



ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

R2024

**CURRICULUM
&
SYLLABI**



GRT INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tiruttani

(An Autonomous Institution)

Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai.

An ISO 9001:2015 Certified Institution. Accredited by NAAC with "A++" Grade.

B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM REGULATIONS - 2024

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABI (SEMESTER I TO VIII)

(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	0	4	4	60/40
2	GE24201	Engineering Graphics	ES	2	0	3	5	4	60/40
3	PH24201	Physics for Information Science	BS	3	0	0	3	3	60/40
4	CS24201	C Language Programming	PC	3	0	0	3	3	60/40
5	TA24201	Tamils and Technology	HS	1	0	0	1	1	60/40
THEORY CUM PRACTICAL COURSES									
6	EE24203	Basic Electrical and Electronics Engineering	ES	3	0	2	5	4	50/50
PRACTICAL COURSES									
7	GE24202	Engineering Practices Laboratory	ES	0	0	4	4	2	40/60
8	CS24202	C Language Programming Laboratory	PC	0	0	4	4	2	40/60
9	HS24201	English Communication Laboratory	HS	0	0	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	MA24305	Probability and Statistics	BS	3	1	0	4	4	60/40
2	AD24301	Artificial Intelligence	PC	3	0	0	3	3	60/40
3	AD24302	Fundamentals of Data Science and Analytics	PC	3	0	0	3	3	60/40
4	AD24303	Java Programming	PC	3	0	0	3	3	60/40
5	EC24303	Computer Organization and Digital Principles	ES	3	0	0	3	3	60/40
THEORY CUM PRACTICAL COURSES									
6	AD24304	Principles of Data Structures and Algorithms	PC	3	0	2	5	4	50/50
PRACTICAL COURSES									
7	AD24305	Artificial Intelligence Laboratory	PC	0	0	4	4	2	40/60
8	AD24306	Data Science and Analytics Laboratory	PC	0	0	4	4	2	40/60
9	AD24307	Java Programming Laboratory	PC	0	0	4	4	2	40/60
10	GE24S01	Professional Development	EEC	0	0	2	2	1	0/100
TOTAL				18	1	16	35	27	

SEMESTER - IV									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	MA24403	Discrete Mathematics	BS	3	1	0	4	4	60/40
2	AD24401	Machine Learning	PC	3	0	0	3	3	60/40
3	AD24402	Relational Database Management Systems	PC	3	0	0	3	3	60/40
4	AD24403	Fundamentals of Operating Systems	ES	3	0	0	3	3	60/40
5	GE24401	Environmental Science and Engineering	ES	2	0	0	2	2	60/40
THEORY CUM PRACTICAL COURSES									
6	AD24404	Data Exploration and Visualization	PC	3	0	2	5	4	50/50
PRACTICAL COURSES									
7	AD24405	Machine Learning Laboratory	PC	0	0	4	4	2	40/60
8	AD24406	Relational Database Management Systems Laboratory	PC	0	0	4	4	2	40/60
9	AD24S01	Technical Skill Practices	EEC	0	0	2	2	1	0/100
TOTAL				17	1	12	30	24	

SEMESTER - V									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	AD24501	Deep Learning	PC	3	0	0	3	3	60/40
2	AD24502	Optimization Techniques	PC	3	0	0	3	3	60/40
3	AD24503	Fundamentals of Computer Networks	ES	3	0	0	3	3	60/40
4		Open Elective – I	OE	3	0	0	3	3	60/40
5		Non-Credit Mandatory Course – I	MC	3	0	0	3	-	0/100
6		Professional Elective – I	PE	-	-	-	-	3	-
7		Professional Elective – II	PE	-	-	-	-	3	-
PRACTICAL COURSES									
8	AD24504	Deep Learning Laboratory	PC	0	0	4	4	2	40/60
9	AD24S02	Design Thinking and Project Development Laboratory	EEC	0	0	2	2	1	0/100
TOTAL				-	-	-	-	21	

SEMESTER - VI									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	AD24601	Generative AI	PC	3	0	0	3	3	60/40
2		Open Elective – II	OE	3	0	0	3	3	60/40
3		Management - Elective	HS	3	0	0	3	3	60/40
4		Non-Credit Mandatory Course – II	MC	3	0	0	3	-	0/100
5		Professional Elective–III	PE	-	-	-	-	3	-
6		Professional Elective–IV	PE	-	-	-	-	3	-
THEORY CUM PRACTICAL COURSES									
7	AD24602	Big Data Analytics	PC	3	0	2	5	4	50/50
PRACTICAL COURSES									
8	AD24603	Generative AI Laboratory	PC	0	0	4	4	2	40/60
TOTAL				-	-	-	-	21	

SEMESTER - VII									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
THEORY COURSES									
1	AD24701	Text and Speech Analysis	PC	3	0	0	3	3	60/40
2	GE24701	Human Values and Ethics	HS	2	0	0	2	2	60/40
3		Open Elective – III	OE	3	0	0	3	3	60/40
4		Open Elective – IV	OE	3	0	0	3	3	60/40
5		Professional Elective–V	PE	-	-	-	-	3	-
PRACTICAL COURSES									
6	AD24702	Summer Internship	EEC	0	0	0	0	2	0/100
TOTAL				-	-	-	-	16	

SEMESTER - VIII									
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
PRACTICAL COURSES									
1	AD24801	Project Work / Internship	EEC	-	-	20	20	10	40/60
TOTAL				-	-	-	20	10	

TOTAL CREDITS	166
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SUMMARY

Name of the Programme: Artificial Intelligence and Data Science										
S. No.	Subject Area	Credits per Semester								Total Credits
		1	2	3	4	5	6	7	8	
1	HS	5	3				3	2		13
2	BS	12	7	4	4					27
3	ES	5	10	3	5	3				26
4	PC		5	19	14	8	9	3		58
5	PE					6	6	3		15
6	OE					3	3	6		12
7	EEC			1	1	1		2	10	15
8	Non-Credit Mandatory					✓	✓			
TOTAL		22	25	27	24	21	21	16	10	166

MANDATORY COURSE

NON-CREDIT MANDATORY COURSE I								
S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	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.NO	COURSE CODE	COURSE TITLE	CATE-GORY	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.NO	COURSE CODE	COURSE TITLE	CATE-GORY	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 Vertical for AIDS I	Vertical II Full Stack Development for IT	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media	Vertical VI Emerging Technologies	Vertical VII Vertical for AIDS II
Knowledge Engineering	App Development	Virtualization	Ethical Hacking	Augmented Reality and Virtual Reality	Robotic Process Automation	Bio-Inspired Optimization Techniques
Recommendation Systems	Web Technology	Data Warehousing	Social Network Security	Multimedia and Animation	Neural Networks and Deep Learning	Reinforcement Learning
Soft Computing	Cloud Services Management	Cloud Computing	Data and Information Security	Video Creation and Editing	Cyber Security	Health Care Analytics
Computer Vision	UI and UX Design	Storage Technologies	Fundamentals of Cryptography	3D Printing and Design	Quantum Computing	Image and Video Analytics
Business Analytics	Software Testing	Software Defined Networks	Engineering Secure Software Systems	Multimedia Data Compression and Storage	Internet of Things	Game Theory
Natural Language Processing	Web Application Security	Stream Processing	Digital and Mobile Forensics	Game Development	Cryptocurrency and Blockchain Technologies	Cognitive Science
Agent Based Intelligent System	DevOps	Security and Privacy in Cloud	Network Security	Visual Effects	Edge Computing	Ethical AI

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: VERTICAL FOR AIDS I

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	AD24P01	Knowledge Engineering	PE	3	0	0	3	3	60/40
2	AD24P02	Recommendation Systems	PE	3	0	0	3	3	60/40
3	AD24P03	Soft Computing	PE	2	0	2	4	3	50/50
4	AD24P04	Computer Vision	PE	3	0	0	3	3	60/40
5	AD24P05	Business Analytics	PE	3	0	0	3	3	60/40
6	AD24P06	Natural Language Processing	PE	3	0	0	3	3	60/40
7	AD24P07	Agent Based Intelligent System	PE	3	0	0	3	3	60/40

VERTICAL II: FULL STACK DEVELOPMENT FOR IT

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24P09	App Development	PE	3	0	0	3	3	60/40
2	IT24P10	Web Technology	PE	3	0	0	3	3	60/40
3	CS24P18	Cloud Services Management	PE	2	0	2	4	3	50/50
4	CS24P06	UI and UX Design	PE	2	0	2	4	3	50/50
5	CS24P12	Software Testing	PE	3	0	0	3	3	60/40
6	CS24P07	Web Application Security	PE	3	0	0	3	3	60/40
7	CS24P05	DevOps	PE	3	0	0	3	3	60/40

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24P21	Virtualization	PE	3	0	0	3	3	60/40
2	CS24P19	Data Warehousing	PE	2	0	2	4	3	50/50
3	AD24P08	Cloud Computing	PE	3	0	0	3	3	60/40
4	CS24P20	Storage Technologies	PE	3	0	0	3	3	60/40
5	IT24P04	Software Defined Networks	PE	3	0	0	3	3	60/40
6	CS24P22	Stream Processing	PE	3	0	0	3	3	60/40
7	CS24P27	Security and Privacy in Cloud	PE	3	0	0	3	3	60/40

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	IT24P05	Ethical Hacking	PE	2	0	2	4	3	50/50
2	IT24P06	Social Network Security	PE	3	0	0	3	3	60/40
3	AD24P09	Data and Information Security	PE	3	0	0	3	3	60/40
4	CS24P28	Fundamentals of Cryptography	PE	3	0	0	3	3	60/40
5	AD24P10	Engineering Secure Software Systems	PE	2	0	2	4	3	50/50

6	IT24P07	Digital and Mobile Forensics	PE	3	0	0	3	3	60/40
7	CS24P25	Network Security	PE	2	0	2	4	3	50/50

VERTICAL V: CREATIVE MEDIA

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	AD24P11	Augmented Reality and Virtual Reality	PE	3	0	0	3	3	60/40
2	IT24P11	Multimedia and Animation	PE	3	0	0	3	3	60/40
3	IT24P12	Video Creation and Editing	PE	3	0	0	3	3	60/40
4	CS24P36	3D Printing and Design	PE	3	0	0	3	3	60/40
5	IT24P13	Multimedia Data Compression and Storage	PE	2	0	2	4	3	50/50
6	CS24P17	Game Development	PE	2	0	2	4	3	50/50
7	IT24P14	Visual Effects	PE	2	0	2	4	3	50/50

VERTICAL VI: EMERGING TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	CS24P32	Robotic Process Automation	PE	2	0	2	4	3	50/50
2	AD24P12	Neural Networks and Deep Learning	PE	2	0	2	4	3	50/50
3	IT24P09	Cyber Security	PE	3	0	0	3	3	60/40
4	CS24P33	Quantum Computing	PE	3	0	0	3	3	60/40
5	AD24P13	Internet of Things	PE	3	0	0	3	3	60/40
6	CS24P26	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	3	60/40
7	CS24P37	Edge Computing	PE	3	0	0	3	3	60/40

VERTICAL VII: VERTICAL FOR AIDS II

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	AD24P14	Bio-Inspired Optimization Techniques	PE	2	0	2	4	3	50/50
2	AD24P15	Reinforcement Learning	PE	3	0	0	3	3	60/40
3	AD24P16	Health Care Analytics	PE	3	0	0	3	3	60/40
4	AD24P17	Image and Video Analytics	PE	3	0	0	3	3	60/40
5	AD24P18	Game Theory	PE	3	0	0	3	3	60/40
6	AD24P19	Cognitive Science	PE	2	0	2	4	3	50/50
7	AD24P20	Ethical AI	PE	3	0	0	3	3	60/40

OPEN ELECTIVES

OPEN ELECTIVE – I

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	AS24901	Space Science	OE	3	0	0	3	3	60/40
2	IE24901	Introduction to Industrial Engineering	OE	3	0	0	3	3	60/40
3	FD24901	Food, Nutrition and Health	OE	3	0	0	3	3	60/40
4	CE24902	Environmental and Social Impact Assessment	OE	3	0	0	3	3	60/40
5	EE24901	Renewable Energy System	OE	3	0	0	3	3	60/40
6	EI24901	Introduction to Industrial Instrumentation and Control	OE	3	0	0	3	3	60/40
7	MA24901	Graph Theory	OE	3	0	0	3	3	60/40

OPEN ELECTIVE – II

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	IE24902	Resource Management Techniques	OE	3	0	0	3	3	60/40
2	MG24901	Fintech Regulation	OE	3	0	0	3	3	60/40
3	FD24903	Holistic Nutrition	OE	3	0	0	3	3	60/40
4	AI24902	IT in Agricultural System	OE	3	0	0	3	3	60/40
5	EC24904	Introduction to Control Engineering	OE	3	0	0	3	3	60/40
6	PY24901	Pharmaceutical Nanotechnology	OE	3	0	0	3	3	60/40
7	AE24902	Aviation Management	OE	3	0	0	3	3	60/40

OPEN ELECTIVE – III

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	HS24901	English for Competitive Examinations	OE	3	0	0	3	3	60/40
2	ME24901	Applied Design Thinking	OE	3	0	0	3	3	60/40
3	MF24901	Reverse Engineering	OE	3	0	0	3	3	60/40
4	IE24903	Industrial Management	OE	3	0	0	3	3	60/40
5	RA24903	Foundation of Robotics	OE	3	0	0	3	3	60/40
6	RA24902	Remote Sensing Concepts	OE	3	0	0	3	3	60/40
7	CH24901	Nano Technology	OE	3	0	0	3	3	60/40
8	AI24901	Urban Agriculture	OE	3	0	0	3	3	60/40
9	EE24903	PLC and SCADA	OE	3	0	0	3	3	60/40
10	EC24901	Fundamentals of Electron Devices	OE	3	0	0	3	3	60/40

OPEN ELECTIVE – IV

S.NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	EXT / INT
				L	T	P			
1	HS24902	Project Report Writing	OE	3	0	0	3	3	60/40
2	AD24903	Multivariate Data Analysis	OE	3	0	0	3	3	60/40
3	RA24905	Concepts in Mobile Robots	OE	3	0	0	3	3	60/40
4	RA24904	Drone Technologies	OE	3	0	0	3	3	60/40
5	GI24901	Geographical Information System	OE	3	0	0	3	3	60/40
6	AI24904	Agriculture Entrepreneurship Development	OE	3	0	0	3	3	60/40
7	FD24902	Food safety and Quality Regulations	OE	3	0	0	3	3	60/40
8	BM24903	Wearable Devices	OE	3	0	0	3	3	60/40
9	EE24904	Sensors and Actuators	OE	3	0	0	3	3	60/40
10	EI24902	Introduction to Industrial Automation Systems	OE	3	0	0	3	3	60/40

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

HS24101	PROFESSIONAL ENGLISH				L	T	P	C
		3	0	0	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	1		
CO2		2		2		2	2		3	3	2	2	1		
CO3		2		2		2	2		3	3	2	3	1		
CO4		1		2		3	2		3	3	2	3	1		
Avg		1.75		2		2.25	2		3	3	2	2.5	1		

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.

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	3	-	-	1	-	-	1	-	1	-	-	-	-	-
CO2	3	2	2	1	2	1	2	2	-	1	-	2	-	1	
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	-	-	-
Avg	2.8	2.6	1.75	1.25	1.6	1	1.3	1.6	-	1	-	2	-	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

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 NANO CHEMISTRY 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	1
CO3	3	1				-	-	2				3			
CO4	3	1	1			1	3	2				2			
CO5	3	2	2	2		3	3	1				3			1
Avg	2.8	1.5	1.33	1.5	2	1.75	2.25	1.6				2.75		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

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							1	1		
CO2	3	3	3		2							1	1		
CO3	3	3	3		2							1	1	1	
CO4	3	3	3		2						1	1	1	1	
CO5	3	2	1		1						1	1	1	1	
Avg	3	2.8	2.6		1.8						0.5	1	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

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 முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தோல்லியல் துறை வெளியீடு).
4. பொருதை - ஆற்றங்கரை நாகரிகம் (தோல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).

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

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	1		
CO2	3	3	3	3	2						3	2	1		
CO3	3	3	3	3	2						3		1	1	
CO4	1	2			1						1		1	1	
CO5	2	2			2						2		1	1	
Avg	2.4	2.6	3	3	1.8						2.4	2	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

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	2				1		1	1
CO3	3	2	1	1			1	1						1	1
CO4	2	1	2			2	2	2							
CO5	2	1	2		1	2	2	2				1	1		1
Avg	2.6	1.3	1.6	1	1	1.4	1.8	1.6				1.3	1	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

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	1		
CO2		2		3		2	3		3	3	3	1	1		
CO3		2		3		1	1		1	3	1	1	1		
Avg		2		3		1.6	2.3		2.3	3	2.3	1	1		

1 - Low, 2 - Medium, 3 - High

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
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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
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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
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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

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

TA242001	தமிழரும் மற்றும் தொழில்நுட்பம்	L	T	P	C
		1	-	-	1

அலகு I நெசவு மற்றும் பாணை தொழில்நுட்பம் 3
சங்க காலத்தில் நெசவுத் தொழில் - பாணை தொழில்நுட்பம் - கருப்பு மற்றும் சிவப்பு பாண்டங்கள் பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெரியகோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றிய அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தி தொழில்நுட்பம் 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற் சாலை- இரும்பு உருகுதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சாடித்தல் - மணிகள் உருவக்கும் தொழிற் சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுங்கள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம் 3
அணை, ஏரி, குளங்கள், மதகு, - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக் குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணிதத்தமிழ் 3
அறிவியல் தமிழின் வளர்ச்சி – கணிதத்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் -சொற்குவைத் திட்டம்.

TEXT-CUM-REFERENCE BOOKS

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

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 **15**
CIVIL ENGINEERING PRACTICES

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 **15**
MECHANICAL ENGINEERING PRACTICES

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, analyse 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
B. Tech - AI&DS

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

COURSE OBJECTIVES:

The main objectives of this course are to:

- 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 measurements ($\bar{X}$ 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:

Upon completion of the course, the students will 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 Freund's Probability Statistics for Engineers, 8th Edition, Pearson Education, 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

SEMESTER-III
B. Tech - AI&DS

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-III
B. Tech - AI&DS

AD24302	FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the techniques and processes of data science
- Apply descriptive data analytics
- Visualize data for various applications
- Understand inferential data analytics
- Analysis and build predictive models from data

UNIT I INTRODUCTION TO DATA SCIENCE

8 Need for

data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

UNIT II DESCRIPTIVE ANALYTICS

10

Frequency distributions – Outliers – interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores – correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean.

UNIT III INFERENCE STATISTICS

9

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure – decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT IV ANALYSIS OF VARIANCE

9

t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA - Introduction to chi-square tests.

UNIT V PREDICTIVE ANALYTICS

9

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values - serial correlation – autocorrelation. Introduction to survival analysis.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- CO1:** Explain the data analytics pipeline
- CO2:** Describe and visualize data
- CO3:** Perform statistical inferences from data
- CO4:** Analyze the variance in the data
- CO5:** Build models for predictive analytics

TEXT BOOKS:

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

REFERENCES:

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”, CRC Press, 2022.
3. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
4. Vineet Raina, Srinath Krishnamurthy, “Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice”, Apress, 2021.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
Avg	1.4	1.4	1.8	1.6	1.5	-	-	-	2.6	2.4	2.2	2.2	2.6	2.2	1.2

1 - Low, 2 - Medium, 3 - High

SEMESTER-III
B. Tech - AI&DS

AD24303	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are 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:**

Upon completion of the course, the students 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	-	-	-	1	1	1	2	3	1	-
CO2	3	3	2	2	2	-	-	-	1	1	1	2	3	1	-
CO3	2	3	2	2	3	-	-	1	2	1	1	2	2	1	-
CO4	3	3	3	2	3	1	-	1	2	2	2	2	2	3	-
CO5	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	-

1 - Low, 2 - Medium, 3 – High

B. Tech - AI&DS

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

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the basic structure and operation of a digital computer.
- Study the design of data path unit, control unit for processor and to familiarize with the hazards.
- Understand the concept of various memories and I/O interfacing.
- Analyze and design combinational circuits.
- 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:

- David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
- 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:

- Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
- William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
- 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

SEMESTER-III
B. Tech - AI&DS

AD24304	PRINCIPLES OF DATA STRUCTURES AND ALGORITHMS (T&P)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand and implement the linear data structures and its applications.
- Understand the tree data structures, priority queues and string matching.
- Learn various graph algorithms.
- Learn the algorithm design and analysis techniques with orders of growth.
- Learn the advanced algorithm design techniques.

UNIT I	LINEAR DATA STRUCTURES	10
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Introduction to Data Structures – Types of Data Structures - List: Array Implementation of List – Linked List – Doubly Linked List – Circular Linked List; Stack: Array and Linked List Implementation – Applications; Queues: Array and Linked List Implementation – Applications – Hashing: Hash Function – Collision resolution techniques.

UNIT II TREE AND STRING-MATCHING ALGORITHMS 8

Trees: Binary trees – Binary Search Trees – AVL Trees - Binary Heap Operations – Heap sort and Priority Queues. String Matching: Naïve String-matching algorithm – Rabin-Karp algorithm – Knuth-Morris-Pratt algorithm.

UNIT III GRAPH ALGORITHMS 9

Representation of Graphs – Breadth First Search – Depth First Search - Topological Sort – Shortest Path Algorithms: Dijkstra’s Algorithm – Floyd-Warshall’s Algorithm – Minimum Spanning Tree: Prim’s Algorithm – Kruskal’s Algorithm.

UNIT IV FOUNDATION AND ALGORITHM ANALYSIS 9

Fundamentals of algorithmic problem solving – Problem types – Brute force approach: Analysis of Non recursive Algorithms - Divide and Conquer: Analysis of recursive algorithms – Sorting: Selection sort - Bubble sort – Insertion Sort - Merge Sort - Quick sort - Searching: Linear Search – Binary Search.

UNIT V ADVANCED ALGORITHM DESIGN TECHNIQUES 9

Dynamic Programming: Longest Common Subsequence; Optimal Binary Search trees. Greedy Algorithm: Huffman Codes; Backtracking: n-Queens Problem – Subset-sum Problem; Branch and Bound: Assignment Problem – Knapsack Problem - Introduction to P, NP, NP-complete and NP-Hard problems.

TOTAL PERIODS: 45

LIST OF EXPERIMENTS:

1. List - Array and Linked List Implementation.
2. Stack - Array and Linked List Implementation.
3. Queue - Array and Linked List Implementation.
4. Applications of Stack - Infix to Postfix Expression, Evaluation of Postfix Expression.
5. Implementation of Binary Search Tree with Tree traversal Techniques and AVL tree.
6. Graph Algorithms
 - a) Graph Traversal's Algorithm - Breadth-first search, Depth-first search.
 - b) Shortest Path Algorithm - Dijkstra's algorithm.
 - c) Minimum Spanning Tree Algorithm - Prim's algorithm.
7. Sorting - Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort.
8. Searching - Linear Search, Binary Search.
9. Backtracking – n-Queens problem
10. Branch and Bound – Knapsack Problem

TOTAL PERIODS: 30

TOTAL PERIODS: 75

COURSE OUTCOMES:

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

CO1: Solve problems using suitable linear data structures.

CO2: Solve problems using suitable nonlinear tree data structures.

CO3: Demonstrate the use of graph algorithms for solving problems.

CO4: Design and analyze time and space complexities of algorithms using different design techniques for various computing problems.

CO5: Design algorithms using advanced algorithm design techniques.

