New Prince Shri Bhavani College Of Engineering and Technology

(An Autonomous Institution)

CURRICULUM

&

SYLLABUS (1 to 8 SEMESTERS)

REGULATION 2023

FOR

B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted from the Academic Year 2023 – 24)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – I

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
THEORY COURSES								
1	HS	U23EN101	Technical English - I	3	0	0	3	3
2	BS	U23MA101	Engineering Mathematics	3	1	0	4	4
3	BS	U23PH101	Engineering Physics	3	0	0	3	3
4	BS	U23CY101	Engineering Chemistry	3	0	0	3	3
5	ES	U23CP101	Programming in C	3	0	2	5	4
6	ES	U23BE104	Basic Electrical and Electronics Engineering	3	0	0	3	3
7	HS	U23TA101	தமிழர் மரபு /Heritage of Tamils	1	0	0	1	1
PRACTICAL COURSES								
8	BS	U23PC101	Physics and Chemistry Laboratory	0	0	3	3	1.5
9	HS	U23EN102	Professional Communication Laboratory	0	0	3	3	1.5
10	SIP	U23IP101	Student Induction Programme	0	0	0	2 Weeks	0
TOTAL CREDITS								**24**

SEMESTER – II

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
THEORY COURSES								
1	HS	U23EN201	Technical English - II	3	0	0	3	3
2	BS	U23MA201	Vector Calculus and Complex Functions	3	1	0	4	4
3	BS	U23PH203	Physics for Computer Technology	3	0	0	3	3
4	ES	U23EG101	Engineering Graphics	2	0	4	6	4
5	ES	U23PY201	Problem Solving and Python Programming	3	0	2	5	4
6	PC	U23CS201	Data Structures	3	0	0	3	3
7	HS	U23TA201	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	1	0	0	1	1
PRACTICAL COURSES								
8	ES	U23EP101	Engineering Practices Laboratory	0	0	3	3	1.5
9	PC	U23CS202	Data Structures Laboratory	0	0	3	3	1.5
TOTAL CREDITS								**25**

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SEMESTER III								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Hours	Credits
THEORY COURSES								
1	BS	U23MA304	Probability and Statistics	3	1	0	4	4
2	ES	U23EC301	Digital Principles and Computer Organization	3	0	2	5	4
3	PC	U23CS301	Foundation of Data Science	3	0	0	3	3
4	PC	U23CS302	Database Management Systems	3	0	0	3	3
5	PC	U23CS303	Object Oriented Programming	3	0	2	5	4
6	PC	U23CS403	Theory of Computation	3	0	0	3	3
PRACTICAL COURSES								
7	PC	U23CS304	Data Science Laboratory	0	0	3	3	1.5
8	PC	U23CS305	Database management Systems Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
9	EEC	U23EEC301	Employability Skills - I	0	0	2	2	1
TOTAL CREDITS								25

SEMESTER IV								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Hours	Credits
THEORY COURSES								
1	PC	U23CS401	Machine Learning Techniques	3	0	2	5	4
2	PC	U23CS402	Design and Analysis Algorithms	3	0	2	5	4
3	PC	U23CS404	Operating Systems	3	0	0	3	3
4	PC	U23CS405	Computer Networks	3	0	0	3	3
5	PC	U23AI401	Statistical Inference	3	0	0	3	3
6	MNC	U23MX01	Personal Values	2	0	0	0	0
PRACTICAL COURSES								
7	PC	U23CS407	Operating Systems Laboratory	0	0	3	3	1.5
8	PC	U23CS408	Computer Networks Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
9	EEC	U23EEC401	Employability Skills - II	0	0	2	2	1
Total Credits								

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SEMESTER – V								
Sl. No	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
THEORY COURSES								
1	PC	U23AI501	Deep Learning with Chatbot	3	0	0	3	3
2	PC	U23AI502	Big Data Analytics	3	0	0	3	3
3	PC	U23AI503	Creative Thinking	3	0	2	5	4
4	HS	U23MG501	Professional Ethics and IPR	2	0	0	2	2
5	PE	U23PEAIXX	Professional Elective - I					3
6	PE	U23PEAIXX	Professional Elective - II					3
7	MNC	U23MX02	Environmental Sciences and Sustainability	2	0	0	2	0
8	HC	U23FLXX	Foreign Language	2	0	0	2	2
PRACTICAL COURSES								
1	PC	U23AI504	Deep Learning Laboratory	0	0	3	3	1.5
2	PC	U23AI505	Big Data Analytics Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSE								
1	EEC	U23EEC501	Employability Skills - III	0	0	2	2	1
TOTAL CREDITS								24

SEMESTER – VI								
Sl. No	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
THEORY COURSES								
1	PC	U23AI601	Generative AI	3	0	2	5	4
2	PC	U23CB501	Cyber Security	3	0	2	5	4
3	PC	U23AI602	Data Visualization	3	0	0	3	3
4	OE	U23OEXX	Open Elective - I					3
5	PE	U23PEAIXX	Professional Elective - III					3
6	PE	U23PEAIXX	Professional Elective - IV					3
EMPLOYABILITY ENHANCEMENT COURSES								
1	EEC	U23EEC601	Employability Skills - IV	0	0	2	2	1
2	EEC	U23EEC602	Internship	0	0	0	0	1
TOTAL CREDITS								22

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SEMESTER – VII								
Sl. No	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
THEORY COURSES								
1	PC	U23AI701	Prompt Engineering	3	0	2	5	4
2	PC	U23AI702	Augmented reality and virtual reality	3	0	0	3	3
3	HS	U23MG701	Project Management and Finance	2	0	0	2	2
4	PE	U23PEAIXX	Professional Elective - V					3
5	PE	U23PEAIXX	Professional Elective - VI					3
6	OE	U23OEXX	Open Elective – II					3
PRACTICAL COURSE								
1	PC	U23AI703	AR & VR Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSES								
2	EEC	U23AI704	Mini Project	0	0	3	3	1.5
3	EEC	U23AI705	Comprehensive Course					1
TOTAL CREDITS								22

SEMESTER – VIII								
Sl. No	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
PRACTICAL COURSES								
1	EEC	U23AI801	Project Work	0	0	16	16	8
TOTAL CREDITS								8

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TOTAL CREDITS:170

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Course Code	Vertical I AI and Automation	Course Code	Vertical II AI-Powered Data Analytics	Course Code	Vertical III Optimization Techniques	Course Code	Vertical IV AI and Human-Centric Innovations	Course Code	Vertical V AI and Emerging Technologies	Course Code	Vertical VI Creative Media
U23PEAI01	Intelligent Automation Systems	U23PEAI07	AI and Big Data Analytics	U23PEAI13	Bio Inspired Optimization Techniques	U23PEAI19	Wearable Technologies	U23PEAI25	Shadow AI	U23PEAI31	AI-Assisted Graphic Design
U23PEAI02	AI in Data Science	U23PEAI08	Data Mining	U23PEAI14	Convex Optimization	U23PEAI20	AI concept using Human Computer Interaction	U23PEAI26	AIoT Smart Agriculture Monitoring	U23PEAI32	AI in Social Media and Content Curation
U23PEAI03	Responsible AI	U23PEAI09	Exploratory data analysis	U23PEAI15	Game Optimization	U23PEAI21	Intelligence Analysis	U23PEAI27	Formal Language and Automata	U23PEAI33	Interactive Media and Animation
U23PEAI04	Destructive AI	U23PEAI10	Data Analysis and Digital Marketing application	U23PEAI16	Visual Interface and User Experience Design	U23PEAI22	Cognitive Neuroscience	U23PEAI28	Rapid Language and AML	U23PEAI34	Computer-Generated Imagery
U23PEAI05	Cognitive Test Automation	U23PEAI11	Advanced Business Analytics	U23PEAI17	Advanced Optimization Techniques	U23PEAI23	Advanced AI and unsupervised learning	U23PEAI29	Explainable AI	U23PEAI35	Game Development
U23PEAI06	Quantum AI	U23PEAI12	Advanced Data Processing Techniques	U23PEAI18	Optimization in Deep Learning	U23PEAI24	Advanced Creative Thinking	U23PEAI30	Advanced Speech and Natural Language Processing	U23PEAI36	Future of Creative Media: Trends and Innovations

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VERTICAL
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VERTICAL 1- AI AND AUTOMATION

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI01	Intelligent Automation Systems	3	0	0	3	3
2	U23PEAI02	AI in Data Science	2	0	2	4	3
3	U23PEAI03	Responsible AI	3	0	0	3	3
4	U23PEAI04	Destructive AI	3	0	0	3	3
5	U23PEAI05	Cognitive Test Automation	2	0	2	4	3
6	U23PEAI06	Quantum AI	3	0	0	3	3

VERTICAL 2 – AI POWERED DATA ANALYTICS

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI07	AI and Big Data Analytics	3	0	0	3	3
2	U23PEAI08	Data Mining	2	0	2	4	3
3	U23PEAI09	Exploratory Data Analysis	3	0	0	3	3
4	U23PEAI10	Data Analysis and Digital Marketing application	2	0	2	4	3
5	U23PEAI11	Advanced Business Analytics	3	0	0	3	3
4	U23PEAI12	Advanced Data Processing Techniques	3	0	0	3	3

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VERTICAL 3 – OPTIMIZATION TECHNIQUES

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI13	Bio Inspired Optimization Techniques	3	0	0	3	3
2	U23PEAI14	Convex Optimization	3	0	0	3	3
3	U23PEAI15	Game Optimization	2	0	2	4	3
4	U23PEAI16	Visual Interface and User Experience Design	2	0	2	4	3
5	U23PEAI17	Advanced Optimization Techniques	3	0	0	3	3
6	U23PEAI18	Optimization in Deep Learning	3	0	0	3	3

VERTICAL 4 – AI & HUMAN – CENTRIC INNOVATIONS

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI19	Wearable Technologies	3	0	0	3	3
2	U23PEAI20	AI concept using Human Computer Interaction	2	0	2	4	3
3	U23PEAI21	Intelligence Analysis	3	0	0	3	3
4	U23PEAI22	Cognitive Neuroscience	2	0	2	4	3
5	U23PEAI23	Advanced AI and unsupervised learning	2	0	2	4	3
6	U23PEAI24	Advanced Creative Thinking	3	0	0	3	3

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VERTICAL 5 - AI AND EMERGING TECHNOLOGIES

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI25	Shadow AI	3	0	0	3	3
2	U23PEAI26	AIOT Smart Agriculture Monitoring	3	0	0	3	3
3	U23PEAI27	Formal Language and Automata	3	0	0	3	3
4	U23PEAI28	Rapid Language and AML	3	0	0	3	3
5	U23PEAI29	Explainable AI	2	0	2	4	3
6	U23PEAI30	Advanced Speech and Natural Language Processing	2	0	2	4	3

VERTICAL 6 – CREATIVE MEDIA

Sl. No.	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
1	U23PEAI31	AI-Assisted Graphic Design	3	0	0	3	3
2	U23PEAI32	AI in social media and Content Curation	3	0	0	3	3
3	U23PEAI33	Interactive Media and Animation	2	0	2	4	3
4	U23PEAI34	Computer-Generated Imagery	2	0	2	4	3
5	U23PEAI35	Game Development	3	0	0	3	3
6	U23PEAI36	Future of Creative Media: Trends and Innovations	3	0	0	3	3

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SET I - OPEN ELECTIVES for CSE, IT, AIDS and Cyber Security							
SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	Total Contact Periods	Credits
1	U23OE101	Algebra and Number Theory	3	0	0	3	3
2	U23OE102	Probability and Queueing Theory	3	0	0	3	3
3	U23OE103	Probability and Random Processes	3	0	0	3	3
4	U23OE104	Linear Algebra	3	0	0	3	3
5	U23OE105	Everyday Physics	3	0	0	3	3
6	U23OE106	Consumer Awareness on Appliances	3	0	0	3	3
7	U23OE107	Bio Physics	3	0	0	3	3
8	U23OE108	Astrophysics	3	0	0	3	3
9	U23OE109	Introduction to Nanoscience and Nanotechnology	3	0	0	3	3
10	U23OE110	Green Technology	3	0	0	3	3
11	U23OE111	The Environment and Society	3	0	0	3	3
12	U23OE112	Industrial corrosion and Prevention	3	0	0	3	3
13	U23OE113	English Through Media	3	0	0	3	3
14	U23OE114	English for Employability Skills	3	0	0	3	3
15	U23OE115	Inventions and Applications	3	0	0	3	3
16	U23OE116	Public Policy and Governance	3	0	0	3	3
17	U23OE117	Introduction to Mobile Communication	3	0	0	3	3
18	U23OE118	Basics of Signals and its Processing	3	0	0	3	3
19	U23OE119	Introduction to Communication Systems	3	0	0	3	3
20	U23OE120	Drone Technologies	3	0	0	3	3
21	U23OE121	Geographical Information System	3	0	0	3	3
22	U23OE122	Fundamentals of Electric and Hybrid Vehicle	3	0	0	3	3
23	U23OE123	Introduction to PLC Programming	3	0	0	3	3
24	U23OE124	Energy Management and Auditing	3	0	0	3	3
25	U23OE125	Fundamentals of Robotics	3	0	0	3	3
26	U23OE126	Medical Instrumentation	3	0	0	3	3
27	U23OE137	Applied Design Thinking	3	0	0	3	3
28	U23OE138	Fire Safety Engineering	3	0	0	3	3
29	U23OE139	Functional Materials	3	0	0	3	3
30	U23OE140	Fundamentals of Aeronautical Engineering	3	0	0	3	3
31	U23OE141	Industrial Design & Rapid Prototyping Techniques	3	0	0	3	3

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SET II - OPEN ELECTIVES for CSE, IT, AIDS and Cyber Security							
SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	Total Contact Periods	Credits
1	U23OE201	Statistics and Numerical Methods	3	0	0	3	3
2	U23OE202	Resource Management Techniques	3	0	0	3	3
3	U23OE203	Graph Theory	3	0	0	3	3
4	U23OE204	Operations Research	3	0	0	3	3
5	U23OE205	Scientific Principles in Historical Monuments	3	0	0	3	3
6	U23OE206	Non-Conventional Energy Sources	3	0	0	3	3
7	U23OE207	Environmental Physics	3	0	0	3	3
8	U23OE208	Entrepreneurship Development	3	0	0	3	3
9	U23OE209	Basics of Bioenergy and Biofuels	3	0	0	3	3
10	U23OE210	Food Science	3	0	0	3	3
11	U23OE211	Fundamentals of Crop Production	3	0	0	3	3
12	U23OE212	Water Pollution and Control Management	3	0	0	3	3
13	U23OE213	Personality Development	3	0	0	3	3
14	U23OE214	Workplace Communication	3	0	0	3	3
15	U23OE215	English for Competitive Examinations	3	0	0	3	3
16	U23OE216	English for Professional Excellence	3	0	0	3	3
17	U23OE217	Tools for Computing and Design Platform	3	0	0	3	3
18	U23OE218	Introduction to Sensors and Actuators	3	0	0	3	3
19	U23OE219	Underwater Communication	3	0	0	3	3
20	U23OE220	Consumer Electronics	3	0	0	3	3
21	U23OE221	Basics of Embedded Systems and IoT	3	0	0	3	3
22	U23OE222	Industrial Safety	3	0	0	3	3
23	U23OE223	Renewable Energy Technologies	3	0	0	3	3
24	U23OE224	Introduction to Smart Grid	3	0	0	3	3
25	U23OE225	Basics of Power Plant Engineering	3	0	0	3	3
26	U23OE226	Automotive Electronics	3	0	0	3	3
27	U23OE237	Nanomaterials and applications	3	0	0	3	3
28	U23OE238	Plastic Materials for Engineers	3	0	0	3	3
29	U23OE239	Production and Operations Management for Entrepreneurs	3	0	0	3	3
30	U23OE240	Quality Engineering	3	0	0	3	3
31	U23OE241	Reverse Engineering	3	0	0	3	3

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U23EN101	TECHNICAL ENGLISH - I	L	T	P	C
	(Common to all branches)	3	0	0	3

Prerequisites: **Fundamentals of Analytical Skills in English**

COURSE OBJECTIVES:

- To enhance reading comprehension skills for technical articles to grasp and interpret complex concepts.
- To prepare students' for effective communication and writing in technical and professional contexts.
- To develop the ability to write persuasive job applications and structured resumes effectively.

UNIT I **INTRODUCTION** 9

Reading – Requirement for Reading – reading short technical texts from journals and newspapers; **Writing** –Compare and Contrast Essay; Email Writing; **Grammar** – Parts of Speech, Mixed Tenses, Prepositional phrases; **Vocabulary Development** – Contextual meaning of words.

UNIT II **READING AND LANGUAGE DEVELOPMENT** 9

Reading – Reading Advertisements, User Manuals, Brochures; **Writing** - Process Writing, Interpreting charts & graphs; **Grammar** – Active and Passive Voice transformations, Infinitive and Gerunds; **Vocabulary Development** – Vocabulary used in formal & informal letters / emails and reports.

UNIT III **TECHNICAL WRITING AND GRAMMAR** 9

Reading – Reading Longer texts both general and technical, practice in speed reading; **Writing** – Writing responses to complaints, Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay; **Grammar** – Error correction; If Clauses, Compound Words, Punctuation; **Vocabulary Development** – Sentence Completion.

UNIT IV **REPORT WRITING** 9

Reading – Reading for detailed comprehension: Skimming and Scanning; **Writing**- Recommendations, Writing Reports – Accident Report, Survey Report, Minutes of a meeting; **Grammar** – Reported Speech, Modals; **Vocabulary Development** – Technical Vocabulary.

UNIT V **GROUP DISCUSSION AND JOB APPLICATIONS** 9

Reading – Reading and understanding Technical Articles; **Writing** – Writing Job Application – Resume Preparation (via email and hard copy); **Grammar** – Numerical Adjectives, Relative Clauses, Idioms and Phrases; **Vocabulary Development** – Verbal Analogies.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1 Veena Selvam, "English for Science and Technology", Cambridge University Press, 2021.

2 N P Sudharshana,m, C Saveetha, "English for Technical Communication", Cambridge University Press, New Delhi, 2016.

REFERENCES:

1 E Suresh Kumar, "Engineering English", Orient Black swan, Hyderabad, 2015.

2 Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.

3 Marion Grussendorf, "English for Presentations", Oxford University Press, 2007.

ONLINE RESOURCES:

1 https://iimskills.com/coursera-technical-writing-course/

2 https://www.udemy.com/course/easy-english-grammar-course

3 https://www.coursera.org/learn/introduction-to-research-for-essay-writing

COURSE OUTCOMES:

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

CO1 Write essays and emails.

CO2 Describe any process, interpretation of charts and graphs both general and technically.

CO3 Write letters and responses to complaints.

CO4 Write Recommendations, minutes and reports of events.

CO5 Write Job application with Resume.

CO – PO – PSO MAPPING:

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

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U23MA101	ENGINEERING MATHEMATICS (Common to all branches)	L T P C 3 1 0 4

Prerequisites: Fundamental Concepts on Matrices and Calculus

COURSE OBJECTIVES:

- To enhance the utilization of matrix algebra techniques that is needed by engineers for practical applications in engineering.
- To familiarize the students with differential calculus and functions of several variables.
- To acquaint the students with the mathematical tools required for the assessment of multiple integrals and their practical applications.

UNIT I **MATRICES** **12**

Symmetric and orthogonal matrices – Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley – Hamilton theorem (Without proof) Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II **DIFFERENTIAL CALCULUS** **12**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules (sum, product, quotient, chain rules) – Implicit differentiation – Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable.

UNIT III **FUNCTIONS OF SEVERAL VARIABLES** **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV **INTEGRAL CALCULUS** **12**

Definite and Indefinite integrals – Substitution rule – Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions – Improper integrals.

UNIT V **MULTIPLE INTEGRALS** **12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

TEXT BOOKS:

1 S K Pundir, Bhupander Singh, "Differential Calculus", Pragathi Prakashan Publishers Pvt. Ltd., 2023.

2 B S Grewal, "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, 2018.

REFERENCES:

1 R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", 6th Edition, Narosa Publications, 2021.
2 Ravish R Singh, Mukul Bhatt, "Advanced Engineering Mathematics", 2nd Edition, Tata McGraw Hill, 2020.
3 H C Taneja, "Advanced Engineering Mathematics", Dreamtech Press, 2019.
4 T K V Iyengar, M V A A N Prasad, B Krishna Gandhi, "Engineering Mathematics", Special Edition, S. Chand & Company Ltd., 2023.

ONLINE RESOURCES :

1 http://nptel.ac.in/courses/111105035/10

2 http://nptel.ac.in/courses/111105035/5

3 http://nptel.ac.in/courses/111105035/17

COURSEOUTCOMES:

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

CO1 Apply Cayley-Hamilton theorem and orthogonal transformation for different process of matrices.
CO2 Analyze the differentiation rules to find the extreme values of functions.
CO3 Apply the concepts of partial derivatives and total derivatives in Taylor's series, Jacobians and maxima and minima of functions.
CO4 Evaluate definite and improper integrals using techniques of integration
CO5 Evaluate area and volume using double and triple integrals.

CO – PO – PSO MAPPING:

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

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U23PH101	ENGINEERING PHYSICS (Common to all branches)	L	T	P	C
		3	0	0	3

Prerequisites: Fundamentals of Mechanics and Optics

COURSE OBJECTIVES:

- To enable the students effectively understand concepts of mechanics and elastic properties of materials.
- To gain knowledge about thermal physics, ultrasonics, lasers, optical fibres with applications.
- To introduce the basics of quantum mechanics, crystal structures and imperfections.

UNIT I **MECHANICS AND ELASTICITY** 9

Center of mass (CM) – Rotational kinematics – Moment of Inertia (M.I.) – Theorems of M.I.:parallel and perpendicular axes theorems – M.I. of continuous bodies – Conservation of angular momentum – Elasticity – Hooke's law – Stress-Strain diagram – Poisson's ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever –Young's modulus by uniform bending – I-shaped girders.

UNIT II **THERMAL PHYSICS AND ULTRASONICS** 9

Modes of heat transfer – Thermal conductivity – Newton's law of cooling – Lee's disc method – Radial heat flow – Rubber tube method – Characteristics and Production of ultrasonics by magnetostriction and piezoelectric methods – Acoustic grating – Non-destructive testing – Medical applications: Sonogram.

UNIT III **LASERS AND FIBRE OPTICS** 9

Laser: characteristics and properties – Einstein's coefficients derivation – Population inversion –Types of lasers: Nd-YAG laser, CO_2 laser, semiconductor laser – Applications of lasers – Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Classification of optical fibres (material, refractive index, mode) – Optical-fibre communication system (Block diagram only).

UNIT IV **QUANTUM MECHANICS** 9

Black body radiation – Photons and light waves – Electrons and matter waves – Compton effect: Theory and experimental verification – The Schrodinger equation: Time dependent and time independent forms – Physical significance of wave function –Particle in an infinite potential well:1D – Electron microscopes: Scanning Electron Microscope and Transmission Electron Microscope.

UNIT V **CRYSTAL PHYSICS** 9

Lattice – Bravais lattice – Lattice planes – Miller indices – d-spacing in cubic lattice– Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP crystal structures – Crystal imperfections: point, line and surface defects.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1 D. Kleppner, R Kolenkow, "An Introduction to Mechanics", Tata McGraw Hill, 2017.

2 Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, "Concepts of Modern Physics", Tata McGraw Hill, 2017.

REFERENCES:

1 R. Wolfson, "Essential University Physics", Volume 1 & 2, 4th Edition, Pearson Education, 2020.

2 K Thyagarajan, A Ghatak, "Lasers: Fundamentals and Applications", 2nd Edition, Laxmi Publication, 2019.

3 P K Palanisamy, "Materials Science", Scitech Publication India Pvt. Ltd., 2015.

ONLINE RESOURCES:

1 https://www.coursera.org/courses?query=physics

2 https://archive.nptel.ac.in/courses/115/102/115102124/

3 https://onlinecourses.nptel.ac.in/noc24_ph17/preview

COURSE OUTCOMES:

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

CO1 Comprehend the basics of mechanics and elastic properties of materials.

CO2 Explain the thermal physics concepts, production and applications of ultrasonic waves.

CO3 Apply the basic concepts of lasers and optical fibre in various fields.

CO4 Describe the basics of quantum mechanical phenomenon and electron microscopes.

CO5 Explain the fundamentals of crystal structures and imperfections.

CO – PO – PSO MAPPING:

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

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U23CY101	ENGINEERING CHEMISTRY (Common to all branches)	L	T	P	C
		3	0	0	3

Prerequisites: Fundamentals of Basic Chemistry

COURSE OBJECTIVES:

- To make the students conversant with water treatment techniques and the electrochemical reactions.
- To facilitate the understanding of fuel classification, preparation, combustion and environmental impact.
- To acquire a deep understanding of renewable energy sources and nano materials, their properties and applications.

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, hardness, alkalinity. Boiler troubles: Scale and sludge. Treatment of boiler feed water: Internal treatment (sodium aluminate and calgon conditioning) and External treatment Ion exchange demineralization process, Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination), Desalination of brackish water: Reverse Osmosis.

UNITII ELECTRO CHEMISTRY AND DEVICE CORROSION 9

Electrochemistry: Introduction, Electrochemical cells – electrolytic cell – reversible and irreversible cells. Electrode potential – Oxidation and reduction Potentials – emf, Nernst equation and applications. Reference electrodes – Calomel electrode – Electro chemical series – its applications.

Device Corrosion: Introduction- chemistry of IC and PCB – causes of corrosion on IC, PC-miniaturization and complex material utilization- forms of corrosion – anodic and cathodic corrosion-Prevention of corrosion.

UNITIII 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.

Combustion of Fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value; Flue gas analysis – ORSAT Method. CO_2 emission and carbon foot print.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Solar energy conversion: Principle, working and applications of solar cells; recent developments in solar cell materials. Wind energy; Geothermal energy. Hydrogen as fuel: Sources of hydrogen – Hydrogen production methods – electrolysis, limitations and applications.

Storage Devices: Batteries – Types of batteries, Primary battery – dry cell, Secondary battery – lead acid battery and lithium – ion battery; Electric vehicles working principles.

UNIT V NANO CHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials; Types of nanomaterials: Definition, properties and uses of nano particles and nanotube. Preparation

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of nano materials: laser ablation, chemical vapours deposition, electrochemical deposition and electro spinning. An application of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Jain P C, Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2021.

2 Chatla Naga Babu, G Kanthimathi, "Text Book of Engineering Chemistry", 1st Edition, AG Publishing House, 2023.

REFERENCES:

1 Reza K Haghi, Fransico Torrens, "Engineering Technology and Industrial Chemistry with Applications", Apple Academic Press, 2021.

2 Anna Klinkova, "Nano Chemistry", 1st Edition, Springer. 2023.

3 Stroud N, "Fundamentals of Engineering Chemistry", American Academic Publishers, 2023.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc22_ch27/preview

2 https://nptel.ac.in/courses/105107207

3 https://onlinecourses.nptel.ac.in/noc19_mm21/preview

COURSEOUTCOMES:

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

CO1 Describe the type of factors present in boilers and the method used to treat hard water.

CO2 Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion.

CO3 Summarize the various solid, liquid and gaseous fuels manufacturing methods and basic reactions involved in combustion reaction.

CO4 Describe the types of batteries their reactions and the significance of storage renewable energy resource.

CO5 Apply the basic concepts of nanomaterials and its application in various sectors.

CO – PO – PSO MAPPING:

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

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U23CP101	PROGRAMMING IN C (Common to all Branches)	L T P C 3 0 2 4

Prerequisites: **Mathematical Fundamentals**

COURSE OBJECTIVES:

- To understand the basic construct of C Language and develop C programming of these construct.
- To develop C program using arrays, strings and modular applications using functions.
- To develop applications in C using pointers, structures and union.

UNIT I **BASICS OF C PROGRAMMING** **9**

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. Illustrative Programs: Use of Variables in expression and their evaluation, Temperature Conversion (Fahrenheit to Celsius) Problem.

UNIT II **DECISION MAKING AND LOOPING** **9**

Simple if Statements, The if.else statements, Nesting of if...else statements, else...if Ladder, switch Statements, goto Statements, while, do...while, for Statements , Illustrative Problems: EB Bill Computations, Determination of Average Cost and the range of the values , and Square root of a Series , Student Grade System.

