibres, conductive fabrics, and conductive inks. Case study on smart fabrics for monitoring biological parameters such as ECG and respiration.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to

- CO1:** Explain the principles, components, and sensors used in wearable systems.
- CO2:** Analyze signal processing techniques and energy harvesting methods for wearable devices.
- CO3:** Apply wireless communication and body area network concepts in healthcare monitoring applications.
- CO4:** Illustrate the smart textile technologies and fabrication methods for biomedical applications.
- CO5:** Compare the various wearable devices in healthcare system.

TEXT BOOKS:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 3rd Edition, 2007
2. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", TMH, 3rd Edition, 2007
3. 3. S. Haykin , "Digital Communications", John Wiley, 2005

REFERENCES:

1. H P Hsu, Schaum "Outline Series, Analog and Digital Communications", TMH, 2006
2. B.Sklar, "Digital Communications Fundamentals and Applications", Pearson Education, 2nd Edition, 2007.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2			2						2	3	2	
CO2	3	3	2	2	3	2				2	2	2	3	2
CO3	2	3	2	2	3				2	2	2	2	3	3
CO4	2	2	3	2	3				2	3	2	3	2	2
CO5	3	2	2		2	2			2	3	3	3	3	3
Avg	2.60	2.40	2.25	2.00	2.60	2.00			2.00	2.50	2.20	2.60	2.60	2.50

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – IV
COMMON TO B.E. BME., CSE., & B.TECH. IT

MF24902	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To summarize the costing concepts and their role in decision making.
- To exploring concepts of project management and selection factors.
- To interpret costing concepts with project execution.
- To understand knowledge of costing techniques in service sector and various budgetary control techniques.
- To illustrate with quantitative techniques in cost management.

UNIT-I INTRODUCTION TO COSTING CONCEPTS 9

Aims of Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Building a Database for Process Control.

UNIT-II FUNDAMENTALS OF PROJECT MANAGEMENT 9

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project Execution as Integration of Technical and Non-Technical Activities, Detailed Engineering activities, Pre-Project Execution Clearances and Documentation, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.

UNIT-III PROJECT EXECUTION AND COSTING CONCEPTS 9

Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

UNIT-IV SERVICE SECTOR COSTING AND BUDGETARY CONTROL 9

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT-V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT (Program Evaluation and Review Technique) /CPM (Critical Path Method), Transportation problems, Assignment problems, Learning Curve Theory- Formulation of Linear Programming Problems- Graphical Method of LPP Solution.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- CO1 :** Understand the costing concepts and their role in decision making.
CO2 : Analysis of Project Management Concepts in Selection Process.
CO3 : Interpret costing concepts with project execution.
CO4 : Overview of Costing and Budgetary Control in Service Operations
CO5 : Become familiar with quantitative techniques in cost management.

TEXT BOOKS:

1. John M. Nicholas, Herman Steyn Project Management for Engineering, Business and Technology, Taylor & Francis, 2 August 2020, ISBN: 9781000092561.
2. Albert Lester, Project Management, Planning and Control, Elsevier/Butterworth-Heinemann, 2007, ISBN: 9780750669566, 075066956X.

REFERENCE BOOKS:

1. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1991.
2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988
3. Charles T. Horngren et al Cost Accounting a Managerial Emphasis, Prentice Hall of India, New Delhi, 2011.
4. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, 2003.
5. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 2007.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	-	-	1	-	2	2	1	1
CO2	3	3	2	2	3	-	-	2	2	3	2	1	1
CO3	3	3	3	2	3	-	-	2	2	2	2	2	2
CO4	3	2	2	2	3	-	-	-	-	2	2	2	2
CO5	3	3	2	3	3	-	-	1	-	2	3	2	3
AVG.	3.00	2.80	2.20	2.20	3.00	-	-	1.20	1.00	2.20	2.20	1.60	1.80

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
(Common to: AI&DS, CSE, EEE & IT)

AI24901	URBAN AGRICULTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts and scope of urban agriculture.
- To learn modern crop production techniques in urban environments.
- To study vertical farming and soil-less cultivation methods.
- To understand irrigation, nutrient, and pest management practices.
- To learn sustainable waste management techniques in urban farming.

UNIT I INTRODUCTION TO URBAN AGRICULTURE 9

Urban agriculture – Definition and scope – Benefits: economic, environmental, social and cultural – Health and nutrition aspects – Food security – Role in sustainable urban development – Urban food supply chain – Climate change impact on urban farming – Government policies and initiatives – Case studies of urban agriculture practices. Digital platforms for marketing and distribution of farm produce – Role of startups in urban agriculture.