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3, Pearson Education, 2009.
3. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-III
B. Tech - AI&DS

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-III
B. Tech - AI&DS

AD24306	DATA SCIENCE AND ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are to:

- Develop data analytic code in python
- Use python libraries for handling data
- Develop analytical applications using python
- Perform data visualization using plots

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statsmodels, seaborn

LIST OF EXPERIMENTS:

1. Working with Numpy arrays
 - a) Write a NumPy program to convert an array to a float type.
 - b) Write a NumPy program to create a 3x3 matrix with values ranging from 2 to 10.
 - c) Write a NumPy program to convert a list of numeric value into a one-dimensional NumPy array.
 - d) Write a NumPy program to convert a list and tuple into arrays.
 - e) Write a NumPy program to find the real and imaginary parts of an array of complex numbers.
 - f) Write a NumPy program to find the maximum and minimum value from the shape of (3,3) array.
2. Working with Pandas data frames
 - a) Creating a dataframe from dictionary of ndarray/lists, perform basic operations on rows/columns like selecting, deleting, adding, and renaming using pandas.
 - b) Write a pandas program to sort the dataframe first by 'name' in descending order, then by 'score' in ascending order.
 - c) Write a pandas program to select the rows where the number of attempts in the examination is greater than 2.
 - d) Write a pandas program to append a new row 'k' to dataframe with given values for each column. Now delete the new row and return the original dataframe.
3. Frequency distributions, Averages, Variability
4. Normal curves, Correlation and scatter plots, Correlation coefficient
5. Basic plots using Matplotlib
6. Time series analysis using Matplotlib
7. Z-test, T-test
 - a) Write a Python Program to demonstrate the Z-Test and T-Test result for the sample of 20 Students +2 exam final marks.
 - b) Write a Python Program to implement T-Test on a sample of ages using NumPy.
ages = [45, 89, 23, 46, 12, 69, 45, 24, 34, 67]
 - c) Evaluate the Data Distribution to formulate hypothesis and calculate Z-Test Statistics with Two-Sample using Pandas and SciPy.

8. ANOVA

- a) Write a Python program to find the null hypothesis or alternate hypothesis using ANOVA.
- b) Write a Python program to implement One-way F-test using ANOVA.
- c) Write a Python program to perform Two-way F-test using ANOVA.

9. Building and validating linear models

10. Building and validating logistic models

TOTAL PERIODS: 60

COURSE OUTCOMES:

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

CO1: Write python programs to handle data using Numpy and Pandas

CO2: Perform descriptive analytics

CO3: Perform data exploration using Matplotlib

CO4: Perform inferential data analytics

CO5: Build models of predictive analytics

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-III
B. Tech - AI&DS

AD24307	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are to:

- 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.

TOTAL PERIODS: 60

COURSE OUTCOMES:

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

- CO1:** Understand basic concepts of Java constructs.
- CO2:** Analyze different forms of inheritance and objects in abstract class.
- CO3:** Analyze different kind of usage of Exception handling.
- CO4:** Build web applications using Servlets, JSP, and integrate with databases using JDBC.
- CO5:** Understand the Multithreading in complex Java programs, and usage of Container classes.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 – High

SEMESTER-III
B. Tech - AI&DS

GE24S01	PROFESSIONAL DEVELOPMENT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the present ability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, present ability, aesthetics, using media elements and enhance the overall quality of presentations.

UNIT I INTRODUCTION TO MS WORD

5

Create and format a document: Working with tables - Working with Bullets and Lists - Working with styles, shapes, smart art, charts - Inserting objects, charts and importing objects from other office tools - Creating and Using document templates.

UNIT II APPLICATIONS OF MS WORD

5

Inserting equations, symbols and special characters - Working with Table of contents and References, citations-
Insert and review, comments - Create bookmarks, hyperlinks, endnotes footnote - Viewing document in
different modes - Working with document protection and security - Inspect document for accessibility

UNIT III INTRODUCTION TO MS EXCEL

5

Create worksheets - insert and format data-Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data - Sort and filter data - Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.) - Work with Lookup and reference formulae - Create and Work with different types of charts.

UNIT IV APPLICATIONS OF MS EXCEL

5

Use pivot tables to summarize and analyze data-Perform data analysis using own formulae and functions - Combine data from multiple worksheets using own formulae and built-in functions to generate, Results - Export data and sheets to other file formats - Working with macros - Protecting data and Securing the workbook.

UNIT V INTRODUCTION TO MS POWERPOINT AND ITS APPLICATIONS**10**

Select slide templates, layout and themes-Formatting slide content and using bullets and numbering-Insert and format images, smart art, tables, charts-Using Slide master, notes and handout master-Working with animation and transitions-Organize and Group slides-Import or create and use media objects: audio, video, animation-Perform slideshow recording and Record narration and create presentable videos.

TOTAL PERIODS: 30**COURSE OUTCOMES:**

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

- CO1:** Create document in MS word for technical requirements.
- CO2:** Create document in MS word for academic requirements.
- CO3:** Perform Data operation and analytics using MS Excel.
- CO4:** Perform record creation and retrieving the data for academic requirements.
- CO5:** Develop document for academic presentation using media objects in MS PowerPoint.

TEXT BOOKS:

1. "Microsoft Word Step by Step"Joan Lambert (Microsoft Press) the latest MS Word version (e.g., 2019 or Microsoft 365).
2. "Microsoft Office 365 – In practice (2021 Edition) by Randy Nordel, McGraw Hill Education.

REFERENCES:**1. MS Word**

Book: Microsoft Word 2019 Step by Step by Joan Lambert (Microsoft Press), Covers document creation, formatting, templates, references, and collaboration. ISBN: 978-1509305845.

2. MS Excel

Book: Excel 2019 Bible by Michael Alexander, Richard Kusleika, and John Walkenbach (Wiley), Comprehensive coverage of Excel functions, data analysis, charts, pivot tables, macros., ISBN: 978-1119517948.

3. MS PowerPoint

Book: PowerPoint 2019 For Dummies by Doug Lowe (For Dummies Series)\, Clear instructions on templates, animations, media, slide masters, and presentations. ISBN: 978-1119514190.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

B. Tech - AI&DS

MA24403	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- Extend student's logical and mathematical maturity and ability to deal with abstraction.
- Understand the concepts of Permutations, Combinations and Induction.
- Acquire the knowledge of graph models
- Familiarize the applications of algebraic structures.
- 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.

TEXT BOOKS:

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	PSO1	PSO2	PSO3
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

SEMESTER-IV
B. Tech - AI&DS

AD24401	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the basic concepts of machine learning.
- Understand and build supervised learning models.
- Understand and build unsupervised learning models.
- Understand the basic concepts of neural networks.
- Evaluate the algorithms based on corresponding metrics identified.

UNIT I INTRODUCTION TO MACHINE LEARNING

8

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING

11

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS

9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks – Unit saturation – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS

8

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- CO1:** Explain the basic concepts of machine learning.
- CO2:** Construct supervised learning models.
- CO3:** Construct unsupervised learning algorithms.
- CO4:** Develop neural network models.
- CO5:** Evaluate and compare different models.

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5. Sebastain Raschka, Vahid Mirjalili, "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	-	-	-	3	3	2	2	2	2	1
CO2	1	3	3	1	2	-	-	-	2	2	2	1	3	1	1
CO3	2	1	3	3	2	-	-	-	1	1	1	1	1	2	1
CO4	2	3	3	2	1	-	-	-	3	2	3	2	1	2	1
CO5	1	1	3	3	1	-	-	-	3	1	1	3	3	3	2
Avg	1.6	1.8	2.8	2	1.5	-	-	-	2.4	1.8	1.8	1.8	2	2	1.2

1 - Low, 2 - Medium, 3 - High

B. Tech - AI&DS

AD24402	RELATIONAL DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Introduce database development life cycle and conceptual modeling.
- Learn SQL for data definition, manipulation and querying a database.
- Learn relational database design using conceptual mapping and normalization.
- Understand the fundamental concepts of transaction, concurrency and recovery processing.
- Learn data model and querying in object-relational and No-SQL databases.

UNIT I CONCEPTUAL DATA MODELING 9

Database environment – Database system development lifecycle – Requirements collection – Database design - Entity-Relationship model – Enhanced-ER model – Conceptual Data Modeling in RDBMS.

UNIT II RELATIONAL MODEL AND SOL 9

Relational model concepts - Integrity constraints - SQL Data manipulation – SQL Data definition – Views - SQL programming.

UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION 9

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

UNIT IV TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control – Two Phase Locking - Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.

UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES 9

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- CO1:** Understand the database development life cycle and apply conceptual modeling.
- CO2:** Apply SQL and programming in SQL to create, manipulate and query the database.
- CO3:** Apply the conceptual-to-relational mapping and normalization to design relational database.
- CO4:** Construct queries to handle transaction processing and maintain consistency of the database.
- CO5:** Apply the data model and querying in Object-relational and No-SQL databases.

TEXT BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson, 2017.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
3. Christian Mancas, “Conceptual Data Modeling and Database Design: A Fully Algorithmic Approach”, Volume 1 (2021), Apple Academic Press.

REFERENCES:

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

B. Tech - AI&DS

AD24403	FUNDAMENTALS OF OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Study the basic concepts and functions of operating systems.
- Learn about Processes, Threads, Scheduling algorithms.
- Understand the process of synchronization and deadlock issues.
- Learn and understand the Memory management systems.
- Learn I/O Management and File Systems.

UNIT I OPERATING SYSTEMS OVERVIEW 9

Introduction – Computer System Organization – Computer System Architecture – Operations – Resource Management – Security and Protection – Virtualization – Computing Environments - Operating Systems Structures: Services – User and OS Interface – System Calls – Linkers and Loaders – Operating system Structure – Building and Booting OS.

UNIT II PROCESS MANAGEMENT 9

Processes: Concepts – Process Scheduling – Operations – Inter process Communication - Shared Memory and Message Passing Systems. - Threads: Overview - multithreading models – issues - CPU Scheduling: FCFS – SJF – Priority – RR – Multilevel Queue Scheduling – Multilevel Feedback Queue.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS 9

Process Synchronization – Critical Section Problem – Peterson’s Solution – Hardware Synchronization – Semaphores - Monitors – Classic Problems of Synchronization - Deadlocks: Characterization – Prevention – Avoidance – Detection – Recovery.

UNIT IV MEMORY MANAGEMENT 9

Main Memory: Background – Contiguous Memory Allocation – Paging – Structure of a page table – Segmentation – Virtual Memory – Demand Paging – Page Replacement - FIFO - Thrashing – Mass Storage Management - Disk scheduling.

UNIT V	FILE MANAGEMENT	9
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File System – Concepts – Access Methods - Directory Structure – Protection – Discretionary Access control and Mandatory Access Control – File System structure – Directory Implementation – Allocation Methods – Free-Space Management - Virtual File System.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- CO1:** Interpret the evaluation of the OS functionality, structure and layers.
CO2: Analyze the various Scheduling algorithms and design a model scheduling algorithm.
CO3: Apply and analyze Intercrosses communications, synchronization and Deadlock.
CO4: Compare and contrast various memory management schemes.
CO5: Mount file systems and evaluate various disk scheduling techniques.

TEXT BOOKS:

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

REFERENCES:

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

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
CO2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
CO3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
CO4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
CO5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Avg	2.0	2.0	1.7	1.0	2.2	-	1.0	1.0	1.4	2.0	2.0	2.0	2.6	2.7	1.6

1 - Low, 2 - Medium, 3 - High

SEMESTER-IV
B. Tech – AI&DS

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

COURSE OBJECTIVES:

The main objectives of this course are to:

- Introduce ecological concepts and biodiversity, emphasizing conservation and public awareness.
- Understand pollution types, impacts, and waste management practices, with industrial safety focus.
- Expose students to various renewable energy technologies and their practical applications.
- Study how people harm the environment and learn ways to prevent and manage disasters.
- 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:

Upon completion of this course, the students will 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	PSO1	PSO2	PSO3
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

SEMESTER-IV
B. Tech - AI&DS

AD24404	DATA EXPLORATION AND VISUALIZATION (T&P)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- Outline an overview of exploratory data analysis.
- Perform univariate data exploration and analysis.
- Apply bivariate data exploration and analysis.
- Use Data exploration and visualization techniques for multivariate and time series data.
- Implement data visualization using Matplotlib.

UNIT I	EXPLORATORY DATA ANALYSIS	9
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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 - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT III BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches – Scatter plots and Resistant Lines – Transformations.

UNIT IV MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

UNIT V VISUALIZING USING MATPLOTLIB 9

Importing Matplotlib – Simple line plots – Simple 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.

TOTAL PERIODS: 45

PRACTICAL EXERCISES:

1. Install the data Analysis and Visualization tool: R / Python / Tableau Public / Power BI.
2. Perform exploratory data analysis (EDA) on 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.
3. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
4. Perform Time Series Analysis and apply the various visualization techniques.
5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
6. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
7. Perform EDA on Wine Quality Data Set.
8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.
9. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.

TOTAL PERIODS: 30

TOTAL PERIODS: 75

COURSE OUTCOMES:

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

- CO1:** Understand the fundamentals of exploratory data analysis.
- CO2:** Perform univariate data exploration and analysis.
- CO3:** Apply bivariate data exploration and analysis.
- CO4:** Use Data exploration and visualization techniques for multivariate and time series data.
- CO5:** Implement the data visualization using Matplotlib.

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O'reilly, 1st Edition, 2016. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-IV
B. Tech - AI&DS

AD24405	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
- Learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
- Experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
- Understand how to build the neural network models for standard data sets.
- Compare the performance of different ML algorithms and select the suitable one based on the application.

LIST OF EXPERIMENTS:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8. Write a program to implement *k*-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.
10. Build a Support Vector Machine (SVM) model using the given dataset to classify the target variable. Perform preprocessing, choose an appropriate kernel, train the model, and evaluate its performance using suitable metrics.

TOTAL PERIODS: 60

COURSE OUTCOMES:

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

CO1: Apply suitable algorithms for selecting the appropriate features for analysis.

CO2: Design supervised machine learning algorithms on standard datasets and evaluate the performance.

CO3: Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.

CO4: Build the neural network learning models for standard data sets.

CO5: Assess and compare the performance of different ML algorithms and select the suitable one based on the application.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-IV
B. Tech - AI&DS

AD24406	RELATIONAL DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the database development life cycle.
- Learn database design using conceptual modeling, Normalization.
- Implement database using Data definition, Querying using SQL manipulation and SQL programming.
- Implement database applications using IDE/RAD tools.
- Learn querying Object-relational databases.

LIST OF EXPERIMENTS:

1. Database Development Life cycle:
 - Problem definition and Requirement analysis
 - Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach:
 - Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming:
 - Stored Procedures/Functions
 - Constraints and security using Triggers
6. Database design using Normalization – bottom-up approach
7. Develop database applications using IDE/RAD tools (Eg., NetBeans, Visual Studio)
8. Database design using EER-to-ODB mapping / UML class diagrams
9. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
10. Querying the Object-relational database using Object Query language

TOTAL PERIODS: 60

COURSE OUTCOMES:

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

- CO1:** Understand the database development life cycle.
- CO2:** Design relational database using conceptual-to-relational mapping, Normalization.
- CO3:** Apply SQL for creation, manipulation and retrieval of data.
- CO4:** Develop a database application for real-time problems.
- CO5:** Design and query object-relational databases.

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 – High

SEMESTER-IV
B. Tech - AI&DS

AD24S01	TECHNICAL SKILL PRACTICES	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are to:

- Introduce the fundamental concepts of Artificial Intelligence and its applications.
- Develop skills in data cleaning, feature engineering, and exploratory data analysis using Python libraries like Pandas.
- Provide hands-on experience in text preprocessing and sentiment analysis using NLP tools such as NLTK and spaCy.
- Develop problem-solving abilities using current tools and technologies.
- Bridge the gap between theoretical knowledge and real-world application.

LIST OF EXPERIMENTS:

Artificial Intelligence

1. Data Cleaning & Feature Engineering with Pandas
2. Exploratory Data Analysis (EDA) on a Real-world Dataset
3. Text Preprocessing & Sentiment Analysis Using NLTK or spaCy
4. AI for Recommendation Systems: Movie Recommendations or Heart Disease Prediction

Web Technologies

5. HTML, CSS, JavaScript basics
6. Simple form validation and UI development
7. Host a static/dynamic webpage

Emerging Technologies

8. Version control using Git and GitHub
9. Virtualization concepts using oracle virtual box
10. Mobile App Development (Android Studio basics)

TOTAL PERIODS: 30

COURSE OUTCOMES:

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

- CO1:** Perform data cleaning and feature engineering on real-world datasets to prepare data for analysis.
- CO2:** Perform exploratory data analysis using AI tools and libraries such as Pandas, NLTK, and spaCy
- CO3:** Understand and implement basic data processing and analysis using AI libraries and tools.
- CO4:** Design and develop simple web-based applications with form validation.
- CO5:** Gain exposure to emerging tools and technologies.

TEXT BOOKS:

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2020.
2. Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto, "Internet & World Wide Web: How to Program", 2002.

REFERENCES:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly, 2022.

ONLINE COURSES / RESOURCES:

1. <https://www.kaggle.com/learn>
2. <https://www.nltk.org/>
3. <https://nptel.ac.in/Courses/>
4. <https://www.virtualbox.org/>
5. <https://developer.android.com/>

CO-PO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-V
B. Tech-AI & DS

AD24501	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the basics of neural networks.
- To Know the basics of Deep learning for computer vision.
- To Understand LSTM and Autoencoders for Deep learning.
- To Understand the architectures of Transformers.
- To Know about the application of Reinforcement learning using Deep neural networks.

UNIT I BASICS OF NEURAL NETWORKS 9

Neurons (Biological and Artificial) – Perceptron Algorithm – Feedforward and Backpropagation Networks – Activation Functions (ReLU, Sigmoid, Tanh) – Loss Functions (MSE, Cross-Entropy) – Optimizers (SGD, Momentum, AdaGrad, Adam) – Regularization Techniques – Bias-Variance Tradeoff – Dropout, Data Augmentation, Batch Normalization

UNIT II CONVOLUTIONAL NEURAL NETWORKS AND COMPUTER VISION 9

CNN Basics – Convolution and Layers – Pooling Layers – CNN Architectures (LeNet, AlexNet, VGG, ResNet, GoogleNet) – Transfer Learning (Pretrained Models, Feature Extraction, Fine-Tuning) – Image Classification using Transfer Learning – Object Detection Methods (R-CNN, Fast R-CNN, Faster R-CNN, YOLO).

UNIT III RECURRENT NEURAL NETWORKS AND SEQUENCE LEARNING 9

Introduction to Sequence Data – RNN – Architecture – Deep RNN – Bidirectional RNN – Long Short Term Memory – Forget Gate – Input Gate – Output Gate - GRU – Update and Reset Gate – Sequence2Sequence models - Encoder/Decoder Architecture - Autoencoders – Standard - Variational Auto Encoders.

UNIT IV TRANSFORMERS AND INTRODUCTION TO LLM 9

GANs – Generator & Discriminator – Transformer Architecture – Attention – BERT & GPT – LLMs – Prompt Engineering – Applications.

UNIT V DEEP REINFORCEMENT LEARNING 9

Reinforcement Learning Basics – Multi-Armed Bandit – Markov Processes and MDP – Optimal Policy – Dynamic Programming (Value and Policy Iteration) – Deep Q Networks (DQN, Double DQN) – Function Approximation – Policy-Based Methods (REINFORCE) – Actor-Critic Methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Understand the basics of Shallow Neural Networks and Deep Neural Networks.
CO2 : Design deep learning models for image classification and object detection.

CO3 : Analyze and implement RNNs and their variants for sequence data.

CO4 : Evaluate GANs and transformer-based models such as BERT and GPT.

CO5 : Design reinforcement learning models using Deep Q-Learning and DQN.

TEXT BOOKS:

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
2. Andrew Glassner, “Deep Learning – A visual Approach”, No Starch Press, 2021.

REFERENCES:

1. Jon Krohn, “Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence”, Addison-Wesley, 2020.
2. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
3. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, “A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
4. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 2018.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1	2	1	1
CO2	2	3	3	2	3	1	-	1	1	-	1	3	3	2
CO3	2	3	2	2	3	-	-	-	-	-	1	2	2	2
CO4	2	3	1	2	2	1	-	-	-	-	2	2	2	3
CO5	2	3	3	2	3	1	-	1	1	1	2	3	3	2
Avg	2.20	2.80	2.25	2.00	2.40	1.00	-	1.00	1.00	1.00	1.40	2.40	2.20	2.00

1 - Low, 2 - Medium, 3 - High

SEMESTER-V
(Common To: B.E – CSE & B. Tech – B. Tech-AI & DS, IT)

AD24502, AD24P21	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand and apply linear programming techniques to solve optimization problems.
- Apply integer programming and network optimization techniques to solve transportation, assignment, and routing problems.
- Analyze and schedule projects using CPM and PERT techniques for effective project management.
- Utilize classical optimization methods to solve unconstrained and constrained optimization problems.
- Analyze and evaluate queueing systems using single- and multi-channel queueing 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 QUEUEING 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: Optimize the function subject to the constraints.

CO5: Identify and solve problems under Markovian queueing 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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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	-	-	-	-	-	1.5	1.0	-	-	-	-

1 - Low, 2 - Medium, 3 - High

SEMESTER-V
B. Tech-AI & DS

AD24503	FUNDAMENTALS OF COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of computer networks, layered architectures and communication models.
- To analyze the functions and protocols of Physical, Data Link and Network layers.
- To apply networking concepts for analyzing data communication and Internet-based applications.
- To study IP addressing techniques, subnetting and IPv4/IPv6 protocols.
- To understand the working principles of Transport and Application layer protocols.

UNIT I INTRODUCTION AND PHYSICAL LAYER

9

Data communication systems – Building networks – Network Edge, Access and Core – Layered Architecture – OSI Model – Internet Architecture (TCP/IP) – Networking Devices: Hubs, Bridges, Switches, Routers and Gateways – Physical Layer – Signals – Bandwidth and Data Rate – Encoding – Multiplexing – Shift Keying – Transmission Media.

UNIT II DATA LINK LAYER

9

Data Link Layer – Framing – Flow Control – Error Control – Media Access Control – Ethernet Basics – Carrier Sense Multiple Access / Collision Detection (CSMA/CD) – Virtual LAN – Wireless LAN – IEEE 802.11 variants – MAC Layer – CSMA/CA.

UNIT III NETWORK LAYER

9

Network Layer - Switching concepts – Packet Switching - Routing – Distance Vector and Link State Algorithms – Routing Information Protocol, Open Shortest Path First and Border Gateway Protocol – Congestion Control mechanisms in Routers – Software Defined Networks – Control Plane and Data Plane.

UNIT IV IP ADDRESSING

9

IPv4 Packet Format and Addressing – Subnetting – Classless Inter-Domain Routing – Variable Length Subnet Mask – Dynamic Host Configuration Protocol – Network Address Translation – Internet Control Message Protocol – Need for IPv6 – Addressing methods and types in IPv6 – IPv6 header – Transition from IPv4 to IPv6.

UNIT V TRANSPORT AND APPLICATION LAYERS

9

Transport Layer functions – End-to-end semantics – Multiplexing and Demultiplexing – User Datagram Protocol (UDP) and Applications – Transmission Control Protocol (TCP) – Connection establishment and release – Flow Control – Congestion Control – Application Layer – Sockets – HTTP – FTP – Email Protocols – DNS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Explain the fundamentals of computer networks, layered models and physical layer concepts.

CO2 : Illustrate the functions of Data Link layer protocols and medium access control mechanisms.

CO3 : Analyze routing algorithms, switching techniques and Network layer protocols.

CO4 : Apply IPv4 and IPv6 addressing techniques including subnetting and network configuration methods.

CO5 : Examine Transport and Application layer protocols used in Internet communication systems.