UNIT III **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. Illustrative Programs: palindrome Checking using arrays and String, Concatenation of strings.

UNIT IV **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, Parameter passing: Pass by value, Pass by reference. Illustrative Program: Fibonacci Series, Towers of Hanoi.

UNIT V **STRUCTURES AND UNION** **9**

Structure - Nested structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility. Illustrative Program: To Print name and address of Employee, Generate Student Mark List.

45 PERIODS

PRACTICAL EXERCISES:

1. 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.

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6. Functions and Pointers: Passing parameters by (value, reference), passing arrays to function, Recursion using pointers.
7. Structures and Unions: Nested Structures, Arrays of Structures and Unions

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 Reema Thareja, "Programming in C", Oxford University Press, 2nd Edition, 2018.

2 Brian W Kernighan, Dennis M Ritchie, "The C Programming language", 3rd Edition, Prentice Hall of India, 2019.

REFERENCES:

1 Paul Deitel, Harvey Deitel, "C How to Program with an Introduction to C++", 8th Edition, Pearson Education, 2018.

2 Yashwant Kanetkar, "Let us C", 17th Edition, BPB Publications, 2020.

3 Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford University Press, 2013.

4 Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2016.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc22_cs40/preview

2 https://onlinecourses.swayam2.ac.in/cec24_cs05/preview

3 https://onlinecourses.swayam2.ac.in/nou24_cs06/preview

COURSE OUTCOMES:

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

CO1 Describe knowledge on C Programming constructs.

CO2 Apply the simple applications in C using decision making and looping.

CO3 Design the various applications using arrays and strings.

CO4 Write and implement modular applications in C using functions and Pointers.

CO5 Apply the User defined concept in C using Structures and Unions.

CO – PO – PSO MAPPING:

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

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U23BE104 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** **L T P C**

(Common to CSE, IT, AIDS & CSE (CS) **3 0 0 3**

Prerequisites: **Engineering Physics**

COURSE OBJECTIVES:

- To understand and gain the knowledge of Electric Circuits and Analysis.
- To understand and gain the knowledge of Electrical Machines and its Applications.
- To understand and gain the knowledge of Analog Devices, Digital Electronics and Measuring Instruments.

UNIT I **ELECTRICAL CIRCUITS** **9**

DC Circuits: Ohm's Law – Kirchhoff's Laws – Simple problems – Nodal Analysis, Mesh analysis with independent sources only, AC Circuits: Average value – RMS Value- Instantaneous power, real power, reactive power and apparent power- power factor.

UNIT II **ELECTRICAL MACHINES** **9**

DC Generator: Construction and Working principle – EMF equation – Types – Applications, DC motor: Working Principle – Torque Equation – Types – Applications, Transformer: Construction – Working principle – Types – Applications, Induction motor: Construction and Working principle of Single phase and Three phase Induction motor-Types – Applications.

UNIT III **ANALOG ELECTRONICS** **9**

Semiconductor Materials – Operation and Characteristics of PN Junction Diodes, Zener Diode, Bipolar Junction Transistors, JFET, MOSFET – Half wave and Full wave Rectifier circuits.

UNIT IV **DIGITAL ELECTRONICS** **9**

Review of Number Systems –Representation of logic functions – SOP and POS forms-minimization using K maps (Simple Problems only) – Combinational logic circuits: Adder and Subtractor.

UNIT V **MEASUREMENTS AND INSTRUMENTATION** **9**

Elements of a generalized measurement system – Static and Dynamic Characteristics – Classification of instruments – moving coil and moving iron meters – Dynamometer type watt meters – Induction type Energy meter – Measurement of Resistances using Megger – DSO.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Kothari D P, I J Nagrath, "Basic Electrical and ElectronicsEngineering", 2nd Edition, Tata McGraw Hill, 2020.

2 S K Bhattacharya "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Education, 2017.

REFERENCES:

1 Thomas L Floyd, "Digital Fundamentals", 11th Edition, PearsonEducation, 2017.

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2 Kothari D P, I J Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill, 2019.

3 Sedha R S, "A text book of Applied Electronics", S Chand & Co., 2017.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/108105112.
2 https://www.udemy.com/course/basic-electrical-engineering-electrical-engineering.
3 https://www.coursera.org/learn/electronics.

COURSE OUTCOMES:

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

CO1 Solve the circuits using basic electrical theorems.
CO2 Explain the working principle and applications of electrical machines.
CO3 Summarize the characteristics of Analog electronic devices.
CO4 Explain the basic concepts of Digital Electronics.
CO5 Describe the operating principles of measuring instruments.

CO – PO – PSO MAPPING:

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

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U23TA101	தமிழர் மரபு	L	T	P	C
	(Common to all Branches)	1	0	0	1

நோக்கம்:

- பாரம்பரியக் கலாச்சாரத்தின் நுண்ணறிவையும் மற்றும் கட்டிடக்கலையின் அற்புதங்களில் நடைபெறும் பொறியியல் நுட்பங்களை எடுத்துரைப்பதாகும்.
- தமிழ்மொழி, பண்பாடு, கலைகள், மரபுகளின் வரலாற்றைப் பற்றி எடுத்துரைப்பதன் நோக்கமாகும்.
- அந்தணர்க்கும் அரசர்க்கும் கல்வியையும், வணிகர்களுக்கு வியாபாரத்தையும், வேளாண் மக்களுக்கு உழவுத்தொழிலையும் தமிழர் மரபின் எடுத்துரைப்பதாகும்.

அலகு – 1 **மொழி மற்றும் இலக்கியம்** 3

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

அலகு – 2 **மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை** 3

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

அலகு – 3 **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு – 4 **தமிழர்களின் திணைக்கோட்பாடுகள்** 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு – 5 **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுய மரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. முனைவர் ஆ. பூபாலன் "தமிழர் மரபு", வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 – 24 அண்ணா பல்கலைக்கழகம்.

2. முனைவர் ஆ. ஹேமமாலினி "தமிழர் மரபு", வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 – 24 அண்ணா பல்கலைக்கழகம்.

REFERENCES:

1. முனைவர் கே.கே. பிள்ளை "தமிழக வரலாறு, மக்களும், பண்பாடும்,", வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 1972.
2. முனைவர் இல. சுந்தரம், "பொருநை, ஆற்றங்கரை நாகரிகம்,", வெளியீடு: தொல்லியல் துறை மற்றும் தமிழ்நாடு அரசுத் துறை, 2022.
3. Dr. S. V. சுப்பிரமணியன், னுச.மு.னு. திருநாவுக்கரசு "தமிழர்களின் வரலாற்று பாரம்பரியம்", சர்வதேச தமிழ் ஆய்வு நிறுவனம், 2022.

ONLINE RESOURCES:

1. https://unacademy.com/lesson/introduction-and-administrative-system-of-cultural-heritage-of-tamil-in-tamil/ATMT6TK4
2. https://unacademy.com/lesson/society-and-sangam-literature-in-tamil/ C5QL4L0Q
3. https://unacademy.com/lesson/classical-tamil-literature-epigraphy-and-hero-stones-in-tamil/817FIREX

COURSE OUTCOMES:

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

CO1 மொழிகள், இலக்கியங்கள் மற்றும் காப்பியங்கள் பற்றி தொகுக்க இயலும்.
Summarize about languages, literatures and scripts.

CO2 நடுகற்கள், நவீன சிற்பங்கள், ஐம்பொன் சிலைகள், மற்றும் இசைக் கருவிகள் பற்றி விளக்க இயலும்.
Explain middle stone, modern sculptures, panchaloga idols and musical instruments.

CO3 நாட்டுப்புறத் தெய்வங்கள், கலைகள் மற்றும் வீர விளையாட்டுகள் பற்றி விளக்க இயலும்.
Explain about the folk gods, arts and heroic sports.

CO4 தமிழர்களின் திணைக்கோட்பாடுகள் பற்றி தொகுக்க இயலும்.
Summarize the political theories of tamils.

CO5 இந்திய தேசிய இயக்கம், மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி தொகுக்க இயலும்.
Summarize Indian national movement contribution of Tamils to Indian culture.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

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U23PC101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common to all branches)	0	0	3	1.5

Prerequisites: Principles of Physics and Chemistry

COURSE OBJECTIVES:

- To provide an experimental foundation for the theoretical concepts introduced in the lectures.
- To teach how to make careful experimental observations and how to think about and draw conclusions from such data.
- To help students understand the role of direct observation in physics and chemistry to distinguish between inferences based on theory and the outcomes of experiments.

PHYSICS LABORATORY

LIST OF EXPERIMENTS (Any FIVE Experiments)

1. Determination of Young's modulus by Non uniform bending method.
2. Determination of Rigidity modulus of wire and moment of inertia using torsional pendulum.
3. Determination of Young's modulus by Simple harmonic oscillations of cantilever.
4. Determination of Wavelength of the Laser using grating.
5. Determination of Numerical aperture and acceptance angle in an optical fiber.
6. Determination of velocity of sound and compressibility of liquid –Ultrasonic Interferometer.
7. Determination of thickness of a thin sheet of wire–Air wedge.

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS (Any FIVE Experiments)

1. Determination of total, temporary and permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by Argentometric method.
3. Determination of alkalinity in water sample.
4. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Conductometric titration of strong acid Vs strong base.
7. Conductometric titration of barium chloride Vs sodium sulphate.
8. Estimation of iron content of the given solution by using potentiometer.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

CO1 Calculate the Young's modulus by non-uniform bending, simple harmonic oscillations by Torsion Pendulum.

CO2 Calculate the thickness of a thin wire by air wedge and velocity of sound, compressibility of liquid using ultra sonic interferometer.

CO3 Calculate the wavelength, acceptance angle and numerical aperture using laser.

CO4 Estimate the amount of Hardness, chloride, alkalinity in water samples.

CO5 Estimate the amount of acid, iron content present in a given solution by using pH, conductivity and potentiometric titration.

CO – PO – PSO MAPPING:

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

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U23EN102	PROFESSIONAL COMMUNICATION LABORATORY (Common to all branches)	L	T	P	C
		0	0	3	1.5

Prerequisites: Basic Communication Skills

COURSE OBJECTIVES:

- To enhance their employability and career prospects by equipping them with soft skills.
- To emphasize the importance of interview etiquette and prepare for job interviews.
- To cultivate a general awareness of current affairs to engage in a professional world.

UNIT I 9

Introduction to basic Communication Skills of learning – Listening – Empathetic Listening- Key role in Organizational communication; Speaking – role plays – asking about routine actions and expressing opinions.

UNIT II 9

Introduction to Soft Skills – Hard skills & soft skills - employability and career Skills – Grooming as a professional with values – Time Management – General awareness of Current Affairs.

UNIT III 9

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice – presenting the visuals effectively – 5 minute presentations.

UNIT IV 9

Introduction to Group Discussion – Participating in group discussions – understanding group dynamics – brainstorming the topic – questioning and clarifying – GD strategies- activities to improve GD skills.

UNIT V 9

Interview etiquette – dress code – body language – attending job interviews – telephone/Skype interview -one to one interview & panel interview – FAQs related to job interviews.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Apply communication proficiency by mastering empathetic listening and speaking skills.

CO2 Apply soft skills fostering comprehensive competence.

CO3 Apply effective techniques to deliver presentations in all aspects.

CO4 Apply effective strategies for active participation in Group Discussion.

CO5 Apply interview etiquette to navigate various interview formats for Job Interviews.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	1	-	-	1	1	1	-	1
CO2	1	-	-	-	1	-	-	1	1	1	-	1
CO3	1	-	-	-	1	-	-	1	1	1	-	1
CO4	1	-	-	-	1	-	-	1	1	1	-	-
CO5	1	-	-	-	1	-	-	1	1	1	-	1

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U23EN201	TECHNICAL ENGLISH - II (Common to all branches)	L	T	P	C
		3	0	0	3

Prerequisites: Basics of Communication discourse

COURSE OBJECTIVES:

- To develop a high level of proficiency in the English language, encompassing LSRW skills to engage effectively.
- To equip students with a strong foundation in English grammar and vocabulary to understand technical texts.
- To foster critical thinking skills including the ability to evaluate texts critically.

UNIT I **GENERAL READING AND FREE WRITING** 9

Listening –Short texts (Listening to Audio & Video) Types of Listening – formal and informal conversations – Telephone conversation; Listening to voicemail & messages; **Speaking** – Basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve; **Reading** – Critical Reading – finding key information in a given text – shifting facts from opinions; **Writing** – free writing on any given topic – autobiographical writing, developing hints, Note – Making; **Grammar** – Tenses; **Vocabulary Development** – Word Formation.

UNIT II **LISTENING AND SUMMATION** 9

Listening – Listening to podcasts / anecdotes / event narration, documentaries and interviews with celebrities; **Speaking** – Narrating personal experiences / events / Reporting and summarizing documentaries / podcasts / interviews; **Reading** – Reading biographies, travelogues, newspaper reports, Excerpts from literature and travel & technical blogs. **Writing** –Short Report on an event (field trip etc.) **Grammar** – Question types: Wh / Yes or No; **Vocabulary Development** – One word substitution.

UNIT III **SPEAKING AND ANALYSIS SKILLS** 9

Listening – Dialogues & Conversations, focused audio track – **Speaking** – Role Play – Asking about routine actions and Expressing Opinions – Group Interaction – Speaking in formal situations (teachers, officials, foreigners); **Reading** – Reading longer texts & Making a Critical Analysis of the given text; **Writing** – Types of Paragraphs and Essays – Rearrangement of Jumbled sentences; **Grammar** - Cause & Effect Expressions; **Vocabulary Development** – Synonyms & Antonyms.

UNIT IV **READING AND LANGUAGE PROGRESSION** 9

Listening – Listening to Dialogues or conversations and completing exercises based on them; **Speaking** – Speaking about one – speaking about one's friend; **Reading** – Comprehension, Reading Different Types of Texts – magazines; **Writing** – Letter Writing - formal or informal letters – E Mails – Conventions of personal email; **Grammar** – Discourse Markers (connectives & sequence words); **Vocabulary development** – Homonyms and Homophones.

UNIT V **COMPREHENSIVE WRITING** 9

Listening –Listening to Speeches / Presentations, Listening to broadcast and telecast from

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Radio and TV; **Speaking** – Participating in Conversations – short group conversations – Making presentations on given topics; **Reading** –Email communication – Reading the attachment files having a poem / joke / proverb; **Writing** – Creative writing, Poster making, dialogue writing; **Grammar** – Degrees of Comparison, Fixed / Semi-Fixed Expressions; **Vocabulary Development** Abbreviations & Acronyms (as used in technical contexts).

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Venkatraman G, "Effective Technical Communication" 1st Edition, Pearson Education, 2022.

2 Lakshminarayanan K R, "English for Communication", Scitech Publications, 2022.

REFERENCES:

1 Raman, Meenakshi, Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2015.

2 Sharma Sangeetha, Mishra Binod, "Communication Skills for Engineers and Scientists", 2nd Edition, Prentice Hall of India, 2023.

3 Ruchi Agarwal, "Academic Writing for Students: A Practical Guide", Eliva Press, 2024.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc22_hs05/preview
2 https://www.coursera.org/specializations/creative-writing
3 https://www.coursera.org/courses-writing

COURSE OUTCOMES:

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

CO1 Apply the concepts of writing in an effective way.

CO2 Write concise reports in a professional context.

CO3 Write different kinds of Paragraphs and Essays.

CO4 Write Email and formal / informal letters without grammatical errors.

CO5 Analyze collaborative work through writing process.

CO – PO – PSO MAPPING:

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

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U23MA201	VECTOR CALCULUS AND COMPLEX FUNCTIONS (Common to all branches)	L	T	P	C
		3	1	0	4

Prerequisites: Engineering Mathematics

COURSE OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems
- To make the students to understand the vector calculus such as divergence, curl needed, for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas.

UNIT I DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Linear differential equation with variable coefficients – Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients – Undetermined coefficients.

UNIT II BASICS OF VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and solenoidal vector fields – Work done by a force – Conservative force field.

UNIT III APPLICATIONS OF VECTOR CALCULUS 12

Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT IV ANALYTIC FUNCTIONS 12

Analytic functions – Necessary and sufficient conditions for analyticity in cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $(z + a, az, z^2, 1/z)$ – Bilinear transformation

UNIT V COMPLEX INTEGRATION 12

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi – circular contour (without poles on real axis).

TOTAL: 60 PERIODS

TEXT BOOKS:

1 B S Grewal, "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, 2020.

2 E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2020.

REFERENCES:

1 H K Dass, "Advanced Engineering Mathematics", S. Chand & Company Ltd., 20th Edition, 2019.
2 Ravish R Singh, Mukul Bhatt, "Advanced Engineering Mathematics", 2nd Edition, Tata McGraw Hill, 2020.
3 H C Taneja, "Advanced Engineering Mathematics", Dreamtech Press, 2019.
4 T K V Iyengar, M V A A N Prasad, B Krishna Gandhi, "Engineering Mathematics", Special Edition, S. Chand & Company Ltd., 2023.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/111105134
2 https://nptel.ac.in/courses/111107111
3 https://nptel.ac.in/courses/111103070

COURSE OUTCOMES:

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

CO1 Solve higher order differential equations of different types for engineering applications.

CO2 Explain the concepts of vector calculus.

CO3 Evaluate line, surface and volume integrals in various vector fields using Greens, Stokes and Gauss theorems.

CO4 Analyze the properties and mappings for constructing analytic functions.

CO5 Evaluate the complex and contour integral using Cauchy's theorem.

CO – PO – PSO MAPPING:

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

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U23PH203	PHYSICS FOR COMPUTER TECHNOLOGY	L	T	P	C
Prerequisites:	**Engineering Physics**	3	0	0	3

COURSE OBJECTIVES:

- To make the students gain knowledge on conducting materials and semiconducting materials.
- To instil knowledge on physics of magnetic and superconducting materials.
- To inculcate an idea of significance of optoelectronic devices, new engineering materials and their applications.

UNIT I **CONDUCTING MATERIALS** **9**

Conductors – Classical free electron theory of metals–Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Success and failures of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – Carrier concentration in metals – Energy bands in solids.

UNIT II **SEMICONDUCTING MATERIALS** **9**

Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Compound semiconductors – Direct and indirect band gap – n-type and p-type semiconductor: derivation of carrier concentration – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – Experimental verification of Hall-effect – Applications.

UNIT III **MAGNETIC AND SUPERCONDUCTING MATERIALS** **9**

Origin of magnetic moment – Magnetic properties of Dia, Para, Ferro, anti-Ferro and ferrite materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) – High temperature superconductors – Applications of superconductors: SQUID, Cryotron, Magnetic levitation.

UNIT IV **OPTICAL MATERIALS** **9**

Classification of optical materials – Carrier generation and recombination processes – Absorption, emission and scattering of light in metals, insulators and semiconductors (concepts) – Opto electronic devices: light detectors and solar cells – Light emitting diode (LED) – Organic LED – Laser diodes – Optical data storage techniques.

UNIT V **NEW ENGINEERING MATERIALS** **9**

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy and application – Metallic glasses: properties, preparation and applications – Nanomaterials: properties – preparation: top-down and bottom-up approach – Quantum structures: Q–dot, Q-wire, Q – well – Carbon Nano tubes (CNT): properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 S O Kasap, "Principles of Electronic Materials and Devices ", Tata McGraw Hill, 2020.

2 Donald A Neamen, "Semiconductor Physics and Devices Basic Principles", Jain Book Agency, 2024.

REFERENCES:

1 Y Slimani, E Hannachi, "Super Conducting Materials, Fundamentals, Synthesis and Applications", Springer, 2022.

2 Kelly S Potter, Joseph Simmons, "Optical Materials", 2nd Edition, Elsevier, 2021.

3 Visakh P M, Artem Semkin, R Balakrishnan, S Lazovic, "Nanotechnology in Electronics: Materials, Properties, Devices", John Wiley & Sons, 2022.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc24_ph05/preview

2 https://onlinecourses.nptel.ac.in/noc24_ph02/preview

3 https://onlinecourses.nptel.ac.in/noc21_ph14/preview

COURSE OUTCOMES:

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

CO1 Explain the properties of conducting materials based on free electron theories.

CO2 Describe the types of semiconducting materials and its applications.

CO3 Summarize the magnetic and superconducting properties of materials and its uses.

CO4 Apply the various optical phenomena in optoelectronic devices.

CO5 Explain the characteristics, preparations and applications of new engineering materials.

CO – PO – PSO MAPPING:

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

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U23EG101	ENGINEERING GRAPHICS (Common to all branches)	L T P C 2 0 4 4

Prerequisites: Nil

COURSE OBJECTIVES:

- To prepare the students for drawing freehand sketch of simple objects and engineering curves.
- To prepare the students for drawing orthographic projection of solids, section of solids and development of lateral surfaces of various solids.
- To prepare the students for drawing pictorial projections like isometric and perspective projection of simple solids.

UNIT I **PLANE CURVES** **6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II **PROJECTION OF POINTS, LINES AND PLANE SURFACES** **6+12**

Orthographic projection- principles – Principal planes – First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III **PROJECTION OF SOLIDS AND FREE HAND SKETCHING** **6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views – Freehand sketching of multiple views from pictorial views of objects.

UNIT IV **SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** **6+12**

Sectioning of simple solids in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids (without Cut out) — Prisms, pyramids cylinders and cones.

UNITV **ISOMETRIC AND PERSPECTIVE PROJECTIONS** **6+12**

Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

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TEXT BOOKS:

1 Bhatt N D, Panchal V M, "Engineering Drawing", Charotar Publishing House, 54th Edition, 2023.
2 Natrajan K V, "A Text Book of Engineering Graphics", 36th Edition, Dhanalakshmi Publishers, 2023.

REFERENCES:

1 Gopalakrishna K R, "Engineering Drawing" (Vol. I&II Combined), Subhas Publications, 27th Edition, 2017.
2 Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International Private Limited, 2008.
3 Parthasarathy N S, Vela Murali, "Engineering Graphics", Oxford University Press, 2015.
4 Basant Agarwal and Agarwal C. M, "Engineering Drawing", Tata McGraw Hill, 2nd Edition, 2019.

ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/112/102/112102304/
2 https://nptel.ac.in/courses/112103019
3 https://onlinecourses.nptel.ac.in/noc24_ar02/preview

COURSE OUTCOMES:

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

CO1 Draw the various curves used in engineering practices.
CO2 Draw the projections of straight lines which are inclined to both the planes.
CO3 Draw the projections of solids inclined to one plane and parallel to other plane.
CO4 Draw the projections of sectioned solids and draw the development of lateral surfaces of a solid.
CO5 Draw the isometric projections and perspective projections of simple solids.

CO – PO – PSO MAPPING:

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

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U23PY201	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to all Branches)	L	T	P	C
		3	0	2	4

Prerequisites: Programming in C

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving 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 and to 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), Towers of Hanoi, insert a card in a list of sorted cards.

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, 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 operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, Strings: string slices, immutability, string functions and methods, Lists as arrays, 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; Illustrative programs: histogram, Retail bill preparation, sorting.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exceptions: text files, reading and writing files, format operator; errors and exceptions, handling exceptions, modules, packages; Illustrative programs: GCD, setting offset in a file, wordcount, copyfile, voter's age, validation, marks range validation.

45 PERIODS

PRACTICAL EXERCISES:

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)
2. Python programming using simple statements and expressions (exchange the values of two variables, compute Simple Interest).
3. Scientific problems using Conditionals and Iterative loops. (Prime factor of an Integer, Bin to Decimal, Octal and Hexa).
4. Implementing programs using Functions. (Factorial, largest number in alist).
5. Implementing programs using Strings. (Reverse, palindrome, character count, replacing characters).
6. Implementing operations of lists, tuples, and dictionaries.

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7a Implementing operations of file handling. (Copy from one file to another, word count).

7b Implementing real-time/technical applications using Exception handling. (Divide by zero error, voter's age validity, student mark range validation).

30 PERIODS

TOTAL: 75 PERIODS

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.

REFERENCES:

1 Paul Deitel, Harvey Deitel, "Python for Programmers", 1st Edition, Pearson Education, 2021.

2 G Venkatesh, 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 Modelling and Understanding Data", 3rd 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 Martin C Brown, "Python: The Complete Reference", 4th Edition, Tata McGraw Hill, 2018.

ONLINE RESOURCES

1 http://www.digimat.in/nptel/courses/video/106106212/L01.html

2 https://onlinecourses.swayam2.ac.in/cec24_cs03/preview

3 https://onlinecourses.swayam2.ac.in/cec24_cs01/preview

COURSE OUTCOMES:

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

CO1 Solve simple computational problems using notations.

CO2 Write python programs using statements and Expressions.

CO3 Apply control flow and functional concepts in a user define problems.

CO4 Apply python data structures - list, tuples and dictionaries for compound data.

CO5 Describe file handling and exceptional handling in python for solving problems.

CO – PO – PSO MAPPING

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

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U23CS201	DATA STRUCTURES	L	T	P	C
Prerequisites: C Programming		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of linear and non-linear data structures.
- To understand and gain the knowledge of sorting, searching and hashingalgorithms.
- To apply Tree and Graph data structures.

UNIT I **LIST** **9**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation– Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

UNIT II **STACKS AND QUEUES** **9**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue-Applications of Queues.

UNIT III **TREES** **9**

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search TreeADT – AVLTrees – Priority Queue (Heaps) – Binary Heap.

UNIT IV **MULTIWAY SEARCH TREES AND GRAPHS** **9**

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of GraphBreadth – first traversal – Depth-first traversal

UNIT V **SORTING AND SEARCHING** **9**

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Merge Sort – Hashing – Hash Functions – Separate Chaining

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition,Pearson Education, 2020.

2 Lovelyn Rose, "Data Structures", 2nd Edition, Wiley & Sons, 2019.

REFERENCES:

1 Yedidyah Langsam, Aaron M Tenenbaum, "Data Structures Using C and C++", 2nd Edition, Pearson Education, 2015.

2 Thomas H Cormen, Charles E Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, Tata McGraw Hill, 2022.

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3 Kruse, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2006.

ONLINE RESOURCES:

1 https://www.coursera.org/learn/data-structures.

2 https://onlinecourses.swayam2.ac.in/nou24_cs06/preview.

3 https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures-in-c

COURSE OUTCOMES:

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

CO1 Describe abstract data types for linear data structures.
CO2 Explain Stack, Queue ADT's operations and its applications.
CO3 Apply various algorithms of tree data structures for solving real world problems.
CO4 Apply appropriate graph algorithm for solving a given problem.
CO5 Analyse various searching, sorting and hashing techniques.

CO – PO – PSO MAPPING:

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

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U23TA201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
	(Common to all Branches)	1	0	0	1

நோக்கம்:

- அறிவியல் மற்றும் பொறியியல் சார்ந்த அறிவுத்திறனைப் பெருக்குவதன் மூலம் உலக அளவில் அவர்களின் தரத்தை உயர்த்துவதன் நோக்கமாகும்.
- தமிழர் தொழில்நுட்பம் ஏனைய நாகரிகங்களுக்கு இணையான வளர்ச்சியைக் கொண்டதே இதன் நோக்கமாகும்.
- வேளாண்மை, கட்டிடக்கலை, இசைக்கருவிகள், கப்பற்கலை, போர்க்கலை என பல துறைகளில் தமிழர் தொழில்நுட்பத்தை சிறந்து விளங்குவதே நோக்கமாகும்.

அலகு – 1 **நெசவு மற்றும் பானைத் தொழில்நுட்பம்** 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறில் குறியீடுகள்.

அலகு – 2 **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்** 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு – 3 **உற்பத்தித் தொழில்நுட்பம்** 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எ.கு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு – 4 **வேளாண்மை மற்றும் நீர்பாசனத் 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 முத்துக்குளித்தல் - பொருங்கடல் குறித்த பண்டைய அறிவு - அறிவு சார் சமூகம்.