UNIT II VERTICAL FARMING SYSTEMS 9

Vertical farming – Types – Green walls and green facades – Roof gardening – Kitchen gardening – Indoor plant systems – Components: plant selection, growing media, irrigation – LED grow lights – Automation in vertical farming – Nutrient Film Technique (NFT) – Space optimization – Cost and economic feasibility. Artificial Intelligence applications in vertical farming - Commercial vertical farming models and case studies.

UNIT III SOIL-LESS CULTIVATION TECHNIQUES 9

Hydroponics, aeroponics and aquaponics – Principles and working – Types of hydroponic systems (wick, DWC, drip) – Advantages and limitations – Nutrient solution preparation – Sensor-based nutrient and water monitoring – Water recycling and reuse in hydroponics-PH and water quality management – Disease control – Greenhouse cultivation – Urban landscaping and backyard gardening.

UNIT IV MODERN URBAN FARMING TECHNOLOGIES 9

GIS and remote sensing in agriculture – Blockchain technology in agricultural supply chain – Robotics and automation in farming operations – Vertical pipe cultivation – Micro irrigation systems – Rain hose system – Polyhouse, greenhouse and shade net farming – Smart farming practices – IoT-based irrigation – Precision agriculture – Use of drones in agriculture – Mobile applications for farm management – Crop selection techniques.

UNIT V WASTE MANAGEMENT AND SUSTAINABILITY 9

Biofertilizers and biopesticides from organic waste – Life Cycle Assessment (LCA) in agriculture - Waste management concepts – Organic waste recycling – Garden waste utilization – Solid waste management – Microbial decomposition – Vermicomposting – Biogas production – Composting methods (aerobic and anaerobic) – Circular economy in agriculture – Zero waste farming – Waste-to-energy techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the principles and scope of urban agriculture and its role in sustainability.

CO2: Explain vertical farming and soil-less cultivation techniques.

CO3: Apply irrigation, nutrient and pest management methods in urban farming.

CO4: Analyze modern urban farming technologies and optimize production.

CO5: Evaluate waste management practices for sustainable urban agriculture.

TEXT BOOKS:

1. David Tracey, "Urban Agriculture: Ideas and Designs for the New Food Revolution", New Society Publishers, 1st Edition, 2011.
2. Howard M. Resh, "Hydroponic Food Production: A Definitive Guidebook for the Advanced Home Gardener and the Commercial Hydroponic Grower", CRC Press, 7th Edition, 2012.

REFERENCES:

1. Dickson Despommier, "Vertical Farming: The Sky's the Limit", Columbia University Press, 1st Edition, 2010.
2. Dickson Despommier, "The Vertical Farm: Feeding the World in the 21st Century", Thomas Dunne Books, 2011.
3. Michael Raviv and J. Heinrich Lieth, "Soilless Culture: Theory and Practice", Elsevier, 2008.
4. Toyoki Kozai, Genhua Niu, and Michiko Takagaki, "Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production", Academic Press, 2016.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	2	3	1	-	1	-	2	1	-
CO2	2	2	2	1	1	-	2	-	-	-	-	2	2	1
CO3	3	2	2	2	2	-	2	-	1	-	-	3	2	1
CO4	2	3	2	2	2	1	2	-	-	-	-	2	3	2
CO5	2	2	1	1	-	3	3	2	-	-	-	2	2	1
Avg	2.2	2.2	1.6	1.4	1.4	1.5	2.4	1.0	1.0	1.0	-	2.2	2.0	1.25

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE -IV
COMMON TO B.E. CSE., & B.TECH. IT

SF24902	INDUSTRIAL HYGIENE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand occupational hygiene standards and their role in workplace safety.
- To compare environmental and biological monitoring methods in workplace safety.
- To identify, assess, and control risks from airborne gases, vapours, and dust particles.
- To understand the use of personal protective equipment (ppe) for reducing workplace exposure risks.
- To explain methods for managing and controlling noise hazards at workplaces.

UNIT I INTRODUCTION AND SCOPE 9

Occupational Health and Environmental Safety Management - Principles practices. Comm on Occupational diseases: Occupational Health Management Services at the work place. Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.

UNIT II MONITORING FOR SAFETY, HEALTH & ENVIRONMENT 9

Occupational Health and Environment Safety Management System, ILO and EPA Standards Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.

UNIT III OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY EDUCATION 9

Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs. Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Exposure Limit.