TEXT BOOKS:

1. Andrew S Tanenbaum, Nick Feamster and David J Wetherall, “Computer Networks”, Pearson Education, Sixth Edition, 2022.
2. Behrouz A. Forouzan, “Data Communications and Networking with TCP/IP Protocol Suite”, TMH, Sixth Edition, 2022.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Eighth Edition, Pearson Education, 2022.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2022.
3. William Stallings, “Data and Computer Communications”, Pearson Education, Tenth Edition, 2017.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open-Source Approach”, McGraw Hill, 2012.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	1	-	-	-	1	-	1	1	-	-
CO2	2	2	1	-	2	-	-	-	1	-	1	1	1	-
CO3	3	3	2	1	2	1	-	-	1	-	1	2	1	-
CO4	3	2	1	1	3	-	-	-	1	-	1	2	2	-
CO5	2	2	1	-	2	-	-	-	2	-	1	1	2	-
Avg	2.4	2.0	1.25	1.0	2.0	1.0	-	-	1.2	-	1.0	1.4	1.5	-

1 - Low, 2 - Medium, 3 - High

SEMESTER-V
B. Tech-AI & DS

AD24504	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the fundamental concepts, tools, and techniques of deep neural networks.
- To apply suitable deep learning architectures (CNN, RNN, etc.) for solving real-world problems.
- To design and implement generative models for data-driven applications.
- To develop, validate, and evaluate deep learning models using appropriate methods.

LIST OF EXPERIMENTS:

1. Implementation of XOR problem using Deep Neural Network (DNN)
2. Character Recognition using Convolutional Neural Network (CNN)
3. Face Recognition using CNN
4. Language Modeling using Recurrent Neural Network (RNN)
5. Sentiment Analysis using Long Short-Term Memory (LSTM)
6. Parts-of-Speech Tagging using Sequence-to-Sequence Model
7. Machine Translation using Encoder–Decoder Architecture
8. Data Generation and Augmentation using Generative Adversarial Networks (GANs)
9. Object Detection using YOLO
10. Mini Project: Real-world Deep Learning Application

REQUIREMENTS:

- Windows 10 or higher Operating System / Linux Ubuntu 22 or higher
- Python 3.9 or above
- Anaconda Distribution
- Jupyter Notebook / PyCharm / Equivalent IDE
- Python Libraries: NumPy, SciPy, Matplotlib, Pandas, Seaborn

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 : Implement deep neural networks to solve basic problems.

CO2 : Apply CNN techniques for image processing.

CO3 : Analyze RNNs and their variants for sequence and text data.

CO4 : Apply generative models for data augmentation.

CO5 : Develop deep learning solutions for real-world applications.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	2	1	1
CO2	2	3	3	2	3	1	-	1	1	1	1	3	3	2
CO3	2	3	2	2	3	-	-	-	-	-	1	2	2	2
CO4	2	2	1	2	2	1	-	-	-	-	2	2	2	3
CO5	3	3	3	2	3	1	-	1	1	1	2	3	3	2
Avg	2.4	2.6	2.0	2.0	2.6	1.0	-	1.0	1.0	1.0	1.4	2.4	2.2	2.0

1 - Low, 2 - Medium, 3 – High

SEMESTER-V
B. Tech-AI & DS

AD24S02	DESIGN THINKING AND PROJECT DEVELOPMENT LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- To introduce the principles of design thinking and human-centered problem solving.
- To develop skills in empathy building, customer discovery, and problem identification.
- To enable students to create user personas, user stories, and value propositions.
- To train students in idea generation, concept development, and evaluation techniques.
- To provide hands-on experience in prototype development, testing, and project implementation.

LIST OF EXPERIMENTS:

1. Empathy Study through User Interviews and Observation.
2. Problem Identification and Definition using Point of View (POV) Statements.
3. Customer Discovery and Problem Validation using Field Study.
4. Development of User Personas for Target Users.
5. Creation of User Stories based on End-User Requirements.
6. Idea Generation using Brainstorming and Mind Mapping Techniques.
7. Design and Analysis of Value Proposition using Value Proposition Canvas.
8. Development of Minimum Viable Prototype (MVP) for Proposed Solution.
9. Prototype Testing, User Feedback Collection and Iterative Improvement.
10. Final Project Development, Systems Thinking Analysis and Presentation.

REQUIREMENTS:

- Windows 10 or higher Operating System / Linux Ubuntu 20 or higher.
- Python 3.9 or above with NumPy, SciPy, Matplotlib, Pandas, Seaborn and Statsmodels libraries.
- Scikit-learn.
- PostgreSQL / SQLite / MySQL 5.7 or higher.
- NetBeans IDE / Eclipse IDE / VS Code.
- Online Collaboration and Design Tools: Figma / Canva / Miro / Lucidchart (or equivalent).

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the 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 problem 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 Viable Prototype (MVP) for the proposed solution.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	2	1	1	2	1	2	1	2	2
CO2	2	3	3	2	1	2	2	2	3	1	2	1	3	2
CO3	2	2	3	1	1	1	1	2	3	2	2	1	3	2
CO4	2	3	3	2	2	2	1	2	2	2	2	2	3	3
CO5	2	2	3	3	3	2	1	3	2	2	3	3	3	3
Avg	2.2	2.6	2.8	1.8	1.6	1.8	1.2	2.0	2.4	1.6	2.2	1.6	2.8	2.4

1 - Low, 2 - Medium, 3 – High

SEMESTER-VI
B. Tech-AI & DS

AD24601	GENERATIVE AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the fundamentals of Generative AI.
- To Know the basics of Text Generation.
- To Understand the process of generating videos.
- To Know about GAN and its variants.
- To Understand and Apply Gen AI tools.

UNIT I INTRODUCTION

9

Historical Overview of Generative Modeling – Generative vs Discriminative Models – Importance of Generative AI – Types of Generative Models: GANs, VAEs, Autoregressive and Diffusion Models – Basics of Probabilistic Modeling – Challenges in Generative AI – Future Trends – Ethical and Responsible AI – Applications and Use Cases.

UNIT II GENERATIVE MODELS FOR TEXT

9

Language Model Basics – Transformer Architecture – Attention Mechanism – BERT and GPT – Text Generation – ChatGPT and Prompt Engineering – RLHF – RAG – Multimodal LLMs – Hallucination Issues.

UNIT III GENERATION OF IMAGES

9

Introduction to GANs and Adversarial Training – Variational Autoencoders (VAE) – Encoder-Decoder Architecture – Stable Diffusion Models – Transformer-based Image Generation – CLIP and Vision Transformers (ViT) – DALL·E and GPT-4V – Challenges in Image Generation such as Mode Collapse and Stability.

UNIT IV GENERATION OF PAINTING, MUSIC, AND PLAY

9

Variants of GAN – Types of GANs - CycleGAN – Using CycleGAN to Generate Paintings – Neural Style Transfer – Style Transfer - Music Generating RNN – MuseGAN – Autonomous agents – Deep Q Algorithm – Actor-critic Network.

UNIT V OPEN SOURCE MODELS AND PROGRAMMING FRAMEWORKS

9

Training and Fine tuning of Generative models – GPT4All - Transfer learning and Pretrained models - Training vision models – Google Copilot - Programming LLM – LangChain – Open Source Models – Llama - Programming for TimeSformer – Deployment – Hugging Face.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1** : Understand the concepts of Generative Modeling.
- CO2** : Apply Gen AI techniques for text generation.
- CO3** : Analyze generative AI models for image and video generation.

CO4 : Evaluate multimodal generative AI techniques for creative content generation.

CO5 : Apply Open Source Tools for solving problems using Gen AI.

TEXT BOOKS:

1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition, Packt Books, 2024.
2. Taulli, T., “Generative AI: The New Frontier”, Apress / Springer, 1st Edition, 2024.

REFERENCES:

1. David Foster, “Generative Deep Learning”, O’Reilly Books, 2024.
2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.
3. Sanseviero, O., “Hands-On Generative AI with Transformers and Diffusion Models”, Packt Publishing, 1st Edition, 2024.
4. Auffarth, B., “Generative AI with LangChain and LLM Applications”, Packt Publishing, 1st Edition, 2024.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	-	1	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	2	3	1
CO3	3	3	-	3	2	-	-	-	-	-	-	2	3	2
CO4	2	3	3	2	2	2	-	-	-	-	-	2	3	2
CO5	3	2	2	2	3	-	-	1	1	-	3	3	3	-
Avg	2.80	2.40	2.50	2.33	2.20	2.00	-	1.00	1.00	-	3.00	2.00	2.60	1.67

1 - Low, 2 - Medium, 3 - High

SEMESTER-VI
B. Tech-AI & DS

AD24602	BIG DATA ANALYTICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand big data concepts and applications.
- To learn NoSQL data management techniques.
- To learn MapReduce analytics using Hadoop and related tools.
- To work with MapReduce applications.
- To understand the usage of Hadoop related tools for Big Data Analytics.

UNIT I INTRODUCTION

9

Introduction to Big Data – Characteristics and Challenges – Big Data Lifecycle and Architecture – Distributed Computing – Batch vs Stream Processing – Hadoop and Open-Source Technologies – Cloud and Big Data – Big Data Applications (Web Analytics, Mobile BI, Crowdsourcing Analytics) – Industry Use Cases – Big Data Tools and Trends.

UNIT II NOSQL DATA MANAGEMENT

9

Introduction to NoSQL – Data Models (Key-Value, Document, Graph) – Schema-less Databases – Distribution and Replication – Consistency Models – CAP Theorem and BASE – SQL vs NoSQL Comparison – Overview of NoSQL Databases – Cassandra and Its Data Model – Cassandra Clients and Examples.

UNIT III MAP REDUCE APPLICATIONS

9

MapReduce Workflow – MRUnit Testing – Job Execution and Lifecycle – Shuffle and Sort – Input and Output Formats – YARN Architecture – Job Scheduling and Failures – MapReduce Design Patterns – Performance Optimization – Introduction to Apache Spark.

UNIT IV BASICS OF HADOOP

9

Data Formats – Hadoop Data Analysis – HDFS Architecture and Concepts – HDFS Federation and High Availability – Data Flow and Java Interface – Hadoop I/O (Integrity, Compression, Serialization, Avro) – Hadoop File Formats – Hadoop Streaming and Pipes – Security Basics – Cassandra and Hadoop Integration.

UNIT V HADOOP RELATED TOOLS

9

HBase (Data Model, Clients, Examples) – Pig (Pig Latin, Grunt, Data Model, Scripting) – Hive (Data Types, HiveQL for DDL, DML, Queries) – Sqoop (RDBMS–Hadoop Data Transfer) – Flume (Log Data Ingestion) – Oozie (Workflow Management).

45 PERIODS

LIST OF EXPERIMENTS:**30 PERIODS**

1. Downloading and installing Hadoop; understanding different Hadoop modes, startup scripts, and configuration files.
2. Implementation of file management operations in Hadoop (HDFS) such as adding files and directories, retrieving files, and deleting files.
3. Implementation of Matrix Multiplication using Hadoop MapReduce.
4. Implementation of a basic Word Count program using MapReduce to understand the MapReduce paradigm.
5. Installation of Hive and execution of basic HiveQL queries.
6. Installation of HBase and Thrift, and performing basic operations using HBase shell.
7. Practice importing and exporting data between Hadoop and external databases.

REQUIREMENTS:

- Windows 10 or higher Operating System / Linux Ubuntu 20 or higher.
- Java JDK 8 or higher.
- Hadoop Framework.
- Apache Hive.
- Apache HBase and Thrift.
- Apache Spark.
- Eclipse IDE / IntelliJ IDEA / VS Code.
- MySQL / PostgreSQL.

TOTAL: 75 PERIODS**COURSE OUTCOMES:**

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

CO1 : Illustrate big data concepts and identify use cases across business domains.

CO2 : Analyze NoSQL data management models and their applications.

CO3 : Install, configure, and run Hadoop and HDFS.

CO4 : Apply MapReduce programming for big data analytics using Hadoop.

CO5 : Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

TEXT BOOKS:

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

REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 4th Edition, 2015.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

3. Sadalage, Pramod J. "NoSQL distilled", 2013.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. Ümit Demirbaga, et al., "Big Data Analytics: Theory, Techniques, Platforms and Applications", 1st Edition, Springer, 2025.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
9. Alan Gates, "Programming Pig", O'Reilley, 2011.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	1	-	-	-	-	-	1	2	1	-
CO2	3	3	-	2	2	-	-	-	-	-	1	3	2	1
CO3	3	2	-	-	3	-	-	-	-	-	1	3	2	-
CO4	3	3	1	2	3	-	-	-	-	-	1	3	3	1
CO5	3	2	-	1	3	-	-	-	-	-	1	3	3	1
Avg	3.0	2.2	1.0	1.67	2.4	-	-	-	-	-	1.0	2.8	2.2	1.0

1 - Low, 2 - Medium, 3 - High

SEMESTER-VI
B. Tech-AI & DS

AD24603	GENERATIVE AI LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To Understand the fundamentals of generative AI and deep learning models.
- To Apply text, image, and multimodal generative techniques using modern AI tools.
- To Develop skills in working with transformers, LLMs, GANs, and diffusion models.
- To Build applications using open-source generative AI frameworks.
- To Evaluate and analyze generative AI systems for real-world applications.

LIST OF EXPERIMENTS:

1. Implementation of Text Preprocessing Pipeline using NLTK / spaCy.
2. Construction of Text Representation Models using Bag of Words, N-Gram, and TF-IDF.
3. Generation of Word Embeddings using Word2Vec and Pretrained Models (GloVe / FastText).
4. Text Generation using Pretrained Transformer Models (GPT-2 / T5).
5. Prompt Design and Optimization for Large Language Models.
6. Development of Retrieval-Augmented Generation (RAG) System using LangChain and Vector Databases.
7. Image Generation using Stable Diffusion Models.
8. Image Synthesis using Generative Adversarial Networks (GAN / DCGAN).
9. Artistic Image Generation using Neural Style Transfer with CNN (VGG19).
10. Development of Generative AI Applications using Open-Source LLM Frameworks (Hugging Face / Llama / LangChain).

REQUIREMENTS:

- Windows 10 or higher Operating System / Linux Ubuntu 20 or higher.
- Python 3.9 or above with NumPy, SciPy, Matplotlib, Pandas, Seaborn and Statsmodels libraries.
- Deep Learning Frameworks: PyTorch / TensorFlow.
- NLP Libraries: Hugging Face Transformers, NLTK and spaCy.
- Generative AI Tools: Diffusers and LangChain.
- PostgreSQL / SQLite / MySQL 5.7 or higher.
- NetBeans IDE / Eclipse IDE / VS Code.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Demonstrate fundamentals of generative AI and deep learning models.
- CO2 :** Apply NLP and transformer-based models for text generation tasks.
- CO3 :** Analyze image generation techniques using GANs and diffusion models.
- CO4 :** Implement multimodal generative AI techniques for creative applications.
- CO5 :** Develop applications using open-source generative AI frameworks and tools.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	-	-	-	-	-	-	1	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	2	3	1
CO3	3	3	-	3	2	-	-	-	-	-	-	2	3	2
CO4	2	3	3	2	2	-	-	-	-	-	-	2	3	2
CO5	3	2	2	2	3	-	-	1	-	-	2	3	3	3
Avg	2.60	2.40	2.50	2.33	2.40	-	-	1.00	-	-	2.00	2.00	2.60	2.0

1 - Low, 2 - Medium, 3 – High

SEMESTER-VII

(Common to: B.Tech-AI&DS, B.E-CSE & IT)

AD24701/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 NLP – Syntax and Structure – Text Preprocessing (Tokenization, Stemming, Lemmatization, Stop-word Removal) – Text Representation (Bag of Words, N-grams, TF-IDF) – Feature Engineering – Corpus and Datasets – POS Tagging – Named Entity Recognition – NLP Pipeline Overview.

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 & PSO 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	-	-	-	-	-	1	2	3	1
CO3	2	2	3	-	2	-	-	1	2	-	-	2	3	1
CO4	3	2	-	1	2	-	-	-	-	-	-	1	2	2
CO5	3	2	1	3	3	-	-	-	-	-	1	1	3	2
Avg	2.8	2.0	2.0	2.0	2.2	-	-	1.0	2.0	-	1.0	1.6	2.4	1.5

1 - Low, 2 - Medium, 3 - High

SEMESTER-VII

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

GE24701	HUMAN VALUES AND ETHICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

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

- To enable students to analyze and appreciate the vital interdependence between 'values' and 'skills' in achieving sustained happiness and prosperity, which represent the core aspirations of all human beings
- To facilitate students in developing a holistic perspective on life, profession, and happiness—grounded in a correct understanding of human nature and the rest of existence—which serves as the foundation for living a value-based life naturally.
- To evaluate and illustrate the potential implications of a holistic understanding in fostering ethical human conduct, trustful and mutually fulfilling human relationships, and a harmonious, enriching interaction with Nature.

UNIT I DEMOCRATIC VALUES

6

Introduction-need, basic guidelines, Content and process for value education-Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Respect for All, Citizen Participation in Governance – World Democracies: French Revolution, Indian Freedom Movement.

UNIT II SECULAR VALUES

6

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. Case Study

UNIT III SCIENTIFIC VALUES

6

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Safety and risk - Assessment of safety and risk -Validating facts using evidence-based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.

UNIT IV SOCIAL ETHICS

6

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination –Globalization- Constitutional protection and policies – Inclusive practices.

UNIT V SCIENTIFIC ETHICS

6

Transparency and Fairness in scientific pursuits-Collegiality and loyalty – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society-Case Study

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- CO1** : Analyze the role of democratic, secular, and scientific values in promoting harmony and effective functioning within social life.
- CO2** : Practice democratic and scientific values in both their personal and professional life.
- CO3** : Develop logical and evidence-based solutions to address contemporary social problems effectively.
- CO4** : Demonstrate ethical behavior in various social situations through responsible decision-making.
- CO5** : Apply critical thinking skills to evaluate information objectively and seek truth through reasoned analysis.

TEXT BOOKS:

1. Excerpts from John Stuart Mills' On Liberty
2. Excerpt from The Scientific Temper by Antony Michaelis R
3. Excerpt from 21 Lessons for the 21st Century by Yuval Noah Harari
4. Excerpt from American Prometheus: The Triumph and Tragedy of J.Robert Oppenheimer by Kai Bird and Martin J. Sherwin.

REFERENCES:

1. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3. The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

SEMESTER-VII
B. Tech-AI & DS

AD24702	SUMMER INTERNSHIP	L	T	P	C
		0	0	0	2

COURSE OBJECTIVES:

To enable the students to:

- Connect with reputed industry / laboratory / academia / research organization.
- Gain practical knowledge on Product Development / Services and Operations / Software Design and Development / Testing / Analytics / Research / Startups / Professionalism / Business Processes and Insights / Domain Knowledge / Industry Practices / and other related aspects and develop skills to solve related problems.
- Develop technical, soft, and team skills to cater to the needs of the industry / academia / businesses / research organizations in the core aspects of Automation and Digitalization.

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

NO. OF WEEKS: 04

COURSE OUTCOMES:

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

- CO1 :** Understand industry practices, processes, techniques, technologies, automation, and other core aspects of the software industry.
- CO2 :** Analyze business requirements and identify suitable solutions for complex problems.
- CO3 :** Design software solutions and appropriate system architectures for target applications.
- CO4 :** Build, test, and deploy solutions for target platforms using suitable tools and technologies.
- CO5 :** Prepare technical reports and deliver effective presentations professionally.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	1	2	2	1	2	1	1	1
CO2	2	3	2	1	2	1	1	2	2	2	2	2	3	2
CO3	2	2	3	2	2	1	1	2	2	2	2	2	3	2
CO4	2	2	2	2	3	1	1	3	2	3	2	2	3	2
CO5	1	2	1	1	1	1	1	3	3	3	3	2	2	2
Avg	1.8	2.2	1.8	1.4	1.8	1.0	1.0	2.4	2.2	2.2	2.2	1.8	2.4	1.8

1 - Low, 2 - Medium, 3 - High

SEMESTER-VIII
B. Tech-AI & DS

AD24801	PROJECT WORK / INTERNSHIP	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

This course aims to train the students to:

- Gain domain knowledge, and technical skills to solve potential business / research problems.
- Gather requirements, Design suitable software solutions and evaluate alternative approaches.
- Work effectively in small teams and understand the processes and practices in the industry.
- Implement, Test and deploy solutions for target platforms.
- Prepare project reports and deliver effective presentation.

The students shall individually / or as group work on business/research domains and related problems approved by the Department / organization that offered the internship / project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 300 PERIODS

COURSE OUTCOMES:

At the end of the project, the student will be able to:

- CO1** :Apply domain knowledge and technical skills to solve industry and research problems.
CO2 :Analyze requirements and design suitable solution architecture, module-level designs, and algorithms.
CO3 :Implement the proposed solution using appropriate tools and technologies.
CO4 :Test, validate, and deploy the solution on the target platform effectively.
CO5 :Prepare detailed technical reports and present the project work professionally through demonstrations and presentations.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	2	2	1	2	2	3	1
CO2	3	3	3	3	2	1	1	2	2	2	2	2	3	2
CO3	3	2	3	2	3	1	1	2	2	2	2	2	3	2
CO4	2	2	3	3	3	1	1	2	3	2	2	2	3	2
CO5	2	2	2	2	2	1	1	3	3	3	3	3	2	2
Avg	2.6	2.4	2.6	2.4	2.4	1.0	1.0	2.2	2.4	2.0	2.2	2.2	2.8	1.8

1 - Low, 2 - Medium, 3 - High

MANDATORY COURSE

NON-CREDIT MANDATORY COURSE I

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

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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Describe the fundamental elements of literature.
- CO2:** Analyze the key components of fiction, including plot, character, narrative technique.
- CO3:** Identify and interpret the elements and types of poetry, including figurative language, tone, and mood.
- CO4:** Examine the structure and features of drama.
- CO5:** 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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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
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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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 both verbally and in

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, ReejaThankachan and Binil Kumar M. R., Introducing Film Studies (2015), Mainspring Publishers.

CO-PO & PSO 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	2.40	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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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**

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: 45 PERIODS

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, Suvabrata, 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 & PSO 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	2.00	2.40

1 - Low, 2 - Medium, 3 -High

NON-CREDIT MANDATORY COURSE II

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

TEXT BOOKS:

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.

REFERENCES:

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 & PSO 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	2.60	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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the managerial functions like planning, organizing, staffing, leading and 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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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 TQM 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 – PDCA 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: 45 PERIODS

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 Urdhwareshe and RashmiUrdhwareshe, 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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 Guptha, “Management Economics “, Tata McGraw Hill Ltd.

CO-PO & PSO 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	2.60	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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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 & PSO 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	2.60	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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

GE24M05	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: 45 PERIODS

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 & PSO 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, CSE, ECE, EEE, MECH, B. Tech – AI&DS & IT)

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: 45 PERIODS

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. TrevisCerto, "Modern Management Concepts and Skills", Pearson Education, 2018.

CO-PO & PSO 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 COURSE: VERTICALS

VERTICAL I: VERTICAL FOR AIDS I

(Common to: B. E – CSE & B. TECH – IT, AI&DS)

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	-	-	1	-	-	-	2	1	2
CO2	3	3	2	2	3	-	-	1	-	-	-	3	1	2
CO3	3	3	3	3	3	-	-	1	1	-	-	3	2	3
CO4	3	3	3	3	3	-	-	2	1	1	1	3	2	3
CO5	3	3	3	3	3	-	-	2	2	2	1	3	3	3
Avg	3.00	2.80	2.40	2.60	2.80	-	-	1.40	1.33	1.50	1.00	2.80	1.80	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
(Common to: B. E – CSE & B. TECH – IT, AI&DS)

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.

REFERENCES:

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
CO2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
CO3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
CO4	3	3	3	2	3	–	–	–	1	1	–	3	3	2
CO5	3	3	3	2	3	1	–	–	2	2	2	3	3	3
Avg	3.00	2.80	2.40	2.00	2.60	1.00	–	–	1.25	1.20	2.00	2.80	3.00	2.00

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
B. Tech-AI & DS

AD24P03	SOFT COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamentals of soft computing techniques and fuzzy logic concepts.
- To study the architecture and learning mechanisms of neural networks.
- To learn the principles and operations of genetic algorithms for optimization problems.
- To analyze neuro-fuzzy modeling techniques and adaptive learning methods.
- To apply soft computing techniques in real-world applications such as pattern recognition and signal analysis.

UNIT I INTRODUCTION 6

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.

UNIT II NEURAL NETWORKS 6

Supervised Learning Neural Networks – Perceptrons - Backpropagation - Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks.