அலகு – 5 **அறிவியல் தமிழ் மற்றும் கணித்தமிழ்** 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. முனைவர் ஆ. பூபாலன் "தமிழரும் தொழில்நுட்பமும்" வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 2024 அண்ணா பல்கலைக்கழகம்.
2. முனைவர் ஆ. ஹேமமாலினி "தமிழரும் தொழில்நுட்பமும்" வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 2024 அண்ணா பல்கலைக்கழகம்.

REFERENCES:

1. முனைவர் கே. கே. பிள்ளை "தமிழக வரலாறு, மக்களும், பண்பாடும்," வெளியீடு:

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தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 1972.

2 முனைவர் இல. சுந்தரம், "பொருநை, ஆற்றங்கரை நாகரிகம்," வெளியீடு: தொல்லியல் துறை மற்றும் தமிழ்நாடு அரசுத் துறை, 2022.

3 Dr. S. V. சுப்பிரமணியன், ஐச.மு.ஐ. திருநாவுக்கரசு "தமிழர்களின் வரலாற்று பாரம்பரியம்", சர்வதேச தமிழ் ஆய்வு நிறுவனம், 2022.

ONLINE RESOURCES:

1 https://youtu.be/7qTXrUs02fs?si=SBBluhJu1i14o6yw

2 https://youtu.be/A0mxzo4f-s4?si=1C92FLv93BliZ2pn

3 https://youtu.be/Qia72HEV_uE?si=dp06r09Gi1SsKEyQ

COURSE OUTCOMES:

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

CO1 தமிழின் தொன்மையான வரலாறு மற்றும் தொழில் நுட்பத்தை தொகுக்க இயலும்.
Summarize the ancient history and technology of Tamil.

CO2 சங்க கால வாழ்க்கை முறை மற்றும் கட்டிடக்கலை நுட்பங்களைப் பற்றி விளக்க இயலும்.
Explain the lifestyle and architectural techniques of the sangam period.

CO3 பண்டைய தமிழ் மக்களின் வணிக நடை முறைகள் மற்றும் நாணய பரிமாற்றம் பற்றி விளக்க இயலும்.
Explain the business practices and currency exchange of ancient Tamil people.

CO4 சங்க காலத்தில் வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்ப முறைகளைப் பற்றி தொகுக்க இயலும்.
Summarize the Agriculturen and Irrigation Technology in sangam period.

CO5 கணினி பயன்பாடுகளில், தமிழின் தொழில்நுட்ப வளர்ச்சியினைப் பற்றி விளக்க இயலும்.
Explain the computer applications in Tamil technological development.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

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U23EP101	ENGINEERING PRACTICES LABORATORY (Common to all branches)	L	T	P	C
		0	0	3	1.5

Prerequisites: Nil

COURSE OBJECTIVES:

- Drawing pipeline plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household woodwork.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping In parts; Assembling simple mechanical assembly of common household equipment's; Making a tray out of metal sheet using sheet metal work.
- 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)

PART I CIVIL ENGINEERING PRACTICES

I. PLUMBING WORK:

1. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2. Preparing plumbing line sketches.
3. Laying pipe connection to the delivery side of a pump.
4. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

II. WOOD WORK:

1. Sawing,
2. Planing
3. Making joints like T-Joint Mortise joint, Tenon joint, and Dovetail joint.
4. Studying joints in door panels and wooden furniture.
5. Studying common industrial trusses using models.

PART II MECHANICAL ENGINEERING PRACTICES

I. WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

II. BASIC MACHINING WORK:

a) (Simple) Turning.
b) (Simple) Drilling.
c) (Simple) Tapping.

III. ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

IV. SHEET METAL WORK:

a) Making of a square tray.

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V. FOUNDRY WORK:

a) Demonstrating basic foundry operations.

GROUP B (ELECTRICAL AND ELECTRONICS)

PART III ELECTRICAL ENGINEERING PRACTICES

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 ELECTRONICS ENGINEERING PRACTICES

I. 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.

II. ELECTRONIC EQUIPMENT STUDY:

a) Study an element of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the basic concept of Plumbing and carpentry in various Residential buildings.
CO2 Apply the concept of arc welding in welding of steel plate.
CO3 Analyze the basics of machining operations and sheet metal works.
CO4 Apply the various electrical joints in common household electrical wire work.
CO5 Apply the basic concept of assemble and testing of simple electronic components on PCB.

CO – PO – PSO MAPPING:

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

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U23CS202	DATA STRUCTURES LABORATORY	L	T	P	C
Prerequisites:	**C Programming**	0	0	3	1.5

COURSE OBJECTIVES:

- To apply Stack, Queue and List ADT's operations for solving a given problem.
- To solve various operations like traversal, insertion, deletion on tree and graph data structure.
- To analyze various kinds of searching and sorting techniques.

LIST OF EXPERIMENTS

1 Implementation of Stack, Queue ADT using array.
2 Implementation of Singly linked list.
3 Linked list implementation of Stack and Linear Queue ADTs.
4 Implementation of Polynomial Manipulation using Linked list.
5 Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion.
6 Implementation of Binary Search Trees.
7 Implementation of Heaps.
8 Tree representation and traversal algorithms.
9 Graph representation and traversal algorithms.
10 Implementation of Searching Algorithms.
11 Implementation of Selection and Insertion Sort.
12 Implementation of Merge and Bubble Sort.
13 Implementation of Hash tables.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Apply Stack, Queue and List ADT's operations for solving a given problem

CO2 Solve various operations like traversal, insertion, deletion on tree data structure.

CO3 Solve various applications using graph algorithms.

CO4 Analyze various kinds of searching and sorting techniques

CO5 Apply appropriate hashing techniques for the given problem

CO – PO – PSO MAPPING:

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

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U23MA304	PROBABILITY AND STATISTICS	L	T	P	C
Pre requisites: Engineering Mathematics		3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and two dimensional random variables.
- To acquaint the knowledge of random processes which plays an important role in real life problems.
- To introduce the concepts of design of experiments which plays important roles in the field of agriculture and statistical.

UNIT I **PROBABILITY AND RANDOM VARIABLES** **12**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II **TWO DIMENSIONAL RANDOM VARIABLES** **12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

UNIT III **RANDOM PROCESSES** **12**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations.

UNIT IV **DESIGN OF EXPERIMENTS** **12**

One way and Two way classifications - Completely randomized design –Randomized block design – Latin square design.

UNIT V **STATISTICAL QUALITY CONTROL** **12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

TEXT BOOKS:

1 P Sivaramakrishna Das, C Vijayakumari, "Probability and Statistics", 2nd Edition, Pearson Education, 2020.

2 R E Walpole, R H Myers, S L Myers and K Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, 2021.

REFERENCES:

1 Richard A Johnson, "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, 2018

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2 Geoffrey Grimmett, David Stirzaker, "Probability and Random Processes", 4th Edition, Oxford University Press, 2020.
3 Anthony Croft, Robert Davison, "Mathematics for Engineers", 5th Edition, Pearson Education, 2019.

ONLINE RESOURCES:

1 https://freevideolectures.com/course/4941/nptel-probabilitystatistics
2 https://cosmolearning.org/courses/introduction-probabilitystatistics/video-lectures/
3 https://nptel.ac.in/courses/111105041/

COURSE OUTCOMES:

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

CO1 Apply the concept of probability and standard distributions in real life problems.

CO2 Analyze the concepts of two-dimensional random variables.

CO3 Apply the concept of random processes in engineering disciplines.

CO4 Analyze the concepts of design of experiments using ANOVA.

CO5 Apply the control charts for measurements in statistical quality control.

CO – PO – PSO MAPPING:

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

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U23EC301 **DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION** **L T P C**

Prerequisites: Nil **3 0 2 4**

COURSE OBJECTIVES:

- To present the fundamentals of digital circuits and simplification methods
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits.
- To understand the basic structure and operation of a digital computer.

UNIT I **BASIC CONCEPTS** **9**

Review of number systems-representation-conversions, Review of Boolean algebra – theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions-Karnaugh map, Implementation of Boolean expressions using universal gates.

UNIT II **COMBINATIONAL LOGIC CIRCUITS** **9**

Problem formulation and design of combinational circuits – Code-Converters (Binary to Gray code, Gray to Binary, BCD to Excess-3 code,Excess-3 to BCD), Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Mux/Demux, Case study: Digital trans-receiver Parity Generator/Checker, Seven Segment display decoder

UNIT III **SEQUENTIAL CIRCUITS** **9**

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, Counters, Shift registers, Stable and Unstable states, output specifications, Hazards, Essential Hazards, Design of Hazard free circuits.

UNIT IV **COMPUTER FUNDAMENTALS** **9**

Functional Units of a Digital Computer: Von Neumann Architecture and Harvard Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes.

UNIT V **PROCESSOR AND MEMORY** **9**

Instruction Execution – Building a Data Path- Pipelining- basic memory, static ROM, PROM, EPROM, EEPROM, Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA.

45 PERIODS

PRACTICAL EXERCISES:

1 Verification of Boolean theorems using logic gates.

2 Design and implementation of combinational circuits using gates for arbitrary functions.

3 Implementation of 4-bit binary adder/subtractor circuits.

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4 Implementation of code converters.

5 Implementation of BCD adder, encoder and decoder circuits

6 Implementation of functions using Multiplexers.

7 Implementation of the synchronous counters and shift register.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 M Morris Mano, Michael D Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", 6th Edition, Pearson Education, 2020.

2 David A Patterson, John L Hennessy, "Computer Organization and Design, The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, 2020.

REFERENCES:

1 Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, 2022.

2 William Stallings, "Computer Organization and Architecture – Designing for Performance", 11th Edition, Pearson Education, 2022.

3 M Morris Mano, "Digital Logic and Computer Design", 6th Edition, Pearson Education, 2018.

ONLINE RESOURCES

1 https://archive.nptel.ac.in/courses/117/105/117105078

2 https://www.coursera.org/courses?query=computer%20architecture

3 https://onlinecourses.nptel.ac.in/noc21_ee39/preview

COURSE OUTCOMES:

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

CO1 Apply Boolean Algebra and Simplification procedures relevant to digital logic.
CO2 Design various combinational digital circuits using logic gates.
CO3 Design synchronous and asynchronous sequential digital circuits using logic gates.
CO4 Summarize the basic structure and operation of a digital computer.
CO5 Analyze the data path unit of processor and concept of various memories.

CO – PO – PSO MAPPING:

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

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U23CS301 FOUNDATION OF DATA SCIENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION 9

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

UNIT II PYTHON LIBRARIES FOR DATA WRANGLING 9

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

UNIT III DATA VISUALIZATION 9

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

UNIT IV DESCRIPTIVE STATISTICS 9

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

UNIT V DESCRIBING RELATIONSHIPS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Jake VanderPlas, "Python Data Science Handbook", O'Reilly, Second Edition,2022.

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2 Hands-On Exploratory Data Analysis with Python Paperback – Import, 30 March 2020.

REFERENCES:

1 Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,latest edition 2020.

2 David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.

3 Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

ONLINE RESOURCES:

1 http://www.digimat.in/nptel/courses/video/106105186/L01.html.

2 https://onlinecourses.swayam2.ac.in/imb24_mg31/preview

3 https://onlinecourses.nptel.ac.in/noc24_cs54/preview

COURSE OUTCOMES:

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

CO1 Summarize the Data Science Process.

CO2 Explain the Python Libraries for Data Wrangling.

CO3 Describe Visualization Libraries in Python to interpret and explore data.

CO4 Explain the different types of data description for data science process.

CO5 Explain the relationships between data.

CO – PO – PSO MAPPING:

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

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U23CS302	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Prerequisites: **Data Structures**

COURSE OBJECTIVES:

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques.
- To understand the fundamental concepts of transaction, concurrency and recovery processing, internal storage structures using different file and indexing techniques and Advanced Data bases.

UNIT I **RELATIONAL DATABASES** **9**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL.

UNIT II **DATABASE DESIGN** **9**

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

UNIT III **TRANSACTIONS** **9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking-Timestamp – Multi version – Validation and Snapshot isolation– Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update.

UNIT IV **IMPLEMENTATION TECHNIQUES** **9**

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

UNIT V **ADVANCED TOPICS** **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 8th Edition, Tata McGraw Hill, 2021.

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2 Ramez Elmasri, Shamkant B Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2018.

REFERENCES:

1 Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 4th Edition, Tata McGraw Hill, 2021.
2 Jeffrey A Hoffer, Ramesh Venkataraman, Heikki Topi, "Modern Database Management", 14th Edition, Pearson Education, 2022.
3 Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems: The Complete Book", 3rd Edition, Pearson Education, 2021.

ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/106/105/106105175/
2 https://www.coursera.org/articles/relational-database
3 https://archive.nptel.ac.in/courses/106105174/

COURSE OUTCOMES:

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

CO1 Write SQL Queries using SQL commands and Relational Algebra.

CO2 Design Database using E-R Model and Normalize the database.

CO3 Summarize transaction Concepts, Concurrency and Recovery Techniques.

CO4 Describe Internal Storage Structures using files, Indexing, Hashing and Query Optimization.

CO5 Comprehend Advanced Data bases and Database Security.

CO – PO – PSO MAPPING:

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

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U23CS303	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	2	4

Prerequisites: Programming in C

COURSE OBJECTIVES:

- To understand the Object Oriented Programming concepts using Java
- To develop Java application with threads, generic classes, exceptions and use I/O streams.
- To design and build Graphical User Interface Application using JAVAFX.

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java –Constructors-Methods -Access specifiers - Static members- Java Doc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces:Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: GenericProgramming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls –ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

45 PERIODS

PRACTICAL EXERCISES:

1 Solve problems by using sequential search and binary search.

2 Develop stack and queue data structures using classes and objects.

3 Solve the above problem using an interface.

4 Implement exception handling and creation of user defined exceptions.

5 Write a program to perform file operations.

6 Develop applications to demonstrate the features of generics classes.

7 Develop applications using JavaFX controls, layouts and menus.

30 PERIODS

TOTAL: 75 PERIODS

TEXT BOOKS:

1 Herbert Schildt, "Java: The Complete Reference", 11th Edition, Tata McGraw Hill, 2019.

2 Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, Tata McGraw Hill, 2018.

REFERENCES:

1 Cay S Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.

2 Y Daniel Liang, "Introduction To Java Programming, Comprehensive", 10th Edition, Pearson Education, 2018.

3 Walter Savitch, "Java An Introduction To Problem Solving And Programming", Pearson Education, 2019.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc22_cs47

2 https://www.w3schools.com

3 https://jenkov.com/tutorials/javafx

COURSE OUTCOMES:

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

CO1 Comprehend OOPS concept and basic concepts of JAVA.

CO2 Apply the principles of inheritance, packages and interfaces

CO3 Apply features of exception handling and multithreading in Java program.

CO4 Develop Java applications with I/O, Generic and string handling.

CO5 Design Java application using JAVAFX Event handling.

CO – PO – PSO MAPPING:

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

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U23CS403	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

Prerequisites: Data Structures

COURSE OBJECTIVES:

- To understand foundations of computation including automata theory with regular expressions and languages.
- To design Normal Forms and Turning machines.
- To design context free grammar and push down automata.

UNIT I **AUTOMATA AND REGULAR EXPRESSIONS** **9**

Need for automata theory - Introduction to formal proof – Finite Automata (FA) Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) Equivalence between NFA and DFA-Finite Automata with Epsilon transitions – Equivalence of NFA and DFA- Equivalence of NFAs with and without ε-moves- Conversion of NFA into DFA – Minimization of DFAs.

UNIT II **REGULAR EXPRESSIONS AND LANGUAGES** **9**

Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions-Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages.

UNIT III **CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA** **9**

Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG Deterministic Pushdown Automata.

UNIT IV **NORMAL FORMS AND TURING MACHINES** **9**

Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) – Pumping lemma for CFL – Closure properties of Context Free Languages –Turing Machine: Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions Programming techniques for Turing machines (subroutines).

UNIT V **POWER DEVICES AND DISPLAY DEVICES** **9**

Unsolvable Problems and Computable Functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine -Tractable and Intractable problems-P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem- 3-CNF SAT problems.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1 Dexter C Kozen, "Theory of Computation", 2nd Edition, Springer, 2020.
2 Manish K Sah, Sagar Khandelwal, "Theory of Computation", 6th Edition, Ashirwad, 2019.

REFERENCES:

1 J E Motwani R, Ullman J D, "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2017.
2 K L P Mishra, N Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2018.
3 Varsha H Patil, Vaishali S Pawar, "Theory of Computation Simplified: Simulate Real-world Computing Machines and Problems with Strong Principles of Computation", BPB Publications, 2022.

ONLINE RESOURCES:

1 http://www.digimat.in/nptel/courses/video/106104148/L01.html
2 https://www.classcentral.com/course/youtube-toc-theory-of-computation-46804
3 https://archive.nptel.ac.in/courses/106/104/106104148/

COURSE OUTCOMES:

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

CO1 Describe Automata Theory by using Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata.
CO2 Apply Regular expressions for any pattern.
CO3 Design context free grammar with Derivations with parse trees and Languages Push Down Automata with equivalence.
CO4 Design Turing machine for computational functions of CNF, CFG and GNF.
CO5 Explain Undecidable, Tractable , Intractable problems and Kruskal's algorithms.

CO – PO – PSO MAPPING:

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

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U23CS304 **DATA SCIENCE LABORATORY**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To develop data analytic code in python
- To be able to use python libraries for handling data.
- To develop analytical applications using python and perform data visualization using plots.

LIST OF EXPERIMENTS

1. Working with Numpy arrays: Perform array operations, aggregations, Boolean logic, and broadcasting.
2. Practice indexing, slicing, filtering, and reshaping data with Pandas.
3. Aggregate data using groupby, merge/join datasets, and work with hierarchical indexes.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Basic plots and Three dimensional plotting using Matplotlib.
6. Visualizing Geographic Data with Basemap using Matplotlib.
7. Describe data using tables, bar charts, histograms, pie charts, and compute mean, median, mode, variance, and standard deviation.
8. Calculate z-scores and visualize normal distribution.
9. Compute correlation coefficients and visualize relationships using scatter plots.
10. Perform simple linear regression, plot the regression line, and interpret R^2.0

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Summarize the python libraries for data science.
CO2	Design a descriptive analysis on the benchmark dataset.
CO3	Design data using visualization packages in python.
CO4	Design Correlation and Regression Analytics on standard data set.
CO5	Design the basic statistical and probability measures for data Science.

CO – PO – PSO MAPPING:

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

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U23CS305 DATABASE MANAGEMENT SYSTEMS LABORATORY **L T P C**

Prerequisites: Programming in C **0 0 3 1.5**

COURSE OBJECTIVES:

- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn how to use database management systems.

PRACTICAL EXERCISES

1. Implementation of DDL commands of SQL with suitable examples
2. Implementation of DML commands of SQL with suitable examples
3. Implementation of different types of where clause conditions and also implement aggregate functions in SQL.
4. Implementation of different types of operators in SQL
5. Implementation of different types of Joins
6. Study and implementation of sub queries in SQL.
7. Study and implementation of pattern matching in SQL.
8. Study and implementation of different types of constraints.
9. Write user defined functions in SQL.
10. Write stored procedures in SQL
11. Execute complex transactions and realize DCL and TCL commands. Write SQL Triggers for insert, delete, and update operations in database table.
12. Write SQL Triggers for insert, delete, and update operations in database table.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Create databases with different types of key constraints.

CO2 Analyze simple and complex SQL queries using DML and DCL commands.

CO3 Apply advanced features such as stored procedures and triggers incorporate in GUI based application development

CO4 Create an XML database and validate with meta-data(XML schema)

CO5 Create and manipulate data using NOSQL database

CO – PO – PSO MAPPING:

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

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U23EEC301	EMPLOYABILITY SKILLS – I	L	T	P	C
Prerequisites: Nil		0	0	2	1

COURSE OBJECTIVES:

- To educate and enrich the students on quantitative aptitude, logical reasoning and written communication.

UNIT I **QUANTITATIVE APTITUDE – PART 1** **6**

Numbers: Number system – Squaring of Numbers – Square Roots – Cube Roots – Divisibility – HCF, LCM – Decimals – Clocks.

UNIT II **QUANTITATIVE APTITUDE – PART 2** **6**

Averages – problem on Ages – Ratio & Proportion – Mixture and Allegations.

UNIT III **LOGICAL REASONING – PART – 1** **6**

Alphabet Test Series – Number Test Series– Analogies – Odd Words – Statement & Conclusions – Blood Relations – Odd man out.

UNIT IV **EFFECTIVE ENGLISH – SPOKEN ENGLISH** **6**

Basic Rules of Grammar – Parts of Speech – Tenses – Verbs – Sentences construction – Vocabulary – idioms & phrases – Synonyms – Antonyms – Dialogues and conversation – Exercise (Speaking).

UNIT V **WRITTEN COMMUNICATION – PART 1** **6**

Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition – Change of Voice – Change of Speech.

TOTAL: 30 PERIODS

TEXT BOOKS:

1 R S Aggarwal, "Quantitative Aptitude", Revised Edition, S Chand & Co Ltd., 2017.

2 R S Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand & Co Ltd., 2018.

REFERENCES:

1 Abhijit Guha, "Quantitative Aptitude", 3rd Edition, Tata McGraw Hill, 2009.

2 Raj N Bakshmi, "English Grammar Practice," 1st Edition, Orient Black Swan, 2009.

3 M Ashra Rizvi, "Effective Technical Communication," 2nd Edition, Tata McGraw Hill, 2017.

4 Norman Lewis, "Word Power Made Easy", W.R. Goyal Publishers, 2020.

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U23CS401	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	2	4

Prerequisites : Problem Solving and Python Programming

COURSE OBJECTIVES:

- To explore uninformed and heuristic search techniques.
- To acquire knowledge in reasoning under uncertainty.
- To introduce supervised learning algorithms and delve into Machine Learning.

UNIT I **PROBLEM SOLVING** **9**

Introduction to AI - AI Applications - Problem solving agents – search algorithms uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search– constraint satisfaction problems (CSP).

UNIT II **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.

UNIT III **SUPERVISED LEARNING** **9**

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Linear Classification Models: Discriminant function -Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier, Decision Trees: ID3, Classification and Regression Trees (CART), Support vector machines.

UNIT IV **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 V **ARTIFICIAL NEURAL NETWORKS** **9**

Neural Network Representation – Problems – Perceptrons, Activation Functions, Artificial Neural Networks (ANN) , Back Propagation Algorithm -Convolutional Neural Networks - Convolution and Pooling layers, Recurrent Neural Networks (RNN).

45 PERIODS

PRACTICAL EXERCISES:

1 Implementation of Uninformed search algorithms (BFS, DFS).

2 Implementation of Informed search algorithms (A*, memory-bounded A*).

3 Implement naïve Bayes models.

4 Implement Bayesian Networks.

5 Build Regression models.

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6 Build decision trees and random forests.

7 Build simple NN models.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education, 2021.
2 Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, MIT Press, 2020.

REFERENCES:

1 Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education, 2020.
2 Kevin Night, Elaine Rich, Nair B, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2019.
3 Kevin P Murphy, "Probabilistic Machine Learning: An Introduction", MIT Press, 2022.

ONLINE RESOURCES

1 https://towardsdatascience.com/machine-learning-probability-statistics-f830f8c09326
2 https://nptel.ac.in/courses/106/105/106105152/
3 https://nptel.ac.in/courses/117105084

COURSE OUTCOMES:

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

CO1 Apply search-based problem-solving methods for AI applications.
CO2 Apply the Bayesian concepts to machine learning problems.
CO3 Apply the concept of Supervised learning models.
CO4 Analyze the strategy for ensembling and unsupervised learning.
CO5 Summarize the significant features of neural networks.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
CO1	3	2	1	2	1	-	-	1	2	2	-	-	3	3
CO2	3	2	1	2	1	-	-	1	2	2	-	-	3	3
CO3	3	2	1	2	1	-	-	1	2	2	-	1	3	3
CO4	3	3	2	2	1	-	-	1	2	2	-	-	3	3
CO5	2	2	1	1	1	-	-	1	2	2	-	-	3	2

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U23CS402	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	2	4

Prerequisites: Data Structures

COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques.
- To understand efficiency and design techniques of different algorithm.
- To understand the basic concepts of NP completeness and approximation algorithm.

UNIT I INTRODUCTION 9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT II GRAPH ALGORITHMS 9

Graph algorithms: Representations of graphs – Graph traversal: DFS – BFS - applications – Connectivity, strong connectivity, bi-connectivity – Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm – Dijkstra's algorithm – Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum – Merge sort – Quick sort Dynamic programming: Elements of dynamic programming – Matrix-chain multiplication – Multi stage graph – Optimal Binary Search Trees, Greedy Technique: Elements of the greedy strategy – Activity – selection problem – Optimal Merge pattern – Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem – Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem – Assignment problem – Knapsack Problem – Travelling Salesman Problem.

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Lower – Bound Arguments – P, NP NP – Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

45 PERIODS

PRACTICAL EXERCISES:

1 Implement Linear Search. Determine the time required to search for an element.

2 Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.

3 Implement recursive Binary Search. Determine the time required to search an element.

4 Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.

5 Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char

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txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.

6 Develop a program to implement graph traversal using Breadth First Search.

7 Develop a program to implement graph traversal using Depth First Search.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 S Sridhar, "Design and Analysis of Algorithms", 2nd Edition, Oxford University Press, 2023.

2 Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", 4 th Edition, MIT Press, 2022.

REFERENCES:

1 Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2018.

2 Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of computer Algorithms", 2nd Edition, Universities Press, 2018.

3 Ethem Alpaydin, "Introduction to Algorithms", 4 th Edition, MIT Press, 2020.

ONLINE RESOURCES

1 http://nptel.ac.in/courses/106106131

2 http://nptel.ac.in/courses/106101059

3 https://www.coursera.org/learn/advanced-algorithms-and-complexity

COURSE OUTCOMES:

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

CO1 Analyze search, sort and string matching algorithms to compute their efficiency.

CO2 Apply graph algorithms to solve problems and analyze their efficiency.

CO3 Apply algorithm design techniques like divide & conquer, dynamic programming and greedy techniques to solve problems.

CO4 Apply the state space tree method for solving problems.

CO5 Solve problems using approximation algorithms and NP-Complete.

CO – PO – PSO MAPPING:

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

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U23CS404	OPERATING SYSTEMS	L	T	P	C
Prerequisites: NIL		3	0	0	3

COURSE OBJECTIVES:

- To acquire basic knowledge on computer operating system structures and functioning and Processes, Thread and analyze the scheduling algorithm, Process Synchronization and concept of deadlocks.
- To analyze various memory management, I/O management and File Systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android

UNIT I INTRODUCTION TO OPERATING SYSTEM 7

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

UNIT II PROCESS MANAGEMENT 11

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling -Scheduling criteria - Scheduling algorithms. The critical-section problem - Mutex- Semaphores - Classic problems of synchronization – Monitors - Deadlock characterization - Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection and Recovery .

UNIT III MEMORY MANAGEMENT 10

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

UNIT IV STORAGE MANAGEMENT 10

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

UNIT V VIRTUAL MACHINES AND MOBILE OS 7

Virtual Machines — History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

TOTAL :45 PERIODS

TEXT BOOKS:

1 C Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc, 2021.

2 William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Prentice Hall, 2019.

REFERENCES:

1 AchyutS.Godbole, Atul Kahate, "Operating Systems", 2nd Edition, McGraw Hill Education, 2018.

2 Andrew S. Tanenbaum, "Modern Operating Systems", 5th Edition, Pearson Eduction, 2022.

ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/106/105/106105214/

2 https://onlinecourses.nptel.ac.in/noc20_cs04/preview

3 https://www.youtube.com/watch?v=3Qfx4geYN91

COURSE OUTCOMES:

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

CO1 Comprehend the basic concepts and functions of operating systems.

CO2 Apply various CPU scheduling algorithms, Synchronization primitives and deadlock, handling methods.

CO3 Apply the Various memory management schemes and page replacement .

CO4 Apply the various disk scheduling algorithms, file system implementation and Security mechanism.

CO5 Describe the basics of Virtualization and Mobile OS.

CO – PO – PSO MAPPING:

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

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U23CS405	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Prerequisites : Nil

COURSE OBJECTIVES:

- To understand the concept of layering in networks and to know the functions of protocols of each layer.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the transport layer.