UNIT IV OCCUPATIONAL SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT 9

Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM. Importance of Industrial safety, role of safety department,

UNIT V INDUSTRIAL HAZARDS 9

Radiation: Types and effects of radiation on human body, Measurement and detection of radiation intensity. Effects of radiation on human body, Measurement – disposal of radioactive waste, Control of radiation. Noise and Vibration: Sources, and its control, Effects of noise on the auditory system and health, Measurement of noise, Different air pollutants in industries, Effect of different gases and particulate matter, acid fumes, smoke, fog on human health, Vibration: effects.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- CO1 :** Understand and apply human factors engineering in existing and new systems.
- CO2 :** Design systems that help prevent occupational injuries.
- CO3 :** Apply the principles of work design, motion economy, and workplace design.
- CO4 :** Understand human sensory, mental, and physical abilities and limitations in human-machine systems.
- CO5 :** Recognize the effect of workplace design and environment on productivity.

TEXTBOOKS:

1. R. K. Jain and Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi, 2024.
2. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, New York., 14th Edition 2026.

REFERENCE BOOKS:

1. Jeanne MagerStellman, Encyclopedia of Occupational Health and Safety (ILO) Ms. Irma Jourdan publication
2. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth Heinemann Ltd., London (1991).
3. Industrial Safety - National Safety Council of India
4. R. K. Jain and Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi (2006).

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	-	-	1
CO2	3	3	3	1	2	2	2	-	-	-	1
CO3	3	2	3	1	2	-	1	-	-	-	1
CO4	3	3	2	2	2	1	-	-	-	-	1
CO5	3	2	2	1	2	1	2	-	-	-	1
AVG.	3	2.4	2.4	1.2	2	1.33	1.67	-	-	-	1

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – IV

RA24904	DRONE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the fundamentals of drone systems and UAV architecture.
- Study aerodynamic principles and flight mechanics of drones.
- Analyze components such as sensors, controllers, and communication systems.
- Learn navigation, control, and autonomous flight techniques.
- Explore applications of drones in various engineering and societal domains.

UNIT I - INTRODUCTION TO DRONE SYSTEMS 9

Overview of UAVs and drones, classification of drones, applications of drones, basic flight principles, drone anatomy and system components, regulatory framework and safety guidelines.

UNIT II - AERODYNAMICS AND FLIGHT MECHANICS 9

Basics of aerodynamics, lift, thrust, drag, and weight, multirotor dynamics, stability and control, propulsion systems, battery and power systems.

UNIT III - DRONE HARDWARE AND SENSORS 9

Flight controller architecture, IMU, GPS, magnetometer, barometer, ultrasonic and vision sensors, motor and ESC systems, communication modules.

UNIT IV - NAVIGATION AND CONTROL SYSTEMS 9

Drone navigation systems, PID control, trajectory planning, autonomous flight control, obstacle detection and avoidance, path planning algorithms.

UNIT V- DRONE APPLICATIONS AND EMERGING TRENDS 9

Applications in agriculture, surveillance, disaster management, delivery systems, mapping and surveying, AI-based drones, swarm robotics, future trends in UAV technology.

TOTAL:45 PERIODS

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Explain drone architecture and UAV systems.

CO2: Apply aerodynamics and flight principles in drones.

CO3: Analyze sensors and control systems used in UAVs.

CO4: Analyze navigation and autonomous flight techniques.

CO5: Identify real-world applications and emerging drone technologies.

TEXT BOOKS:

1. Reg Austin, Unmanned Aircraft Systems: UAV Design, Development and Deployment, Wiley, 2023 Edition.
2. Kimon P. Valavanis, Advances in Unmanned Aerial Vehicles, Springer, 2022 Updated Edition.

REFERENCE BOOKS:

1. Rafael Yanushevsky, Guidance of Unmanned Aerial Vehicles, CRC Press, 2023 Edition.
2. Abdul Basit et al., Drone Technology in Engineering Applications, Elsevier, 2024 Edition.
3. S. N. Omkar, Unmanned Aerial Vehicles: A Primer on Drone Technology, CRC Press, 2024 Edition.

CO- PO & PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	-	2	-	2	-	-	-	-	2	2	2
CO3	3	2	-	2	-	2	-	-	-	-	2	2	2
CO4	3	3	-	2	-	2	-	-	-	-	2	3	3
CO5	3	3	-	2	-	-	-	-	-	-	2	3	3
Avg.	3	2.6	-	2	-	2	-	-	-	-	2	2.4	2.4

1 - Low, 2 - Medium, 3 – High