UNIT III GENETIC ALGORITHMS 6

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function.

UNIT IV NEURO FUZZY MODELING 6

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability.

UNIT V APPLICATIONS 6

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition.

30 PERIODS

LIST OF EXPERIMENTS: 30 PERIODS

1. a) Perform union, intersection, complement on fuzzy sets.
b) Implementation of fuzzy control/ inference system.
2. Programming exercise on classification with a discrete perceptron.
3. a) Implementation of XOR with backpropagation algorithm.
b) Implementation of self organizing maps for a specific application.
4. Programming exercises on maximizing a function using Genetic algorithm.

5. Implementation of Genetic Operators (crossover and mutation).
6. Implementation Simple Neuro-Fuzzy Model.
7. a) Implementation of two input sine function.
b) Implementation of three input non linear function.

REQUIREMENTS:

- Python (recommended version: 3.9+)
- Anaconda Distribution (for package management + Jupyter)
- Google Colab (optional but very useful for lab work without installation)
- VS Code (coding + debugging alternative)
- Git (version control for submissions, optional)

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of soft computing and fuzzy logic systems.

CO2: Apply neural network models and learning algorithms for solving real-world problems.

CO3: Implement genetic algorithms for optimization and search problems.

CO4: Analyze and design neuro-fuzzy systems such as ANFIS for adaptive learning applications.

CO5: Utilize soft computing techniques in pattern recognition and prediction.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. S. N. Sivanandam, S. N. Deepa, “Principles of Soft Computing”, Wiley India, 3rd Edition, 2021.
2. JANG, J.-S. R., SUN, C.T., & MIZUTANI, E., “Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence”, Upper Saddle River, NJ, Prentice Hall, 1997.

REFERENCES:

1. Saroj Kaushik and Sunita Tiwari, “Soft Computing-Fundamentals Techniques and Applications”, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Samir Roy, Udit Chakraborty, “Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms”, Pearson Education, 2013.
4. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996.
5. Himanshu Singh, Yunis Ahmad Lone, “Deep Neuro-Fuzzy Systems with Python with Case Studies and Applications from the Industry”, Apress, 2020.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	-	-	1	-	-	2	2	1	1
CO2	3	3	2	2	3	-	-	2	-	-	2	2	2	1
CO3	3	3	2	2	3	-	-	2	-	-	2	2	2	2
CO4	3	3	3	2	3	-	-	2	-	-	2	2	3	2
CO5	2	2	3	2	3	1	-	2	1	-	2	3	3	3
Avg	2.8	2.8	2.2	1.8	2.8	1.0	-	1.8	1.0	-	2.0	2.2	2.2	1.8

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
(Common to: B.E-BME, CSE, ECE, & B. Tech-AI & DS, IT)

AD24P04	COMPUTER VISION	L	T	P	C
		3	0	0	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 9

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 9

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 9

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 9

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 9

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.

TOTAL: 45 PERIODS

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.
2. Jagadeesh Kakarla, R. Balasubramanian, Subrahmanyam Murala, Santosh Kumar Vipparthi and Deep Gupta, “Computer Vision and Image Processing”, Springer Nature, 2025 Edition, 2025.

REFERENCES:

1. Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision”, Packt Publishing, 2018 Edition, 2018.
2. Ahmed Fawzy Gad, “Practical Computer Vision Applications Using Deep Learning with CNNs”, BPB Publications, 2021 Edition, 2021.
3. Satyabrata Roy, Deepak Sinwar, Nilanjan Dey and Thinakaran Perumal (Eds.), “Innovations in Computational Intelligence and Computer Vision”, Springer, 2025 Edition, 2025.
4. Benjamin Planche and Eliot Andres, “Hands-On Computer Vision with TensorFlow 2”, BPB Publications, 2020 Edition, 2020.
5. Nilanjan Dey, Amira Ashour and Suvojit Acharjee, “Artificial Intelligence and Computer Vision”, Springer, 2021 Edition, 2021.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	-	-	-	-	-	2	1	2
CO2	3	3	2	2	3	1	-	-	-	-	-	3	2	2
CO3	3	3	3	2	3	1	-	-	-	-	-	3	2	3
CO4	3	3	3	3	3	1	-	-	-	-	-	3	2	3
CO5	3	3	3	3	3	2	-	-	-	-	-	3	3	3
Avg	3.0	2.8	2.4	2.2	2.8	1.2	-	-	-	-	-	2.8	2.0	2.6

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
(Common to B. E – CSE & B. TECH – IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
CO2	3	3	2	2	2	–	–	–	1	1	–	3	3	1
CO3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
CO4	3	3	2	2	3	–	–	–	1	2	–	3	3	2
CO5	3	3	3	2	3	–	–	–	2	2	2	3	3	3
Avg	3.00	2.80	2.20	2.00	2.40	–	–	–	1.25	1.40	2.00	2.80	3.00	1.80

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
(Common to B. E – CSE & B. TECH – IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
CO2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
CO3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
CO4	3	3	3	2	3	–	–	–	1	1	–	3	3	3
CO5	3	3	3	2	3	–	–	–	2	2	2	3	3	3
Avg	3.00	2.80	2.40	2.00	2.60	–	–	–	1.25	1.20	2.00	2.80	3.00	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL I: VERTICAL FOR AIDS I
B. Tech-AI & DS

AD24P07	AGENT BASED INTELLIGENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand basic concepts of agents and their role in intelligent systems.
- To learn how agents perform reasoning and decision making.
- To study how agents communicate and work together.
- To understand how to design and develop intelligent agents.
- To learn real-world applications of intelligent agents.

UNIT I INTRODUCTION

9

Agents as a paradigm for software engineering - Agents as a tool for understanding human societies- Intelligent Agent: Agents and Objects - Agents and Expert Systems - Agents as Intentional Systems - Abstract Architectures for Intelligent Agents - How to Tell an Agent What to Do.

UNIT II LEARNING IN AGENTS

9

Proportional case - Handling variables and qualifiers - Dealing with intractability - Reasoning with horn clauses - Procedural control of reasoning - Rules in production – Reasoning with Higher order Logics.

UNIT III COMMUNICATION AND COOPERATION IN AGENTS

9

Software tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Combining Task and Result Sharing - Handling Inconsistency - Coordination - Multi agent Planning and Synchronization.

UNIT IV DEVELOPING INTELLIGENT AGENT SYSTEMS

9

Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events - Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle - Deciding on the Agent Types - Grouping functionalities - Review Agent Coupling - Develop Agent Descriptors.

UNIT V APPLICATIONS

9

Agent for workflow and business process management- Mobile agents - Agents for distributed systems - agents for information retrieval and management - agents for electronic commerce - agent for human-computer interface - agents for virtual environments - agents for social simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand basic concepts of intelligent agents.
- CO2:** Study reasoning and learning mechanisms in intelligent agents.
- CO3:** Analyze communication and cooperation in multi-agent systems.
- CO4:** Design intelligent agent systems with proactive and reactive behaviors.
- CO5:** Apply intelligent agent technologies in real-world applications.

TEXT BOOKS:

1. Michael Wooldridge, “An Introduction to Multi Agent Systems”, John Wiley and Sons, Second Edition, 2009.
2. Russell S., Norvig P., “*Artificial Intelligence: A Modern Approach*”, Pearson, 4th Edition, 2020.

REFERENCES:

1. Ronald Brachman, Hector Levesque “Knowledge Representation and Reasoning”, The Morgan Kaufmann Series in Artificial Intelligence 2004.
2. Arthur B. Markman, “Knowledge Representation”, Lawrence Erlbaum Associates, 1998.
3. Lin Padgham, Michael Winikoff, “Developing Intelligent Agent Systems: A Practical Guide”, Wiley publications, 2005.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	-	-	-	-	-	-	2	2	1	-
CO2	3	3	2	2	2	-	-	-	-	-	2	2	1	-
CO3	3	2	3	2	2	-	-	3	3	-	2	2	2	-
CO4	2	2	3	3	3	-	-	2	2	-	2	3	2	-
CO5	2	1	2	2	2	-	-	-	1	-	2	2	3	-
Avg	2.60	2.20	2.20	2.20	2.25	-	-	2.50	2.00	-	2.00	2.20	1.80	-

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – CSE & B. TECH – IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	3
CO2	2	3	3	1	2	–	–	–	1	1	–	2	3	3
CO3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO5	3	3	2	3	2	–	–	–	1	1	3	3	2	3
Avg	2.80	2.80	2.40	2.00	2.20	–	–	–	1.00	1.00	2.30	2.60	2.80	3.00

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(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.

TOTAL: 45 PERIODS

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.

TEXT BOOKS:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	-	-	-	1	1	-	3	2	2
CO2	3	3	2	2	3	-	-	-	1	1	-	3	3	2
CO3	3	2	3	2	3	-	-	-	1	1	-	3	3	2
CO4	3	3	2	2	3	-	-	-	1	1	-	3	2	2
CO5	3	3	3	3	3	-	-	-	2	2	-	3	3	3
Avg	3.00	2.60	2.40	2.00	3.00	-	-	-	1.20	1.20	-	3.00	2.60	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – CSE & B. TECH – IT, AI&DS)

CS24P18	CLOUD SERVICES MANAGEMENT	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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
CO2	3	3	3	2	3	–	1	–	1	1	2	3	3	3
CO3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
CO4	3	3	3	2	3	2	2	3	1	1	2	3	3	3
CO5	3	3	3	2	3	2	2	1	1	2	3	3	3	3
Avg	3.00	2.80	2.60	2.00	2.60	2.00	1.60	2.00	1.00	1.20	2.25	2.80	3.00	2.80

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – CSE & B. TECH – IT, AI&DS)

CS24P06	UI AND UX DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To Understand the basic concepts of UI/UX design and the design thinking process.
- To Analyse user needs and problems using UX research methods.
- To Apply UI design principles to create visually effective user interfaces.
- To Develop wireframes, prototypes, and interaction designs for digital products
- To 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 Elmquist 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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	1	1	–	2	3	3
CO2	2	3	2	2	1	1	–	1	2	1	–	2	3	2
CO3	2	3	3	2	2	–	–	1	1	1	–	3	3	3
CO4	2	3	3	2	3	–	–	–	1	1	1	3	3	3
CO5	2	3	3	3	2	2	–	2	2	2	2	3	3	3
Avg	2.20	2.80	2.40	2.25	1.80	1.50	–	1.33	1.40	1.20	1.50	2.60	3.00	2.80

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – CSE & B. TECH – IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	2	3
CO2	3	3	3	2	2	–	–	–	1	1	1	3	3	3
CO3	3	3	3	2	2	–	–	–	1	1	2	3	3	3
CO4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO5	3	3	3	2	3	–	–	–	2	2	3	3	3	3
Avg	3.00	2.80	2.60	2.00	2.20	–	–	–	1.25	1.20	2.00	2.80	2.80	3.00

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – CSE & B. TECH – IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	2	–	1	–	2	3	2
CO2	3	3	2	2	2	1	–	3	1	1	–	3	3	2
CO3	3	3	3	2	3	1	–	3	1	1	1	3	3	3
CO4	3	3	3	2	3	–	–	3	1	1	2	3	3	3
CO5	3	3	3	2	3	1	–	3	1	2	2	3	3	3
Avg	3.00	2.80	2.40	2.00	2.40	1.00	–	2.80	1.00	1.20	1.67	2.80	3.00	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL II: FULL STACK DEVELOPMENT FOR IT
(Common to B. E – BME, CSE, ECE & B. TECH – IT & AI&DS)

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 – DevOps principles – Site Reliability Engineering (SRE) concepts – AI for DevOps (AIOps) – Future trends in DevOps.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	2	2	3	2
CO2	3	3	2	2	3	–	–	–	1	1	2	3	3	2
CO3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO4	3	3	3	2	3	1	–	–	1	1	3	3	3	3
CO5	3	3	3	2	3	1	–	–	2	2	3	3	3	3
Avg	3.00	2.80	2.40	2.00	2.60	1.00	–	–	1.25	1.20	2.40	2.80	3.00	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT & AI&DS)

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.

TOTAL: 45 PERIODS

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.

TEXT BOOKS:

1. Virtualization Essentials (3rd Edition) – Matthew Portnoy, Sybex (Wiley), 2022.
2. Data Centre Virtualisation Fundamentals – Gustavo A. A. Santana, Cisco Press, 2022.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
CO2	3	3	3	2	2	–	1	–	1	1	2	3	3	2
CO3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
CO4	3	3	3	2	3	1	3	–	1	1	2	3	3	3
CO5	3	3	3	2	3	2	3	3	1	1	3	3	3	3
Avg	3.00	2.80	2.60	2.00	2.40	1.50	2.00	3.00	1.00	1.00	2.25	2.80	3.00	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT & AI&DS)

CS24P19	DATA WAREHOUSING	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) – S6chema 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

TOTAL: 60 PERIODS

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.

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.

REFERENCES:

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 Mendelevitch, 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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	2
CO2	3	3	3	2	2	–	–	–	1	1	2	3	3	2
CO3	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO4	3	3	2	2	3	–	–	–	1	1	1	3	3	2
CO5	3	3	3	2	3	1	–	–	2	2	3	3	3	3
Avg	3.00	2.80	2.40	2.00	2.40	1.00	–	–	1.25	1.20	2.00	2.80	3.00	2.40

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & 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.

TOTAL: 45 PERIODS

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.

TEXT BOOKS:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	–	–	–	1	2	1	2	2	1
CO2	2	2	3	2	3	–	–	–	1	2	1	3	2	3
CO3	2	3	2	2	3	–	–	–	1	2	1	3	3	2
CO4	2	3	3	2	3	1	–		1	2	2	3	3	2
CO5	2	2	2	2	3	1	–	–	1	2	2	3	3	3
Avg	2.20	2.40	2.20	1.80	2.80	1.00	–	–	1.00	2.00	1.40	2.80	2.60	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT & AI&DS)

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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
CO2	3	3	3	2	2	–	2	–	1	1	2	3	3	2
CO3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
CO4	3	3	3	2	2	2	2	–	1	1	2	3	3	2
CO5	3	3	3	2	3	1	2	–	1	1	3	3	3	3
Avg	3.00	2.80	2.60	2.00	2.20	1.50	1.80	–	1.00	1.00	2.25	2.80	3.00	2.40

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

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

IT24P04	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	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 I EVOLUTION OF NETWORK ARCHITECTURE 9

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 II SDN ARCHITECTURE AND COMPONENTS 9

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 III SDN CONTROLLERS AND PROGRAMMING 9

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 IV VIRTUALIZATION AND DATA CENTRE NETWORKING 9

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 V SECURITY AND EMERGING TRENDS IN SDN 9

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.

TOTAL: 45 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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	-	-	-	-	-	1	-	1
CO2	3	3	2	2	3	2	-	-	-	-	-	2	1	3
CO3	3	3	3	3	3	1	-	-	-	-	-	3	3	3
CO4	3	3	2	3	3	3	-	-	-	-	-	3	3	3
CO5	3	3	2	2	2	3	-	-	-	-	-	2	3	3
Avg	3.00	2.80	2.00	2.20	2.60	2.00	-	-	-	-	-	2.20	2.50	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT & AI&DS)

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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	–	–	1	–	2	3	2
CO2	3	3	2	2	2	–	1	–	1	1	–	3	3	2
CO3	3	3	3	2	3	–	2	–	1	1	2	3	3	3
CO4	3	3	3	2	3	–	2	–	1	1	2	3	3	3
CO5	3	3	3	2	3	1	2	–	2	2	3	3	3	3
Avg	3.00	2.80	2.40	2.00	2.40	1.00	1.60	–	1.25	1.20	2.33	2.80	3.00	2.60

1 - Low, 2 - Medium, 3 - High

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES
(Common to B. E – CSE & B. TECH – IT & AI&DS)

CS24P27	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand cloud security concepts and basic cryptography.
- To Apply security principles to protect cloud systems and data.
- To Implement identity and access control in cloud environments.
- To Use security design patterns for securing cloud resources.
- To Perform monitoring and auditing for secure cloud operations.

UNIT I	FUNDAMENTALS OF CLOUD SECURITY CONCEPTS	9
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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
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Cloud monitoring and security tracking – Detecting attacks and unauthorized access – Event logging and alerts – Security audits – SIEM systems – User and identity management in cloud.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	–	1	3	–	1	–	2	3	2
CO2	3	3	3	2	3	1	2	3	1	1	2	3	3	3
CO3	3	3	3	2	3	1	2	3	1	1	2	3	3	3
CO4	3	3	3	2	3	1	2	3	1	1	2	3	3	3
CO5	3	3	3	3	3	2	2	3	1	2	3	3	3	3
Avg	3.00	2.80	2.60	2.00	2.60	1.25	1.80	3.00	1.00	1.20	2.25	2.80	3.00	2.80

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY
(Common to B. E – CSE & B. TECH – IT & AI&DS)

IT24P05	ETHICAL HACKING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To understand ethical hacking and cyber security 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 cyber security – 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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand ethical hacking and cyber security 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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	3	–	1	–	2	3	2
CO2	3	3	3	2	2	–	1	3	1	1	1	3	3	2
CO3	3	3	3	2	3	1	2	3	1	1	2	3	3	3
CO4	3	3	2	2	2	2	2	3	1	1	1	3	3	2
CO5	3	3	3	3	3	2	2	3	1	2	3	3	3	3
Avg	3.00	2.80	2.40	2.25	2.20	1.67	1.60	3.00	1.00	1.20	1.75	2.80	3.00	2.40

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY
(Common to B. E – CSE & B. TECH – IT & AI&DS)

IT24P06	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand basics of social network security and privacy.
- To Learn authentication and access control techniques.
- To Understand cyber attacks and threats in social media.
- To Learn privacy, forensic, and legal aspects of social networks.
- To Explore advanced security methods in social networking systems.

UNIT I	INTRODUCTION TO SOCIAL NETWORK SECURITY	9
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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.

TOTAL: 45 PERIODS

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.

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 Aadhyta, "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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	3	–	1	–	2	3	2
CO2	3	3	2	2	2	1	1	3	1	1	1	3	3	2
CO3	3	3	3	2	2	1	2	3	1	1	1	3	3	2
CO4	3	3	2	2	1	2	2	3	1	2	2	2	3	2
CO5	3	3	3	3	3	2	2	3	1	2	2	3	3	3
Avg	3.00	2.80	2.20	2.25	1.80	1.50	1.60	3.00	1.00	1.40	1.50	2.60	3.00	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

B. Tech-AI & DS

AD24P09	DATA AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the fundamental concepts of information security and its importance.
- To study the various types of threats, attacks and vulnerabilities in information systems.
- To learn authentication mechanisms and digital signature techniques.
- To understand network security concepts including email and IP security.
- To study web security protocols and secure electronic transactions.

UNIT I INTRODUCTION

9

History of Information Security – Definition of Information Security – Critical Characteristics of Information – NSTISSC Security Model – Components of an Information System – Securing the Components – Balancing Security and Access – The Systems Development Life Cycle – The Security Systems Development Life Cycle.

UNIT II SECURITY INVESTIGATION

9

Need for Security – Business Needs – Threats and Attacks -Types of Attacks (Passive, Active, Insider, Outsider)– Legal, Ethical and Professional Issues – Overview of Computer Security – Access Control Matrix – Security Policies- Security Awareness and Training Programs – Confidentiality Policies – Integrity Policies – Hybrid Policies.

UNIT III DIGITAL SIGNATURE AND AUTHENTICATION

9

Digital Signature – Digital Signature Schemes - Digital Signature Standards (DSS) – Variants – Authentication – Authentication Requirements– Authentication Protocols – Applications – Kerberos – X.509 Directory Services.

UNIT IV E-MAIL AND IP SECURITY

9

E-Mail Security: Electronic Mail Architecture – Pretty Good Privacy (PGP)– Operational Description – Key Management – Trust Model – S/MIME - IP Security: Overview of IP Security – IP Security Architecture – Authentication Header (AH) – Encapsulating Security Payload (ESP) – IP Security Modes – Security Associations – Key Management.

UNIT V WEB SECURITY

9

Web Security Requirements – Web Application-Secure Sockets Layer (SSL) – SSL Architecture – SSL Protocols – Transport Layer Security (TLS)– Secure Electronic Transaction (SET) – Entities – Dual Signature – Processing of SET

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of information security and system components.

CO2: Identify threats, attacks and apply security policies.

CO3: Implement authentication and digital signature techniques.

CO4: Understand email and IP security mechanisms.

CO5: Analyze web security protocols and secure transaction systems.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, 8th Edition, 2023.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Pearson, 6th Edition, 2021.

REFERENCES:

1. Matt Bishop, "Computer Security: Art and Science", Addison-Wesley, 2nd Edition, 2021.
2. Ross J. Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Wiley, 3rd Edition, 2022.
3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley, 2nd Edition, 2021.
4. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", Wiley, 3rd Edition, 2022.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	2	3	1	2	3	1	1
CO2	2	3	-	3	2	-	-	1	2	2	2	1	2	2
CO3	2	2	3	3	2	-	-	1	3	2	2	1	2	1
CO4	3	2	3	1	2	-	-	3	1	1	3	2	3	3
CO5	3	3	3	3	3	-	-	1	2	2	2	2	2	1
Avg	2.60	2.40	3.00	2.20	2.25	-	-	1.60	2.20	1.60	2.20	1.80	2.00	1.60

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY
(Common to B. E – CSE & B. TECH – IT & AI&DS)

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.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	–	–	–	–	–	–	2	–	1
CO2	3	3	2	2	2	–	–	1	–	–	–	3	1	2
CO3	3	3	3	2	2	–	–	1	1	1	–	3	2	2
CO4	2	3	3	3	2	–	–	1	1	–	1	3	1	3
CO5	3	3	3	3	3	–	–	2	2	2	1	3	3	3
Avg	2.80	2.80	2.40	2.40	2.00	–	–	1.25	1.33	1.50	1.00	2.80	1.75	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

B. Tech-AI & DS

AD24P10	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Identify sources and causes of software insecurity.
- Learn secure design principles for developing robust software systems.
- Identify threats, vulnerabilities, and risk exposure factors.
- Gain knowledge of advanced security testing techniques.
- Apply security principles in managing real-world software projects.

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 6

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory - Based Attacks.

UNIT II SECURE SOFTWARE DESIGN 7

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UNIT III SECURITY RISK MANAGEMENT 5

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 8

Secure Software Development Life Cycle (SSDLC); Risk-Based Security Testing; Threat Modeling for prioritizing security testing - Penetration Testing – planning and scoping – enumeration - remote and web application exploitation - client-side attacks - post-exploitation - Advanced Security Testing.

UNIT V SECURE PROJECT MANAGEMENT 4

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice.

30 PERIODS

LIST OF EXPERIMENTS:**30 PERIODS**

1. a) Implement the SQL injection attack.
b) Implement the Buffer Overflow attack.
2. Implement Cross Site Scripting and Prevent XSS.
3. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.
4. a) Develop and test the secure test cases.
b) Penetration test using kali Linux.
5. Design and implement a secure web application that uses HTTPS protocol.
6. a) Develop a program to perform secure file operations by implementing proper access control, exception handling, and file permission mechanisms.
b) Design and implement a Role-Based Access Control (RBAC) system for an application.
7. Create a web application vulnerable to Cross-Site Scripting (XSS) attacks and demonstrate how input validation and output encoding techniques can be used to prevent such attacks.