UNIT I INTRODUCTION AND APPLICATION LAYER 9

Data Communication – Networks – Network Types – Protocol Layering – TCP/IP Protocol suite –OSI Model – Introduction to Sockets – Application Layer protocols: HTTP – FTP – Email protocols (SMTP – POP3 – IMAP – MIME) – DNS – SNMP.

UNIT II TRANSPORT LAYER 9

Introduction – Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control –Congestion Control – Congestion avoidance (DECbit, RED) – SCTP – Quality of Service.

UNIT III NETWORK LAYER 9

Switching : Packet Switching – Internet protocol – IPV4 – IP Addressing – Subnetting – IPV6, ARP, RARP, ICMP, DHCP.

UNIT IV ROUTING 9

Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing– OSPF– Path-vector routing – BGP – Multicast Routing: DVMRP – PIM.

UNIT V DATA LINK AND PHYSICAL LAYERS 9

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC –PPP – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11)–Physical Layer: Data and Signals – Performance – Transmission media- Switching – Circuit Switching.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 James F Kurose, Keith W Ross, "Computer Networking A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2021.

2 Behrouz A Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", 6th Edition, Tata McGraw Hill, 2022.

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REFERENCES:

1 Larry L Peterson, Bruce S Davie, "Computer Networks A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, 2018.
2 William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2019.
3 Nader F Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2018.

ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/106/105/106105183.
2 https://archive.nptel.ac.in/courses/106/105/106105154/
3 https://archive.nptel.ac.in/courses/106/106/106106168/

COURSE OUTCOMES:

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

CO1 Summarize the basic layers and various application layer protocols.
CO2 Comprehend the transport layer protocols, congestion control and avoidance techniques.
CO3 Describe the switching techniques and various protocols on the network layer.
CO4 Analyze various routing algorithms and protocols.
CO5 Comprehend the data flow in data link layer and physical layer.

CO – PO – PSO MAPPING:

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

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U23AI401	STATISTICAL INFERENCE	L	T	P	C
		3	0	0	3

Pre requisites : Probability and Statistics

COURSE OBJECTIVES:

- To understand the techniques and processes of data science
- To apply descriptive data analytics
- To visualize data for various applications

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 PREDICTIVE 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 r2 – multiple regression equations – regression toward the mean.

UNIT III INFERENTIAL STATISTICS AND ESTIMATION 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 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 Stats Models – multiple regression – nonlinear relationships logistic regression – estimating parameters – Time series analysis – moving averages missing values –serial correlation – autocorrelation. Introduction to survival analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 David Cielen, Arno D B Meysman, Mohamed Ali, "Introducing Data Science", 1st Edition, Manning Publications, 2018.
2 Robert S Witte, John S Witte, "Statistics", 11th Edition, John Wiley & Sons, 2019.

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REFERENCES:

1 Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", 2nd Edition, Green Tea Press, 2018.

2 Sanjeev J Wagh, Manisha S Bhende, Anuradha D Thakare, "Fundamentals of Data Science", 1st Edition, CRC Press, 2022.

ONLINE RESOURCES:

1 https://warwick.ac.uk/fac/sci/statistics/apts/students/resources-1415/apts_si.pdf

2 https://onlinecourses.nptel.ac.in/noc23_ma28/preview

3 https://onlinecourses.nptel.ac.in/noc20_ma19/preview

COURSE OUTCOMES:

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

CO1 Explain the data analytics pipeline

CO2 Analyze visualize data

CO3 Summarize statistical inferences from data

CO4 Analyze the concepts of design of experiments using ANOVA

CO5 Analyze models for predictive analytics

CO – PO – PSO MAPPING:

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

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U23MX01	PERSONAL VALUES	L	T	P	C
Prerequisites: Nil		2	0	0	0

COURSE OBJECTIVES:

- To understand the values through practical activities.
- To understand about physical and mental well-being.
- To know about meditation methods.

UNIT I **SELF CONCEPT** **6**

Understanding self-Concept – Identify Yourself – Who am I – an individual, Engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II **INDIVIDUAL VALUES** **6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, and Responsibility – Measuring personal values.

UNIT III **MORAL VALUES** **6**

Understanding self-Concept – Identify Yourself – Who am I – an individual, engineer, and citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life. Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values
Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV **PHYSICAL AND MENTAL WELL-BEING** **6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness.

UNIT V **DECISION MAKING** **6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness.

TOTAL: 30 PERIODS

REFERENCES:

1 Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2 B. N. Ghosh, "Managing Soft Skills for Personality Development", Tata McGraw Hill, 2012.

COURSE OUTCOMES:

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

CO1 Become an individual in knowing the self.

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CO2 Acquire and express Personal Values, Spiritual values and fitness.

CO3 Practice simple physical exercise and breathing techniques.

CO4 Practice Yoga asana which will enhance the quality of life.

CO5 Practice Meditation and get benefitted.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	1	-	-	-	1
CO2	-	-	-	-	-	-	-	1	-	-	-	1
CO3	-	-	-	-	-	-	-	1	-	-	-	1
CO4	-	-	-	-	-	-	-	1	-	-	-	1
CO5	-	-	-	-	-	-	-	1	-	-	-	1

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U23CS407 **OPERATING SYSTEMS LABORATORY** L T P C

Prerequisites Programming in C 0 0 3 1.5

COURSE OBJECTIVES:

- To install windows operating systems.
- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.

PRACTICAL EXERCISES

1. Illustrate UNIX commands and Shell Programming.
2. Process Management using System Calls: Fork, Exit, Getpid, Wait, Close.
3. Write C programs to implement the various CPU Scheduling Algorithms.
4. Write C programs to avoid Deadlock using Banker's Algorithm.
5. Write C program to implement Threading.
6. Implement the paging Technique using C program.
7. Write C programs to implement the following Memory Allocation Methods
   a. First Fit b. Worst Fit c. Best Fit
8. Write C programs to implement the various Page Replacement Algorithms.
9. Implement the following File Allocation Strategies using C programs
   a. Sequential b. Indexed c. Linked
10. Write C programs for the implementation of various disk scheduling algorithms.

COURSE OUTCOMES: **TOTAL :45 PERIODS**

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

CO1 Design and implement UNIX Commands, Shell Programming and System calls.
CO2 Write the Program for various CPU Scheduling and Deadlock using Banker's algorithms.
CO3 Design the Program for Threading and Paging.
CO4 Create Program for Memory Allocation Methods and Page Replacement Algorithms.
CO5 Design the Program for File allocation and various disk Scheduling Algorithms.

CO – PO – PSO MAPPING:

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

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U23CS408	COMPUTER NETWORKS LABORATORY	L	T	P	C
Prerequisites:	**Data Base Management Systems Laboratory**	0	0	3	1.5

COURSE OBJECTIVES:

- To understand socket programming.
- To learn various networking protocols.
- To understand various routing algorithms and congestion control algorithms.

LIST OF EXPERIMENTS:

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and trace route Capturing and trace route PDUs using a network protocol analyzer and examine.
2. Applications using TCP Sockets like a) Echo client and echo server, b) Chat
3. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
4. Write a HTTP web client program to download a web page using TCP sockets.
5. Implementation of Remote Command Execution.
6. Simulation of DNS using UDP sockets.
7. Implementation of Remote Method Invocation
8. Write a code simulating ARP /RARP protocols.
9. Implementation of Subnetting.
10. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
11. Simulation of Distance Vector/ Link State Routing algorithm.
12. Simulation of an error correction code (like CRC).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Write commands and program for packets capturing and traceroute.
CO2 Create applications using TCP and UDP Sockets.
CO3 Write program for simulating ARP/RARP protocols.
CO4 Write program for Subnetting.
CO5 Write commands and program for packets capturing and traceroute.

CO – PO – PSO MAPPING:

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

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U23EEC401	EMPLOYABILITY SKILLS – II	L	T	P	C
Prerequisites: Nil		0	0	2	1

COURSE OBJECTIVES:

- To educate and enrich the students on quantitative aptitude, logical reasoning and written communication.

UNIT I **QUANTITATIVE APTITUDE PART – 3** **6**

Percentages – Profit and Loss – Simple Interest & Compound Interest – logarithms.

UNIT II **QUANTITATIVE APTITUDE PART – 4** **6**

Algebra – Linear Equation – Quadratic equation – Polynomials – Time and Distance – Problems on train – Time and Work.

UNIT III **LOGICAL REASONING PART – 2** **6**

Coding and Decoding – Data Sufficiency – Seating Arrangement – syllogism.

UNIT IV **WRITTEN COMMUNICATION PART – 2** **6**

Sentences Formation – Sentence Completion - Sentence Correction – Jumbled Sentences – Letter Drafting – Reading Comprehension – Contextual Usage.

UNIT V **WRITTEN COMMUNICATION PART – 3** **6**

Practices: Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms and Antonyms – Using the same word as different parts of speech – Interpretation of Pictorial Representations – Editing.

TOTAL: 30 PERIODS

TEXT BOOKS:

1 R S Aggarwal, "Quantitative Aptitude", Revised Edition, S Chand & Co Ltd., 2017.

2 R S Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand & Co Ltd., 2018.

REFERENCES:

1 Abhijit Guha, "Quantitative Aptitude", 3rd Edition, Tata McGraw Hill, 2009.

2 Raj N Bakshmi, "English Grammar Practice," 1st Edition, Orient Black Swan, 2009.

3 M Ashra Rizvi, "Effective Technical Communication," 2nd Edition, Tata McGraw Hill, 2017.

4 Norman Lewis, "Word Power Made Easy", W.R. Goyal Publishers, 2020.

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U23AI501	DEEP LEARNING WITH CHATBOT	L	T	P	C
Prerequisites:	Foundation of Data Science	3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of deep network.
- To gain knowledge about CNN.
- To design baseline models.

UNIT I **DEEP NETWORK BASICS** 9

Linear Algebra: Scalars - Vectors - Matrices and tensors; Probability Distributions - Gradient-based Optimization – Machine Learning Basics: Capacity - Overfitting and underfitting -Hyperparameters and validation sets – Estimators - Bias and variance - Stochastic gradient descent.

UNIT II **CONVOLUTIONAL NEURAL NETWORKS** 9

Convolution Operation - Sparse Interactions - Parameter Sharing - Equivariance - Pooling - Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions - Regularization - Optimizers - Gradient Computation.

UNIT III **RECURRENT NEURAL NETWORK** 9

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder -Transducer; Gradient Computation - Sequence Modeling Conditioned on Contexts - Bidirectional RNN - Sequence to Sequence RNN – Deep Recurrent Networks -Recursive Neural Networks.

UNIT IV **MODEL EVALUATION** 9

Performance metrics - Baseline Models - Hyperparameters: Manual Hyperparameter - Automatic Hyperparameter - Grid search - Random search - Debugging strategies.

UNIT V **AUTOENCODERS AND GENERATIVE MODELS** 9

Autoencoders: Undercomplete autoencoders - Regularized autoencoders - Stochastic encoders and decoders - Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Navin Kumar Manaswi, "Deep Learning with Applications Using Python: Chatbots and Face, Object, and Speech Recognition with TensorFlow and Keras ", 2nd Edition, Apress Publication, 2020.

2 Andrew Glassner, "Deep Learning: A Visual Approach", 1st Edition, No Starch Press, 2021.

REFERENCES:

1 Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, "A Guide to Convolutional Neural Networks for Computer Vision, Synthesis Lectures on Computer Vision", 1st Edition, Morgan & Claypool Publishers, 2018.

2 Yoav Goldberg, "Neural Network Methods for Natural Language Processing, Synthesis Lectures on Human Language Technologies", 2ndEdition, Morgan & Claypool Publishers, 2021.

3 Francois Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2018.

ONLINE RESOURCES:

1 https://medium.com/@Coursesteach/best-free-resources-to-learn-deep-learning-dl-a301d809c41d

2 https://www.deeplearning.ai/resources/

3 https://www.kaggle.com/discussions/getting-started/37999

COURSE OUTCOMES:

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

CO1 Explain the basics in deep neural networks.

CO2 Apply Convolution Neural Network for image processing.

CO3 Apply Recurrent Neural Network and its variants for text analysis.

CO4 Apply model evaluation for various applications.

CO5 Design auto encoders and generative models for suitable application.

CO – PO – PSO MAPPING:

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

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U23AI502 **BIG DATA ANALYTICS** L T P C
3 0 0 3

Prerequisites: Data Structures

COURSE OBJECTIVES:

- To understand big data and Hadoop
- To learn and use NoSQL big data management and mapreduce analytics using Hadoop and related tools.
- To understand the usage of Hive and Hbase

UNIT I **INTRODUCTION OF BIG DATA** 9

Introduction to big data – convergence of key trends – unstructured data – web analytics – big data applications– big data technologies – introduction to Hadoop – open-source technologies – cloud and big data – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II **NOSQL DATA MANAGEMENT AND CASSANDRA** 9

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schema less databases –distribution models – master-slave replication - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III **BASICS OF HADOOP CONCEPTS** 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

UNIT IV **MAP REDUCE APPLICATIONS** 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT V **HBASE AND HIVE DATA MODELS** 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Dr. Jugnesh Kumar, Dr. Anubhav Kumar, Dr. Rinku Kumar, "Big Data and Analytics ", 1st Edition, BPB Publications, 2024.

2 Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, John Wiley & Sons, 2019.

REFERENCES:

1 Bhushan Mayank, "Big Data and Hadoop", 2nd Edition, BPB Publications, 2023.

2 Raj Kamal, Preethi Saxena, "Big Data Analytics", 1st Edition, Tata McGraw Hill, 2019.

3 Simhadri Govindappa, " Big Data Analytics with Apache Hadoop", 1st Edition, Orange Education, 2024.

ONLINE RESOURCES:

1 https://www.digimat.in/nptel/courses/video/106104189/L07.html
2 https://www.coursera.org/in/articles/big-data-analytics
3 https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics

COURSE OUTCOMES:

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

CO1 Describe big data and Hadoop introduction.

CO2 Explain NoSQL big data management and Cassandra.

CO3 Design, configure and run Hadoop and HDFS.

CO4 Create map-reduce analytics using Hadoop.

CO5 Apply Hadoop-related tools such as HBase, Cassandra, Hive.

CO – PO – PSO MAPPING:

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

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U23AI503 **CREATIVE THINKING** L T P C
3 0 2 4

Prerequisites: Statistical Inference

COURSE OBJECTIVES:

- To understand collaborating team work and innovation.
- To analyze different opinion and logical reasoning.
- To explain various arguments and Problem Solving.

UNIT I **INTRODUCTION** 9

What is critical thinking – 21st century skills – collaboration and teamwork discussions – focus on creativity and Imagination – problem solving (oral and written communication activities)- importance of thinking critically- multiple intelligences.

UNIT II **FOSTERING AND REASONING** 9

Fostering critical thinking- statement of facts and opinions – inference of assumptions & evidences - logical reasoning – deductive & inductive reasoning – changing perspectives – (choice of appropriate words& expressions, perceived logical linkages, avoidance of irrelevance).

UNIT III **FOSTERING AND REASONING** 9

Claims, issues & arguments – Ambiguities in argument – jargon, emotional barriers and their influence on reasoning - Semantic disagreements (Vocabulary specific to the linguistic acts of disagreeing & disputing) – Inconsistencies in an argument - Discourse rules in group Discussion.

UNIT IV **GENERALIZATION AND FALLACIES** 9

Detecting Fallacies (Hasty Generalizations, Circular argument, Red herring) – Types of Fallacies – Making inferences – Drawing conclusions – Conceptualization of ideas - Analysis & synthesis of ideas - Evaluating information - Scientific reasoning (thinking about many dimensions at the same time).

UNIT V **PROBLEM SOLVING** 9

Internet & critical thinking (using the internet as a resource) – Collaborative problem solving, Creative critical thinking (analyzing, synthesizing, reflecting, evaluating) - Media & critical thinking.

45 PERIODS

PRACTICAL EXERCISES:

1 Enhance AI-generated design thinking
2 Explore AI creativity and human-AI collaboration.
3 Develop creative AI-driven user experiences.
4 Use AI to co-create narratives.

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5 Explore AI's role in creative music composition.

6 AI based creative thinking speech recognition.

7 AI based movie creation.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 Christopher Hayes, Patrick Magana "The Art of Critical Thinking", 2nd Edition, Lawrence Erlbaum Associates, 2023.

2 Bradley H Dowden, "Logical Reasoning", 1st Edition, Pearson Education, 2017.

REFERENCES:

1 Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach",1st Edition, O'Reilly Media, 2017.

2 A. L. Costa, "Developing minds: A Resource Book for Teaching Thinking", 5th Edition, ASSN Publications, 2021.

3 Howard Gardner, "Multiple Intelligences: New Horizons in Theory and Practice", 3rd Edition, Ingram Publisher, 2019.

ONLINE RESOURCES:

1 https://www.edx.org/learn/critical-thinking-skills

2 https://www.coursera.org/courses?query=critical%20thinking

3 https://www.edweek.org/teaching-learning/opinion-eight-instructional-strategies-for-promoting-critical-thinking/2021/03

COURSE OUTCOMES:

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

CO1 Apply creativity in problem solving.
CO2 Apply deductive and inductive reasoning.

CO3 Analyse the arguments, words and expressions.

CO4 Create new ideas of synthesis and drawing.

CO5 Analyse and collaborate problem solving.

CO – PO – PSO MAPPING:

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

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U23MG501	PROFESSIONAL ETHICS AND IPR	L T P C
Prerequisites: Nil		2 0 0 2

COURSE OBJECTIVES:

- To enable the students to create an awareness on engineering ethics and human values.
- To know how to apply safety, responsibility and rights in workplaces.
- To install moral and social values and loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 6

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring - Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 6

Senses of 'Engineering Ethics' – variety of moral issued - types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory - Gilligan's theory – consensus and controversy – Models of Professional Roles – theories about right action - Self-interest – customs and religion – uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 6

Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – Case study: The challenger disaster.

UNIT IV SAFETY, RESPONSIBILITIES AND IPR 6

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – Collegiality and loyalty – respect for authority - collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination. Case studies: The Three mile island and Chernobyl disaster

UNIT V GLOBAL ISSUES 6

Multinational corporations - Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility

TOTAL: 30 PERIODS

TEXT BOOKS:

1 Mike W Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition, McGraw Hill, New York 2017.

2 Govindarajan M, Natarajan S and Senthil Kumar V S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2013.

REFERENCES:

1 John R Boatright, "Ethics and the Conduct of Business", 4th Edition, Pearson Education, New Delhi, 2017.
2 Charles D and Fleddermann, "Engineering Ethics", Pearson Education, New Jersey, 2012.
3 Charles E Harris, Michael S Protchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", 4th Edition, Wadsworth Thompson Learning, United States, 2005.

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

CO1 Comprehend the core human values that shape the ethical behaviour of an Engineer.

CO2 Apply ethics in the profession.

CO3 Summarize the structure and function of state government and local bodies.

CO4 Apply safety, responsibility and rights in workplaces.

CO5 Summarize the global issues with regard to ethics.

CO – PO – PSO MAPPING:

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

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U23MX02	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
Prerequisites:	**Engineering Chemistry**	2	0	0	0

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.

UNIT I **ENVIRONMENT AND BIODIVERSITY** 6

Definition, scope and importance of environment – need for public awareness, Eco-system and Energy flow – ecological succession, Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II **ENVIRONMENTAL POLLUTION** 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions, Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS), Environmental protection, Environmental protection acts.

UNIT III **RENEWABLE SOURCES OF ENERGY** 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources, Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion, Concept, origin and power plants of geothermal energy.

UNIT IV **USTAINABILITY AND MANAGEMENT** 6

Development, GDP, Sustainability – concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols Sustainable Development Goals – targets, indicators and intervention Areas Climate change – Global, Regional and local environmental issues and possible solutions-case studies, Concept of Carbon Credit, Carbon Footprint. Environmental management in industry – A case study.

UNIT V **SUSTAINABILITY PRACTICES** 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

REFERENCES:

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.

COURSE OUTCOMES:

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

CO1 Explain the functions of environment, ecosystems and biodiversity and their conservation.
CO2 Explain the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3 Comprehend renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4 Summarize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5 Explain the sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

CO – PO – PSO MAPPING:

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

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U23AI504	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- Explore the importance of deep learning in the modern AI landscape.
- Understand the differences between traditional machine learning and deep learning.
- Understand how these concepts apply to the training and implementation of neural networks.

PRACTICAL EXERCISES:

1. Install Python, Jupyter Notebooks, and necessary libraries (TensorFlow, Keras, PyTorch).
2. Implement a simple feedforward neural network using Keras/PyTorch for classification (e.g., MNIST dataset).
3. Implement a basic GAN using Keras/PyTorch for generating images (e.g., generating handwritten digits).
4. Implement grid search and random search for hyperparameter optimization.
5. Export a trained model (e.g., Keras model, PyTorch model) to a saved format (e.g., .h5, .pth).
6. Implement a deep reinforcement learning agent using TensorFlow/PyTorch.
7. Choose a project related to deep learning (e.g., image classification, NLP task, or time series prediction).
8. Design, train, and evaluate a deep learning model for the chosen project.
9. Write a report summarizing methodology, results, and challenges.
10. Present results and discuss model performance and optimization techniques

COURSE OUTCOMES:

CO1 Explain Jupyter notebooks configuration.

CO2 Analyse GAN using keras and PYTorch

CO3 Apply grid search and random search.

CO4 Design a project related to deep learning.

CO5 Create a report summarising methodology, results and challenges.

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CO - PO MAPPING

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

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U23AI505 **BIG DATA ANALYTICS LABORATORY** L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To understand setting up of Hadoop Cluster.
- To solve problems using Map Reduce Technique.
- To solve Big Data problems.

PRACTICAL EXERCISES:

1 Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2 MapReduce application for word counting on Hadoop cluster.
3 Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4 K-means clustering using map reduce.
5 Page Rank Computation.
6 Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7 Application of Recommendation Systems using Hadoop/mahout libraries.
8 Implementation of Matrix Multiplication using Hadoop Map Reduce.
9 Hadoop implementation of file management tasks such as adding a file, retrieving and deleting files.
10 Practice exporting and importing of data from various databases.

COURSE OUTCOMES:

CO1 Explain Hadoop and HDFS configuration.

CO2 Analyse multi-node Hadoop Clusters.

CO3 Apply Map Reduce algorithms for various algorithms.

CO4 Design new algorithms that use Map Reduce.

CO5 Evaluate database exporting and importing.

CO - PO MAPPING

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

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U23EEC501	EMPLOYABILITY SKILLS – III	L	T	P	C
Prerequisites: Nil		0	0	2	1

COURSE OBJECTIVES:

- To educate and enrich the students on quantitative aptitude, data interpretation and analysis and written communication.

UNIT I **QUANTITATIVE APTITUDE PART – 5** 6

Probability –Permutation and Combination - Calendars – Logarithm.

UNIT II **QUANTITATIVE APTITUDE PART – 6** 6

Geometry – Straight Line – Triangles – Quadrilaterals – Circle – Co-ordinate Geometry – Cube – Cone – Sphere.

UNIT III **DATA INTERPRETATION AND ANALYSIS- 1** 6

Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs Column Graphs.

UNIT IV **DATA INTERPRETATION AND ANALYSIS -2** 6

Bar Graphs - Line Charts - Pie Chart - Graphs representing Area - Venn Diagram & Flow Charts.

UNIT V **LOGICAL REASONING PART – 3** 6

Syllogism – Assertion and Reasons – Statements and Assumptions – Identifying Valid Inferences – Identifying strong arguments and weak arguments – Statements and Conclusions – Cause and Effect – Deriving conclusions from passages.

TOTAL: 30 PERIODS

TEXT BOOKS:

1 R S Aggarwal, "Quantitative Aptitude", Revised Edition, S Chand & Co Ltd., 2017.

2 R S Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand & Co Ltd., 2018.

REFERENCES:

1 Abhijit Guha, "Quantitative Aptitude", 3rd Edition, Tata McGraw Hill, 2009.

2 Raj N Bakshmi, "English Grammar Practice," 1st Edition, Orient Black Swan, 2009.

3 M Ashra Rizvi, "Effective Technical Communication," 2nd Edition, Tata McGraw Hill, 2017.

4 Norman Lewis, "Word Power Made Easy", W.R. Goyal Publishers, 2020.

U23AI601	GENERATIVE AI	L	T	P	C
		3	0	2	4

Prerequisite: Deep Learning

COURSE OBJECTIVES:

- To understand the concepts of neural networks.
- To gain conceptual understanding of GPT and BERT techniques.
- To apply generative AI with real time systems.

UNIT I FOUNDATIONS OF AI AND NEURAL NETWORKS 9

History and evolution of AI/ML, Deep learning revolution, Transfer learning, History of Neural Natural Language Processing, Structure of Artificial Neural Networks, Steps in Training an Artificial Neural Network, Parameters and Hyperparameters, Backpropagation

UNIT II ADVANCED NEURAL NETWORK ARCHITECTURES 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions, Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS), Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources, Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion, Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability – concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols Sustainable Development Goals – targets, indicators and intervention Areas Climate change – Global, Regional and local environmental issues and possible solutions-case studies, Concept of Carbon Credit, Carbon Footprint. Environmental management in industry – A case study.

UNIT V SUSTAINABILITY PRACTICES 9

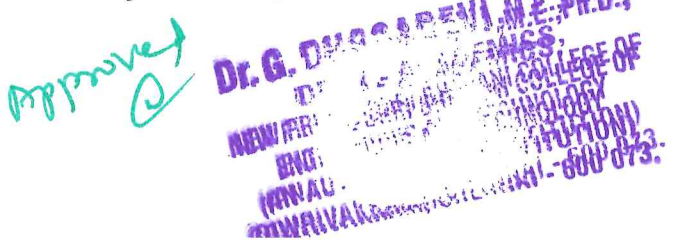
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economic and technological change.

45 PERIODS

PRACTICAL EXERCISES:

1 Build a simple VAE using a deep learning framework (TensorFlow/PyTorch)

2 Build a simple GAN to generate images from random noise



3 Build a simple text generation model using LSTM

4 Fine-tuning a pre-trained GPT-2 or GPT-3 model for text generation

5 Implement a simple diffusion model for image generation

6 Build a basic text-to-speech model

7 Fine-tuning a pre-trained language model on a custom dataset

30 PERIODS

TOTAL: 75 PERIODS

TEXTBOOKS:

1 Altaf Rehmani, "Generative AI for everyone: Understanding the essentials and applications of this breakthrough technology", 2nd Edition, Blue Rose Publishers, 2020.

2 Numa Dhamani, "Introduction to Generative AI", 1st Edition, Manning Publications, 2024.

REFERENCES

1 Josh Kalin, "Generative Adversarial Networks Cook book: Over 100 recipes to build generative models using Python, Tensor Flow, and Keras", 3rd Edition, Packt Publications, 2019.

2 Jesse Sprinter, "Generative AI in Software Development: Beyond the Limitations of Traditional Coding" 1st Edition, Jessi Publications, 2024.

3 Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook" 1st Edition, Springer, 2018.

ONLINE RESOURCES

1 https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-teaching-programming-course s/?v=c86ee0d9d7ed

2 https://www.geeksforgeeks.org/what-is-generative-ai/

3 https://generativeai.net

COURSE OUTCOMES:

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

CO1 Explain the evolution of AI/ML.
CO2 Apply the knowledge of Neural Networks.
CO3 Analyze the GPT models.
CO4 Analyze BERT techniques.
CO5 Apply the generative AI with real time systems.

CO - PO MAPPING

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

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U23CB501 **CYBER SECURITY** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To understand the basics of cyber security, cyber crimes and cyber law.
- To learn about social media issues relevant to cyber security.
- To know about digital devices security, tools and technologies for cyber security.

UNIT I **INTRODUCTION TO CYBER SECURITY** 9

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Concept of cyber security, Issues and challenges of cyber security.

UNIT II **CYBERCRIME AND CYBER LAW** 9

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, financial frauds, malware and ransomware attacks, zero day and zero click attacks, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber security in India.

UNIT III **SOCIAL MEDIA OVERVIEW AND SECURITY** 9

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Social media privacy, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

UNIT IV **E - COMMERCE AND DIGITAL PAYMENTS** 9

E- Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment, Modes of digital payments – Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions.

UNIT V **DIGITAL DEVICES SECURITY, TOOLS AND TECHNOLOGIES FOR CYBER SECURITY** 9

Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security.

45 PERIODS

PRACTICAL EXERCISES:

1 Checklist for reporting cyber crime at cyber crime Police Station and reporting cyber crime online.
2 Configuring security settings in Mobile Wallets and UPIs and Checklist for secure net banking.
3 Setting and configuring two factor authentication in the Mobile phone and Security patch management and updates in Computer and Mobiles.
4 Managing Application permissions in Mobile phone.
5 Wi-Fi security management in computer and mobile.

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30 PERIODS

TOTAL: 75 PERIODS

REFERENCES:

1 Ramesh Chandra Mishra, "Cyber Crime Impact in the New Millennium", Authors Press, 2010.
2 Sumit Belapure, Nina Godbole, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", 1st Edition, Wiley India Pvt. Ltd., 2011.
3 Kumar K, "Cyber Laws: Intellectual Property & E-Commerce Security", Dominant Publishers, 2011.
4 Eric Cole, Ronald Krutz, James W Conley, "Network Security Bible", 2nd Edition, Wiley India Pvt. Ltd., 2011.
5 E Maiwald, "Fundamentals of Network Security", Tata McGraw Hill, 2017.

ONLINE RESOURCES

1 http://www.digimat.in/nptel/courses/video/106106212/L01.html
2 https://onlinecourses.swayam2.ac.in/cec24_cs03/preview
3 https://onlinecourses.swayam2.ac.in/cec24_cs01/preview

COURSE OUTCOMES:

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

CO1 Explain the concept of Cyber security and issues and challenges associated with it.
CO2 Explain cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
CO3 Apply various privacy and security concerns on online Social media.
CO4 Apply concepts related cyber security aspects to E-Commerce and digital payments.
CO5 Apply Wi-Fi security management concepts in computer and mobile.

CO – PO – PSO MAPPING:

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

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U23AI602	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis.
- To understand technological advancements of data visualization

UNIT I INTRODUCTION AND DATA FOUNDATION 9

Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data Structure within and between Records - Data Preprocessing - Data Sets

UNIT II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson 's Affordance theory – A Model of Perceptual Processing.

UNIT III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data Visualization of Point Data -Visualization of Line Data - Visualization of Area Data Other Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - Line Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT IV INTERACTION CONCEPTS AND TECHNIQUES 9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations – Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space –Data Space Attribute Space- Data Structure Space - Visualization Structure – Animating Transformations Interaction Control.

UNIT V RESEARCH DIRECTIONS IN VISUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 3rd Edition, CRC Press, 2021.

2 Colin Ware, "Information Visualization Perception for Design", 4th Edition, Morgan Kaufmann Publishers, 2021.

REFERENCES:

1 Robert Spence, "Information visualization – Design for interaction", 2nd Edition, Pearson Education, 2017.

2 Alexandru C. Telea, "Data Visualization: Principles and Practice," 3rd Edition, A. K. Peters Ltd., 2018.

ONLINE RESOURCES:

1 https://chart-studio.plotly.com/create/#/

2 https://www.datawrapper.de/

3 https://www.tableau.com

COURSE OUTCOMES:

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

CO1 Explain the objects in different dimensions.

CO2 Design and process the data for Visualization.

CO3 Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences.

CO4 Apply the virtualization techniques for research projects.

CO5 Design appropriate data visualization techniques.

CO – PO – PSO MAPPING:

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

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U23EEC601	EMPLOYABILITY SKILLS – IV	L	T	P	C
Prerequisites: Nil		0	0	2	1

COURSE OBJECTIVES:

- To educate and enrich the students on quantitative aptitude, logical reasoning and verbal communication.

UNIT I **ADVANCED QUANTITATIVE APTITUDE – 1** **6**

Averages – problem on Ages – Ratio & Proportion – Mixture and Allegations.

UNIT II **ADVANCED QUANTITATIVE APTITUDE – 2** **6**

Percentages – Profit and Loss – Simple Interest & Compound Interest – logarithms.

UNIT III **ADVANCED QUANTITATIVE APTITUDE – 3** **6**

Algebra – Linear Equation – Quadratic equation – Polynomials – Time and Distance – Problems on train – Time and Work.

UNIT IV **ADVANCED LOGICAL REASONING** **6**

Coding and decoding – Blood relations – Direction Series – Syllogism – puzzles.

UNIT V **ADVANCED VERBAL COMMUNICATION** **6**

Error Spotting – Jumbled Sentences – Comprehension – Idioms and Phrases – Synonyms and Antonyms.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. R S Aggarwal, "Quantitative Aptitude", Revised Edition, S Chand & Co Ltd., 2017.
2. R S Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand & Co Ltd., 2018.

REFERENCES:

1. Abhijit Guha, "Quantitative Aptitude", 3rd Edition, Tata McGraw Hill, 2009.
2. Raj N Bakshmi, "English Grammar Practice," 1st Edition, Orient Black Swan, 2009.
3. M Ashra Rizvi, "Effective Technical Communication," 2nd Edition, Tata McGraw Hill, 2017.
4. Norman Lewis, "Word Power Made Easy", W.R. Goyal Publishers, 2020.

U23AI701	PROMPT ENGINEERING	L	T	P	C
Prerequisites:	**Machine Learning**	3	0	2	4

COURSE OBJECTIVES:

- To introduce students to the fundamentals of prompt engineering for AI applications.
- To equip students with the skills to design effective prompts for various AI models
- To apply prompt engineering techniques for problem-solving in AI-based systems.

UNIT I INTRODUCTION TO PROMPT ENGINEERING 9

Understanding Prompts – Role of Prompts in AI Systems – Types of Prompts – Prompt Templates and Patterns – Introduction to Large Language Models (LLMs) – Evolution of AI Prompting Techniques – Use Cases in AI Applications.

UNIT II DESIGNING EFFECTIVE PROMPTS 9

Prompt Optimization Strategies – Few-shot, Zero-shot, and Chain-of-Thought Prompting – Contextual Prompting Techniques – Refining Prompts Using Feedback – Tools for Prompt Engineering (e.g., ChatGPT, Gemini, Claude) – Case Studies on Effective Prompt Design.

UNIT III APPLICATIONS OF PROMPT ENGINEERING 9

Using Prompts for Text Generation – Information Extraction – Code Generation – Conversational AI – Problem Solving with Prompts – AI in Creative Writing and Content Generation – Evaluating Prompt Performance.

UNIT IV ETHICS AND BIAS IN PROMPTING 9

Bias and Fairness in AI Prompts – Ethical Prompt Design – Impact of Prompting on AI Model Behavior – Mitigating Bias Through Responsible Prompting – Data Privacy and Security in AI Interactions – Legal and Compliance Considerations.

UNIT V REAL-WORLD SCENARIOS AND FUTURE TRENDS 9

Real-World Applications of Prompt Engineering – Enhancing Business Operations with AI Prompts – Customizing AI Models for Domain-Specific Tasks – Advances in Prompt Engineering Research – Future Directions in AI Prompting.

45 PERIODS

PRACTICAL EXERCISES:

1. Implement basic prompts for zero-shot, one-shot, and few-shot learning using AI models.
2. Create and optimize prompts for tasks like text generation, information extraction, and problem-solving using tools like ChatGPT or Gemini.
3. Develop prompts for real-world applications such as code generation, chatbot conversations, and creative content generation.
4. Analyze AI-generated outputs to identify biases and apply ethical prompt engineering techniques to mitigate them.
5. Design domain-specific prompts for industries like healthcare or finance and evaluate their effectiveness.
6. Assess prompt performance using feedback and metrics, then refine prompts for improved accuracy and relevance.

7 Practice the model to extract structured information from unstructured input.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

1 Brian Roemmele, "The Art of Prompt Engineering: Building AI Interactions," 1st Edition, AI Publishing, 2023.

2 Ethan Mollick, "Co-Intelligence: Using AI for Problem Solving and Creativity," 1st Edition, Penguin, 2024.

REFERENCES:

1 Chris Lu, "Mastering ChatGPT: A Guide to Effective Prompting," 1st Edition, O'Reilly Media, 2023.

2 Adam Smith, "Prompt Engineering for AI Developers", 2nd Edition, Packt Publishing, 2024.

3 John Berryman, Albert Ziegler, "Prompt Engineering for LLMs", 1st Edition, O'Reilly Media, 2024.

ONLINE RESOURCES:

1 https://platform.openai.com/docs/guides/prompt-engineering

2 https://learnprompting.org

3 https://www.promptingguide.ai

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of prompt engineering and its applications.

CO2 Design effective prompts for AI-driven solutions.

CO3 Apply prompt engineering for various AI applications.

CO4 Analyze ethical considerations in prompt design.

CO5 Apply prompts for better AI model performance

CO – PO – PSO MAPPING:

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

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U23AI702	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
Pre requisites:	**Creative Thinking, Creative Media**	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.

UNIT I **INTRODUCTION** **9**

Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR ,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

UNIT II **VR SYSTEMS** **9**

VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.

UNIT III **STEREOSCOPIC VISION & HAPTIC RENDERING** **9**

Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.

UNIT IV **VR SOFTWARE DEVELOPMENT** **9**

Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available sdk to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR).

UNIT V **3D INTERACTION TECHNIQUES** **9**

3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation. AR software, Camera parameters and camera calibration, Marker based augmented reality, AR Toolkit. Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher,2nd Edition, 2023.

2 Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 3rd Edition, 2023.

REFERENCES:

REFERENCES:

1 John Vince, "Introduction to Virtual Reality", 2nd Edition, Springer-Verlag Publisher, 2024.

2 William R. Sherman, Alan B. Craig: "Understanding Virtual Reality – Interface, Application, Design", 2nd Edition, Morgan Kaufmann Publisher, 2023.

3 Andrew Yeh Ching Nee, Soh Khim Ong "Handbook of Augmented Reality", 1st Edition, Springer-Verlag Publisher, 2023

ONLINE RESOURCES

1 http://msl.cs.uiuc.edu/vr/

2 https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality/1/

3 https://www.coursera.org/learn/augmented-reality

COURSE OUTCOMES:

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

CO1 Summarize the basic concepts of AR and VR.

CO2 Design the tools and technologies related to AR/VR

CO3 Analyse the working principle of AR/VR related Sensor devices.

CO4 Apply in various AR/VR models using modelling techniques

CO5 Develop AR/VR applications in different domains

CO – PO – PSO MAPPING:

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

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U23MG701	PROJECT MANAGEMENT AND FINANCE	L	T	P	C
Prerequisites:	**Basic management and finance concepts**	2	0	0	2

COURSE OBJECTIVES:

- To know about basic concepts of operational and project management
- To impart the knowledge of the project structure and process of project appraisal.
- To know about formulation of a team, implementation, monitoring and controlling a project.

UNIT I **BASIC CONCEPT** 6

Concept and categories of project - Project development cycle - Concept, tools and techniques of project management - Logistics and supply chain management - Forms of project organizations.

UNIT II **THE VERTICAL STRUCTURE PLANE** 6

Project identification, formulation and preparation. Market and demand estimation – Market survey techniques - Demand forecasting. Materials management - Analysis of materials input, technology, production, plant capacity, location and site, civil works, charts, layouts and work schedule. Cost of project - Means of financing, estimates of cost – Financial projections.

UNIT III **PROCESS OF PROJECT APPRAISAL** 6

Technical, Economic, Financial, Legal and Social appraisal of the Industrial Projects Problems due to rate of discount, wage-rate, exchange rates, treatment of taxes, social cost – benefits -treatment of risk and uncertainty - sensitivity analysis and probability approach - Single as well as multiple projects - Big data analytics - PLM and SLM.

UNIT IV **PROJECT TEAM FORMULATION AND MAXIMIZING PARTICIPATION** 6

Project Team frame works – Project Team cultures - Barriers and challenges – Selecting Team Members – Key skills of effective project leaders - Giving / receiving feedback from different members of the project.

UNIT V **IMPLEMENTATION, MONITORING AND CONTROL OF PROJECTS** 6

Project scheduling, network techniques for resource, cost budgeting and scheduling – project management teams and coordination – Monitoring and post implementation, evaluation of the project – ERP – Project financing.

TOTAL: 30 PERIODS

TEXT BOOKS:

1 Gobalakrishnan P and Ramamoorthy V E, "Textbook of Project Management", Trinity Press, 7th Edition, 2014.

2 Harvey Maylor, "Project Management", 3rd Edition, Pearson Education, 2010.

REFERENCES:

1 James P Clements, Jack Gido, "Effective project management", 3rd Edition, Cengage Learning, 2008.

2 Clifford F Gray, Erik W Larson, "Project Management: The Managerial Process", 3rd Edition, TMH, 2010.
3 Sadhan Choudhury, "Project Management", Tata Mc-Graw Hill Publishing Co., 1st Edition, 2007.

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

CO1 Explain the concept of operational and project management.

CO2 Define the scope of a project and develop the project plan.

CO3 Evaluate the technical, business and social environment related to the project.

CO4 Explain team formulation and successful team management.

CO5 Design projects using tools and techniques.

CO – PO – PSO MAPPING:

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

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U23AI703	AR & VR LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The objective of this course is to explore the concepts of Virtual reality and develop 3D virtual environment.

PRACTICAL EXERCISES:

1 Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.

2 Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.

3 Develop a scene in Unity that includes:

i. a cube, plane and sphere, apply transformations on the 3 game objects.

ii. add a video and audio source.

4 Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click.

5 Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects. Write a C# program tc grab and throw the sphere using vr controller.

6 Develop a simple UI (User interface) menu with images, canvas, sprites and button. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene.

7 Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.

8 Include animation and interaction in the immersive environment created in 3D models.

9 Create a virtual environment for any use case. The application must include at least 4 scenes which can be changed dynamically, a good UI, animation and interaction with game objects. (e.g VR application to visit a zoo).

10 Display a 3D object when a marker is detected and create a panoramic viewer using 360^0 images.

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COURSE OUTCOMES:

CO1 Create and deploy a VR application.

CO2 Explain the physical principles of VR.

CO3 Create a comfortable, high-performance VR application using Unity.

CO4 Develop software that reflects fundamental techniques in applications.

CO5 Design and deployment of VR experiences.

CO – PO – PSO MAPPING:

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

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PROFESSIONAL ELECTIVE COURSES: VERTICALS											
Course Code	Vertical I AI and Automation	Course Code	Vertical II AI-Powered Data Analytics	Course Code	Vertical III Optimization Techniques	Course Code	Vertical IV AI and Human-Centric Innovations	Course Code	Vertical V AI and Emerging Technologies	Course Code	Vertical VI Creative Media
U23PEAI01	Intelligent Automation Systems	U23PEAI07	AI and Big Data Analytics	U23PEAI13	Bio Inspired Optimization Techniques	U23PEAI19	Wearable Technologies	U23PEAI25	Shadow AI	U23PEAI31	AI-Assisted Graphic Design
U23PEAI02	AI in Data Science	U23PEAI08	Data Mining	U23PEAI14	Convex Optimization	U23PEAI20	AI concept using Human Computer Interaction	U23PEAI26	AIoT Smart Agriculture Monitoring	U23PEAI32	AI in Social Media and Content Curation
U23PEAI03	Responsible AI	U23PEAI09	Exploratory data analysis	U23PEAI15	Game Optimization	U23PEAI21	Intelligence Analysis	U23PEAI27	Formal Language and Automata	U23PEAI33	Interactive Media and Animation
U23PEAI04	Destructive AI	U23PEAI10	Data Analysis and Digital Marketing application	U23PEAI16	Visual Interface and User Experience Design	U23PEAI22	Cognitive Neuroscience	U23PEAI28	Rapid Language and AML	U23PEAI34	Computer-Generated Imagery
U23PEAI05	Cognitive Test Automation	U23PEAI11	Advanced Business Analytics	U23PEAI17	Advanced Optimization Techniques	U23PEAI23	Advanced AI and unsupervised learning	U23PEAI29	Explainable AI	U23PEAI35	Game Development
U23PEAI06	Quantum AI	U23PEAI12	Advanced Data Processing Techniques	U23PEAI18	Optimization in Deep Learning	U23PEAI24	Advanced Creative Thinking	U23PEAI30	Advanced Speech and Natural Language Processing	U23PEAI36	Future of Creative Media: Trends and Innovations

U23PEAI01 **INTELLIGENT AUTOMATION SYSTEMS** **L T P C**

Prerequisite: Foundation of Data Science **3 0 0 3**

COURSE OBJECTIVES:

- To acquire knowledge in automation systems.
- To gain conceptual understanding in automation process automation.
- To apply the concept of intelligent automation in the real-world scenario.

UNIT I **RPA -AN INTRODUCTION** **9**

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II **AUTOMATION PROCESS ACTIVITIES** **9**

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UI Explorer, Handling Events.

UNIT III **MINING PROCESS** **9**

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, scraping data from website and writing to CSV. Process Mining.

UNIT IV **EXCEPTION HANDLING AND CODE MANAGEMENT** **9**

Exception handling, Common exceptions, Logging- Debugging techniques, collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V **DEPLOYMENT AND MAINTENANCE** **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath", 2nd Edition, Packt Publishing, 2022.

2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", 1st Edition, Apress publications, 2020.

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REFERENCES:

1 Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: A Primer, Institute of Robotic Process Automation", 1st Edition, 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", 1st Edition, Amazon Asia-Pacific Holdings Private Limited, 2018.

3 A Gerardus Blokdyk, "Robotic Process Automation Rpa: A Complete Guide", 1st Edition, 5star cooks Publishers, 2020.

ONLINE RESOURCES:

1 https://aws.amazon.com/what-is/intelligent-automation/

2 https://www.automationanywhere.com/rpa/intelligent-automation

3 https://www.blueprism.com/guides/ai-automation/

COURSE OUTCOMES:

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

CO1 Explain the concepts of RPA.

CO2 Design automation process activities.

CO3 Apply App integration.

CO4 Explain code management and maintenance.

CO5 Design and publish using public utility.

CO – PO – PSO MAPPING:

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

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U23PEAI02 **AI IN DATA SCIENCE** L T P C

Prerequisites: Foundation of Data Science 2 0 2 3

COURSE OBJECTIVES:

- To understand the concepts of neural networks.
- To gain conceptual understanding of GPT and BERT techniques.
- To apply generative AI with real time systems.

UNIT I INTELLIGENT AGENTS 6

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 6

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 – online search agents and unknown environments

UNIT III GAME PLAYING AND CSP 6

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 6

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 6

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

30 PERIODS

PRACTICAL EXERCISES:

1 Install python (with libraries like NumPy, Pandas, Matplotlib, SciPy, Scikit-learn)

2 Plot data using Matplotlib, Seaborn (e.g., histograms, scatter plots, box plots, pair plots)

3 Implement simple linear regression from scratch

4 Use Scikit-learn to apply linear regression on real datasets (e.g., predicting house prices)

5 Implement an SVM for classification tasks

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1 Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education,2021.

2 Dan W. Patterson, "Introduction to AI and ES", 4th Edition, Pearson Education, 2021.

REFERENCES:

1 Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2018.

2 Patrick H. Winston, "Artificial Intelligence", 2nd Edition, Pearson Education, 2017.

3 Deepak Khemani, "Artificial Intelligence", 1st Edition, Tata McGraw Hill, 2013.

ONLINE RESOURCES:

1 https://www.geeksforgeeks.org/artificial-intelligence/ai-ml-ds/

2 https://github.com/mrsaeeddev/free-ai-resources

3 https://www.datacamp.com/

COURSE OUTCOMES:

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

CO1 Explain intelligent agent frameworks.

CO2 Apply problem solving techniques.

CO3 Apply game playing and CSP techniques.

CO4 Analyze logical reasoning.

CO5 Analyze probabilistic reasoning under uncertainty.

CO – PO – PSO MAPPING:

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

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U23PEAI03	RESPONSIBLE AI	L	T	P	C
Prerequisites: Machine Learning Techniques		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of responsible AI.
- To analyze fairness and bias in AI.
- To apply safety, security and privacy.

UNIT I INTRODUCTION TO RESPONSIBLE AI 9

Overview of AI – Common misconception of AI – Introduction to Responsible AI – Characteristics of Responsible AI – Key principles of responsible AI - Challenges in implementing responsible AI - ELSI Framework and AI - Safety and Alignment – Fairness and Privacy.

UNIT II FAINESS AND BIAS 9

Human Bias - Types of biases - Effects of biases on different demographics - Bias vs Fairness - Sources of Biases - Exploratory data analysis - Bias Mitigation Techniques - Pre-processing techniques – In processing techniques - Post-processing techniques - Bias detection tools - Overview of fairness in AI - Demographic parity - Equalized odds - Simpson's paradox and the risks of multiple testing - Group fairness and Individual fairness - Counterfactual fairness - Fairness metrics - Bias and disparity mitigation with Fair learn.

UNIT III EXPLAINABILITY AND INTERPRETABILITY 9

Importance of Explainability and Interpretability – Challenges - Interpretability through simplification and visualization - Intrinsic interpretable methods - Post Hoc interpretability – Interpretability Evaluation methods - Explainability through causality - Model agnostic Interpretation - LIME (Local Interpretable Model-agnostic Explanations) - SHAP (SHapley Additive explanations).

UNIT IV RESPONSIBLE AI 9

Importance of ethical and unbiased algorithms in AI systems, Ethical frameworks and principles for AI development, Techniques for Implementing Unbiased Algorithms, Roles and responsibilities of stakeholders in the AI ecosystem. Case Study: IBM's AI Fairness 360 Toolkit.

UNIT V SAFETY, SECURITY AND PRIVACY 9

Overview of safety – security – privacy - resilience - Taxonomy of AI safety and Security - Adversarial attacks and mitigation - Model and data security - The ML life cycle - Adopting an ML life cycle ML Ops and Model Ops - Model drift - Data drift - Concept drift - Privacy-preserving AI techniques- Differential privacy - Federated learning.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", 1st Edition, Springer, 2019.

2 Adnan Masood, Heather Dawe, "Responsible AI in the Enterprise", 1st Edition, Packt Publication, 2023.

REFERENCES:

1 Silja Voeneky, Philipp Kellmeyer et. al, "The Cambridge Handbook of Responsible Artificial Intelligence", 1st Edition, Cambridge University Press 2022.

2 Beena Ammanath, "Trustworthy AI", 1st Edition, O' Reilly Media, 2022.

3 Shashin Mishra and Sray Agarwal, "Responsible AI: Implementing Ethical and Unbiased Algorithms", 2nd Edition, Springer, 2020.

ONLINE RESOURCES:

1 https://www.ibm.com/topics/responsible-ai

2 https://www.techtarget.com/searchenterpriseai/definition/responsible-AI

3 https://www.tensorflow.org/responsible_ai

COURSE OUTCOMES:

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

CO1 Explain the characteristics of responsible AI.

CO2 Apply bias mitigation techniques.

CO3 Analyze the importance of explainability and interpretability.

CO4 Explain the ethical and unbiased algorithm in responsible AI.

CO5 Create safety, security and privacy in AI.

CO – PO – PSO MAPPING:

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

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U23PEAI04	DESTRUCTIVE AI	L	T	P	C
Prerequisites:	**Machine Learning Techniques**	3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge in AI context.
- To gain conceptual understanding in weaponization of AI.
- To apply the concept of intelligent automation in the real-world scenario.

UNIT I **DESTRUCTIVE AI -AN INTRODUCTION** **9**

Overview and goals, Defining "destructive" in the AI context, Review of basic AI concepts, Case studies: Flash crashes, Boeing 737 Max, autonomous vehicle deaths, Early warning signs of poorly controlled AI.

UNIT II **BIAS AND DISCRIMINATION IN ALGORITHMS** **9**

Machine learning systems replicate and amplify human bias, Facial recognition and racial bias, Predictive policing and COMPAS.

UNIT III **WEAPONIZATION OF AI** **9**

Autonomous weapons systems (LAWS), Hacking and adversarial AI, AI in cyberwarfare and information control, AI-generated misinformation campaigns, Deepfakes, synthetic media, and trust erosion, Chatbots as tools for radicalization.

UNIT IV **EXISTENTIAL RISK AND AGI** **9**

Superintelligence alignment problem, The control problem and paperclip maximizers, Scenarios of global catastrophic risk, AI and gig economy exploitation, Techno-feudalism and inequality.

UNIT V **BUILDING ETHICAL AND RESILIENT AI** **9**

Global treaties on AI and arms control, Human-in-the-loop and interpretable AI, Alignment and value loading, Designing for robustness, fairness, and transparency.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Robertas Damaševičius, "Disruptive Creativity with Generative AI: Case Studies from Science, Technology and Education", 1st Edition, Cambridge Scholars Publishing, 2024.
2. Nick Bostrom, "Superintelligence", 2nd Edition, Oxford University Press, 2020.

REFERENCES:

1. Moses Strydom, Sheryl Buckley, "AI and Big Data's Potential for disruptive innovation", 1st Edition, IGI Global, 2020.
2. Anamika Pandey, Balamurugan Balusamy, Naveen Chilamkurti, "Disruptive Artificial Intelligence and Sustainable Human Resource Management Impacts and Innovations -The Future of HR", 2nd Edition, River Publishers, 2023.
3. Rosario Girasa, "Artificial Intelligence as a Disruptive Technology Economic Transformation and Government Regulation", 1st Edition, Palgrave Macmillan, 2020.

ONLINE RESOURCES:

1. https://ijirl.com/wp-content/uploads/2023/04/DESTRUCTIVE-ARTIFICIAL-INTELLIGENCE-IMPACT-AND-CHALLENGES.pdf
2. https://link.springer.com/book/10.1007/978-3-030-35975-1

3 https://unogeeks.com/destructive-artificial-intelligence/

COURSE OUTCOMES:

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

CO1 Explain the concepts of AI.

CO2 Analyze the bias and discrimination in the algorithms.

CO3 Analyze weaponization of AI.

CO4 Explain risk and AGI.

CO5 Design and build resilient AI.

CO – PO – PSO MAPPING:

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

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U23PEAI05	COGNITIVE TEST AUTOMATION	L	T	P	C
Prerequisites: Deep Learning with Chatbot		2	0	2	3

COURSE OBJECTIVES:

- To learn the basic concepts of automation process.
- To understand the automation process activities.
- To apply AI ethics and privacy.

UNIT I **INTRODUCTION** 6

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II **AUTOMATION PROCESS ACTIVITIES** 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, Ui Explorer, Handling Events.

UNIT III **ETHICS INITIATIVES IN AI** 6

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT IV **AI STANDARDS AND REGULATIONS** 6

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT V **AI ETHICS AND PRIVACY** 6

Auditing AI models, fairness assessment, Principles for ethical practices, Privacy preservation - Attack models, Privacy-preserving Learning, Differential privacy, Federated learning

30 PERIODS

PRACTICAL EXERCISES:

1. Install and set up Selenium WebDriver with a simple test automation script for a web application.
2. Use an AI tool or library (such as Testim.io or Functionize) to auto-generate and run tests.
3. Implement a predictive analysis model (using a tool like AI-powered Selenium Grid or frameworks like PyTest with AI libraries) to identify the most critical parts of the application that need to be tested after every code change.
4. Implement a visual regression testing system using machine learning (for example, using OpenCV or TensorFlow for identifying UI changes).
5. Use machine learning algorithms to analyze test results and detect anomalies or unexpected behaviors in automated tests.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1 Banzhaf, W., Machado, P., Zhang, M., "Handbook of Evolutionary Machine Learning", 3rd Edition, Springer, 2023.

2 Eiben, A. E., Smith, J. E., "Introduction to Evolutionary Computing", 2nd Edition, Springer, 2015.

REFERENCES:

1 Song, T., Zheng, P., Wong, M. L. D., Wang. X., "Bio-Inspired Computing Models and Algorithms", 3rd Edition, World Scientific, 2020.

2 Floreano, D., Mattiussi, C., "Bio-Inspired Artificial Intelligence", 2nd Edition, MIT Press, 2018.

3 Mitchell. T., "Machine Learning", 4th Edition, Tata McGraw Hill Education, 2021.

ONLINE RESOURCES:

1 https://www.geeksforgeeks.org/top-ai-testing-tools-for-test-automation/

2 https://www.istqb.org/certifications/artificial-inteligence-tester

3 https://www.guvi.in/blog/automation-testing-syllabus/

COURSE OUTCOMES:

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

CO1 Explain the basic concept of automation process.