REQUIREMENTS:

- VirtualBox or VMware Workstation Player (for virtual lab setup)
- Apache HTTP Server (web server)
- XAMPP (Apache + MySQL + PHP stack)
- MySQL (database backend)

COURSE OUTCOMES:**Upon completion of the course, the student will be able to:****CO1:** Understand software security concepts, software assurance, and sources of insecurity.**CO2:** Apply secure requirements engineering using the SQUARE process model.**CO3:** Analyze threats, vulnerabilities, and risk exposure factors.**CO4:** Understand SSDLC and risk-based security testing approaches.**CO5:** Evaluate maturity models for secure software development processes.**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Robert C. Seacord, "Secure Coding in C and C++", Addison-Wesley, 2nd Edition, 2022
2. Mark Graff, Kenneth R. van Wyk, "Secure Coding: Principles and Practices", O'Reilly Media, 3rd Edition, 2021

REFERENCES:

1. Michael Howard, David LeBlanc, John Viega, "24 Deadly Sins of Software Security", McGraw-Hill, 2nd Edition, 2021.
2. Michael Howard, Steve Lipner, "The Security Development Lifecycle", Microsoft Press, 3rd Edition, 2022.
3. Bart De Win, Riccardo Scandariato, "Secure Software Design", Springer, 2nd Edition, 2023.
4. Gary McGraw, "Software Security: Building Security In", Addison-Wesley, 2nd Edition, 2023

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	-	-	2	1	2	2	2	2	1
CO2	2	2	2	3	3	-	-	2	1	2	2	1	2	1
CO3	1	2	2	2	1	-	-	1	1	2	1	2	2	1
CO4	2	3	2	2	2	-	-	2	1	2	2	2	2	1
CO5	2	1	2	2	3	-	-	2	1	1	2	2	1	2
Avg	1.8	2.2	2.0	2.4	2.2	-	-	1.8	1.0	1.8	1.8	1.8	1.8	1.2

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY
(Common to B. E – CSE & B. TECH – IT & AI&DS)

IT24P07	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To Understand the fundamentals of digital forensics and digital evidence handling.
- To Learn investigation methods for digital crime and evidence collection.
- To Gain knowledge of digital forensic readiness frameworks and enterprise practices.
- To Understand iOS forensics concepts, tools, and investigation procedures.
- To 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.

TOTAL: 45 PERIODS

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.

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.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	–	3	–	1	–	2	3	2
CO2	3	3	3	3	3	2	–	3	1	1	2	3	3	2
CO3	3	3	3	2	2	2	–	3	1	1	2	3	3	2
CO4	3	3	3	2	3	1	–	3	1	1	2	3	3	3
CO5	3	3	3	2	3	1	–	3	1	1	2	3	3	3
Avg	3.00	2.80	2.60	2.00	2.40	1.40	–	3.00	1.00	1.00	2.00	2.80	3.00	2.40

1 - Low, 2 - Medium, 3 - High

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY
(Common to B. E – CSE & B. TECH – IT & AI&DS)

CS24P25	NETWORK SECURITY	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.

30 PERIODS

LIST OF EXPERIMENTS:

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

TOTAL: 60 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	2	-	-	-	-	2	2	2	2
CO2	2	2	2	2	1	1	-	-	-	-	1	2	2	3
CO3	3	2	2	2	2	1	-	-	-	-	2	3	3	3
CO4	2	2	2	2	2	1	-	-	-	-	1	1	2	1
CO5	2	2	2	2	1	1	-	-	-	-	2	2	2	3
Avg	2.40	2.20	2.20	1.80	1.60	1.20	-	-	-	-	1.60	2.00	2.20	2.40

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA
(Common to: B.E-CSE, ECE, EEE, & MECH, B.Tech-IT, AI&DS)

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:

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

CO1: Understand VR and AR fundamentals and components.

CO2: Apply VR modeling techniques for virtual environments.

CO3: Develop VR applications using programming tools and interaction methods.

CO4: Analyze VR applications in various domains.

CO5: Design AR systems using computer vision and wearable technologies.

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. Alan B. Craig, William R. Sherman, Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2nd Edition, 2022.
2. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", Morgan & Claypool Publishers, 2nd Edition, 2023.
3. Steve Aukstakalnis, "Practical Augmented Reality", Addison-Wesley Professional, 2nd Edition, 2021.
4. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley-IEEE Press, 3rd Edition, 2020.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3	2
CO4	2	3	2	2	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	3	3
Avg	2.8	2.8	2.2	2.0	2.6	-	-	-	-	-	-	2.6	2.8	2.2

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA

B. Tech-AI & DS

IT24P11	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To grasp the fundamental knowledge of Multimedia elements and systems.
- To get familiar with Multimedia file formats and standards.
- To learn the process of Authoring multimedia presentations.
- To learn the techniques of animation in 2D and 3D and for the mobile UI.
- To explore different popular applications of multimedia.

UNIT I INTRODUCTION

9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS

9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models, Multimedia compression techniques, Streaming media formats and protocols for web delivery.

UNIT III MULTIMEDIA AUTHORIZING

9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modelling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV ANIMATION

9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Key frame, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS

9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Get the bigger picture of the context of Multimedia and its applications.

CO2: Use the different types of media elements of different formats on content pages.

CO3: Author 2D and 3D creative and interactive presentations for different target multimedia applications.

CO4: Use different standard animation techniques for 2D, 2 1/2 D, 3D applications.

CO5: Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)
2. Tay Vaughan, “Multimedia: Making It Work”, McGraw-Hill.

REFERENCES:

1. John M Blain, “The Complete Guide to Blender Graphics: Computer Modeling & Animation”, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.
3. Prabhat K. Andleigh, Kiran Thakrar, “Multimedia System Design”, Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, “Multimedia Cloud Computing Systems”, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, “3D Graphics and Animation”, New Riders, Second Edition, 2002.
6. Rogers David, “Animation: Master – A Complete Guide (Graphics Series)”, Charles River Media, 2006.
7. Rick parent, “Computer Animation: Algorithms and Techniques”, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, “UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native”, Packt Publishing, 2022.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	2	2	1	2	2	1	2	-
CO2	3	2	2	1	3	-	3	2	2	3	3	1	2	-
CO3	3	3	2	2	3	-	3	2	1	2	3	2	2	-
CO4	3	3	3	2	3	-	3	2	2	3	3	2	2	-
CO5	3	3	3	3	3	-	3	3	3	3	3	3	3	-
Avg	3.0	2.6	2.4	2.0	3.0	-	2.8	2.2	1.8	2.6	2.8	1.8	2.2	-

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA

B. Tech-AI & DS

IT24P12	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording and apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.
- To develop practical skills in multimedia production, post-production workflows, and digital content creation for real-world applications.

UNIT I FUNDAMENTALS

9

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II STORYTELLING

9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO

9

Capturing digital and analog video, importing audio putting video on, video editing and sequencing, applying visual effects and transitions, exporting digital video to tape, and recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO

9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4

9

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compare the strengths and limitations of nonlinear editing.

CO2: Identify the infrastructure and significance of storytelling.

CO3: Apply suitable methods for recording to CDs and VCDs.

CO4: Address the core issues of advanced editing and training techniques.

CO5: Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS:

1. Robert M. Goodman and Partick McGrath, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.
2. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.

REFERENCES:

1. Michael Rabiger, *Directing: Film Techniques and Aesthetics*.
2. John Watkinson – *The Art of Digital Video*, Focal Press.
3. Robert B. Musburger – *Foundations of Video Production*, Focal Press.
4. Paul Wheeler – *Video Editing with Adobe Premiere Pro*, Routledge.
5. Blain Brown – *Cinematography: Theory and Practice*, Focal Press.
6. Avid Xpress DV 4 User Guide, 2007.
7. Final Cut Pro 6 User Manual, 2004.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	1	2	3	2	3	1	1	-
CO2	2	3	3	3	2	-	1	2	2	1	1	1	1	-
CO3	2	2	3	3	3	-	3	1	1	1	2	1	2	-
CO4	2	2	2	2	3	-	3	1	1	1	2	2	2	-
CO5	2	3	3	1	-	-	3	2	1	2	2	2	1	-
Avg	2.0	2.4	2.4	2.0	1.8	-	2.2	1.6	1.6	1.4	2.0	1.4	1.4	-

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA
(Common to B. E – CSE & B. TECH – IT & AI&DS)

CS24P36	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand the fundamentals of additive manufacturing and 3D printing processes.
- To Learn different 3D printing technologies, materials, and process principles.
- To Gain knowledge of inkjet-based 3D printing and material jetting techniques.
- To Understand laser-based additive manufacturing systems and working principles.
- To 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

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	–	1	–	1	–	–	1	–	2	2	1
CO2	3	3	3	2	2	1	2	–	1	1	2	3	2	1
CO3	3	3	2	2	3	–	1	–	1	1	2	2	2	1
CO4	3	3	2	2	3	–	2	–	1	1	2	2	2	1
CO5	3	3	2	1	2	2	2	–	1	2	2	2	3	1
Avg	3.00	2.80	2.20	1.75	2.20	1.50	1.60	–	1.00	1.20	2.00	2.20	2.20	1.00

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA

B. Tech-AI & DS

IT24P13	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of compression techniques.
- To understand the categories of compression for text, image and video.
- To explore the modalities of text, image and video compression algorithms.
- To know about basics of consistency of data availability in storage devices.
- To understand the concepts of data streaming services.

UNIT I INTRODUCTION

6

Introduction to Data Compression – Lossless and Lossy Compression – Basics of Huffman Coding – Arithmetic Coding – Dictionary Techniques – Run-Length Encoding (RLE) – Applications.

UNIT II IMAGE COMPRESSION

6

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding.

UNIT III VIDEO COMPRESSION

6

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263, H.264/AVC (Advanced Video Coding).

UNIT IV DATA PLACEMENT ON DISKS

6

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.

UNIT V DISK SCHEDULING METHODS

6

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Construct Huffman codes for given symbol probabilities.
 - Encode run lengths with fixed-length code.
2. Lempel-Ziv algorithm for adaptive variable-length encoding
3. Compress the given word using arithmetic coding based on the frequency of the letters.
4. Write a shell script, which converts all images in the current directory in JPEG.
 - Write a program to split images from a video without using any primitives.

5. Create a photo album of a trip by applying appropriate image dimensions and format.
6. Write the code for identifying the popularity of content retrieval from media server.
 - Write the code for ensuring data availability in disks using strip based method.
7. Program for scheduling requests for data streams.

REQUIREMENTS:

- Ubuntu — Fully open source (Linux-based)
- Python — Open source
- Jupyter Notebook — Open source
- VS Code — Open source (MIT license version is open source)
- FFmpeg — Open source
- ImageMagick — Open source/GIMP — Open source/Krita — Open source
- Blender — Open source/Audacity — Open source/Ardour — Open source
- NumPy, SciPy, Matplotlib, Scikit-learn → all open-source Python libraries

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of text, Image and Video compression.

CO2: Understand the various compression algorithms for multimedia content.

CO3: Explore the applications of various compression techniques.

CO4: Explore knowledge on multimedia storage on disks.

CO5: Understand scheduling methods for request streams.

TEXT BOOKS:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Series in Multimedia Information and Systems, 5th Edition, 2018.
2. Philip K.C.Tse, “Multimedia Information Storage and Retrieval: Techniques and Technologies”, 2008.

REFERENCES:

1. David Salomon, “A concise introduction to data compression”, 2008.
2. Lenald Best, “Best’s Guide to Live Stream Video Broadcasting”, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, “Image and Video Compression for Multimedia Engineering Fundamentals Algorithms and Standards”, Taylor& Francis, 2019.
4. Irina Bocharova, “Compression for Multimedia”, Cambridge University Press; 1st edition, 2009.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA

(Common to B. E – CSE & B. TECH – IT & AI&DS)

CS24P17	GAME DEVELOPMENT	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

TOTAL: 60 PERIODS**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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	3
CO2	3	3	3	2	3	–	–	–	1	1	–	3	3	3
CO3	3	3	3	2	3	–	–	–	1	1	–	3	3	3
CO4	3	3	3	2	3	–	–	–	1	1	2	3	3	3
CO5	2	3	2	1	1	2	–	–	1	2	2	2	3	3
Avg	2.80	2.80	2.40	1.75	2.20	2.00	–	–	1.00	1.20	2.00	2.60	3.00	3.00

1 - Low, 2 - Medium, 3 - High

VERTICAL V: CREATIVE MEDIA

B. Tech-AI & DS

IT24P14	VISUAL EFFECTS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To get a basic idea on animation principles and techniques.
- To get exposure to CGI, color and light elements of VFX.
- To have a better understanding of basic special effects techniques.
- To have a knowledge of state-of-the-art vfx techniques.
- To become familiar with popular compositing techniques.

UNIT I ANIMATION BASICS

6

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II CGI, COLOR, LIGHT

6

Computer-Generated Imagery – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image-based lights, PBR lights, photometric light, BRDF shading model

UNIT III SPECIAL EFFECTS

6

Special Effects – Props, Scaled Models, Animatronics, Pyrotechnics, Schüfftan process, Matte Painting, Particle Effects – Wind, Rain, Fog, Fire.

UNIT IV VISUAL EFFECTS TECHNIQUES

6

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V COMPOSITING

6

Compositing – Chroma Key, Blue Screen/Green Screen, Background Projection, Alpha Compositing, deep image compositing, Motion Tracking, Multiple Exposure, Matting, VFX Tools – Blender, Natron, GIMP.

30 PERIODS

LIST OF EXPERIMENTS:

30 PERIODS

1. Study the Natron environment and create a basic node-based compositing workflow.
 - Perform colour correction and cinematic colour grading for video footage using Natron.
2. Use channels and image merging techniques to create a green screen compositing effect in Natron.

3. Remove unwanted objects from video footage using Roto Paint tools in Natron.
 - Perform motion tracking and stabilize shaky video footage using Natron.
4. Transform and composite graphical elements into live-action video using Natron.
5. Perform camera motion tracking and integrate 3D objects into live footage using Blender.
6. Perform object tracking and attach virtual elements to moving objects using Blender.
7. Apply camera FX, colour grading, and vignette effects to enhance cinematic video scenes using Blender.
 - Perform multilayer rendering and final compositing of images and video files using Blender.

REQUIREMENTS:

- Ubuntu — Fully open source (Linux-based)
- VS Code — Open source (MIT license version is open source)
- FFmpeg — Open source
- ImageMagick — Open source/GIMP — Open source/Krita — Open source
- Blender — Open source/Audacity — Open source/Ardour — Open source
- NumPy, SciPy, Matplotlib, Scikit-learn → all open-source Python libraries

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Implement animation in 2D / 3D following the principles and techniques.

CO2: Use CGI, color and light elements in VFX applications.

CO3: Create special effects using any of the state of the art tools.

CO4: Apply popular visual effects techniques using advanced tools.

CO5: Use compositing tools for creating VFX for a variety of applications.

TEXT BOOKS:

1. Chris Roda, “Real Time Visual Effects for the Technical Artist”, CRC Press, 1st Edition, 2022.
2. Steve Wright, “Digital Compositing for film and video”, Routledge, 4th Edition, 2017.

REFERENCES:

1. Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, “The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, “Lighting for Animation: The art of visual storytelling”, Routledge, 1st Edition, 2016.
5. Eran Dinur, “The Complete guide to Photorealism, for Visual Effects, Visualization and Games”, Routledge, 1st Edition, 2022.
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, “The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures”, Third Edition, 2020.
7. <https://www.blender.org/features/vfx/>
8. <https://natrongithub.github.io/>

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	1	2	1	1	3	2
CO2	1	3	3	2	1	-	-	-	3	2	2	2	1	1
CO3	2	3	3	2	2	-	-	-	1	2	1	2	2	2
CO4	3	3	2	2	3	-	-	-	3	3	2	2	3	1
CO5	1	2	1	1	2	-	-	-	1	3	3	3	3	1
Avg	2.0	2.8	2.4	2.0	1.8	-	-	-	1.8	2.4	1.8	2.0	2.4	1.4

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E- BME, CSE, ECE & B.Tech-IT, AI&DS)

CS24P32 / RA24901	ROBOTIC PROCESS AUTOMATION	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.
- 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.

UNIT II AUTOMATION PROCESS ACTIVITIES 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making.

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.

UNIT IV EXCEPTION HANDLING 6

Exception handling, Common exceptions, Logging- Debugging techniques, collecting crash dumps, Error reporting.

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.

30 PERIODS

LIST OF EXPERIMENTS: 30 PERIODS

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.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the concepts, evolution, benefits, applications, core components, and platforms of Robotic Process Automation (RPA).
- CO2:** Develop automation workflows using sequence, flowchart, activities, and control flow constructs for decision-making processes.
- CO3:** Implement application integration, recording, scraping, selectors, and workflow activities to automate data extraction and operational tasks.
- CO4:** Analyze exceptions, logging mechanisms, debugging techniques, and error-reporting methods to improve the reliability of RPA solutions.
- CO5:** Deploy and maintain software robots using publishing tools, orchestration servers, licensing mechanisms, and update management techniques.

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

CO-PO & PSO MAPPING

	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	2.0	1.8	2.0	1.0	1.8	2.2	1.2	2.2	2.4	2.8	2.0

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E-BME, CSE, & ECE, B.Tech-IT, AI&DS)

AD24906/ AD24P12	NEURAL NETWORKS AND DEEP LEARNING	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. a) Implement simple vector operations (addition, multiplication) in TensorFlow.
b) Implement a regression model in Keras.
2. Implement a perceptron in TensorFlow/Keras Environment.
3. a) Implement a Feed-Forward Network in TensorFlow/Keras.
b) Implement an Image Classifier using CNN in TensorFlow/Keras.
4. a) Improve the Deep learning model by fine tuning hyper parameters.
b) Implement a Transfer Learning concept in Image Classification.
5. Using a pre trained model on Keras for Transfer Learning.
6. Implement an LSTM based Autoencoder in TensorFlow/Keras.
7. Image generation using GAN.

REQUIREMENTS:

- Python (recommended version: 3.8+)
- Anaconda Distribution (for package management + Jupyter)
- VS Code (coding + debugging alternative)
- NumPy, SciPy, Matplotlib, Scikit-learn → all open-source Python libraries

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	-	-	-	-	3	3	2
CO2	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	1	1	-	3	3	2
CO4	3	3	3	3	3	-	-	-	1	-	-	3	3	3
CO5	3	3	2	3	3	-	-	-	-	-	-	3	3	3
Avg	3.0	2.8	2.2	2.4	2.8	-	-	-	1.0	1.0	-	2.8	2.8	2.4

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

IT24P09	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand fundamentals of cyber security, cybercrime, and cyber laws.
- To Learn about cyber attacks, threats, vulnerabilities, and countermeasures.
- To Gain knowledge of reconnaissance techniques and information gathering tools.
- To Understand intrusion detection systems and network security monitoring.
- To 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).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand fundamentals of cyber security, 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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	3	–	1	–	2	3	2
CO2	3	3	3	2	2	-	-	3	1	1	1	3	3	3
CO3	3	3	3	2	3	-	-	3	1	1	1	3	3	3
CO4	3	3	3	3	3	-	-	3	1	2	2	3	3	3
CO5	3	3	3	3	3	-	-	3	1	2	2	3	3	3
Avg	3.00	2.80	2.60	2.20	2.40	-	-	3.00	1.00	1.40	1.50	2.80	3.00	2.80

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	1	2	–	1	–	2	3	2
CO2	3	3	3	2	3	–	1	2	1	1	2	3	3	2
CO3	3	3	3	2	2	–	1	2	1	1	2	3	3	3
CO4	3	3	2	2	2	–	2	2	1	1	2	3	3	2
CO5	3	3	2	2	2	–	2	3	1	2	2	3	3	2
Avg	3.00	2.80	2.20	2.00	2.00	–	1.40	2.20	1.00	1.20	2.00	2.80	3.00	2.20

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES

(Common to: B.E-CSE & B. Tech-AI & DS)

CS24602 / AD24P13	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To understand the concepts of IoT and its working models
- To know the various IoT protocols
- To understand about various IoT Physical devices and Endpoints
- To know the security and privacy issues connected with IoT
- To apply the concept of Internet of Things in a real-world scenario.

UNIT I FUNDAMENTALS OF IOT

9

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT II IOT PROTOCOLS

9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACnet Protocol–Modbus – KNX – Zigbee– Network layer – APS layer – Security.

UNIT III IOT PHYSICAL DEVICES AND ENDPOINTS

9

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.

UNIT IV INTERNET OF THINGS PRIVACY AND SECURITY

9

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

UNIT V APPLICATIONS

9

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals and working concepts of IoT.

CO2: Explain various IoT protocols and communication standards.

CO3: Apply IoT devices and interfaces using Arduino and Raspberry Pi.

CO4: Analyze security and privacy issues in IoT systems.

CO5: Develop IoT-based solutions for real-world applications.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach (2nd Edition) – Arshdeep Bahga and Vijay Madisetti, Universities Press, 2023.
2. Internet of Things: Principles and Paradigms – Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2021.

REFERENCES:

1. Internet of Things: Architecture and Design Principles (3rd Edition) – Raj Kamal, McGraw-Hill Education, 2022.
2. Building the Internet of Things with Arduino and Raspberry Pi – Agus Kurniawan, Packt Publishing, 2021.
3. Designing Connected Products: UX for the Consumer Internet of Things (2nd Edition) – Claire Rowland et al., O'Reilly Media, 2022.
4. Practical Internet of Things with Python and MQTT – Gastón C. Hillar, BPB Publications, 2022.
5. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things (2nd Edition) – David Hanes et al., Cisco Press, 2023.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	–	–	–	1	2	1	2	2	1
CO2	2	2	2	1	3	–	–	–	1	2	1	3	2	2
CO3	2	2	3	2	3	–	–	–	1	2	1	3	2	2
CO4	2	3	2	2	3	–	–	–	1	2	2	2	3	1
CO5	2	3	3	2	3	–	–	–	2	2	2	3	3	2
Avg	2.2	2.4	2.2	1.6	2.8	–	–	–	1.2	2.0	1.4	2.6	2.4	1.6

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

TEXT BOOKS:

1. Mastering Blockchain (3rd Edition) – Imran Bashir, Packt Publishing, 2023.
2. Blockchain and Cryptocurrency: Technologies and Applications – Arshdeep Bahga & Vijay Madiseti, VPT, 2022.

REFERENCES:

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	1	-	-	2	3	1	1	-
CO2	3	3	3	3	1	-	2	-	-	2	1	2	1	-
CO3	3	3	3	3	2	-	3	-	-	2	2	3	3	-
CO4	2	3	2	3	-	-	3	-	-	2	2	2	3	-
CO5	3	3	3	3	3	-	3	-	-	2	2	3	2	-
Avg	2.8	2.8	2.6	2.6	2.0	-	2.4	-	-	2.0	2.0	2.2	2.0	-

1 - Low, 2 - Medium, 3 - High

VERTICAL VI: EMERGING TECHNOLOGIES
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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 Madiseti 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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	–	–	1	–	–	–	2	1	2
CO2	3	3	2	3	3	–	–	1	–	–	–	3	2	3
CO3	3	3	3	3	3	–	–	1	1	–	–	3	2	3
CO4	3	3	2	3	3	–	–	3	1	1	1	3	2	3
CO5	3	3	3	3	3	–	–	2	2	2	1	3	3	3
Avg	3.00	2.80	2.20	2.80	2.80	–	–	1.60	1.33	1.50	1.00	2.80	2.00	2.80

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II
B. Tech-AI & DS

AD24P14	BIO-INSPIRED OPTIMIZATION TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand fundamental topics in bio-inspired optimization techniques.
- To Learn the collective systems such as ACO, PSO, and BCO.
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems.
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

UNIT I INTRODUCTION

6

Introduction to optimization problems - single and multi-objective optimization - classical techniques - overview of optimization methods-Evolutionary computing - genetic algorithms - representation - fitness function - reproduction - comparison with traditional methods-Bio-inspired computing.

UNIT II SWARM INTELLIGENCE

6

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO.

UNIT III NATURAL TO ARTIFICIAL SYSTEMS

6

Biological nervous systems - artificial neural networks - Neural Network Architectures - Evolution of neural networks - Hybrid neural systems - Supervised – Unsupervised-Reinforcement learning. Biological inspirations in problem solving.

UNIT IV SWARM ROBOTICS

6

Behavior of social insects - Foraging - Division of labor - Task allocation - Nest building - Cooperative transport. – Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems

UNIT V CASE STUDIES

6

Fish Swarm Optimization – Bacteria foraging Optimization – Intelligent Water Drop Algorithms
Applications of biologically inspired algorithms in engineering.