CO2 Apply automation process activities.

CO3 Explain ethics initiatives in AI.

CO4 Explain AI standards and regulations.

CO5 Apply AI ethics in automation process.

CO – PO – PSO MAPPING:

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

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U23PEAI06	QUANTUM AI	L T P C
Prerequisites:	**Machine Learning Techniques**	3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge in quantum computing.
- To gain conceptual understanding in quantum machine learning.
- To apply the concept of quantum AI in the real-world scenario.

UNIT I QUANTUM COMPUTING FUNDAMENTALS 9

Quantum Mechanics - Basic principles, quantum states, qubits, superposition, and entanglement. Quantum Algorithms- Grover's algorithm, Shor's algorithm, and quantum Fourier transform, Quantum Circuits, Quantum Gates, Quantum Measurement.

UNIT II QUANTUM MACHINE LEARNING 9

Quantum Neural Networks, Quantum Algorithms for AI, Quantum Feature Mapping, Quantum-Enhanced AI Models.

UNIT III QUANTUM DATA ENCODING

Classical-to-quantum data conversion, Amplitude encoding, angle encoding, basis encoding, Complexity and limitations, Parametrized quantum circuit, Hybrid quantum-classical optimization, Barren plateaus & training challenges.

UNIT IV QUANTUM REINFORCEMENT LEARNING 9

Markov decision processes in quantum settings, Quantum-enhanced policy search, Applications in quantum control, Quantum Computing Platforms-IBM Q, Google Cirq, Xanadu PennyLane, Rigetti, D-Wave, Gate-based vs annealing-based approaches, Limitations and choosing the right platform.

UNIT V FUTURE TRENDS 9

Quantum AI Applications - potential of Quantum AI in various fields like finance, natural language processing, and drug discovery, Challenges and Ethical Considerations, Future research directions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Santanu Ganguly, "Quantum Machine Learning: An Applied Approach", 1st Edition, Apress Publications, 2021.

2 Peter Wittek, "Quantum Machine Learning: What Quantum Computing Means to Data Mining", 2nd Edition, Elsevier Science, 2024.

REFERENCES:

1 Maria Schuld, Francesco Petruccione, "Supervised Learning with Quantum Computers", 1st Edition, Springer, 2018.

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2 Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information", 4th Edition, Cambridge University Press, 2020.

3 Philipp Scherstjanoi, Maria Schuld, Francesco Petruccione, "Machine Learning with Quantum Computers: From Linear Regression to Reinforcement Learning", 1st Edition, Springer Nature, 2021.

ONLINE RESOURCES:

1 https://quantumai.google/

2 https://www.geeksforgeeks.org/what-is-quantum-ai/

3 https://www.signitysolutions.com/tech-insights/what-is-quantum-ai

COURSE OUTCOMES:

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

CO1 Explain the concepts of quantum computing.

CO2 Analyze quantum machine learning.

CO3 Analyze quantum data encoding.

CO4 Explain quantum computing platforms.

CO5 Apply quantum AI in real world scenarios.

CO – PO – PSO MAPPING:

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

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U23PEAI07 **AI AND BIG DATA ANALYTICS** **L T P C**

Prerequisites: Big Data Analytics **3 0 0 3**

COURSE OBJECTIVES:

- To introduce fundamental concepts of Big Data and its applications.
- To explore the architecture and frameworks used in Big Data analytics.
- To analyze different data processing techniques using Hadoop, Spark and to understand various machine learning approaches applied to Big Data, and to apply Big Data analytics in real-world domains.

UNIT I INTRODUCTION TO BIG DATA 9

Definition, Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value), Big Data Ecosystem, Sources of Big Data, Challenges in Big Data, Data Storage and Management, Data Lake vs. Data Warehouse, Role of AI in Big Data.

UNIT II BIG DATA PROCESSING FRAMEWORKS 9

Hadoop Ecosystem – HDFS, MapReduce, YARN, NoSQL Databases (MongoDB, Cassandra, HBase), Distributed File Systems, Data Ingestion using Apache Flume and Sqoop, Hive and Pig for Data Querying and Transformation.

UNIT III DATA ANALYTICS USING SPARK 9

Apache Spark Architecture – Resilient Distributed Dataset (RDD), DataFrames and Datasets, Spark SQL, Spark Streaming, Machine Learning with MLlib, Graph Processing with GraphX, Real-time Analytics using Kafka and Spark Streaming.

UNIT IV MACHINE LEARNING WITH BIG DATA 9

Supervised and Unsupervised Learning in Big Data, Scalable Machine Learning Algorithms, Deep Learning on Big Data, Feature Engineering at Scale, Reinforcement Learning with Large Datasets, Explainable AI in Big Data.

UNIT V BIG DATA APPLICATIONS AND CASE STUDIES 9

Big Data in Healthcare, Financial Services, E-Commerce, Social Media Analytics, Cybersecurity, Smart Cities, Ethical and Privacy Issues in Big Data, Data Governance, Regulatory Compliance (GDPR, CCPA), Future Trends in Big Data Analytics.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015.

2 Bill Chambers, Matei Zaharia, "Spark: The Definitive Guide: Big Data Processing Made Simple", 1st Edition, O'Reilly Media, 2018.

REFERENCES:

1 Viktor Mayer-Schönberger, Kenneth Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think", 3rd Edition, Mariner Books, 2020.

2 Benjamin Bengfort, Jenny Kim, "Data Analytics with Hadoop", 2nd Edition, O'Reilly Media, 2019.

3 Muhammad M. Chaudhry, "Big Data Analytics for Internet of Things", 1st Edition, John Wiley & Sons, 2021

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ONLINE RESOURCES:

1 https://spark.apache.org/

2 https://hadoop.apache.org/

3 https://aws.amazon.com/big-data/

COURSE OUTCOMES:

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

CO1 Explain fundamental concepts of Big Data and its challenges.

CO2 Analyze data storage and processing using Hadoop and NoSQL databases.

CO3 Explain large-scale data analytics using Apache Spark.

CO4 Apply machine learning techniques to analyze Big Data.

CO5 Apply Big Data analytics in real-world applications.

CO – PO – PSO MAPPING:

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

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U23PEAI08	DATA MINING	L T P C
Prerequisites:	**Database Management Systems**	2 0 2 3

COURSE OBJECTIVES:

- To understand the fundamental concepts of data warehousing and data mining.
- To explore various data preprocessing techniques for data mining.
- To study different data warehouse architectures and implementation techniques, to analyze different data mining algorithms and their applications and to apply advanced data mining techniques in real-world scenarios.

UNIT I **INTRODUCTION TO DATA WAREHOUSING** 6

Definition, Characteristics of Data Warehouse, Data Warehouse Architecture, OLTP vs. OLAP, Data Warehouse Models (Enterprise, Virtual, Federated), Data Warehouse Design Process, ETL (Extract, Transform, Load), Data Cube Technology, Star and Snowflake Schema, Fact and Dimension Tables.

UNIT II **DATA MINING FUNDAMENTALS** 6

Definition and Scope of Data Mining, Data Mining Process, Types of Data in Data Mining, Data Preprocessing – Data Cleaning, Data Transformation, Data Reduction, Data Discretization, Handling Missing Values, Feature Selection Techniques, Attribute Relevance Analysis.

UNIT III **ASSOCIATION RULE MINING & CLASSIFICATION** 6

Association Rule Mining – Apriori Algorithm, FP-Growth Algorithm, Constraint-Based Association Mining, Rule-Based Classifiers. Classification – Decision Trees (ID3, C4.5), Naïve Bayes Classifier, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM), Random Forest, Performance Evaluation Metrics for Classification Models.

UNIT IV **CLUSTERING & ADVANCED DATA MINING TECHNIQUES** 6

Clustering – Partitioning Methods (k-Means, k-Medoids), Hierarchical Clustering, Density-Based Clustering (DBSCAN), Grid-Based Clustering. Advanced Techniques – Text Mining, Web Mining, Graph Mining, Temporal and Spatial Data Mining, Big Data Mining with Hadoop and Spark, Ethical Considerations in Data Mining.

UNIT V **APPLICATIONS OF DATA WAREHOUSING AND MINING** 6

Data Warehousing Applications – Business Intelligence, Healthcare Analytics, Retail Analytics, Financial Data Warehousing. Data Mining Applications – Fraud Detection, Sentiment Analysis, Recommender Systems, Social Media Analytics, Cybersecurity, Real-World Case Studies on Data Mining and Warehousing.

30 PERIODS

PRACTICAL EXERCISES:

1. Installation of WEKA Tool
2. Pre-process a given dataset based on Handling Missing Values
3. Creating new Arff File
4. Generate Association Rules using the Apriori Algorithm
5. Naïve bayes classification on a given data set

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2021.
2. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", 3rd Edition, John Wiley & Sons, 2023.

REFERENCES:

1 Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, "Introduction to Data Mining", 2nd Edition, Pearson Education,2019.

2 Ian Witten, Eibe Frank, Mark Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 4th Edition, Morgan Kaufmann ,2019.

3 Thomas W. Miller, "Web and Network Data Science: Modeling Techniques in Predictive Analytics", 3rd Edition, Pearson, 2021.

ONLINE RESOURCES:

1 https://www.geeksforgeeks.org/data-warehousing-and-mining/

2 https://www.datacamp.com/courses/data-mining

3 https://www.coursera.org/specializations/data-mining

COURSE OUTCOMES:

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

CO1 Explain the fundamental concepts of data warehousing and mining.

CO2 Apply data preprocessing techniques for effective data mining.

CO3 Analyze different association rule mining and classification techniques.

CO4 Analyze clustering and advanced data mining methods for data analysis.

CO5 Apply data warehousing and mining techniques in real-world applications.

CO – PO – PSO MAPPING:

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

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U23PEAI09	EXPLORATORY DATA ANALYSIS	L	T	P	C
Prerequisites: Big Data Analytics		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of responsible AI.
- To analyze fairness and bias in AI.
- To apply safety, security and privacy.

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science - Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA – Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single Variable: Distribution Variables – Numerical Summaries of Level and Spread – Scaling and Standardizing – Inequality.

UNIT IV BIVARIATE ANALYSIS 9

Relationships between Two Variables – Percentage Tables – Analysis Contingency Tables – Handling Several Batches – Scatterplots and Resistant Lines.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", 1st Edition, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", 2nd Edition, O Reilly Media, 2021.

REFERENCES:

1. Taylor, Francis, "Exploratory Data Analysis Using R", 1st Edition, Pearson Education, 2020.
2. Eric Pimpler, "Data Visualization and Exploration with R, Geospatial Training service", 2nd Edition, Create Space Independent Publishing, 2021.
3. Claus O. Wilke, "Fundamentals of Data Visualization", 1st Edition, O'Reilly Media, 2019.

ONLINE RESOURCES

1. https://www.jmp.com/en/online-statistics-course/exploratory-data-analysis
2. https://www.coursera.org/courses?query=exploratory%20data%20analysis

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3 https://nptel.ac.in/courses/109107190

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of exploratory data analysis

CO2 Analyze the data Visualization using Matplotlib.

CO3 Design univariate data exploration and analysis.

CO4 Apply bivariate data exploration and analysis.

CO5 Analyze Data exploration and visualization techniques for multivariate and time series data.

CO – PO – PSO MAPPING:

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

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U23PEAI10 DATA ANALYSIS AND DIGITAL MARKETING APPLICATION L T P C

Prerequisites: Problem Solving & Python Programming 2 0 2 3

COURSE OBJECTIVES:

- To understand the fundamentals of data analysis and its role in decision-making.
- To explore digital marketing concepts, strategies, and tools.
- To analyze customer behavior using data-driven approaches, to apply machine learning and AI techniques to digital marketing and to develop and optimize data-driven marketing campaigns

UNIT I INTRODUCTION TO DATA ANALYSIS 6

Introduction to Data Science and Analytics, Types of Data, Data Collection and Cleaning, Exploratory Data Analysis (EDA), Descriptive and Inferential Statistics, Data Visualization Techniques, Business Intelligence Tools, Real-world Applications of Data Analytics.

UNIT II DIGITAL MARKETING FUNDAMENTALS 6

Overview of Digital Marketing, SEO (Search Engine Optimization), SEM (Search Engine Marketing), Content Marketing, Social Media Marketing (SMM), Email Marketing, Web Analytics, Google Ads and PPC (Pay-Per-Click) Advertising, Digital Marketing Trends.

UNIT III DATA-DRIVEN MARKETING STRATEGIES 6

Customer Segmentation and Targeting, Customer Lifetime Value (CLV), Conversion Rate Optimization (CRO), A/B Testing, Personalization Strategies, Predictive Analytics for Marketing, Sentiment Analysis, Customer Churn Prediction, Case Studies in Data-driven Marketing.

UNIT IV AI AND MACHINE LEARNING IN DIGITAL MARKETING 6

Role of AI in Marketing, Chatbots and Conversational AI, Recommendation Systems, Programmatic Advertising, Natural Language Processing (NLP) for Sentiment Analysis, AI-powered Content Generation, Fraud Detection in Digital Marketing, Case Studies in AI-driven Marketing.

UNIT V DATA PRIVACY, ETHICS, AND PERFORMANCE ANALYSIS 6

Data Protection Laws (GDPR, CCPA), Ethical Considerations in Digital Marketing, Security Challenges in Online Marketing, Marketing ROI (Return on Investment) Analysis, KPI (Key Performance Indicators) in Digital Marketing, Dashboarding and Report Generation, Future Trends in Data Analysis and Digital Marketing.

30 PERIODS

PRACTICAL EXERCISES:

1. Review and calculate basic digital marketing KPIs based on a sample dataset (e.g., website traffic, ad campaigns).
2. Use Google Analytics or social media platform data to collect information such as user behavior, page views, and social media engagement.
3. Calculate summary statistics for the dataset to understand the central tendency and spread of key variables.
4. Create visualizations such as histograms, bar charts, scatter plots, and heatmaps to explore the data.
5. Build a logistic regression model to predict the likelihood of a customer converting based on their engagement.

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability & Science of Customer Centricity", 4th Edition, John Wiley & Sons, 2020.
2. Matt Bailey, "Internet Marketing: An Hour a Day", 3rd Edition, John Wiley & Sons, 2021.

REFERENCES:

1. Eric Siegel, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", John Wiley & Sons, 2016.
2. Ryan Deiss, Russ Henneberry, "Digital Marketing for Dummies", 1st Edition, John Wiley & Sons, 2020.
3. Jim Sterne, "Artificial Intelligence for Marketing: Practical Applications", 2nd Edition, John Wiley & Sons, 2019.

ONLINE RESOURCES:

1. https://www.hubspot.com/
2. https://analytics.google.com/analytics/academy/
3. https://www.coursera.org/specializations/digital-marketing

COURSE OUTCOMES:

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

CO1 Explain fundamental data analysis techniques and their importance in decision-making.

CO2 Apply digital marketing strategies to optimize online engagement.

CO3 Analyze customer behavior using data-driven marketing approaches.

CO4 Explain AI and machine learning applications in digital marketing.

CO5 Design ethical and data-driven marketing campaigns for real-world applications.

CO – PO – PSO MAPPING:

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

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U23PEAI11	ADVANCED BUSINESS ANALYTICS	L	T	P	C
Prerequisites:	**Statistical Inference**	3	0	0	3

COURSE OBJECTIVES:

- To introduce students to fundamental concepts of business analytics.
- To understand data-driven decision-making using analytics.
- To apply advanced statistical and machine learning techniques in business scenarios, to explore business intelligence tools and predictive modeling and to develop real-world business solutions using analytics.

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Definition of Business Analytics, Importance of Data-Driven Decision Making, Types of Business Analytics (Descriptive, Predictive, and Prescriptive), Business Intelligence and Analytics Tools, Data Processing and Cleaning, Case Studies in Business Analytics.

UNIT II STATISTICAL AND MACHINE LEARNING TECHNIQUES FOR BUSINESS 9

Descriptive and Inferential Statistics, Probability Distributions, Hypothesis Testing, Regression Analysis, Classification Techniques, Clustering Methods, Time Series Forecasting, Applications of ML in Business.

UNIT III BUSINESS INTELLIGENCE AND VISUALIZATION 9

Introduction to Business Intelligence, Data Warehousing, OLAP (Online Analytical Processing), Dashboard and Report Generation, Data Visualization Tools (Power BI, Tableau), KPI (Key Performance Indicators) for Business, Exploratory Data Analysis (EDA).

UNIT IV PREDICTIVE ANALYTICS AND DECISION MAKING 9

Predictive Modeling Techniques, Sentiment Analysis, Market Basket Analysis, Customer Segmentation, Recommendation Systems, Fraud Detection in Business, AI-Driven Decision Support Systems, Case Studies in Predictive Analytics.

UNIT V BIG DATA AND ETHICAL CONSIDERATIONS IN BUSINESS ANALYTICS 9

Introduction to Big Data in Business, Big Data Tools (Hadoop, Spark), Cloud Computing in Analytics, Ethics and Privacy in Business Analytics, Data Governance and Compliance (GDPR, CCPA), Business Case Studies in Data-Driven Innovation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. James Evans, "Business Analytics: Methods, Models, and Decisions", 3rd Edition, Pearson Education, 2021.
2. Jeffrey D. Camm, James J. Cochran, "Essentials of Business Analytics", 2nd Edition, Cengage Learning, 2020.

REFERENCES:

1. Foster Provost, Tom Fawcett, "Data Science for Business", 5th Edition, O'Reilly Media, 2023.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", 4th Edition, John Wiley & Sons, 2020.
3. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", 3rd Edition, John Wiley & Sons,2019.

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ONLINE RESOURCES:

1. https://www.coursera.org/specializations/business-analytics
2. https://www.edx.org/course/business-analytics
3. https://towardsdatascience.com/tagged/business-analytics

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of business analytics and its role in decision-making.

CO2 Apply statistical and machine learning techniques to business scenarios.

CO3 Analyze business data using business intelligence and visualization tools.

CO4 Explain predictive analytics models for strategic decision-making.

CO5 Design data-driven business solutions while ensuring ethical compliance.

CO – PO – PSO MAPPING:

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

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U23PEAI12	ADVANCED DATA PROCESSING TECHNIQUES	L	T	P	C
Prerequisites:	**Big Data Analytics**	3	0	0	3

COURSE OBJECTIVES:

- To introduce students to fundamental concepts of data processing.
- To understand different types of data processing.
- To apply the concepts of real time data processing.

UNIT I **FOUNDATIONS OF DATA SYSTEMS** **9**

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II **REAL-TIME DATA PROCESSING** **9**

Introduction to Big data, big data infrastructure, Real-time Analytics, near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.

UNIT III **DATA MODELS AND QUERY LANGUAGES** **9**

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL.

UNIT IV **EVENT PROCESSING WITH APACHE KAFKA** **9**

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT V **REAL-TIME PROCESSING USING SPARK STREAMING** **9**

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tyler Akidau, Slava Chemyak, Reuven Lax, "Streaming Systems: The What, Where, When and How of Large-Scale Data Processing", 1st Edition, O'Reilly Media, 2024.
2. Martin Kleppmann, "Designing Data-Intensive Applications", 3rd Edition, O'Reilly Media, 2022.

REFERENCES:

1. Flink, Storm and Kafka, "Practical Real-time Data Processing and Analytics: Distributed Computing and Event Processing using Apache Spark", 2nd Edition, Packt Publishing, 2019.
2. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Media, 2023.
3. Joe Reis, Matt Housley, "Fundamentals of Data Engineering", 1st Edition, O'Reilly Media, 2022.

ONLINE RESOURCES:

1 https://spark.apache.org/docs/latest/streaming-programming-guide.html

2 Kafka.apache.org

3 https://radixweb.com/blog/data-analytics-techniques

COURSE OUTCOMES:

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

CO1 Explain the applicability and utility of different streaming algorithms.

CO2 Apply current research trends in data-stream processing.

CO3 Analyze the suitability of stream mining algorithms for data stream systems.

CO4 Explain data processing systems, services and applications.

CO5 Evaluate problems in real time scenario.

CO – PO – PSO MAPPING:

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

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U23PEAI13	BIO INSPIRED OPTIMIZATION TECHNIQUES	L	T	P	C
Prerequisites:	Probability and Statistics	3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of optimization techniques.
- To explain about the Swarm Intelligence.
- To understand Swarm Robotics.

UNIT I **INTRODUCTION** **9**

Optimization Techniques: Introduction to Optimization Problems – Single and Muti-objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications.

UNIT II **SWARM INTELLIGENCE** **9**

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 – Other Metaheuristics – Simulated annealing.

UNIT III **NATURAL TO ARTIFICIAL SYSTEMS** **9**

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

UNIT IV **SWARM ROBOTICS** **9**

Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V **CASE STUDIES** **9**

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesman problem.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 E Elben, J E Smith, "Introduction to Evolutionary Computing", 1st Edition, Springer, 2020.

2 Floreano D. Mattiussi C, "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", 2nd Edition, MIT Press, 2008.

3 Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts,

Algorithms and Applications", 3rd Edition, Chapman & Hall/ CRC, Taylor and Francis Group, 2017.

REFERENCES:

1 Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", 2nd Edition, Oxford University Press, 2020.

2 Christian Blum, Daniel Merkle, "Swarm Intelligence: Introduction and Applications", 1st Edition, Springer Verlag, 2021.

3 Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", 1st Edition, Idea Group Inc., 2021.

ONLINE RESOURCES:

1 https://www.oga.ai/en/blog/bio-inspired-optimization-algorithms/

2 https://www.coursera.org/courses?query=optimization

3 https://www.coursera.org/courses?query=computer%20graphics

COURSE OUTCOMES:

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

CO1 Explain the basic concepts of Optimization Techniques.

CO2 Explain the swarm intelligence.

CO3 Analyze natural and artificial systems.

CO4 Explain the Swarm Robotics.

CO5 Create different applications on Swarm Intelligence algorithms.

CO – PO – PSO MAPPING:

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

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U23PEAI14	CONVEX OPTIMIZATION	L	T	P	C
Prerequisites:	**Vector Calculus and Complex Functions**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To acquire knowledge about convex sets.
- To gain conceptual understanding of convex optimization problems.
- To apply the concept of Interior Point Methods

UNIT I INTRODUCTION 9

Convex sets: affine sets – operations that preserve convexity – generalized inequalities – separating and supporting hyper planes – dual cones and generalized inequalities. Convex functions: basic properties and examples – operations that preserve convexity – conjugate functions – log concave and log convex functions – convexity with respect to generalized inequalities.

UNIT II CONVEX OPTIMIZATION PROBLEMS 9

Optimization problems – convex optimization – linear optimization problems - quadratic optimization problems – geometric programming – generalized inequality constraints – vector optimization.

UNIT III DUALITY 9

Lagrange dual function – Lagrange dual problem – geometric interpretation – saddle point interpretation – optimality conditions – perturbation and sensitivity analysis – generalized inequalities.

UNIT IV UNCONSTARINED AND EQUALITY CONSTARINT MINIMIZATION 9

Unconstrained minimization problems – descent methods- gradient descent method - steepest descent method – newton's method – self concordance – Equality constrained minimization problems – newton's method with equality constraints – infeasible start newton method.

UNIT V INTERIOR POINT METHODS 9

Inequality constrained minimization problems – logarithmic barrier function and central path – barrier method – feasibility and phase I methods – complexity analysis via self-concordance – problems with generalized inequalities – primal dual interior point methods.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", 3rd Edition, Springer, 2020.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", 2nd Edition, MIT Press, 2018.

REFERENCES:

1. Hamdy A Taha, "Operations Research - An Introduction", 10th Edition, Pearson Education, 2018.

2 Stephen Boyd, LievenVandenberghe, "Convex Optimization", 2nd Edition, Cambridge India, 2016.

3 Bertsekas, Dimitri P., "Nonlinear Programming", 3rd Edition, Athena Scientific Press, 2016.

ONLINE RESOURCES:

1 https://online.stanford.edu/courses/soe-yeecvx101-convex-optimization

2 https://www.coursera.org/courses?query=convex%20optimization

3 https://www.solver.com/convex-optimization.

COURSE OUTCOMES:

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

CO1 Explain about convex sets.

CO2 Describe Convex Optimization Problems.

CO3 Explain about Duality Function.

CO4 Evaluate unconstrained and equality constrained minimization.

CO5 Apply Interior Point Methods.

CO – PO – PSO MAPPING:

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

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U23PEAI15	GAME OPTIMIZATION	L	T	P	C
Prerequisites: Problem Solving & Python Programming		2	0	2	3

COURSE OBJECTIVES:

- To understand the concepts of Games with perfect and Imperfect Information.
- To gain knowledge about Game theory.
- To design different Game Mechanism

UNIT I **INTRODUCTION** 6

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 **GAME WITH PERFECT INFORMATION** 6

Games with Perfect Information – Strategic games – prisoner's dilemma, matching pennies-Nash equilibria- theory and illustrations – Cournot and Bertrand models of oligopoly-auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information-repeated games (prisoner's dilemma)- subgame perfect Nash equilibrium; computational issues.

UNIT III **GAMES WITH IMPERFECT INFORMATION** 6

Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions –Information aspects – Illustrations – Extensive Games with Imperfect – Information – Strategies Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner's Dilemma – Bargaining.

UNIT IV **NON-COOPERATIVE GAME THEORY** 6

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 **MECHANSIM DESIGN** 6

Aggregating Preferences-Social Choice – Formal Model- Voting – Existence of social functions – Ranking systems – Protocols for Strategic Agents: Mechanism Design –profit maximization Computational applications of mechanism design – applications in Computer Science – Google's sponsored search – eBay auctions – K-armed bandits.

30PERIODS

PRACTICAL EXERCISES:

1. Texture compression formats (JPEG, PNG, etc.), mipmaps, and texture atlases.
2. Choose a game (or game prototype) and analyze performance metrics.
3. Identify areas where optimization is needed (e.g., memory usage, frame rate, CPU/GPU load).
4. Apply asset optimization, CPU/GPU optimizations, and network optimizations.
5. Test game performance on different platforms (PC, Android, iOS) and optimize for each platform's limitations.

30 PERIODS

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TOTAL: 60 PERIODS

TEXT BOOKS:

1. Ritu Arora, Kavita Gupta, "Linear Programming and Game Theory" 1st Edition, Narosa Publishing House Pvt Ltd., 2022.
2. Michael Maschler, Eilon Salon, Shmuel Zahir, "Game Theory " 2nd Edition, Cambridge University Press, 2021.

REFERENCES:

1. Y.Narahari, "Game Theory and Mechanism Design", 1st Edition, IISC Press, World Scientific, 2015
2. Anna R. Karlin, Yuval Peres, "Game Theory", 1st Edition, AMS, 2016.
3. Ivan Pastine, Tuvana Pastine, Tom Humberstone, "Introducing Game Theory: A Graphic Guide", 1st Edition, Icon Books, 2017.

ONLINE RESOURCES:

1. https://www.intel.com/content/www/us/en/docs/gpa/user-guide/2022-4/game-optimization-methodology.html
2. https://codefinity.com/blog/Optimization-Techniques-in-Game-Development
3. https://agatelevelup.com/how-to-optimize-web-game-performance/

COURSE OUTCOMES:

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

CO1 Explain the basic concepts of Game theory

CO2 Describe the concept of Game with Perfect Information.

CO3 Describe the concept of Game with Imperfect Information.

CO4 Apply non cooperative game theory.

CO5 Design different mechanism using game optimization techniques.

CO – PO – PSO MAPPING:

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

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U23PEAI16	VISUAL INTERFACE AND USER EXPERIENCE DESIGN	L	T	P	C
Prerequisites: Creative Thinking		2	0	2	3

COURSE OBJECTIVES:

- To understand the concepts of UI and UX Design.
- To gain knowledge about Wireframing, Prototyping and Testing.
- To design Personas and create architecture.

UNIT I FOUNDATIONS OF DESIGN 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

UNIT III FOUNDATIONS OF UX DESIGN 6

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

30 PERIODS

PRACTICAL EXERCISES:

1. Designing a Responsive layout for a societal application.
2. Exploring various UI Interaction Patterns.
3. Developing an interface with proper UI Style Guides.
4. Developing Wire flow diagram for application using open-source software.
5. Exploring various open-source collaborative interface Platform.
6. Hands on Design Thinking Process for a new product.
7. Brainstorming feature for proposed product.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", 2nd Edition, O'Reilly Media, 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", 3rd Edition, O'Reilly Media, 2021.