30 PERIODS

LIST OF EXPERIMENTS:**30 PERIODS**

1. Implementation of Genetic Algorithm for Function Optimization
2. Implementation of Ant Colony Optimization for Shortest Path Problem
3. Solving Travelling Salesman Problem using Ant Colony Optimization
4. Implementation of Supervised Learning using Artificial Neural Network
5. Reinforcement Learning using Neural Networks
6. Implementation of Particle Swarm Optimization (PSO) for Function Optimization
7. Implementation of Fish Swarm Optimization for Function Optimization

TOTAL: 60 PERIODS**REQUIREMENTS:**

Software Requirements: Python 3.x / MATLAB, Jupyter Notebook / VS Code

COURSE OUTCOMES:

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

CO1: Understand the basics of bio-inspired optimization and evolutionary computing techniques.**CO2:** Gain knowledge of bio-inspired models like swarm intelligence, neural networks, and hybrid systems.**CO3:** Apply suitable bio-inspired algorithms to solve different computational problems.**CO4:** Compare and analyze various bio-inspired optimization methods based on performance.**CO5:** Explore advanced swarm intelligence methods and hybrid optimization techniques for real-world problems.**TEXT BOOKS:**

1. A. E. Eiben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2nd Edition, 2015.
2. D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, 2nd Edition, 2023.

REFERENCES:

1. E. Bonabeau, M. Dorigo, and G. Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University Press, Latest Reprint Edition, 2020.
2. C. Blum and D. Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer, Revised Edition, 2019.
3. L. N. De Castro and F. J. Von Zuben, "Recent Developments in Biologically Inspired Computing", IGI Global, Revised Edition, 2018.
4. L. N. de Castro, "Fundamentals of Natural Computing: Basic Concepts, Algorithms and Applications", CRC Press (Taylor & Francis), 2nd Edition, 2022.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II
(Common to: B.E-CSE, ECE, & EEE, B.Tech-IT & AI&DS)

CS24906/ AD24P15	REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- 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. A. Zai and B. Brown, "Deep Reinforcement Learning in Action", Manning Publications, 2nd Edition, 2024.
2. C. Szepesvári, "Algorithms for Reinforcement Learning", Morgan & Claypool Publishers, Updated Edition, 2019.
3. Sudharsan Ravichandiran, "Deep Reinforcement Learning with Python", Packet Publishing, Birmingham, Second Edition, 2020.
4. Csaba Szepesvari, "Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence & Machine Learning)", Morgan & Claypool Publishers, 2010.
5. Laura Graesser and Wah Loon Keng, "Foundations of Deep Reinforcement learning: theory and Practice in Python", Pearson India, New Delhi, 2022.
6. Michael Hu, "The Art of Reinforcement Learning – Fundamentals, Mathematics and Implementations with Python", Apress, 2024.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	2	2	1	2	1	1
CO2	3	3	1	1	1	-	-	-	2	2	1	2	2	1
CO3	2	3	2	2	2	-	-	-	2	2	1	3	2	2
CO4	2	2	3	3	3	-	-	-	2	2	1	3	3	2
CO5	2	2	2	2	3	-	-	-	3	3	2	3	3	3
Avg	2.4	2.4	1.8	1.8	2.0	-	-	-	2.2	2.2	1.2	2.6	2.2	1.8

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II

B. Tech-AI & DS

AD24P16	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enable the students

- To Understand the health data formats, health care policy and standards.
- To Learn the significance and need of data analysis and data visualization.
- To Understand the health data management frameworks.
- To Learn the use of machine learning and deep learning algorithms in healthcare.
- To Apply healthcare analytics for critical care applications.

UNIT I INTRODUCTION TO HEALTHCARE ANALYSIS

9

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

UNIT II MACHINE LEARNING CONCEPTS

9

Data preprocessing-visualization-feature selection-model training - evaluation (accuracy, sensitivity, specificity, PPV-NPV-FPR-ROC-precision-recall); basics of Python (variables-data structures - Pandas operations) and Scikit-learn (preprocessing- feature selection).

UNIT III HEALTH CARE MANAGEMENT

9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

UNIT IV DEEP LEARNING CONCEPTS

9

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System...

UNIT V CASE STUDIES

9

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Use machine learning and deep learning algorithms for health data analysis.

CO2: Apply the data management techniques for healthcare data.

CO3: Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care Applications.

CO4: Design health data analytics for real time applications.

CO5: Design emergency care system using health data analysis.

TEXT BOOKS:

1. D. A. Delen and H. Demirkan, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", Pearson, 2nd Edition, 2022.
2. C. K. Reddy and C. C. Aggarwal, "Healthcare Data Analytics", CRC Press (Taylor & Francis), 2nd Edition, 2023.

REFERENCES:

1. H. C. Koh and G. Tan, "Data Mining Applications in Healthcare", IGI Global, Updated Edition, 2020.
2. J. F. Hair, W. C. Black, and B. J. Babin, "Multivariate Data Analysis", Cengage Learning, 8th Edition, 2021.
3. T. H. Davenport and R. Kalakota, "The Potential for Artificial Intelligence in Healthcare", Future Healthcare Journal, Revised Edition, 2019.
4. K. H. W. Lee and H. Y. Lee, "Introduction to Healthcare Data Analytics", Springer, 1st Edition, 2021.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

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.

TOTAL: 45 PERIODS

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: Analyse deep learning models for visual analytics.

CO5: Develop image and video analytics applications.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	1	–	2	3	1
CO2	3	3	2	2	3	–	–	–	1	1	–	3	3	2
CO3	3	3	3	2	3	–	–	–	1	1	–	3	3	2
CO4	3	3	3	2	3	–	–	–	1	1	–	3	3	3
CO5	3	3	3	2	3	–	–	–	2	2	2	3	3	3
Avg	3.00	2.80	2.40	2.00	2.60	–	–	–	1.25	1.20	2.00	2.80	3.00	2.20

1 - Low, 2 - Medium, 3 - High

B. Tech-AI & DS

AD24P18	GAME THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basic concepts and mathematical foundations of Game Theory.
- Analyze strategic interactions using cooperative and non-cooperative game models.
- Apply solution methods like Nash equilibrium and dominant/mixed strategies.
- Use Game Theory to study real-world problems in economics, computing, and social systems.
- To develop problem-solving skills for modeling and analyzing competitive and cooperative situations.

UNIT I INTRODUCTION

9

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-non-cooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION

9

Games with Perfect Information Strategic games — prisoner's dilemma, matching pennies - Nash equilibria — mixed strategy equilibrium — zero-sum games.

UNIT III GAMES WITH IMPERFECT INFORMATION

9

Games with Imperfect Information — Bayesian Games — Motivational Examples — General Definitions — Information aspects — Illustrations — Extensive Games with Imperfect — Information — Strategies — Nash Equilibrium — Repeated Games — The Prisoner's Dilemma — Bargaining.

UNIT IV NON-COOPERATIVE GAME THEORY

9

Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games — Computing Nash equilibria of two-player, zero-sum games — Computing Nash equilibria of two-player, general- sum games — Identifying dominated strategies.

UNIT V MECHANISM DESIGN

9

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design with unrestricted preferences.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand strategic games, equilibria, and their applications.

CO2: Apply Nash Equilibrium to solve different types of problems.

CO3: Analyze real-world situations using appropriate game theory concepts.

CO4: Identify some applications that need aspects of Bayesian Games.

CO5: Implement a typical Virtual Business scenario using Game theory.

TEXT BOOKS:

1. E. N. Barron, "Game Theory: An Introduction", John Wiley & Sons, 3rd Edition, 2024.
2. A. Espinola-Arredondo and F. Muñoz-Garcia, "Game Theory: An Introduction with Step-by-Step Examples", Palgrave Macmillan, 1st Edition, 2023.

REFERENCES:

1. R. K. Amit, "Game Theory with Applications in Operations Management", Springer, 1st Edition, 2024.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	-	-	3	2	1	2	3	2	3
CO2	3	3	3	2	3	-	-	2	2	2	1	3	3	1
CO3	1	1	3	3	3	-	-	3	3	1	2	3	2	2
CO4	2	1	1	1	1	-	-	2	3	3	3	2	2	2
CO5	2	2	3	2	1	-	-	3	3	2	2	3	3	2
Avg	2.2	2.0	2.4	2.2	2.2	-	-	2.6	2.6	1.8	2.0	2.8	2.4	2.0

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II

B. Tech-AI & DS

AD24P19	COGNITIVE SCIENCE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To enable the students

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 6

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II	COMPUTATIONAL INTELLIGENCE	6
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Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 6

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions
– Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration

UNIT IV INFERENCE MODELS OF COGNITION 6

Generative Models – conditioning mechanisms - causal relationships - statistical/conditional dependence; modeling joint - conditional distributions - understanding dependencies among variables

UNIT V LEARNING MODELS OF COGNITION 6

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

30 PERIODS

LIST OF EXPERIMENTS: **30 PERIODS**

1. Demonstration of Mathematical functions using WebPPL.
2. Implementation of reasoning algorithms for cognitive decision-making.
3. Development of an application system using generative models.
4. Implementation of conditional inference learning models for decision tasks.
5. Development of applications using hierarchical cognitive models.
6. Development of applications using mixture models for probabilistic reasoning.
7. Decision-making under risk and learning curve analysis using cognitive models.

REQUIREMENTS:

- Windows 10 or higher Operating System / Linux Ubuntu 20 or higher
- WebPPL (Web Probabilistic Programming Language)
- Node.js
- Python 3.9 or above
- Libraries: NumPy, Matplotlib, SciPy
- Jupyter Notebook / Google Colab / VS Code

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the underlying theory behind cognition.

CO2: Connect to the cognition elements computationally.

CO3: Implement mathematical functions through WebPPL.

CO4: Develop applications using cognitive inference model.

CO5: Develop applications using cognitive learning model.

TEXT BOOKS:

1. J. L. Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, 4th Edition, 2023.
2. T. H. Leahey, "Fundamentals of Cognitive Science: Minds, Brain, Magic, and Evolution", Routledge, 1st Edition, 2023.
3. V. Khare, S. K. Dwivedi, and M. Bhatia, "Cognitive Science, Computational Intelligence, and Data Analytics: Methods and Applications with Python", Elsevier, 1st Edition, 2024.

REFERENCES:

1. S. Mukherjee, V. Dutt, and N. Srinivasan (Eds.), "Applied Cognitive Science and Technology: Implications of Interactions Between Human Cognition and Technology", Springer, 1st Edition, 2023.
2. D. Talsma, "The Psychology of Cognition: An Introduction to Cognitive Neuroscience", Routledge, 1st Edition, 2023.
3. L. Behera and A. Bandyopadhyay (Eds.), "Consciousness, Cognition, and Contemplative Sciences", Springer, 1st Edition, 2023.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	2	2	-	-	1	1	2	2	1	2	2
CO2	2	2	1	1	2	-	-	3	2	3	1	2	3	2
CO3	1	3	1	3	3	-	-	1	3	1	3	3	1	2
CO4	2	1	1	2	3	-	-	1	2	3	1	3	3	1
CO5	1	2	3	2	2	-	-	1	2	2	2	2	2	1
Avg	1.8	1.8	1.8	2.0	2.4	-	-	1.4	2.0	2.2	1.8	2.2	2.2	1.6

1 - Low, 2 - Medium, 3 - High

VERTICAL VII: VERTICAL FOR AIDS II
(Common to: B.E-CSE, & B.Tech-IT, AI&DS)

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.

TOTAL: 45 PERIODS

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.

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-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	–	–	3	2	3	–	1	–	1	2	–
CO2	2	3	2	2	1	3	2	3	1	1	–	2	3	1
CO3	3	3	2	2	2	3	2	3	1	2	1	2	3	1
CO4	2	3	2	2	1	3	2	3	1	2	1	2	3	1
CO5	3	3	3	2	2	3	2	3	2	2	2	3	3	2
Avg	2.40	2.80	2.00	2.00	1.50	3.00	2.00	3.00	1.25	1.60	1.33	2.00	2.80	1.25

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVES

OPEN ELECTIVE - I

(Common To: B. TECH-AI&DS & IT; BE-BME, CSE, ECE & EEE)

AS24901	SPACE SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize space science and gravitation fundamentals.

CO2: Explain Big Bang theory and universe expansion.

CO3: Identify types of galaxies and their features.

CO4: Describe star classification and evolution.

CO5: Analyze solar system formation and constituents.

TEXT BOOKS:

1. Hess, Wilmot N. Introduction to Space Science. Updated ed., Springer, 2021.
2. Krishnaswami, K. S. Astrophysics: A Modern Perspective. Revised ed., New Age International, 2020.
3. Fraknoi, Andrew, David Morrison, and Sidney C. Wolff. Astronomy. 2nd ed., OpenStax, 2022.

REFERENCES:

1. Choudhuri, Arnab Rai. Astrophysics for Physicists. 2nd ed., Cambridge University Press, 2023.
2. Krishnaswami, K. S. Understanding Cosmic Panorama. Revised ed., New Age International, 2021.
3. Bennett, Jeffrey O., et al. The Cosmic Perspective. 10th ed., Pearson, 2023.
4. Karttunen, Hannu, et al. Fundamental Astronomy. 7th ed., Springer, 2024.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	-	-	-	-
CO2	3	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	-	1	1	-	-	-	2	-	-	-
Avg	3.00	2.00	1.00	1.25	-	1.00	1.00	-	-	-	2.00	-	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - I
B.TECH. – AI&DS

IE24901	INTRODUCTION TO INDUSTRIAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand productivity and ways to measure it.
- To Learn the basics of facilities planning and plant location.
- To Use work study and ergonomics to design better workplaces.
- To Gain skills to apply Statistical Process Control in industries.
- To Recognize how Production and Operations Management builds competitive advantage.

UNIT I INTRODUCTION

9

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT

9

Factors affecting Plant location –of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN& ERGONOMICS

9

Need – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study –Work sampling- Ergonomics and its areas of application in the work system - Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing.

UNIT IV STATISTICAL QUALITY CONTROL

9

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling –Single sampling plan – Double sampling plan.

UNIT V PRODUCTION PLANNING AND CONTROL

9

Forecasting – Qualitative and Quantitative forecasting techniques – Types of production – Process planning – Economic Batch Quantity– Loading – Scheduling and control of production – Dispatching–Progress control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Define productivity concepts and measurement methods.

CO2 : Evaluate facility location models and design layouts.

CO3 : Conduct method and time studies for efficiency.

CO4 : Apply control charts to manage process quality.

CO5 : Formulate planning strategies and MRP.

TEXT BOOK:

1. O. P. Khanna. Industrial Engineering and Management. 17th ed. New Delhi: Dhanpat Rai Publications, 2021.

REFERENCES:

1. Salvendy, G. (Ed.), Handbook of Industrial Engineering and Management, Wiley, 2021.
2. Dr. Navin Kumar Dev, Production and Operations Management, Khanna Publishing House, 2026 Edition.
3. Ravi Shankar, Industrial Engineering and Management, Galgotia Publications, 2009
4. Martand Telsang, Industrial Engineering and Production Management, S. Chand & Company, 2006

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	-	-	-	2	-	2
CO2	3	3	3	2	2	-	-	-	2	-	2
CO3	3	3	3	2	2	-	-	-	2	-	2
CO4	3	3	3	2	2	-	-	-	2	-	2
CO5	3	3	3	2	2	-	-	-	2	-	2
AVG.	3.0	3.0	2.8	2.0	2.0	-	-	-	2.0	-	2.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE I

(Common To: B. Tech - AI&DS, B. E - BME, ECE)

FD24901	FOOD, NUTRITION AND HEALTH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

- Understand different food resources from plants, animals and microbes.
- Understand digestion, absorption and utilization of nutrients.
- Learn the steps involved in food product development.
- Understand preventive and remedial measures for health problems.
- Study the role of regulatory agencies and case studies related to GM foods.

UNIT I FOOD AND MICROBIOLOGY OF HEALTH

9

Food resources (plant, animal, microbes); Overview of current production systems; constraints and necessity of novel strategies. Functional and “Super” Foods - role in optimal nutrition. Sugar, protein and fat substitutes. Food and behaviour- physiological disturbances in alcoholism, drug abuse and smoking. Food Related Laws: Inspection – Microbial Indicators of product quality – Indicators of food safety – 229 Microbiological safety of foods - control strategies – Hazard Analysis Critical Point System (HACCP concept)- Microbiological criteria.

UNIT II NUTRIENTS AND FOOD ADDITIVES

9

Macro nutrients- carbohydrates, proteins and lipids. Micronutrients-Minerals: Calcium, Magnesium, Iron, Zinc, Copper and Selenium; Vitamins. Nutritional Physiology: Digestion, absorption, and utilization of major and minor nutrients. Biotechnology of food additives- Bioflavors and colors, microbial polysaccharides, recombinant enzymes in food sector.

UNIT III NANO FOOD TECHNOLOGY

9

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf-life assessment.

UNIT IV FOOD RELATED NUTRITIONAL DISORDERS AND ENERGY CALCULATION 9

9

Type I Disorders-Causes of life style and stress related diseases. Cardio-vascular diseases, hypertension, obesity. Type-II Disorders: Cancer, diabetics, ulcers, electrolyte and water imbalance. Health indices. Preventive and remedial measures. Energy balance and methods to calculate individual nutrient and energy needs. Planning a healthy diet.

UNIT V CONSUMERS ON GM FOODS AND CONTEMPORARY ISSUES

9

Global perspective of consumers on GM foods; Major concerns of transgenic, foods GM ingredients in food products. (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods, Case studies- GM foods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the nutritional value and health importance of different foods.

CO2: Describe the role of nutrients and food additives in human health and metabolism.

CO3: Understand the applications of nanotechnology in food processing and packaging.

CO4: Identify nutritional disorders, calculate energy needs and plan healthy diets.

CO5: Evaluate food safety laws, HACCP principles and issues related to GM foods.

TEXT BOOKS:

1. P.J. Fellows.2009. Food Processing Technology -Principles and Practice (Third Edition). A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition.
2. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin. 2015. Food Biotechnology. CRC Press. Second edition.

REFERENCES:

1. Understanding Nutrition. 2010. Ellie Whitney, Sharon Rady Rolfes, 11e. Thompson Wadsworth.
2. Nutritional Sciences- From Fundamentals to Food.2013. Michelle McGuire, Kathy A. Beerman, 2nd ed., Thompson Wadsworth.
3. Yasmine Motarjemi, Huub Lelieveld, Food Safety Management - A Practical Guide for the Food Industry (2014), 1st Edition, Academic Press, London, UK.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	3	2	2	2	2	2	-	2	3	2	-	-
CO2	3	-	3	2	2	2	2	2	-	2	3	2	-	-
CO3	3	-	3	2	2	2	2	2	-	2	3	2	-	-
CO4	3	-	3	2	2	2	2	2	-	2	3	2	-	-
CO5	3	-	3	2	2	2	2	2	-	2	3	2	-	-
Avg	3.0	-	3.0	2.0	2.0	2.0	2.0	2.0	-	2.0	3.0	2.0	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - I
B.TECH. – AI&DS

CE24902	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects
- To familiarize students with various ESIA tools, techniques, and methodologies.

UNIT I INTRODUCTION TO EIA **9**

Impacts of Development on Environment – Rio Principles of Sustainable Development Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT **9**

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN **9**

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing-Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT **9**

Baseline monitoring of Socio-economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V SOCIAL IMPACT CASE STUDIES **9**

EIA case studies pertaining to Infrastructure Projects – Roads, Mining and Bridges – Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1** : Carry out scoping and screening of developmental projects for environmental and social assessments.
- CO2** : Explain different methodologies for environmental impact prediction and assessment.
- CO3** : Plan environmental impact assessments and environmental management plans.

CO4 : Value socio-economic impacts, identify affected persons, and analyze rehabilitation plans and cost-benefit of environmental effects.

CO5 : Evaluate environmental impact assessment reports.

TEXT BOOKS:

1. Canter, R.L, “Environmental impact Assessment “, 2nd Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, “Environmental Impact Assessment for Developing Countries in Asia”, Volume 1 – Overview, Asian Development Bank, 1997.
3. Peter Morris, Riki Therivel “Methods of Environmental Impact Assessment”, Routledge Publishers, 2009.

REFERENCES:

1. Becker H. A., Frank Vanclay, “The International handbook of social impact assessment” conceptual and methodological advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, “Environmental Impact Assessment Training Resource Manual”, United Nations Environment Programme, 2002.
3. Judith Petts, “Handbook of Environmental Impact Assessment Vol. I and II”, Blackwell Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	2	2	-	1	-	1
CO2	-	-	-	-	1	3	2	-	1	-	2
CO3	-	-	-	-	2	3	2	-	1	-	2
CO4	-	-	-	-	-	3	3	-	1	-	2
CO5	-	-	-	-	1	3	3	-	1	-	2
AVG.	-	-	-	-	1.33	2.80	2.40	-	1.00	-	1.80

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – I
B. Tech-AI & DS

EE24901	RENEWABLE ENERGY SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on renewable energy technologies.
- To enable students to understand solar energy and design of PV system.
- To impart understanding of wind energy system.
- To familiarize students with various possible hybrid energy systems.
- To impart knowledge on application of various renewable energy technologies.

UNIT I INTRODUCTION

6

Primary energy sources – Classification - renewable vs. non-renewable energy sources - renewable energy scenario in India and world. Current usage and future potential of renewable energy sources in India - development of renewable energy technologies.

UNIT II SOLAR ENERGY

12

Solar Radiation and solar energy measurements - Solar Thermal power plants: Solar Collectors - types and its applications - Central receiver power plants – solar pond – Thermal energy storage system with Phase Changing Materials (PCM). Photovoltaic energy generation – Solar cell - types of solar cells and its application – Solar PV power generation schemes: Standalone power system, Grid connected system and Hybrid system.

UNIT III WIND ENERGY

9

Introduction on Wind energy, Factors influencing wind, site selection of windmills - Wind energy conversion systems (WECS): Wind turbine components, Classification – Horizontal Axis Wind Turbine (HAWT), Vertical Axis Wind Turbine (VAWT) and types – Wind turbine control systems – Challenges in grid integration.

UNIT IV BIO-ENERGY

9

Energy from biomass, Principle of biomass conversion technologies/process and their classification, Biogas generation - types of biogas plants, selection of site for biogas plant, Advantage and disadvantages of biogas generation, Thermal gasification of biomass - biomass gasifies, Application of biomass and biogas plants and their economics – Environmental effects of Biomass.

UNIT V OTHER TYPES OF ENERGY

9

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini- hydel power plants and their economics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize the importance, classification, future potential of renewable energy and its technologies.

CO2: Interpret the operating principles and applications of solar thermal and photovoltaic systems.

CO3: Analyze different wind turbine systems, site selection criteria, and grid integration challenges.

CO4: Evaluate biomass and biogas conversion technologies along with their environmental and economic impacts.

CO5: Explain the concepts and applications of hydrogen energy, geothermal, OTEC, tidal, wave, and mini-hydel power systems.

TEXT BOOKS:

1. D. P. Kothari, K. C. Singhal, “Renewable energy sources and emerging technologies”, PHI Learning, 2022.
2. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2015.

REFERENCES:

1. D. S. Chauhan, S. K. Srivastava, “Non – Conventional Energy Resources”, New Age International Publishers, 4th Edition 2021.
2. G. N. Tiwari and M. K. Ghosal, “Renewable energy resources: Basic Principles and Applications”, Alpha Science International, 2005.
3. B. H. Khan, “Non – Conventional Energy Resources”, Tata Mc Graw Hill, 3rd Edition 2017.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	3	-	-	-	-	2	-	3	3
CO2	3	3	3	2	2	3	-	-	-	-	2	-	3	3
CO3	3	3	3	2	2	3	-	-	-	-	2	-	3	3
CO4	3	3	2	2	2	3	-	-	-	2	2	-	3	3
CO5	3	3	2	2	2	3	-	-	-	2	2	-	3	3
Avg	3.0	3.0	2.5	2.0	2.0	3.0	-	-	-	2.0	2.0	-	3.0	3.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - I
(Common To: B.Tech – AI&DS & B.E - BME)

EI24901	INTRODUCTION TO INDUSTRIAL INSTRUMENTATION AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand unit operations involved in process industries and transport systems.
- To study evaporators, crystallizers, dryers, distillation, refrigeration, and chemical reactors.
- To learn unit operations used in the petrochemical industry.
- To understand unit operations and processes in thermal power plants.
- To study unit operations in the paper and pulp industry.

UNIT I	COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES -I	9
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Unit Operation, Measurement and Control -Transport of solid, liquid and gases - Evaporators – Crystallizers- Dryers.

UNIT II	COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES -II	9
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Unit Operation, Measurement and Control: - Distillation – Refrigeration processes – Chemical reactors.

UNIT II	PROCESS MEASUREMENT AND CONTROL IN PETROCHEMICAL INDUSTRY	9
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Process flow diagram of Petro Chemical Industry - Gas oil separation in production platform – wet gas processing – Fractionation Column – Catalytic Cracking unit – Catalytic reforming unit.

UNIT IV	PROCESS MEASUREMENT AND CONTROL IN THERMAL POWER PLANT INDUSTRY	9
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Process flow diagram of Coal fired thermal Power Plant– Coal pulverizer - Deaerator – Boiler drum - Superheater – Turbines.

UNIT V PROCESS MEASUREMENT AND CONTROL IN PAPER & PULP INDUSTRY 9

Process flow diagram of paper and pulp industry – Batch digester – Continuous sulphate digester –Control problems on the paper machine.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the basic unit operations used in process industries such as transport systems, evaporators, crystallizers, and dryers.
- CO2:** Explain the basic unit operations used in process industries including distillation, refrigeration processes, and chemical reactors.

- CO3:** Identify and understand the working dynamics of important unit operations in the petrochemical industry.
- CO4:** Identify and understand the working dynamics of important unit operations in Thermal power plant industry.
- CO5:** Identify and understand the working dynamics of important unit operations in paper & pulp industry.

TEXT BOOKS:

1. Balchen ,J.G., and Mumme, K.J., “ Process Control structures and applications”, Van Nostrand Reinhold Co., New York, 1988
2. Warren L. McCabe, Julian C. Smith and Peter Harriot, “Unit Operations of Chemical Engineering”, McGraw-Hill International Edition, New York, Sixth Edition, 2001.

REFERENCES:

1. Liptak B.G., “Instrument and Automation Engineers' Handbook: Process Measurement and Analysis”, Fifth Edition, CRC Press, 2016.
2. James R.couper, Roy Penny, W., James R.Fair and Stanley M.Walas, “Chemical Process Equipment: Selection and Design”, Gulf Professional Publishing, 2010.
3. Austin G.T and Shreeves, A.G.T., “Chemical Process Industries”, McGraw–Hill International student, Singapore, 1985.
4. Luyben W.C., “Process Modeling, Simulation and Control for Chemical Engineers”,
5. McGraw-Hill International edition, USA, 1989.
6. K. Krishnaswamy, Process Control, new age publishers, 2009.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	3	2	-	2	-	3	2	-
CO2	3	3	-	-	-	-	3	2	-	2	-	3	2	-
CO3	3	3	2	3	3	2	3	2	-	2	2	3	2	-
CO4	3	3	2	3	3	2	3	2	-	2	2	3	2	-
CO5	3	3	2	3	3	2	3	2	-	2	2	3	2	-
Avg	3.0	3.0	2.0	3.0	3.0	2.0	3.0	2.0	-	2.0	2.0	3.0	2.0	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - I

(Common To: 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.

C04: 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	PO10	PO11
CO1	3	3	3	-	-	-	-	-	-	-	-
CO2	-	2	2	-	2	-	-	-	-	-	-
CO3	-	2	2	2	-	-	-	-	2	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-
CO5	-	3	2	2	-	-	-	-	3	-	-
Avg	2.5	2.4	2.2	2.0	2.0	-	-	-	2.5	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II

(Common to: B.E-BME, CSE & B.Tech-AI&DS, IT)

IE24902	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

C01: Use Simplex method to solve optimization problems

C02: Solve the problems to find minimum cost and shortest route.

C03: Apply integer programming to solve real-life applications.

C04: Apply the methods to solve Non-linear programming problems.

CO5: Use PERT & CPM for project management.

TEXT BOOK:

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
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	1.40	2.00	1.50	-	-	-	-	-	1.00	1.33	1.25

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II

(Common to: B.E-BME, ECE & B.Tech-AI&DS)

MG24901	FINTECH REGULATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

- To understand the fundamentals of FinTech and the role of financial regulations.
- Introduces the concepts and regulatory aspects of Financial Technology
- To understand crowdfunding models, digital assets, and cryptocurrency regulations.
- To explore digital lending systems and consumer protection laws.
- To examine cybersecurity, anti-money laundering practices, and compliance requirements in Fintech.

UNIT I INTRODUCTION

9

The Role of the Regulators, Equal Treatment and Competition, Need for a regulatory assessment of Fintech, India Regulations, The Risks to Consider, Regtech and SupTech, The rise of TechFins, Regulatory sandboxes, compliance and whistleblowing.

UNIT II INNOVATION AND REGULATION

9

The technology, market and the law, Regulation and Innovation in Banking and Finance, Regulations of Fintech Firms and their role in Market-Based Chains, Current Regulatory Approach, Fintech Innovations in Banking, Asset Management, Insurance, Pensions and Healthcare Schemes, Patentability of FinTech inventions.

UNIT III CROWDFUNDING AND DIGITAL ASSETS

9

Types of crowdfunding, The Jobs Act, Regulation crowdfunding, Regulation A+, Regulation D crowdfunding, Intrastate offerings, Digital Assets – Three uses of Digital Assets, A world of Altcoins, Stablecoins, Digital Asset Forks, Initial Coin Offerings, Regulatory Framework for Digital and Crypto Assets, Central Bank Digital Currencies.

UNIT IV MARKETPLACE LENDING AND MOBILE PAYMENTS

9

Online Lending Business Models, Payday Loans, Consumer Protection Laws, Debt Collection, Equal Credit Opportunity Act, Contract Formation and the E-Sign Act, Military Lending Act, Securities Laws Considerations, Mobile Devices, Payment Cards and the Law, Truth in Lending Act and Regulation Z, Card Act, Electronic Fund Transfer Act and Regulation E, Fair Credit Reporting Act, Federal Bank Secrecy Act, State Money Transmitter Laws.

UNIT V ANTI-MONEY LAUNDERING AND CYBERSECURITY

9

Reporting requirements under the Bank Secrecy Act, Patriot Act, Penalties for violating the BSA, Virtual currencies and the Bank Secrecy Act, Cybersecurity Frameworks, Cybersecurity Act of 2015, Contractual and Self-Regulatory obligations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain FinTech regulations, compliance, and associated risks.
- CO2:** Analyze innovation and regulatory aspects in digital finance systems.
- CO3:** Interpret crowdfunding, digital assets, and crypto regulations.
- CO4:** Examine lending platforms, mobile payments, and transaction laws.
- CO5:** Apply AML regulations and cybersecurity frameworks in FinTech environments.

TEXT BOOKS:

1. Gupta, C. M., and Gagandeep Kaur, editors. "E-Banking, FinTech, & Financial Crimes: The Current Economic and Regulatory Landscape", Springer, 2024.
2. Joshi, V. C., "Changing Dimensions of Financial Services and Banking Regulation: Cases and Perspectives from India within an International Context", Palgrave Macmillan, 2025.

REFERENCES:

1. Kevin C. Taylor, "FinTech Law: A Guide to Technology Law in the Financial Services Industry", BNA Books, 2014.
2. Jelena Madir, "FinTech 3 Law and Regulation", Edward Elgar Publishing Limited, 2019.
3. Valerio Lemma, "Fintech Regulation: Exploring New Challenges of the Capital Markets Union", Palgrave Macmillan, 2020.
4. Chris Brummer, "Fintech Law in a Nutshell", West Academic Publishing, 2020.
5. Bernardo Nicoletti, "The Future of Fintech, Integrating Finance and Technology in Financial Services", Springer Nature, 2017.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	3	-	3	-	2	2	2	2	3
CO2	3	3	2	2	2	2	-	2	-	2	2	2	3	2
CO3	3	2	2	2	3	2	-	2	-	1	2	1	3	2
CO4	2	3	2	2	3	3	-	2	-	2	3	2	3	2
CO5	3	3	2	2	3	3	2	3	1	2	2	2	3	3
Avg	2.8	2.6	2.0	2.0	2.6	2.6	2.0	2.4	1.0	1.8	2.2	1.8	2.8	2.4

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
(Common To: B. TECH - AI&DS, B.E - BME)

FD24903	HOLISTIC NUTRITION	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 nutrition, metabolism, and essential nutrients.
- Learning the holistic and Ayurvedic principles in diet and lifestyle planning.
- Analyzing the role of nutrition, environment, and food safety in health.
- Studying different dietary approaches for health and wellness.
- Exploring the preventive nutrition, nutraceuticals, and antioxidants in managing lifestyle diseases.

UNIT I NUTRITION AND HEALTH

9

Introduction to the principles of nutrition; Basics of nutrition including; micronutrients (vitamins and minerals), the energy-yielding nutrients (Carbohydrates, Lipids and Proteins), metabolism, digestion, absorption and energy balance. Lipids: their functions, classification, dietary requirements, digestion & absorption, metabolism and links to the major fatal diseases, heart disease and cancer.

UNIT II AYURVEDA – MIND/BODY HEALING

9

Philosophy of Holistic Nutrition with spiritual and psychological approaches towards attaining optimal health; Principles and practical applications of Ayurveda, the oldest healing system in the world. Three forces – Vata, Pitta and Kapha, that combine in each being into a distinct constitution. Practical dietary and lifestyle recommendations for different constitutions will also be explored in real case studies.

UNIT III NUTRITION AND ENVIRONMENT

9

Based on an underlying philosophy that environments maintain and promote health and that individuals have a right to self-determination and self-knowledge, Nutrition principles which promote health and prevent disease. Safety of our food supply, naturally occurring and environmental toxins in foods, microbes and food poisoning.

UNIT IV COMPARATIVE DIETS

9

Evaluating principles of food dynamics, nutrient proportions, holistic individuality, the law of opposites, food combining, and more. Therapeutic benefits and limitations of several alternative diet approaches, including: modern diets (intermittent fasting), food combining (colour-therapy/rainbow diet), high protein diets (Paleo), Vegetarian approaches (plant-based/vegetarian/vegan variations, fruitarian), as well as cleansing and detoxification diets (caffeine, alcohol, and nicotine detoxes, juice fasts).

UNIT V PREVENTIVE HEALTH CARE

9

Proper nutrition protection against, reverse and/or retard many ailments including osteoporosis, diabetes, atherosclerosis and high blood pressure, arthritis, cancer, anemia, kidney disease and colon cancer. Current research developments on phytochemicals, antioxidants and nutraceuticals will be explored.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain nutrition principles, metabolism, and the role of macro- and micronutrients.

CO2: Apply holistic and Ayurvedic concepts for dietary and lifestyle recommendations.

CO3: Analyze the role of nutrition, environment, and food safety in disease prevention.

CO4: Evaluate modern and alternative dietary approaches.

CO5: Assess preventive nutrition, nutraceuticals, and antioxidants in lifestyle disorders.

TEXT BOOKS:

1. Desai, B. B., Handbook of Nutrition and Diet. Marcel Dekker, New York. 2000
2. Macrae, R., Rolonson Roles and Sadlu, M.J. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XI. Academic Press.

REFERENCES:

1. Modern Nutrition in Health & Disease by Young & Shils.
2. Food, Nutrition and Diet Therapy – by Krause and Mahan 1996, Publisher- W.B. Saunders, ISBN: 0721658350.
3. Nutritive Value of Indian Foods.- by C. Gopalan, B. V. Rama Sastri, S. C. Balasubramanian Published by National Institute of Nutrition, Indian Council of Medical Research, 1989.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II

(Common to: B.E-BME, CSE, ECE, EEE & B.Tech-AI&DS, 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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	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	2	3	2	2	-	-	-	2	3	3	-
Avg	2.4	2.6	2.0	2.2	2.4	2.0	2.4	-	-	-	2.0	2.0	2.6	2.5

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
(Common To: B. TECH-AI&DS; B.E-MECH)

EC24904	INTRODUCTION TO CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand basic concepts and mathematical modeling of control systems.
- To Analyze system response using time domain techniques.
- To Apply frequency domain analysis methods.
- To Study stability of control systems using various criteria.
- To Understand state space analysis and modern control concepts.

UNIT I	INTRODUCTION AND SYSTEM MODELING	9
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Basic elements of control systems – Open loop and closed loop systems – Examples – Mathematical modeling of electrical and mechanical systems – Transfer function – Block diagram representation – Signal flow graphs – Mason's gain formula.

UNIT II TIME RESPONSE ANALYSIS 9

Standard test signals – Time response of first and second order systems – Time domain specifications – Steady state error – Error constants – Design specifications for second order systems.

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency response – Bode plot – Polar plot – Gain margin and phase margin – Nyquist stability criterion – Relative stability analysis.

UNIT IV STABILITY ANALYSIS 9

Concept of stability – Routh-Hurwitz stability criterion – Root locus technique – Construction of root locus – Effects of poles and zeros – Stability analysis using root locus.

UNIT V STATE SPACE ANALYSIS 9

State space representation – State models of linear systems – Solution of state equations – Controllability and observability – Introduction to modern control systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

C01: Explain basic concepts and modeling of control systems.

CO2: Analyze time domain response of systems.

CO3: Evaluate system performance using frequency response methods.

C04: Determine stability of systems using various techniques.

CO5: Apply state space methods for system analysis.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, Control Systems Engineering, 5th Edition, New Age International Publishers, 2007.
2. Katsuhiko Ogata, Modern Control Engineering, 5th Edition, Prentice Hall, 2010.
3. Benjamin C. Kuo, Automatic Control Systems, 9th Edition, Wiley India, 2014.

REFERENCES:

1. Norman S. Nise, Control Systems Engineering, 7th Edition, Wiley, 2015.
2. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 13th Edition, Pearson, 2017.
3. M. Gopal, Control Systems: Principles and Design, 4th Edition, McGraw Hill, 2012.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II

(Common To: B. TECH-AI&DS & IT; BE-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 AND FOOD INDUSTRY

9

Overview of reconstructive interventions and surgery; nanomaterials in bone substitutes and dentistry; implants and prostheses; nanorobotics in surgical procedures; nanocarriers for sustained, controlled, and targeted drug delivery systems. Nanotechnology in food processing; nanoencapsulation of nutrients; nanotechnology in food preservation and packaging; nanosensors for food quality and safety monitoring.

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: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe nanostructures and their characterization.

CO2: Utilize nanotechnology in biomedical and food industry 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. Bhushan, Bharat, editor. Springer Handbook of Nanotechnology. 4th ed., Springer, 2022.
2. Niemeyer, C. M., and Chad A. Mirkin, editors. Nanobiotechnology: Concepts, Applications and Perspectives. Wiley, 2021 reprint edition.
3. Shatkin, Jo Anne. Nanotechnology: Health and Environmental Risks. CRC Press, 2022.
4. Jain, Kewal K. Nanobiotechnology in Medicine and Drug Delivery. 2nd ed., Springer, 2020.

REFERENCES:

1. Rai, Mahendra, et al. Nanotechnology in Medicine and Biology. Springer, 2021.
2. C. N. R. Rao, A. Müller, and A. K. Cheetham, editors. The Chemistry of Nanomaterials. 2nd ed., Wiley-VCH, 2020.
3. Kumar, Challa S. S. R., editor. Nanomaterials for Drug Delivery and Therapy. 2023 edition, Wiley.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	1	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	2	1	-	-	-	-	2	-	-	-
CO3	3	3	1	2	2	2	1	-	-	-	2	-	-	-
CO4	2	2	1	-	1	2	1	-	-	-	2	-	-	-
CO5	2	3	-	2	-	3	3	1	-	-	2	-	-	-
Avg	2.60	2.40	1.00	1.75	1.50	2.00	1.67	1.00	-	-	2.00	-	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - II
B. TECH. - AI&DS

AE24902	AVIATION 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 aviation history and the Indian aviation environment.
- Learning the airport infrastructure, operations, and management practices.
- Gaining the knowledge of air transport services and airport operations.
- Understanding the aviation safety, security, and regulations.
- Introducing the aviation economics and sustainable development.

UNIT I INTRODUCTION

9

Overview of aviation history, its organizational, global, social, and ethical aspects; evolution of aviation in India; key airline players; SWOT analysis; market potential; airport development plans; current challenges; and domestic and international competition from an Indian perspective.

UNIT II AIRPORT INFRASTRUCTURE AND MANAGEMENT

9

Airport planning and operations, terminal design, airline organizational structure, the role of the Airports Authority of India, comparison of global and Indian airport management, and airline privatization models including full, gradual, and partial privatization.

UNIT III AIR TRANSPORT SERVICES

9

Overview of various airport services, international air transport services, the Indian aviation scenario, major airports in Delhi, Mumbai, Hyderabad, and Bangalore, the role of private operators, and airport development fees, rates, and tariffs.

UNIT IV AVIATION SAFETY AND SECURITY

9

Principles of aviation safety and Safety Management Systems (SMS). Risk assessment and hazard analysis. Airport and aircraft security measures. Emergency response planning. Aviation regulations and compliance with international safety standards.

UNIT V AVIATION ECONOMICS AND REGULATIONS

9

Fundamentals of aviation economics and airline cost structures. Pricing strategies in air transport. Government policies and regulatory framework in aviation. Role of regulatory bodies and aviation laws. Environmental impact of aviation and principles of sustainable development.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain aviation evolution and industry structure.
- CO2:** Apply airport planning and management concepts.
- CO3:** Analyze air transport services and operations.
- CO4:** Interpret safety, security, and regulatory frameworks.
- CO5:** Evaluate aviation economics and sustainability.

TEXT BOOKS:

1. Graham. A., Managing Airports: An International Perspective - Oxford; Boston: Butterworth-Heinemann, 2023.
2. Seth Young and Alexander T. Wells, Airport Planning and Management, 7th Edition McGraw- Hill, London 2019.

REFERENCES:

1. Doganis. R. The Airport Business Routledge, London 2005
2. P S Senguttavan Fundamentals of Air Transport Management, Excel Books 2007
3. Richard de Neufille, Airport Systems: Planning, Design and Management, McGraw-Hill London 2007.
4. Manual of Aerodrome licensing of AAI airports – AAI website – freely downloadable – issue may 2010

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	2	-	-	-	2
CO3	2	3	2	2	2	2	2	-	-	-	-
CO4	2	2	-	2	-	3	2	3	-	-	-
CO5	2	3	2	2	-	2	3	2	-	-	2
Avg	2.40	2.60	2.33	2.00	2.00	2.33	2.25	2.50	-	-	2.00

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
(Common To: B. Tech – AI&DS, IT, B.E – BME, CSE, ECE, EEE & MECH)

HS24901	ENGLISH FOR COMPETITIVE EXAMINATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

- To master grammar, vocabulary, and comprehension for GRE, CAT, UPSC, IELTS, and TOEFL.
- To develop critical reasoning, paraphrasing, and summarization.
- To enhance academic writing.
- To refine verbal logic, error detection, and contextual word usage.
- To apply time-efficient test strategies.
- To create awareness of accuracy and precision in communication.

UNIT I EXAMS & ETTIQUETTE

9

Orientation on different formats of competitive exams- Vocabulary- Verbal ability – Verbal reasoning – Exploring the world of words- Essential words – Essential Etiquette & its Vocabularies – Meaning and their usage – Synonyms and Antonyms- Word Substitution- Verbal analogy—Idioms and phrases-Commonly confused Words.

UNIT II GRAMMAR & LINGUISTICS ACCURACY

9

Grammar -Sentence Improvement -Sentence Completion – Rearranging phrases into sentences -Error identification – Tenses – Preposition – Adjectives-Adverbs – Subject verb agreement – Voice -Reported speech – Articles - Clauses – Speech patterns

UNIT III READING COMPREHENSION & ANALYSIS

9

Reading- Specific information and detail- Identifying main and supporting ideas- Speech reading techniques- Improving global reading skills -- Linking ideas – Summarizing – Understanding argument – Identifying opinion/attitude and making inferences- Critical reading.

UNIT IV ACADEMIC COMPETITIVE WRITING

9

Writing – Prewriting techniques – Mind map – Describing pictures and facts – paragraph structures— Organizing points – rhetoric writing – Improving an answer – Drafting, writing and developing an argument—Focus on cohesion—Using cohesive devices – Analytic writing – structures and types of essays- Mind maps – structure of drafts, letters, memos, emails – statements of purpose – structure, content and style.

UNIT V LISTENING & SPEAKING STRATEGIES

9

Listening and Speaking – Contextual listening – Listening to instructions – Listening for specific information – Identifying detail main ideas – Following signpost words – stress, rhythm and intonation. Speaking to respond and elicit ideas __ Guided speaking – Opening phrases – interactive communication – Dysfluency – Sentence stress – Speaking on a topic – Giving opinions – Giving an oral presentation – Telling a story on a personal anecdote—Talking about oneself – Utterance Speech acts – Brainstorming ideas – Group Discussion.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Demonstrate proficiency in vocabulary, grammar, and verbal reasoning by accurately using synonyms, antonyms, idioms, and correcting grammatical errors in competitive exam contexts.
- CO2:** Apply critical reading strategies to analyze and interpret complex texts, summarize key ideas, and infer opinions/attitudes in reading comprehension passages.
- CO3:** Develop structured and coherent academic writing skills by constructing well-organized essays, reports, statements of purpose, and formal letters with appropriate rhetorical techniques.
- CO4:** Enhance listening and speaking proficiency by identifying key details in spoken discourse, participating in group discussions, and delivering structured oral presentations with clarity and confidence.
- CO5:** Employ effective test-taking strategies for competitive exams.

TEXT BOOKS:

1. "Word Power Made Easy" – Norman Lewis, Pocket Books (Simon & Schuster), 2014
2. "High School English Grammar & Composition" – Wren & Martin, S. Chand Publishing, 2022 (Revised by N.D.V. Prasada Rao)
3. "The Official Guide to the GRE General Test" – ETS (Educational Testing Service) McGraw-Hill Education, 2023
4. "Ace the IELTS: General Training Module" – Simone Braverman, Independently Published, 2020 (6th Edition).
5. "TOEFL iBT: The Official ETS Study Guide" – ETS, McGraw-Hill Education, 2021.

REFERENCES:

1. "30 Days to a More Powerful Vocabulary" (2003) – Wilfred Funk & Norman Lewis, Simon & Schuster
2. "Practical English Usage" (2020) – Michael Swan, Oxford University Press
3. "How to Read Better & Faster" (2014)– Norman Lewis, Barnes & Noble Books
4. "On Writing Well" (2016) – William Zinsser, HarperCollins
5. "The Art of Public Speaking" (2020) – Dale Carnegie, McGraw-Hill Education
6. "Barron's Essential Words for the GRE" (2022) – Philip Geer, Barron's Educational Series
7. "Analytical Reasoning" (2023)– M.K. Pandey, BSC Publishing
8. "Cambridge IELTS Books (Latest Edition)" (2024)– Cambridge University Press

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	-	3	2	3	3	3	3
CO2	2	2	2	1	-	2	1	2	3	2	3
CO3	2	2	2	3	-	3	2	2	3	2	3
CO4	3	3	3	3	-	3	3	3	3	3	3
CO5	3	3	3	3	-	3	3	3	3	3	3
Avg	2.4	2.2	2.2	2.2	-	2.8	2.2	2.6	3.0	2.6	3.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III

(Common To: B.E. - BME, CSE, ECE, EEE & B.TECH. – AI&DS & 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 and 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
3. Proposition Design: How to Create Products and Services Customers Want, Wiley
4. Donella H. Meadows, (2015), "Thinking in Systems -A Primer", Sustainability Institute.
5. Tim Brown, (2012) "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business.

REFERENCES:

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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 – III

(Common To: B.E. - CSE, ECE, & B.TECH. – AI&DS & 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
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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).