REFERENCES:

1 Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly Media, 2020.

2 Sharanpreet Kaur, "Ultimate UI/UX Design for Professionals", 1st Edition, Orange Publishers, 2024.

3 Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", 3rd Edition, Pearson Education, 2015.

ONLINE RESOURCES

1 https://www.nngroup.com/articles/

2 https://www.interaction-design.org/literature

3 https://blog.uxtweak.com/best-ux-resources/

COURSE OUTCOMES:

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

CO1 Explain the basic concepts of UI and UX Design.

CO2 Evaluate UX design of any product or application.

CO3 Apply UX Skills in product development.

CO4 Apply the Sketching principles.

CO5 Create Wireframe and Prototype.

CO – PO – PSO MAPPING:

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

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U23PEAI17 **ADVANCED OPTIMIZATION TECHNIQUES** **L T P C**

Prerequisites: Probability and Statistics **3 0 0 3**

COURSE OBJECTIVES:

- To explain the classical optimization Techniques.
- To explain and illustrate Integer Programming.
- To discuss the applications of optimization.

UNIT I **LINEAR PROGRAMMING** **9**

Revised Simplex Method, Duel simplex Method, Sensitivity Analysis DYNAMIC PROGRAMMING (D.P): Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.

UNIT II **CLASSICAL OPTIMIZATION TECHNIQUES** **9**

Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions. Numerical Methods: Nelder Mead's Simplex search method, Gradient of a function, steepest descent method, Newton's method.

UNIT III **MODERN METHODS OF OPTIMISATION** **9**

GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems.

UNIT IV **INTEGER PROGRAMMING** **9**

Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero– One Programming, Branch-and-Bound Method.

UNIT V **APPLICATION OF OPTIMIZATION** **9**

Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 S S Rao, "Engineering Optimization", 4th Edition, New Age International, 2021.

2 Pablo Pedregal, "Introduction to Modern Optimization", 2nd Edition, Springer, 2 2023.

REFERENCES:

1 Alessandro Benfenati, Federica Porta, Fabrizia Bubba, Marco Viola, 1 "Advanced Techniques in Optimization for Machine Learning and Imaging", 1st

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Edition, Springer, 2024.
2 Mykel J. Kochenderfer, "Algorithms for Optimization", 1st Edition, MIT Press, 2019.
3 Dr.Hari Arora, "Numerical Methods and Optimization", 1st Edition, S K Kataria & Sons, 2013.

ONLINE RESOURCES:

1 https://www.optimization-online.org/
2 https://ocw.mit.edu/
3 https://www.coursera.org/

COURSE OUTCOMES:

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

CO1 Explain the concepts of Linear Programming.
CO2 Apply necessary and sufficient conditions for a given optimization problem for optimality.
CO3 Explain the concept of the modern method of optimization.
CO4 Analyze Integer Programming.
CO5 Create different applications of Optimization.

CO – PO – PSO MAPPING:

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

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U23PEAI18	OPTIMIZATION IN DEEP LEARNING	L	T	P	C
Prerequisites:	**Deep Learning**	3	0	0	3

COURSE OBJECTIVES:

- To explain the classical optimization Techniques.
- To explain and illustrate Integer Programming.
- To discuss the applications of optimization.

UNIT I LINEAR PROGRAMMING 9

Supervised learning and unconstrained optimization: deep nets, trees, and kernels, The tools in the warchest: first and second order methods, Deep learning and engineering-focused first order methods, Dimension reduction, clustering, and constrained optimization, Dealing with discontinuities via heuristic methods.

UNIT II FUNDAMENTAL MATHEMATICAL AND COMPUTATIONAL TOOLS 9

Review of Linear Algebra, probability and statistics, Calculus of multivariate functions, Taylor series and local function approximation, Optimality conditions for unconstrained / constrained optimization, Numerical methods for computing derivatives, automatic differentiation, Numerical computation of eigenvalues / singular values.

UNIT III UNCONSTRAINED OPTIMISATION VIA LOCAL SEARCH 9

Local search as a general optimization paradigm, Random local search and the curse of dimensionality, Step length rules and intuition, Formal principles of random local search.

UNIT IV FIRST ORDER METHODS: GRADIENT DESCENT AND EXTENSIONS 9

Gradient descent - normalized and unnormalized versions, Step size selection and convergence, Conservative theoretical guarantees and line search, Formal principles of gradient descent, Steepest descent - norm generalization, Batch / Stochastic gradient descent, Variations on normalized stochastic gradient descent (e.g., RMSprop, Adagrad).

UNIT V SECOND ORDER METHODS: NEWTON AND QUASI 9

Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 S.S.Rao ,"Engineering Optimization",4th Edition, New Age International,2021.

2 Pablo Pedregal, "Introduction to Modern Optimization", 2nd Edition, Springer 2023.

REFERENCES:

1 Christopher M. Bishop," Pattern Recognition and Machine Learning" 3rd Edition, Springer Verlag, 2016.

2 S. Sra, S. Nowozin, S.J. Wright," Optimization for Machine Learning ", 1st Edition, MIT Press, 2011.

3 Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2015.

ONLINE RESOURCES:

1 https://www.optimization-online.org/

2 https://ocw.mit.edu/

3 https://www.coursera.org/

COURSE OUTCOMES:

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

CO1 Explain the concepts of Supervised Learning.

CO2 Apply linear algebra, probability and statistics concepts.

CO3 Explain the concept of Unconstrained optimization.

CO4 Analyze Gradient Descent.

CO5 Create Optimization of path synthesis.

CO – PO – PSO MAPPING:

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

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U23PEAI19	WEARABLE TECHNOLOGIES	L	T	P	C
Prerequisites:	**Big Data Analytics**	3	0	0	3

COURSE OBJECTIVES:

- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT I INTRODUCTION 9

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor.

UNIT II SIGNAL PROCESSING FOR WEARBALE DEVICES 9

Wearability issues -physical shape and placement of sensor, technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based.

UNIT III WIRELESS HEALTH SYSTEM 9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.

UNIT IV SMART TEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques, Conductive Fibers, Treated Conductive Fibers, Conductive Fabrics, Conductive Inks. Case study smart fabric for monitoring biological parameters - ECG, respiration.

UNIT V APPLICATION OF WEARABLE SYSTEM 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Annalisa Bonfiglo and Danilo De Rossi, "Wearable Monitoring Systems", 2nd Edition, Springer, 2021.
2. Zhang and Yuan-Ting, "Wearable Medical Sensors and Systems", 1st Edition, Springer, 2013.

REFERENCES:

1. Edward Sazonov, Micheal R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications", 1st Edition, Elsevier, 2014.

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2 Kevin Chen, "Wearable Technology",1st Edition, Royal Collins Publication, 2024.

3 Daniel A. James, Nicola Petrone, "Sensors and Wearable Technologies in Sport Technologies, Trends and Approaches for Implementation", 3rd Edition, Springer, 2016.

ONLINE RESOURCES:

1 https://www.happiestminds.com/insights/wearable-technology/

2 https://www.techtarget.com/searchmobilecomputing/definition/wearable-technology

3 https://www.cambridge.org/core/journals/wearable-technologies

COURSE OUTCOMES:

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

CO1 Explain the basics of Wearable Technology.

CO2 Comprehend the Signal Processing.

CO3 Explain about Wireless Health Systems.

CO4 Evaluate the Smart Textile.

CO5 Design application of Wearable Systems.

CO – PO – PSO MAPPING:

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

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U23PEAI20	AI CONCEPT USING HUMAN COMPUTER INTERACTION	L T P C
Prerequisites:	**Machine Learning**	2 0 2 3

COURSE OBJECTIVES:

- To understand the concepts of HCI
- To design software process,models and theories.
- To design Web Interfaces.

UNIT I **FOUNDATIONS OF HCI** 6

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT II **DESIGN AND SOFTWARE PROCESS** 6

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III **MODELS AND THEORIES** 6

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV **MOBILE HCI** 6

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT V **WEB INTERFACE DESIGN** 6

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

30 PERIODS

PRACTICAL EXERCISES:

1. Build a basic voice assistant using Python libraries like speech_recognition and pyttsx3.
2. Use OpenCV and a pre-trained facial emotion recognition model to detect user emotions via webcam.
3. Build a chatbot with Rasa or Dialogflow that maintains conversation context (e.g., remembering user's name or preferences).
4. Create a web app that adapts layout or content based on user behavior (e.g., dark mode at night, larger text for visually impaired).
5. Use Mediapipe or OpenCV to detect hand gestures and control UI elements (e.g., swipe left/right with hand movements).
6. Build an intelligent typing assistant that suggests next words using GPT-2 or a simpler language model.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2020.
2. Brian Fling," Mobile Design and Development", 1st Edition, O'Reilly Media,2019.

REFERENCE BOOKS:

1. Bill Scott, Theresa Neil, "Designing Web Interfaces", 2nd Edition, O'Reilly Media, 2019.
2. Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale, "Human Computer Interaction",3rd Edition, Pearson Education, 2014.
3. Gerard Kim, "Human-Computer Interaction: Fundamentals and Practice", 1st Edition, CRC Press, 2015.

ONLINE RESOURCES:

1. https://hcibib.org/
2. https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_resources.htm
3. https://careerfoundry.com/en/blog/ux-design/human-computer-interaction/

COURSE OUTCOMES:

CO1 Explain the basics foundations of HCI.

CO2 Design different scenarios using software process.

CO3 Determine the concepts of HCI Model.

CO4 Evaluate Mobile HCI.

CO5 Create Web interface design.

CO – PO – PSO MAPPING:

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

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U23PEAI21	INTELLIGENCE ANALYSIS	L	T	P	C
Prerequisites:	**Big Data Analytics**	3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of Artificial Intelligence.
- To know about clustering algorithms.
- To design computer vision using image segmentation.

UNIT I INTRODUCTION 9

Overview of AI and Machine Learning- Analyzing Intelligence-Reducing Uncertainty-Intelligence Analysis-Overview of Models in Intelligence-Intelligence Cycle and Analytical Process-Collection Planning-Turning the collected 'raw information' into intelligence-Assessing confirmed or unconfirmed intelligence-Understanding networks and groups.

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 – online search agents and unknown 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: 45 PERIODS

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education, 2021.
2. Dan W. Patterson, "Introduction to AI and ES", 4th Edition, Pearson Education, 2017.

REFERENCE BOOKS:

1. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", 2nd Edition, Tata McGraw Hill, 2020.

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2 Patrick H. Winston, "Artificial Intelligence", 3rd Edition, Pearson Education, 2021.

3 Deepak Khemani, "Artificial Intelligence", 2nd Edition, Tata McGraw Hill, 2019.

ONLINE RESOURCES:

1 https://ai-pro.org/learn-ai/articles/the-top-ai-resources-for-learning-courses-and-online-platforms/

2 https://www.shiksha.com/online-courses/articles/best-resources-to-learn-artificial-intelligence/

3 https://www.coursera.org/courses?query=artificial%20intelligence&productDifficultyLevel=Advanced

COURSE OUTCOMES:

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

CO1 Explain the basic concepts of Artificial Intelligence.

CO2 Analyze the different concepts of Problem Solving

CO3 Explain the concepts of Game Playing

CO4 Evaluate logical reasoning in knowledge representation.

CO5 Create probabilistic reasoning in casual networks.

CO – PO – PSO MAPPING:

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

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U23PEAI22	COGNITIVE NEUROSCIENCE	L	T	P	C
Prerequisites:	Probability and Statistics	2	0	2	3

COURSE OBJECTIVES:

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

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

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 – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V WEB INTERFACE DESIGN 6

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

30 PERIODS

PRACTICAL EXERCISES:

1. Identify major brain structures and their cognitive functions.
2. Record and interpret basic brain electrical activity during cognitive tasks.
3. Examine neural activation and performance in working memory tasks.
4. Analyze real fMRI data from open databases.
5. Examine word recognition and language networks.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Marie T. Banich, Rebecca J. Compton, "Cognitive Neuroscience", 1st Edition, Cambridge University Press, 2023.
2. Jose Luis Bermúdez, "Cognitive Science -An Introduction to the Science of the Mind", 1st Edition, Cambridge University Press 2020.

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REFERENCE BOOKS:

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, "Cognitive Computing: Theory and Applications: (Handbook of Statistics 35)", 1st Edition, Elsevier publications, 2016.
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive Computing and Big Data Analytics", 1st Edition, John Wiley & Sons, 2015.
3. Michael S. Gazzaniga, "Handbook of Cognitive Neuroscience", 1st Edition, Springer, 2014.

ONLINE RESOURCES:

1. https://www.bna.org.uk/resources-archive/online-resources/
2. https://pmc.ncbi.nlm.nih.gov/articles/PMC10653246/
3. https://onlinecourses.nptel.ac.in/noc22_hs97/preview

COURSE OUTCOMES:

CO1 Explain the basic concepts of Artificial Intelligence.

CO2 Describe the different concepts of Robotic Process Activities.

CO3 Explain the concepts of App Integration.

CO4 Develop applications using cognitive inference model.

CO5 Develop applications using cognitive learning model.

CO – PO – PSO MAPPING:

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

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U23PEAI23	ADVANCED AI AND UNSUPERVISED LEARNING	L	T	P	C
Prerequisites:	Machine Learning	2	0	2	3

COURSE OBJECTIVES:

- To understand the concepts of Artificial Intelligence
- To know about clustering algorithms
- To design computer vision using image segmentation.

UNIT I **INTRODUCTION** 6

Overview of AI and Machine Learning. -Advanced AI Algorithms: Overview and types-Difference between Supervised and Unsupervised Learning. -Applications of Unsupervised Learning in AI.Hidden Markov Models (HMMs) and their applications.

UNIT II **CLUSTERING ALGORITHMS** 6

Introduction to Clustering-K-Means Clustering: Algorithm-convergence, and applications. DBSCAN (Density-Based Spatial Clustering of Applications with Noise)-Hierarchical Clustering (Agglomerative and Divisive)-Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events-Principal Component Analysis.

UNIT III **GAUSSIAN MIXTURE MODELS** 6

Overview of Gaussian Mixture Models (GMM)-Expectation-Maximization (EM) algorithm-Applications of GMM in clustering and density estimation-Introduction to Anomaly Detection-Isolation Forests, One-Class SVM, and Local Outlier Factor (LOF)-Applications.

UNIT IV **AUTOENCODERS AND GENERATIVE MODELS** 6

Introduction to Autoencoders for unsupervised learning-Variational Autoencoders (VAEs) and their use in generative modeling-Generative Adversarial Networks (GANs) in unsupervised learning-Markov Decision Processes-Q-Learning and Deep Q-Networks (DQN)-Exploration vs. Exploitation in RL.

UNIT V **DEEP UNSUPERVISED LEARNING** 6

Introduction to Deep Unsupervised Learning-Deep Belief Networks (DBNs) and Restricted Boltzmann Machines (RBMs)-Self-Organizing Maps (SOM). Applications in natural language processing (NLP): Topic modeling (LDA), Word2Vec. Computer Vision: Image segmentation and clustering.Recommendation Systems: Collaborative filtering using clustering methods.

30 PERIODS

PRACTICAL EXERCISES:

1. Implement k-Means clustering and visualize clusters.
2. Use hierarchical clustering to identify patterns in data.
3. Compare clustering results using different distance metrics.
4. Apply Principal Component Analysis (PCA) on a high-dimensional dataset.
5. Perform feature scaling and normalization.

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. François Chollet," Deep Learning with Python", 1st Edition, Manning Publisher, 2017.
2. Giuseppe Bonaccorso, "Hands-On Unsupervised Learning with Python", 1st Edition, packt Publishers, 2019.

REFERENCE BOOKS:

1. David Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play", 2nd Edition, O'Reilly Media, 2019.
2. Samuel Holt, "Machine Learning with TensorFlow 2.0", 1st Edition, Packt Publishers, 2020.
3. Denis Rothman, "Transformers for Natural Language Processing", 1st Edition, Packt Publishers, 2021.

ONLINE RESOURCES:

1. https://ai-pro.org/learn-ai/articles/the-top-ai-resources-for-learning-courses-and-online-latforms/
2. https://www.shiksha.com/online-courses/articles/best-resources-to-learn-artificial-intelligence/
3. https://www.coursera.org/courses?query=artificial%20intelligence&productDifficultyLevel=Advanced

COURSE OUTCOMES:

CO1 Explain the basic concepts of Artificial Intelligence.

CO2 Describe the different concepts of Robotic Process Activities.

CO3 Explain the concepts of App Integration.

CO4 Develop applications using cognitive inference model.

CO5 Develop applications using cognitive learning model.

CO – PO – PSO MAPPING:

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

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U23PEAI24	ADVANCED CREATIVE THINKING	L	T	P	C
Prerequisites:	**Creative Thinking**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the concepts of creative thinking
- To explain mechanism of thinking
- To create problem solving models in innovation.

UNIT I INTRODUCTION 9

Overview of AI and Machine Learning- Analyzing Intelligence-Reducing Uncertainty-Intelligence Analysis-Overview of Models in Intelligence-Intelligence Cycle and Analytical Process-Collection Planning-Turning the collected 'raw information' into intelligence-Assessing confirmed or unconfirmed intelligence-Understanding networks and groups.

UNIT II MECHANISM OF THINKING AND VISUALIZATION 9

Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, colour symmetry. Spatial relationships and compositions in 2- and 3-dimensional space.

UNIT III CREATIVITY 9

Nature of Creativity: Person, Process, Product and Environment, Methods and tools for Directed Creativity – Basic Principles – Tools that prepare the mind for creative thought – stimulation – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation the Bridge between man creativity and the rewards of innovativeness.

UNIT IV CREATIVITY IN PROBLEM SOLVING 9

Generating and acquiring new ideas, product design, service design – case studies and hands-on exercises, stimulation tools and approaches, six thinking hats, lateral thinking – Individual activity, group activity, contextual influences. Assessing Your Personal Creativity and Ability to Innovate, Enhancing Your Creative and Innovative Abilities.

UNIT V INNOVATION 9

Innovation- radical vs evolutionary, – Introduction to TRIZ methodology of Inventive Problem Solving – the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption -Managing the Strategy Development Process.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Neil Francis, "The Creative Thinking Book: How to ignite and boost your creativity", 1st Edition, LID Publishers, 2024.
2. Donald J. Treffinger, Scott G. Isaksen, K. Brian Stead-Doraty," Creative Problem Solving: An Introduction", 3rd Edition, Prufrock Press, 2021.

REFERENCE BOOKS:

1 Sagar chakraborty, " The Art of Creative Thinking", 1st Edition, Sagar Chakraborty Publishers, 2023.

2 Andrew Pressman, "Design Thinking: A Guide to Creative Problem Solving for Everyone", 1st Edition, Taylor & Francis, 2018

3 Edward de Bono," Lateral Thinking: Creativity Step by Step", 3rd Edition, HarperCollins, 2020

ONLINE RESOURCES

1 https://www.aim.com.au/leadership-strategy/courses/creative-thinking-and-continuous-improvement-online

2 https://professional.dce.harvard.edu/programs/creative-thinking-innovative-solutions-to-complex-challenges/

3 https://creativityandeducation.com/creative-thinking-network-for-educators/

COURSE OUTCOMES:

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

CO1 Explain the concepts of creative thinking.

CO2 Apply the mechanism of creative thinking.

CO3 Explain principles of creativity.

CO4 Apply creativity in problem solving.

CO5 Create different innovation models.

CO – PO – PSO MAPPING:

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

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U23PEAI25	SHADOW AI	L	T	P	C
Prerequisites: Machine Learning Techniques		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to the fundamentals of shadow AI.
- To understand difference between shadow IT versus shadow AI.
- To analyze the risks of shadow AI

UNIT I **INTRODUCTION** **9**

Introduction of shadow AI - Shadow AI is the unauthorized use of generative AI -Identifying Operational Needs-Experimentation and Prototyping- Deployment and Integration- Agile Development-t and Prototyping- Customer Experience Enhancement- Compliance and Governance.

UNIT II **SHADOW IT VERSUS SHADOW AI** **9**

Introduction to Shadow IT, software, hardware or information technology,- enterprise network without an IT department, - CIO's approval, knowledge , - service, shadow AI m zeros in on AI-specific tools -, platforms and use cases large language model (LLM) - quickly generate a report -realizing the security risks.- key difference lies in the nature of the tools being used: Shadow AI is about the unauthorized use of artificial intelligence.

UNIT III **RISKS OF SHADOW AI** **9**

Data breaches and security vulnerabilities-Noncompliance with regulations-Reputational Damage-Emphasize Collaboration-Develop a flexible governance framework-Implement guardrails- Monitor AI usage-Reiterate the risks.

UNIT IV **CAUSES OF SHADOW AI** **9**

Enhance productivity -Accelerate Innovation-Streamline Solutions-Challenges of Shadow AI-Security Risk: Data Management Inefficiencies: Lack of Control- Compliance Issues: Using unauthorized AI tools - Marketing Optimization- Common AI tools in shadow AI.

UNIT V **EXAMPLES OF SHADOW AI** **9**

AI-powered chatbots-ML models for data analysis-Marketing automation tools-Data visualization tools Future of Shadow AI- Integration with Centralized IT Governance-Enhanced Collaboration Tools- Advancements in AI Ethics and Compliance: - AI-driven Innovation Hubs- Expanded Applications Across Industries- AI-powered Automation and Decision Support.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D. Puthal, A.K. Mishra, S.P. Mohanty, "Shadow AI: Cyber Security Implications, Opportunities and Challenges in the Unseen Frontier", 1st Edition, SN Computer Science publication, 2025.
2. Madhumita Murgia, "Code Dependent: Living in the Shadow of AI — Shortlisted for the Women's Prize for Non-Fiction Hardcover", 2nd Edition, Picador Publishers, 2024.

REFERENCES:

1. Michael Sipser," Introduction to the Theory of Computation", 3rd Edition, Cengage Learning, 2021.
2. Parmy Olson, Supremacy:" AI, ChatGPT, and the Race that Will Change the World", 1st Edition, Pan Macmillan Publications, 2024.

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3 Ken Huang, Yang Wang Generative AI Security: Theories and Practices",1st Edition, Springer Publications, 2024.

ONLINE RESOURCES:

1 https://www.shadow.do/

2 https://www.shadowai.app/

3 https://thoropass.com/blog/compliance/shadow-ai/

COURSE OUTCOMES:

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

CO1 Explain the fundamental concepts of shadow AI.

CO2 Apply the concepts of Shadow IT versus shadow AI.

CO3 Analyze the Risks of shadow AI.

CO4 Analyze the causes of shadow AI

CO5 Analyze the AI-powered chatbots-ML models for data analysis.

CO – PO – PSO MAPPING:

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

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U23PEAI26	AIOT SMART AGRICULTURE MONITORING	L	T	P	C
Prerequisites: Deep Learning		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to the fundamentals of AI.
- To understand approaches to KR.
- To analyze various search strategies.

UNIT I INTRODUCTION 9

Foundations and History of Artificial Intelligence (AI)- Decoding Artificial Intelligence-Meaning, Scope, and Stages of Artificial Intelligence - Current AI systems, Effects of Artificial Intelligence on Society Artificial Neural Network and Neural Expert Systems: How brain works, the Neuron as a single computing element, Perceptron, Various Learning Rules.

UNIT II KNOWLEDGE REPRESENTATION 9

Knowledge Representation (KR)- Approaches to KR: Relational knowledge, Procedural knowledge and knowledge represented as logic-Propositional Logic (PL)-Predicate Logic and Fuzzy Logic Introduction-Structure and Properties of Intelligent Agents, Configuration and PEAS description- Types of Agents (Environment & Utility based).

UNIT III SEARCH STRATEGIES 9

Definition of state space search- Problem formulation and State Space search- Production systems and characteristics- Search Strategies-Hill Climbing, Breadth first and depth first search, Simulated Annealing-Mini-max Search, Alpha-Beta Pruning.

UNIT IV AI IN AGRICULTURE 9

Potential applications of Artificial Intelligence- Crop Yield Prediction and Price forecasting, Predictive Insights- Monitoring crop and soil health, AI and machine learning-based surveillance systems- track-and-traceability of agricultural supply chains- Optimization of Irrigation Systems- Monitoring livestock's health Post.

UNIT V GIS SYSTEM 9

An introduction to precision farming, GIS/ GPS positioning system for precision farming- AI and IoT based Gradation of yield (fruits, cereals etc.)- Automation of industry towards precision agriculture-Visual image interpretation-digital image processing, Computers and Geographic-information systems-Precision Farming-Issues and conditions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" ,4th Edition, Pearson Education, 2020.
2. Souvik Pal, Prasant Kumar Pattnaik , Raghvendra Kumar, S N Panda, "IoT and Analytics for Agriculture", 1st Edition, Springer, 2020.

REFERENCES:

1. S. Rajesekaran, G.A. Vijayalakshmi Pai, "Neural networks, fuzzy logic and Genetic Algorithm", 1st Edition, Prentice-Hall of India Publications, 2024.
2. M. Negnevitsky, Addison Wesley "Artificial Intelligence: A Guide to Intelligent Systems" 3rd Edition, Pearson Education, 2020.

3 D. Khemani," A first course in Artificial Intelligence", 1st Edition, Tata McGraw Hill, 2021.

ONLINE RESOURCES:

1 https://www.coursera.org/learn/ai-for-everyone

2 https://www.edx.org/course/internet-of-things-iot-for-sustainable-agriculture

3 https://www.coursera.org/learn/agriculture-technology

COURSE OUTCOMES:

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

CO1 Explain about foundations and History of Artificial Intelligence (AI).

CO2 Apply the concepts of types of Agents.

CO3 Analyze the Problem formulation and State Space search.

CO4 Analyze the Monitoring crop and soil health.

CO5 Analyze the Geographic information systems.

CO – PO – PSO MAPPING:

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

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U23PEAI27	FORMAL LANGUAGE AND AUTOMATA	L	T	P	C
Prerequisites: Theory of Computation		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to the fundamentals of formal languages and automata theory
- To understand different grammars, automata, and their applications in AI.
- To analyze the computational power of various automata and Turing machines.

UNIT I INTRODUCTION TO AUTOMATA THEORY 9

Introduction to Automata – Deterministic Finite Automata (DFA) – Non-Deterministic Finite Automata (NFA) – Equivalence of DFA and NFA – Minimization of Finite Automata – Applications of Finite Automata in AI.

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular Expressions – Equivalence of Regular Expressions and Finite Automata – Properties of Regular Languages – Pumping Lemma for Regular Languages – Applications in AI, NLP, and Pattern Recognition.

UNIT III CONTEXT-FREE GRAMMARS AND PUSHDOWN AUTOMATA 9

Context-Free Grammars (CFGs) – Parse Trees – Ambiguity in Grammars – Pushdown Automata (PDA) – Equivalence of PDA and CFGs – Applications in AI-driven Compilers and Syntax Analysis.

UNIT IV TURING MACHINES AND COMPUTABILITY 9

Turing Machines (TM) – Variants of Turing Machines – The Church-Turing Thesis – Decidable and Undecidable Problems – Complexity Classes (P, NP, NP-Complete, NP-Hard) – Role of Turing Machines in AI and Computation.

UNIT V APPLICATIONS AND ADVANCED TOPICS 9

Applications of Automata in Natural Language Processing, AI, and Machine Learning – Automata in AI-driven Decision-Making Systems – Introduction to Neural Turing Machines – Emerging Trends in Computational Theory.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 3rd Edition, Pearson Education, 2006.
2. Peter Linz, "An Introduction to Formal Languages and Automata", 1st Edition, Jones & Bartlett Learning, 2016.

REFERENCES:

1. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012.
2. Kamala Krithivasan, R. Rama, "Introduction to Formal Languages, Automata Theory, and Computation", Pearson Education, 2010.
3. John C. Martin, Introduction to Languages and the Theory of Computation, 4th Edition, Tata McGraw-Hill Education, 2010.