REFERENCES:

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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	-	1.0	-	-	-	1.2	2.0	2.5	2.0	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE – III**B. Tech – AI&DS**

IE24903	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: 45 PERIODS

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. TrevisCerto, "Modern Management Concepts and Skills", Pearson Education, 2018.

CO-PO & PSO 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

OPEN ELECTIVE - III

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

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: 45 PERIODS

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.

REFERENCES:

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	3.0	2.0	2.0	2.0	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High

TEXT BOOKS:

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan Chipman, Remote Sensing and Image Interpretation, Wiley India, Seventh Edition, Reprint 2021.
2. George Joseph, Fundamentals of Remote Sensing, Universities Press, Third Edition, Reprint 2022.

REFERENCES:

1. John A. Richards, Remote Sensing Digital Image Analysis, Springer, Sixth Edition, Reprint 2021.
2. Lucas L. F. Janssen, Principles of Remote Sensing, ITC Educational Textbook Series, Reprint 2022.
3. Lo C.P. and Yeung Albert, Concepts and Techniques of Geographic Information Systems, Pearson Education, Reprint 2021.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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	3.00	3.00	2.75	2.75	3.00	2.00	2.00	-	-	-	2.00	2.40	2.40	-

1 - Low, 2 - Medium, 3 -High

COURSE OUTCOMES:

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

CO1: Know the basic properties such as structural, physical, chemical properties of nanomaterials and their applications.

CO2: Acquire knowledge about the different types of nano material synthesis.

CO3: Describes about the shape, size, structure of composite nano materials and their interference.

CO4: Appreciate the different characterization techniques for nanomaterials.

CO5: Develop a deeper knowledge in the application of nanomaterials in different fields.

TEXT BOOKS:

1. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simoom, Burkhard Raguse, "Nano Technology: Basic Science & Engineering Technology", 2005, Overseas Press.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
3. William A Goddard "Handbook of Nanoscience, Engineering and Technology", 3rd Edition, CRC Taylor and Francis group 2012.
4. Nanotechnology and Its Applications by R.K. Gupta, Edition: 2019.
5. Principles of Nanotechnology by M. S. P. Shaikh, Edition: 2020.
6. Nanotechnology for Sustainable Development by Vijay Kumar (Ed.) Edition: 2020.

REFERENCES:

1. R.H.J. Hannink & A.J. Hill, Nanostructure Control, Wood Head Publishing Ltd. Cambridge, 2006.
2. C.N.R. Rao, A. Muller, A.K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications Vol. I & II, 2nd edition, 2005, Wiley VCH Verlag Gbtl & Co
3. Ivor Brodie and Julius J. Muray, 'The physics of Micro/Nano – Fabrication', Springer International Edition, 2010.
4. "Handbook of Nanoscience, Engineering, and Technology" edited by William A. Goddard III, Dudley W. Brenner, and Sergey Edward Lyshevski. 3rd Edition (2016)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	3	-	-	-	-	-	-	3
CO2	2	3	1	3	-	-	-	1	1	-	3
CO3	2	2	2	3	-	1	-	1	1	-	3
CO4	2	2	1	3	-	1	1	1	-	1	3
CO5	2	2	1	3	-	1	1	1	-	1	3
Avg	2.0	2.4	1.4	3.0	-	1.0	1.0	1.0	1.0	1.0	3.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
(Common to: B.E- CSE, EEE & B.Tech-AI&DS, 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, "The Vertical Farm: Feeding the World in the 21st Century", Thomas Dunne Books, 2011.
2. Dickson Despommier, "Vertical Farming: The Sky's the Limit", Columbia University Press, 1st Edition, 2010.
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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	3	2	-	1	-	2	1	2
CO2	3	2	2	2	2	1	2	-	-	-	-	2	2	3
CO3	3	3	2	2	3	2	2	-	1	-	-	3	2	1
CO4	3	3	3	3	3	1	2	-	-	-	-	2	3	2
CO5	2	3	2	2	2	3	3	2	-	-	-	2	2	1
Avg	2.6	2.6	2.0	2.0	2.2	1.8	2.4	2.0	1.0	1.0	-	2.2	2.0	1.8

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - III
(Common to: B.E- BME, ECE & B.Tech-AI&DS)

EE24P48 / EE24903	PLC AND SCADA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand about the basics of PLC and safety standards used in industrial automation.
- To develop knowledge of PLC programming concepts and languages for automation applications.
- To acquire knowledge on the basic concepts, components and functions of SCADA systems used for industrial monitoring and control.
- To learn industrial communication protocols and their applications in process automation systems.
- To analyze the designing and implementing PLC programs for industrial control applications.

UNIT I INTRODUCTION TO PLC AND SAFETY 9

Introduction to Programmable Logic Controller (PLC) – PLC block diagram and working – PLC programming languages and basic instructions – Alarm and interlock design – PLC networking basics – Safety concepts in PLC with examples – Process safety using PLC – Introduction to IEC 61131-3 standards and their role in safety control.

UNIT II PLC PROGRAMMING USING IEC61131-3 9

Basic PLC programming concepts: rails, rungs, relay logic and latch switch – Timers and counters – Boolean logic and mathematical instructions – Data handling instructions – PLC communication and PLC-to-computer communication – Introduction to Function Block Diagram (FBD), Ladder Logic (LL), Instruction List (IL), Sequential Function Chart (SFC) and Structured Text (ST).

UNIT III INTRODUCTION TO SCADA 9

Overview of SCADA system – Elements and history of SCADA – Remote Terminal Unit (RTU) – Discrete and analog control systems – Master Terminal Unit (MTU) – Operator interface and monitoring functions.

UNIT IV HART AND FIELD BUS COMMUNICATION 9

Introduction to industrial communication standards – HART communication protocol and working – Communication modes, networks and commands in HART – HART and OSI model basics – Introduction to Field Bus, architecture, standards, topology, interoperability and interchangeability.

UNIT V PLC PROGRAMMING APPLICATIONS 9

PLC programming exercises using IEC61131-3 languages – Traffic light control (two-way and four-way) – Water level control – Automatic material sorting and bottle filling systems – Code converters – DC motor control – Alarm circuit design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain PLC architecture and safety standards used in industrial automation.

CO2: Develop simple PLC programs using IEC61131-3 programming languages and instruction sets.

CO3: Describe SCADA components and apply basic monitoring and control concepts in industrial systems.

CO4: Explain HART and Field Bus communication concepts and their role in industrial automation.

CO5: Design PLC-based control programs for selected industrial applications.

TEXT BOOKS:

1. Frank D.Petruzella, “Programmable Logic Controllers”, 5th Edition, McGraw-Hill, New York, 2019.
2. Stuart Boyer A, “SCADA: Supervisory control and data Acquisition”, ISA - The Instrumentation, Systems, and Automation Society, 4th Edition, 2010.

REFERENCES:

1. Frank D.Petruzella, “Programmable Logic Controllers”, 5th Edition, 2020.
2. John W. Webb and Ronald A. Reis, “Programmable Logic Controllers: Principles and Applications”, 6th Edition, 2019.
3. W.Bolton, “Programmable Logic Controllers”, 6th Edition, 2015.
4. Stuart A.Boyer, “SCADA: Supervisory Control and Data Acquisition”, 5th Edition, 2018.
5. Bela G.Liptak, “Instrument Engineers’ Handbook: Process Control and Optimization”, 5th Edition, 2018.
6. William Stallings, “Data and Computer Communications”, 11th Edition, 2020.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson Education, 2013.
2. Sedra and Smith, Microelectronic Circuits, 7th Edition, Oxford University Press, 2015.
3. Jacob Millman and Christos C. Halkias, Electronic Devices and Circuits, 3rd Edition, McGraw Hill, 2010.

REFERENCES :

1. Donald A. Neamen, Electronic Circuit Analysis and Design, 3rd Edition, McGraw Hill, 2007.
2. Thomas L. Floyd, Electronic Devices, 10th Edition, Pearson Education, 2017.
3. S. M. Sze, Semiconductor Devices: Physics and Technology, 3rd Edition, Wiley India, 2012.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High

- CO3** : Explain the purpose and intension of the proposed project coherently
- CO4** : Create writing texts to suit achieve the intended purpose.
- CO5** : Master the art of writing winning proposals and projects.

TEXT BOOKS:

1. Writing for Science and Engineering: Papers, Presentations and Reports, Heather Silyn-Roberts, Butterworth-Heinemann (Elsevier).
2. Project Work: Guidelines, K. Padma Raju, Neelkamal Publications Pvt. Ltd.
3. How to Write and Publish a Scientific Paper, Robert A. Day and Barbara Gastel, Cambridge University Press.

REFERENCES:

1. Gerson and Gerson-Technical Communication: Process and Product, 7th Edition, Prentice Hall (2012).
2. Virendra K. Pamecha - Guide to Project Reports, Project Appraisals and Project Finance (2012).
3. Daniel Riordan - Technical Report Writing Today (1998).
4. Darla-Jean Weatherford - Technical Writing for Engineering Professionals (2016), Penwell Publishers.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	-	3	2	3	3	3	3
CO2	2	2	2	1	-	2	1	2	3	2	3
CO3	2	2	2	3	-	3	2	2	3	2	3
CO4	3	3	3	3	-	3	3	3	3	3	3
CO5	3	3	3	3	-	3	3	3	3	3	3
Avg	2.4	2.2	2.2	2.2	-	2.8	2.2	2.6	3.0	2.6	3.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
(Common to: B.E-BME, CSE & B.Tech-AI&DS, 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 DATA PREPROCESSING 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.

TOTAL: 45 PERIODS

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 & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	1	-	2	1	-
CO2	3	3	2	2	3	-	-	-	-	1	-	3	2	1
CO3	3	3	3	2	3	-	-	-	-	1	-	3	3	2
CO4	3	3	2	3	3	-	-	-	-	1	-	3	3	2
CO5	3	3	3	3	3	-	-	-	-	2	-	3	3	3
Avg	3.0	2.8	2.2	2.5	2.8	-	-	-	-	1.2	-	2.8	2.4	2.0

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV

B.Tech. – AI&DS

RA24905	CONCEPTS IN MOBILE ROBOTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce mobile robotic technology and its types in detail.
- To learn the kinematics of wheeled and legged robot.
- To familiarize the intelligence into the mobile robots using various sensors.
- To acquaint the localization strategies and mapping technique for mobile robot
- To aware the collaborative mobile robotics in task planning, navigation and intelligence.

UNIT I INTRODUCTION TO MOBILE ROBOTICS 9

Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Robots – Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues – Unmanned Aerial and Underwater Vehicles.

UNIT II KINEMATICS 9

Kinematic Models – Representation of Robot – Forward Kinematics – Wheel and Robot Constraints – Degree of Mobility and Steerability – Maneuverability – Workspace – Degrees of Freedom – Path and Trajectory Considerations – Motion Controls - Holonomic Robots.

UNIT III PERCEPTION 9

Sensor for Mobile Robots – Classification and Performance Characterization – Wheel/Motor Sensors – Heading Sensors - Ground-Based Beacons - Active Ranging - Motion/Speed Sensors – Camera - Visual Appearance based Feature Extraction.

UNIT IV LOCALIZATION 9

Localization Based Navigation Versus Programmed Solutions - Map Representation - Continuous Representations - Decomposition Strategies - Probabilistic Map-Based Localization - Landmark-Based Navigation - Globally Unique Localization - Positioning Beacon Systems - Route-Based Localization - Autonomous Map Building - Simultaneous Localization and Mapping (SLAM).

UNIT V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS 9

Introduction - Competences for Navigation: Planning and Reacting - Path Planning - Obstacle Avoidance - Navigation Architectures - Control Localization - Techniques for Decomposition - Case Studies – Collaborative Robots – Swarm Robots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Evaluate the appropriate mobile robots for the desired application.

CO2 : Create the kinematics for given wheeled and legged robot.

CO3 : Analyse the sensors for the intelligence of mobile robotics.

CO4 : Create the localization strategies and mapping technique for mobile robot.

CO5 : Create the collaborative mobile robotics for planning, navigation and intelligence for desired applications.

TEXT BOOKS:

1. Roland Siegwart, Illah R. Nourbakhsh and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, 2nd Edition, MIT Press, Cambridge, 2023.

REFERENCES:

1. Dragomir N. Nenchev, Atsushi Konno, Teppei Tsujita, “Humanoid Robots: Modelling and Control”, Butterworth-Heinemann, 2018.
2. Mohanta Jagadish Chandra, “Introduction to Mobile Robots Navigation”, LAP Lambert Academic Publishing, 2015.
3. Peter Corke, “Robotics, Vision and Control”, Springer, 2017.
4. Ulrich Nehmzow, “Mobile Robotics: A Practical Introduction”, Springer, 2003.
5. Xiao Qi Chen, Y.Q. Chen and J.G. Chase, “Mobile Robots - State of the Art in Land, Sea, Air, and Collaborative Missions”, Intec Press, 2009.
6. Alonzo Kelly, Mobile Robotics: Mathematics, Models, and Methods, Cambridge University Press, 2013, ISBN: 978-1107031159.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	2	-	-	2	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	2	-	-	-	-
CO3	3	3	2	3	3	-	-	-	-	2	-	-	-	-
CO4	3	3	3	3	3	-	2	-	-	-	-	-	-	-
CO5	3	3	3	2	3	-	2	-	-	2	-	-	-	-
Avg	3.0	2.8	2.6	2.2	2.6	-	2.0	-	-	2.0	-	-	-	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
(Common To: B.E. - BME, CSE, ECE, EEE, MECH & B.TECH. – AI&DS & IT)

RA24904	DRONE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the fundamentals of drone systems and UAV architecture .
- To Study aerodynamic principles and flight mechanics of drones .
- To Analyze components such as sensors, controllers, and communication systems .
- To Learn navigation, control, and autonomous flight techniques.
- To 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, multicopter 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.

REFERENCES:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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	3.0	2.6	-	2.0	-	2.0	-	-	-	-	2.0	2.4	2.4	-

1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE - IV
(Common To: B. TECH-AI&DS & IT; B.E - CSE & ECE)

GI24901	GEOGRAPHICAL INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 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. Application of GIS - Natural Resource Management and Agriculture and Precision Farming.

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

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:

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

CO1: Explain the basic concepts of Geographic Information Systems (GIS).

CO2: 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. Bolstad, Paul. GIS Fundamentals: A First Text on Geographic Information Systems. 7th ed., XanEdu, 2022.
2. Worboys, Michael, and Matt Duckham. GIS: A Computing Perspective. 3rd ed., CRC Press, 2023.

REFERENCES:

1. Longley, Paul A., et al. Geographic Information Science and Systems. Wiley, 2021
2. Paul Bolstad & Steven Manson, "GIS Fundamentals: A First Text on Geographic Information Systems", 7th Edition, Eider Press, 2022.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	2	-	-	-
CO2	3	3	1	2	3	-	-	-	-	-	2	-	-	-
CO3	3	3	2	2	3	-	1	-	-	-	2	-	-	-
CO4	2	3	1	3	2	1	2	-	-	-	2	-	-	-
CO5	3	3	2	2	3	1	2	-	-	1	2	-	-	-
Avg	2.80	2.80	1.50	2.25	2.40	1.00	1.67	-	-	1.00	2.00	-	-	-

1 - Low, 2 - Medium, 3 - High

COURSE OUTCOMES:

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

- CO1:** Judge about agricultural finance, banking and cooperation.
- CO2:** Evaluate basic concepts, principles and functions of financial management.
- CO3:** Improve the skills on basic banking and insurance schemes available to customers.
- CO4:** Analyze various financial data for efficient farm management.
- CO5:** Identify the financial institutions.

TEXT BOOKS:

1. Joseph L. Massie, 1995, "Essentials of Management", prentice Hall of India Pvt limited, New Delhi
2. Mohanty S K, 2007, Fundamentals of Entrepreneurship, Prentice Hall India, New Delhi.

REFERENCES:

1. Harih S B, Conner U J and Schwab G D, 1981, Management of the Farm Business, Prentice Hall Inc, New Jersey.
2. Omri Ralins, N.1980, Introduction to Agricultural: Prentice Hall Inc, New Jersey.
3. Gittenger Price, 1989, Economic Analysis of Agricultural project, John Hopkins University, Press, London.
4. Thomas W Zimmer and Norman M Scarborough, 1996, Entrepreneurship, Prentice Hall, New Jersey.
5. Mar J Dollinger, 1999, Entrepreneurship strategies and resources, Prentice –Hall, Upper Saddal Rover, New Jersey.
6. Khanka S, 1999, Entrepreneurial Development, S, Chand and Co, New Delhi.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 –High

OPEN ELECTIVE - IV

(Common To: B. TECH - AI&DS, IT & B. E - BME, CSE)

FD24902	FOOD SAFETY AND QUALITY REGULATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

- Understanding food safety, sanitation practices, and food contaminants.
- Learning food quality assessment and evaluation techniques.
- Gaining knowledge of food safety management systems and HACCP principles.
- Exploring the national and international food safety regulation.
- Studying the Codex standards and food regulatory administration systems.

UNIT I **FUNDAMENTALS OF FOOD SAFETY AND SANITATION** **9**

Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials.

UNIT II	FOOD QUALITY ASSESSMENT TECHNIQUES	9
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Food quality and quality attributes – Instrumental, chemical, and microbial quality control methods – Sensory evaluation of food and statistical analysis – Water quality and other utility requirements in food processing.

UNIT III	FOOD SAFETY MANAGEMENT AND REGULATORY SYSTEMS	9
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Critical quality control points at various stages of food production, including raw and processing materials – Food quality assurance and quality control with HACCP principles – Food inspection and food laws – Risk assessment methods including microbial risk assessment, dose–response – Risk management and implementation of food surveillance systems for monitoring food safety.

UNIT IV **FOOD SAFETY GOVERNANCE AND GLOBAL REGULATORY SYSTEMS** 9

Indian and international food regulations – Role of FAO in India and its technical cooperation programs – Biosecurity in food and agriculture – Functions of the World Health Organization (WHO), World Organization for Animal Health (OIE), and International Plant Protection Convention (IPPC).

UNIT V FOOD STANDARDS AND CODEX ADMINISTRATION 9

Codex Alimentarius Commission and Codex India – Role of the Codex Contact Point – National Codex Contact Point (NCCP) – National Codex Committee of India: terms of reference (ToR), functions, and shadow committees.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand food safety, sanitation, and contaminants.

CO2: Apply food quality assessment and evaluation techniques.

CO3: Analyze food safety management and HACCP systems.

CO4: Explain national and international food safety regulations.

CO5: Interpret Codex standards and food regulatory administration.

TEXT BOOKS:

1. Handbook of food toxicology by S. S. Deshpande, 2002.
2. The food safety information handbook by Cynthia A. Robert, 2009.
3. Nutritional and safety aspects of food processing by Tannenbaum SR, Marcel Dekker Inc., New York 1979.

REFERENCES:

1. Microbiological safety of Food by Hobbs BC, 1973.
2. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick, A John Wiley & Sons Publication, 2003.

CO-PO & PSO MAPPING

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

1 - Low, 2 - Medium, 3 –High

OPEN ELECTIVE - IV

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

BM24903 / BM24P08	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: 45 PERIODS

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. 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 & PSO 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-ECE, EEE & B.Tech–AI&DS)

EE24904	SENSORS AND ACTUATORS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Identify and classify automotive sensors and actuators.
- To Design instruments for measuring pressure, force, temperature, and flow.
- To Develop innovative automotive sensor and actuator systems.
- To Explain the operation and electronic control of sensors and actuators.
- To Design temperature control actuators for vehicle applications.

UNIT I INTRODUCTION TO SENSORS

9

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS

9

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III VARIABLE AND OTHER SPECIAL SENSORS

9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magneto strictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor and antiglare sensor. Sensors for Autonomous Vehicles, EVs and Drones.

UNIT IV AUTOMOTIVE ACTUATORS

9

Definition, types and selection of Actuators -Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS

9

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify and classify the common types of sensors and actuators used in vehicles.

CO2: Design measuring equipment's for the measurement of pressure force, temperature and flow.

CO3: Develop innovative sensor and actuator designs for automotive applications.

CO4: Explain the operation and electronic control of automotive sensors and actuators.

CO5: Design temperature control actuators for vehicle applications.

TEXT BOOKS:

1. A.K. Sawhney & Puneet Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai, 2023 Reprint.
2. D. Patranabis, Sensors and Transducers, 3rd Edition, PHI Learning, 2017
3. Clarence de Silva, Sensors and Actuators: Engineering System Instrumentation, CRC Press.

REFERENCES:

1. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs and Applications, 6th Edition, Springer, 2022.
2. Tai-Ran Hsu, MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering, 3rd Edition, John Wiley & Sons, 2020.
3. Nadim Maluf and Kirt Williams, An Introduction to Microelectromechanical Systems Engineering, 3rd Edition, Artech House, 2021.
4. Julian W. Gardner, Vijay K. Varadan, and Osama O. Awadelkarim, Microsensors, MEMS and Smart Devices, 2nd Edition, John Wiley & Sons, 2021.
5. Mohammad Tabib-Azar, Microactuators: Electrical, Magnetic, Thermal, Optical, Mechanical, Chemical and Smart Structures, Springer, Reprint Edition, 2014.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3	3	2	3	2	2	3	2	-
CO2	3	2	3	2	3	3	3	2	3	3	3	3	2	-
CO3	3	3	3	3	3	3	3	2	3	2	2	3	2	-
CO4	3	3	3	2	3	3	3	3	3	2	3	3	2	-
CO5	3	3	3	3	3	3	3	3	3	3	3	3	2	-
Avg	2.8	2.6	2.8	2.4	2.8	3.0	3.0	2.4	3.0	2.4	2.6	3.0	2.0	-

1 - Low, 2 - Medium, 3 -High

OPEN ELECTIVE - IV
B.Tech-AI & DS

EI24902	INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the design and application of signal conditioning circuits.
- To learn signal transmission techniques used in instrumentation systems.
- To study data acquisition systems and interfacing techniques.
- To gain knowledge of distributed control system components.
- To understand industrial communication buses used in automation industries.

UNIT I INTRODUCTION

9

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus & Profibus.

UNIT II AUTOMATION COMPONENTS

9

Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement.
Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT.
Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS

9

Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, and process related interfaces, Communication and networking, Industrial communication systems.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS

9

Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM

9

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design a signal conditioning circuits for various applications.

CO2: Acquire detail knowledge on data acquisition system interface and DCS system.

CO3: Describe the Importance of communication buses in applied automation Engineering.

CO4: Design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.

CO5: Develop PLC logic for a specific application on real world problem.

TEXT BOOKS:

1. S.K.Singh, "Industrial Instrumentation", Tata McGraw Hill, 2nd edition companies, 2003.
2. C D Johnson, "Process Control Instrumentation Technology", Prentice Hall India, 8th Edition, 2006.

REFERENCES:

1. Frank D. Petruzella, Programmable Logic Controllers, 6th Edition, McGraw-Hill Education, 2024/2025.
2. William Bolton, Programmable Logic Controllers, 6th Edition, Newnes (Elsevier), 2015.
3. Krishna Kant, Computer-Based Industrial Control, 2nd Edition, Prentice Hall of India, 2011.
4. Glen A. Mazur and William J. Weindorf, Programmable Logic Controllers: Principles and Applications, American Technical Publishers, 2021.
5. Kelvin T. Erickson, Programmable Logic Controllers: An Emphasis on Design and Application, 3rd Edition, Dogwood Valley Press, 2019.

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	2	2	-	-	3	3	-
CO2	3	3	-	-	-	-	-	2	2	-	-	-	3	-
CO3	3	3	2	3	3	2	-	2	2	-	2	3	-	-
CO4	3	3	2	3	3	2	-	2	2	-	2	3	3	-
CO5	3	3	2	3	3	2	-	2	2	-	2	3	3	-
Avg	3.0	3.0	2.0	3.0	3.0	2.0	-	2.0	2.0	-	2.0	3.0	3.0	-

1 - Low, 2 - Medium, 3 –High