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ONLINE RESOURCES:

1 https://www.geeksforgeeks.org/theory-of- computation-automata/

2 https://ocw.mit.edu/courses/electrical-engineering-and- computer-science/

3 https://www.coursera.org/learn/automata

COURSE OUTCOMES:

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

CO1 Explain the fundamental concepts of formal languages and automata.

CO2 Describe the working of finite automata and regular expressions.

CO3 Analyze context-free grammars and pushdown automata.

CO4 Evaluate the computational capabilities of Turing Machines.

CO5 Develop applications of automata in AI and data science.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO4	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-	2	2

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U23PEAI28	RAPID LANGUAGE AND AML	L	T	P	C
Prerequisites: Programming in C		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to Rapid Programming Languages used in AI and data science
- To familiarize students with Anti-Money Laundering (AML) techniques in financial crime detection.
- To apply AI-based AML models and regulatory compliance measures

UNIT I INTRODUCTION TO RAPID PROGRAMMING LANGUAGES 9

Introduction to Rapid Development Frameworks – Popular Rapid Languages (Python, R, Julia) – Syntax and Semantics – Data Types and Control Flow – Functional and Object-Oriented Programming – Libraries for AI & ML (NumPy, Pandas, TensorFlow, PyTorch, Scikit-learn) – Use Cases in AI and Data Science.

UNIT II FUNDAMENTALS OF ANTI-MONEY LAUNDERING 9

Introduction to AML – Overview of Financial Crime – AML Regulations and Compliance (FATF, FinCEN, RBI, SEBI) – Key AML Concepts (KYC, Transaction Monitoring, Risk-Based Approach) – Case Studies on Money Laundering.

UNIT III MACHINE LEARNING FOR AML 9

AI Techniques for AML – Supervised and Unsupervised Learning for Anomaly Detection – Fraud Detection Models – Decision Trees, Random Forests, Neural Networks for AML – Feature Engineering for Financial Transactions – Evaluating Model Performance in AML.

UNIT IV DATA PRIVACY AND REGULATORY FRAMEWORKS 9

Data Security in AML – Privacy-Preserving ML – Differential Privacy – GDPR, CCPA, and AML Compliance – Explainability and Fairness in AI for AML – Regulatory Sandbox for AI-driven AML Solutions.

UNIT V REAL-WORLD IMPLEMENTATIONS OF AML 9

AI-Powered AML Systems – Graph-Based Approaches for Fraud Detection – Secure Transaction Monitoring Pipelines – Blockchain in AML – Future Trends in AI for AML – Case Studies on Financial Institutions Using AI for AML.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Anand Tamboli, "Artificial Intelligence for Financial Applications", 1st Edition, Springer Publications, 2023.
2. Darwin Makhija & Santosh Sirur, "Ultimate Forensic Guide to AML, KYC & CFT", 1st Edition, Darwin Publications, 2024.

REFERENCES:

1. Gilit Saporta & Shoshana Maraney, "Practical Fraud Prevention: Fraud and AML Analytics for Fintech and Ecommerce, Using SQL & Python", 3rd Edition, O'Reilly Media, 2022.
2. Kweku-Muata Osei-Bryson, "Handbook on AI in Finance and AML", 1st Edition, Springer, 2023.
3. Christian Blume & Wilfried Jakob, "Programming Languages for Industrial Robots", 1st Edition, Springer Publication,2020.

ONLINE RESOURCES:

1 https://www.fincen.gov – Financial Crimes Enforcement Network (AML Guidelines)

2 https://www.fatf-gafi.org – FATF AML Recommendations.

3 https://www.kaggle.com/datasets/anti-money-laundering – AML Datasets for AI.

COURSE OUTCOMES:

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

CO1 Explain Rapid Programming Languages and their role in AI applications.

CO2 Evaluate key AML principles and regulations.

CO3 Analyze AI-based techniques for financial fraud detection.

CO4 Evaluate privacy and regulatory aspects in AML compliance.

CO5 Develop AI models for AML detection and risk assessment.

CO – PO – PSO MAPPING:

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

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GOWRIVAKKAM, CHENNAI -

U23PEAI29	EXPLAINABLE AI	L	T	P	C
Prerequisites: Deep Learning		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamentals of Explainable AI (XAI).
- Learn to interpret various machine learning models.
- Explore model-agnostic XAI techniques for generating explanations across different models.

UNIT I **INTRODUCTION TO XAI** 6

Introduction to Explainable AI: Motivation, Importance - Challenges and limitations of black box models - Types of Explainability – taxonomy of explanations - Interpretability – Importance of Interpretability - Taxonomy of Interpretability Methods - Scope of Interpretability - Evaluation of Interpretability - Properties of Explanations - Human-friendly Explanations

UNIT II **INTERPRETABLE MACHINE LEARNING MODELS** 6

Overview of Interpretable Machine Learning – Decision Trees, Random Forests – principles, interpretation techniques, Rule based Models – Rule induction, Decision list, rule-based classifiers, Linear models – Interpreting Coefficients, regularization techniques, feature selection.

UNIT III **MODEL AGNOSTIC XAI TECHNIQUES** 6

Overview of model Agnostic systems – LIME – local feature importance explanations – SHAP – individual predictions and feature importance – Partial Dependence Plot – Individual Conditional Expectation Plot - Counterfactual explanations.

UNIT IV **XAI FOR DEEP LEARNING** 6

XAI for deep learning models - Gradient-based methods: Grad-CAM, Integrated gradients, Saliency Maps – Layer wise relevance propagation (LRP)– feature visualization- Deep Dream – Activation Maximization

UNIT V **EVALUATION AND ETHICAL CONSIDERATIONS** 6

Evaluating XAI Methods - Metrics and criteria for evaluating explanation - Human-in-the-loop evaluation - User studies and feedback - Ethical Considerations in XAI - Bias, fairness, and transparency - Privacy and security concerns - Social and legal aspects of XAI – Applications

30 PERIODS

PARCTICAL EXERCISES:

1. Visualize and Compare Interpretability of Machine Learning Models.
2. Generate Local and Global Explanations Using LIME and SHAP.
3. Implement and Visualize Gradient-Based XAI Methods in CNN.
4. Evaluate Interpretability Using Human Feedback and Metrics.
5. Design Counterfactual Explanations for Classification Models.
6. Ethical Assessment of XAI in Real Applications.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1 Christoph Molnar, "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable", 2nd Edition, Springer Publication, 2019.

2 Wojciech Samek, Thomas Wiegand, and Klaus-Robert Müller, "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning",1st Edition, Springer Publication,2021.

REFERENCES:

1 Leonida Gianfagna, Antonio Di Cecco, Explainable AI with Python, 2nd Edition, Springer, 2021.

2 Denis Rothman, "Hands-On Explainable AI (XAI) with Python: Interpret, Visualize, Explain, and Integrate Reliable AI for Fair, Secure, and Trustworthy AI Apps", 1st Edition, Packt Publishing Ltd, 2020.

ONLINE RESOURCES:

1 https://christophm.github.io/interpretable-ml-book/

2 https:// shap.readthedocs.io/

3 https:// lime-ml.readthedocs.io

COURSE OUTCOMES:

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

CO1 Explain interpretable machine learning principles of decision tree, rule based and linear models.

CO2 Apply Model Agnostic XAI techniques, interpret and explain predictions of machine learning models.

CO3 Develop XAI techniques for deep learning models.

CO4 Evaluate XAI methods and propose innovative solutions to address ethical considerations

CO5 Apply XAI techniques in practical scenarios, for real-world datasets and problems.

CO – PO – PSO MAPPING:

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

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U23PEAI30	ADVANCED SPEECH AND NATURAL LANGUAGE PROCESSING	L	T	P	C
Prerequisite:	**Machine Learning Techniques.**	2	0	2	3

COURSE OBJECTIVES:

- To introduce students to the fundamental concepts of speech and natural language processing (NLP).
- To understand speech processing techniques and machine learning models for NLP.
- To explore advanced topics in deep learning-based NLP and their applications.

UNIT I **INTRODUCTION TO SPEECH AND NLP** **6**

Overview of Speech Processing – Speech Signal Processing – Phonetics and Phonology – Acoustic Phonetics – Prosody – Speech Recognition and Synthesis – NLP Overview – Components of NLP – Text Preprocessing Techniques – Tokenization, Stemming, Lemmatization – Part-of-Speech (POS) Tagging.

UNIT II **LANGUAGE MODELING AND STATISTICAL NLP** **6**

N-gram Language Models – Probability Estimation – Smoothing Techniques – Hidden Markov Models (HMM) – Maximum Entropy Models – Probabilistic Context-Free Grammars – Named Entity Recognition (NER) – Word Sense Disambiguation – Text Classification using Machine Learning.

UNIT III **DEEP LEARNING FOR NLP** **6**

N-gram Language Models – Probability Estimation – Smoothing Techniques – Hidden Markov Models (HMM) – Maximum Entropy Models – Probabilistic Context-Free Grammars – Named Entity Recognition (NER) – Word Sense Disambiguation – Text Classification using Machine Learning.

UNIT IV **SPEECH RECOGNITION AND SYNTHESIS** **6**

Automatic Speech Recognition (ASR) – Feature Extraction (MFCC, LPC, Spectrogram) – Acoustic and Language Models – Hidden Markov Model-based Speech Recognition – Speech Synthesis (Text-to-Speech) – Speech Emotion Recognition – Speaker Identification – Applications of Speech Processing in AI.

UNIT V **CHATBOTS** **6**

Machine Translation (Google Translate, DeepL) – Chatbots and Conversational AI – Question Answering Systems – Speech-enabled AI Assistants – Ethical Issues in NLP – Bias in AI Language Models – Current Trends and Future Directions in NLP Research.

30 PERIODS

PRACTICAL EXERCISES:

1. Clean and preprocess text data for NLP tasks.
2. Represent text in numerical formats for use in machine learning models
3. Extract linguistic features such as parts of speech and named entities from text
4. Implement modern NLP models such as BERT.
5. Explore advanced topics like question answering, summarization, and machine translation.

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1 Daniel Jurafsky, James H. Martin, "Speech and Language Processing", 3rd Edition, Pearson Publications, 2021.

2 Palash Goyal, Sumit Pandey, and Karan Jain, "Deep Learning for Natural Language Processing", 1st Edition, Springer Publications, 2021.

REFERENCES:

1 Hermann Ney, Bodo Reis, "Neural Networks for Speech Recognition", 1st Edition, Springer Publication, 2020.

2 Yoav Goldberg, Neural Network Methods for Natural Language Processing, 1st Edition, Morgan & Claypool Publications, 2017.

3 Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python",1st Edition, O'Reilly Media, 2019.

ONLINE RESOURCES:

1 https://www.geeksforgeeks.org/natural-language-processing-overview/

2 https://www.coursera.org/learn/nlp

3 https://nlp.stanford.edu/

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of speech and natural language processing.

CO2 Apply machine learning techniques for NLP.

CO3 Analyze deep learning approaches for NLP applications.

CO4 Evaluate speech recognition and synthesis models.

CO5 Develop AI applications using advanced NLP techniques.

CO – PO – PSO MAPPING:

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

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U23PEAI31 **AI – ASSISTED GRAPHIC DESIGN** L T P C

Prerequisite: Creative Thinking 3 0 0 3

COURSE OBJECTIVES:

- To introduce students to the fundamental concepts of AI.
- To understand AI powered features in Photoshop.
- To explore integrating AI in typography design.

UNIT I **FOUNDATIONAL AI CONCEPTS** 9

Introduction to AI in graphic design, History and evolution of AI in the design industry, AI's impact on the design workflow and industry, Ethical considerations and responsible AI use in design.

UNIT II **ADOBE PHOTOSHOP WITH AI INTEGRATION** 9

Understanding AI-powered features in Photoshop, Image enhancement using AI algorithms, AI-based object removal and content-aware fill, Automating repetitive tasks with AI.

UNIT III **ADOBE ILLUSTRATOR AND VECTOR GRAPHICS** 9

Advanced vector graphics techniques, Integrating AI for precise shape recognition, AI-assisted color palette creation, Dynamic vector patterns using AI, Creating responsive designs with AI-generated vectors.

UNIT IV **AI TOOLS IN GRAPHIC DESIGN** 9

Overview of popular AI tools for designers, implementing style transfer in design projects, Using AI for layout suggestions and composition, AI-generated typography and font selection, Collaborative design using AI platforms.

UNIT V **INTEGRATING AI IN TYPOGRAPHY DESIGN** 9

AI-driven font pairing and selection, creating custom fonts with machine learning, Dynamic and responsive typography, AI in kerning and spacing optimization, Exploring experimental AI typography projects.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Thomas D. Ladd, "Artificial Intelligence for Graphic Designers: A Practical Guide to Using AI in Design" 1st Edition, Rockport Publishers,2022.

2 Scott Belsky, "The AI-Powered Design: How Artificial Intelligence Will Revolutionize Graphic Design", 1st Edition, John Wiley & Sons, 2021.

REFERENCES:

1 Robin Nichols, "Mastering Adobe Photoshop Elements 2022: Boost your image-editing skills using the latest Adobe Photoshop Elements tools and techniques ", 1st Edition, Peachpit Press,2021.

2 D.T. Pham, "Artificial Intelligence in Design", 1st Edition, Springer Publication, 2018.

3 D. Neal Hettinger, "Modern Graphic Design with AI ", 2nd Edition, CRC Publisher,2022.

ONLINE RESOURCES:

1 https://careerfoundry.com/en/blog/ux-design/ai-graphic-design-tools/

2 https://www.bluehost.in/blog/ai-in-graphic-design/

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3 https://www.andacademy.com/resources/blog/graphic-design/ai-in-graphic-design/

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of AI concepts.

CO2 Analyze image enhancement with AI algorithms.

CO3 Analyze vector graphics techniques.

CO4 Evaluate AI tools for designing.

CO5 Develop AI integration in typography.

CO – PO – PSO MAPPING:

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

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U23PEAI32	AI IN SOCIAL MEDIA AND CONTENT CURATION	L	T	P	C
Prerequisite:	**Foundations of Data Science**	3	0	0	3

COURSE OBJECTIVES:

- To Understand social media fundamentals.
- To Create a social media campaign.
- To Publish social media updates and engage with a community.

UNIT I **INTRODUCTION** 9

Evolution of online communities - History and Evolution of social media- social media vs. traditional media - Social Media Audience and Goals for using social media - Understanding social media: Strong and weak ties – Influencers - How ideas travel – Viralness - Social theory and social media.

UNIT II **SOCIAL MEDIA TOOLS** 9

Overview of current social media tools and the history of its use – 4 zones of social media: Social Community: Activities and Multimedia Applications; Sites: Ello, Google+, Facebook, LinkedIn,Twitter, Reddit, Path, Mylife - Social Publishing: Activities; Multimedia Applications; Sites: Tumblr, Instagram, Pinterest, Wikipedia, Vine, Orkut, StumbleUpon - Social Entertainment: Activities and Multimedia Applications.

UNIT III **SOCIAL MEDIA CONTENT PLANNING** 9

Social Media Engagement-Social Media Editorial Calendar- Writing for Social Media: Knowing & Reaching Your Audience - Location-based Tools and the mobile social web - Text messaging/mobile/ experimental applications - Photos in social media-Video in social media-social media for Business.

UNIT IV **COMMUNITY BUILDING AND MANAGEMENT** 9

Science of social media - Keys to Community Building - Promoting social media Pages Linking Social Media Accounts-The Viral Impact of social media-Digital PR-Encourage Positive Chatter in social media - Identity in social media: formation of identities, communities, activist movements, and consumer markets.

UNIT V **SOCIAL MEDIA POLICIES AND MEASUREMENTS** 9

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The road ahead in social media- The Basics of Tracking social media.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajendra Akerkar, "Artificial Intelligence in Digital Marketing", 1st Edition, Springer publications,2021.
2. K.M. Shrivastava, "Social Media in Business and Governance", 2nd Edition, Sterling Publishers, 2023.

REFERENCES:

1. Bittu Kumar, "Social Networking: Make Money Online", 1st Edition, V & S Publishers, 2022.
2. Henry A. Kissinger, Eric Schmidt, Daniel Huttenlocher, "The Age of AI: And Our Human Future", 1st Edition, Hachette Books ,2021.

3 Marshall Sponder, "Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics", 1st Edition, Tata McGraw-Hill Education,2020.

ONLINE RESOURCES:

1 https://100poundsocial.com/blog/social-media-marketing/how-to-use-curated-content/

2 https://buffer.com/resources/content-curation-sources/

3 https://www.juicer.io/content-curation

COURSE OUTCOMES:

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

CO1 Explain about the evolution of social media.

CO2 Describe different social media tools.

CO3 Analyze social media content planning.

CO4 Develop community building and management.

CO5 Develop social media policies and measurements.

CO – PO – PSO MAPPING:

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

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U23PEAI33 **INTERACTIVE MEDIA AND ANIMATION** L T P C

Prerequisite: Python Programming 2 0 2 3

COURSE OBJECTIVES:

- To introduce students to the fundamental concepts of Animation.
- To understand 2D animation and shaping objects.
- To explore advanced 3D animations.

UNIT I **INTRODUCTION** 6

Introduction to Animation -History of Animation-Types of Animation - Basic Principles of Animation-Animator's Drawing Tools - Rapid Sketching & Drawing - Developing Animation Character.

UNIT II **2D ANIMATION** 6

2D Animation: 2 D virtual drawing for animation- sequential movement drawing -Developing characters with computer animation - drawing for motion - Introduction to the flash and Flash interface- working with panels, panel layouts - drawing tools.

UNIT III **SHAPING OBJECTS** 6

Shaping Objects –Drawing & Modifying Shapes – Text- Bitmap Images & Sounds Animation - Frame by frame animation-tweening Building a Movie- Symbol, Libraries, Structure & Exporting Movie.

UNIT IV **3D ANIMATION** 6

3D Animation- Essentials & qualities of good animation characters- Three dimensional drawings of characters- Types of 3D Animation – Skeleton & Kinetic3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking.

UNIT V **SCRIPT ANIMATION** 6

Motion Caption – Formats – Methods – Usages – Expression –– Script Animation Usage – Concept Development –Story Developing –Audio & Video – Color Model – 3D Animated Movies.

30 PERIODS

PRACTICAL EXERCISES:

1. Create smooth transitions and movements using key frames.
2. Design a character and rig it for animation.
3. Create animations that interact with user input.
4. Animate and implement characters in a game-like environment
5. Create a text-based adventure with interactive elements and basic animations.
6. Create a 3D animation of an object in motion.
7. Design and animate text and graphics for a promotional video.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1 Mark R. H. A. McManus, "Interactive Media: The Semiotics of Embodied Interaction", 1st Edition, Palgrave Macmillan,2020.

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2 Maureen Furniss, "The Animation Bible: A Practical Guide to the Art of Animating from Flipbooks to Flash", 2nd Edition, Watson-Guptill,2021.

REFERENCES:

1 David Benyon, "Interactive Design: An Introduction to the Theory and Application of User-Centered Design", 3rd Edition, Pearson Education,2019.

2 Andrew B. Z, "Digital Animation: A Visual Guide to Techniques and Applications", 1st Edition, Springer,2021.

3 Isaac V. Kerlow, "The Art of 3D Computer Animation and Imaging", 4th Edition, John Wiley & Sons, 2019.

ONLINE RESOURCES:

1 https://www.investopedia.com/terms/i/interactive-media.asp

2 https://ebooks.inflibnet.ac.in/hsp13/chapter/interactive-media/

3 https://www.teachfloor.com/elearning-glossary/what-is-interactive-multimedia

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of animation.

CO2 Analyze 2D virtual drawing for animation.

CO3 Analyze frame by frame animation in 2D.

CO4 Evaluate essentials of 3D animation.

CO5 Develop 3D animated movies.

CO – PO – PSO MAPPING:

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

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U23PEAI34	COMPUTER GENERATED IMAGERY	L	T	P	C
Prerequisite:	**Python programming**	2	0	2	3

COURSE OBJECTIVES:

- To introduce students to the fundamental concepts of CGI.
- To understand 3D Modeling techniques.
- To explore advanced 3D animations.

UNIT I **INTRODUCTION** **6**

History of CGI in film, animation, and video games, The role of CGI in various industries (film, television, gaming, advertising), Key software tools for CGI (Blender, Maya, 3ds Max, Houdini, Cinema 4D), Introduction to computer graphics (2D vs. 3D graphics), Basic Concepts of Graphics-Pixels, resolution, and color depth, Bitmap vs. vector graphics, Types of images (raster, vector, 3D models), CGI in the Workflow.

UNIT II **3D MODELING TECHNIQUES** **6**

Introduction to 3D Modeling-Types of 3D models (polygonal, NURBS, parametric),Modeling tools and techniques (extrusion, subdivision, sculpting), Basic Shapes and Complex Modeling-Creating simple objects (cubes, spheres, etc.), Modeling organic objects (characters, creatures), Creating hard surface models (vehicles, buildings),Texturing and UV Mapping- Understanding UV mapping, Applying textures to 3D models (materials, shaders), Introduction to tools like Substance Painter.

UNIT III **ANIMATION PRINCIPLES IN CGI** **6**

Fundamentals of Animation- The 12 principles of animation (squash and stretch, anticipation, follow-through, etc.), Keyframe animation vs. procedural animation, Character Animation-Rigging and skeletons for character animation, Posing and key framing, Facial animation and lip-syncing, Walk cycles and motion study, Physics and Simulations - Rigid body dynamics, soft body dynamics. Cloth and hair simulation.

UNIT IV **LIGHTING AND SHADING IN CGI** **6**

Lighting Fundamentals-Types of lights (point lights, spotlights, area lights), Light positioning, intensity, and color, Three-point lighting setup, Shading and Material Creation- Understanding shaders (Phong, Lambert, etc.), Creating realistic materials (metal, glass, skin), Use of textures and normal maps, Global Illumination and Ray Tracing- Concepts of GI (Global Illumination), Ray tracing vs. rasterization, Reflection, refraction, and caustics.

UNIT V **RENDERING SETTINGS** **6**

Rendering Basics- Introduction to rendering (frame by frame, resolution), Render engines (Arnold, V-Ray, Renderman), The rendering pipeline, Optimizing Render Settings- Anti-aliasing, depth of field, Sampling and noise reduction, Optimizing render times and memory usage, Final Image and Video Output- Render passes and layers (diffuse, specular, shadow, etc.), Compositing renders in software like Nuke, After Effects, or Fusion.

30 PERIODS

PRACTICAL EXERCISES:

1 Create and manipulate basic primitives (cube, sphere, cylinder).
2 Model a basic object (e.g., table, lamp, or chess piece).
3 Animate a simple scene.

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4 Add visual effects to a CGI scene

5 Combine rendered images and effects.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1 Jeremy Birn, "Digital Lighting and Rendering", 3rd Edition, New Riders publications,2019.

2 John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, "Computer Graphics: Principles and Practice", 3rd Edition, Addison-Wesley publication,2013.

REFERENCES:

1 Isaac V. Kerlow, "The Art of 3D Computer Animation and Imaging", 4th Edition, John Wiley & Sons,2019.

2 Chris Strom, "3D Game Programming for Kids: Create Interactive Worlds with Unity and C#", 2nd Edition, No Starch Press publications,2021.

3 George Maestri, "Digital Character Animation 3" 3rd Edition, John Wiley & Sons,2019.

ONLINE RESOURCES:

1 https://www.techtarget.com/whatis/definition/CGI-computer-generated-imagery

2 https://en.wikipedia.org/wiki/Computer-generated_imagery

3 https://www.geeksforgeeks.org/what-is-cgi-computer-generated-imagery/

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of CGI.

CO2 Apply 3D model techniques.

CO3 Analyze animation principles in CGI.

CO4 Evaluate essentials of shading and lighting in CGI.

CO5 Develop rendering settings.

CO – PO – PSO MAPPING:

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

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U23PEAI35 **GAME DEVELOPMENT** **L T P C**

Prerequisites: Data Structures **3 0 0 3**

COURSE OBJECTIVES:

- To train the students to acquire knowledge in game design and development
- To learn the mathematics behind game development
- To know the mechanics involved in game design
- To acquire knowledge about the algorithms related to game development
- To survey the gaming development environment and tool kits

UNIT I INTRODUCTION TO GAME DESIGN 9

Games- Designing and Developing Games-Genres- Understanding: Players, Machine-Game: Concepts, Worlds-Creative and Expressive Play- Character Development-Storytelling—Screenplay-Storyboard- Pre-visulaization- Script-Creating User Experience-Game play-Introduction to Core Mechanics- Game Balancing- Level Design

UNIT II FOUNDATIONS TO GAME DESIGN 9

Cartesian Coordinate Systems-Vectors-Linear Interpolation- Multiple Coordinate Spaces-Matrices and Linear –Transformations - Polar Coordinate Systems-3D Rotations, Transformation, Scaling - Geometric Primitives-Viewing in 3D-Viewing Pipeline-Clipping Algorithms-Text Transformation.

UNIT III MECHANICS FOR GAME DESIGN 9

Linear Kinematics and Calculus –Linear and Rotational Dynamics –Curves and Surfaces-Curves in 3D– Lighting-Shading - Shadowing- Depth Cueing- Projections - Perspective - Orthogonal -Intersection Testing - Rigid Body Dynamics - Animation System – Controller based animation- Cameras Details.

UNIT IV ARCHITECTURE AND ALGORITHMS FOR GAME DEVELOPMENT 9

Foundation- Low-Level Engine System – State Based Behaviours – Strategy and Planning-Game Play - Path and Waypoints – Navigation – Behaviours - Collision Detection - Game Logic - Game Artificial Intelligence - Spatial Sorting - singleton - Object Pooling-Basic Sound – 3D Sound - Event-Based Input Systems.

UNIT V LANGUAGES FOR GAME DEVELOPMENT 9

Scripting Languages and Data Format – PyGame/Unity-Networked Games – Sample Game – iOS, Windows, Android-Developing 2D and 3D interactive games using Unity - DirectX – Isometric and Tile Based Games - Puzzle games - Single Player games - Multi Player game-Marker Systems

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Adam Kramarzewski and Ennio De Nucci, "Practical Game Design: A modern and Comprehensive Guide to Video game Design", 2nd Edition, Packt Publishers, 2023.
2. Morteza M. Nikooghadam,Mastering Game Design with Unity 2021: Immersive Workflows, Visual Scripting, Physics Engine,Game Objects", 1st Edition, BPB Publications, 2022.

REFERENCES:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", 2nd Edition, Addison Wesley, 2019.
2. Sebastiano M.Cossu, "Beginning Game AI with Unity: Programming Artificial Intelligence

with C#", 1st Edition, Apress Publications,2020.

3 Robert Nystrom, "Game Programming Patterns", 1st Edition, Genever Benning, 2021

ONLINE RESOURCES:

1 https://learn.unity.com

2 https://www.unrealengine.com/en-US/onlinelearning-courses

3 https://gamedevelopment.tutsplus.com

COURSE OUTCOMES:

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

CO1 Explain the concepts and techniques used in game development.

CO2 Explain the mathematical and graphical concepts used for game development.

CO3 Apply the physical and mechanical concepts for interactive and real time game development.

CO4 Design and develop algorithms for effective gaming environments.

CO5 Create and implement various applications for game development.

CO – PO – PSO MAPPING:

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

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U23PEAI36 **FUTURE OF CREATIVE MEDIA TRENDS AND INNOVATIONS** **L T P C**

Prerequisites: Big Data Analytics **3 0 0 3**

COURSE OBJECTIVES:

- To explore emerging trends and technological innovations shaping the future of creative media
- To understand the role of AI, AR/VR, and immersive technologies in creative industries
- To analyze how creative media is evolving across content creation, storytelling, entertainment, and digital platforms.

UNIT I EVOLUTION AND LANDSCAPE OF CREATIVE MEDIA **9**

Definition and Scope of Creative Media – History and Milestones – Current Trends in Digital Content, Animation, Film, Gaming, and Design – Impact of Digital Transformation – Convergence of Media and Technology – New-Age Consumer Behaviors and Platforms.

UNIT II TECHNOLOGICAL INNOVATIONS IN CREATIVE INDUSTRIES **9**

Artificial Intelligence in Content Generation – Generative Art and Music – Role of Machine Learning in Personalization – Deepfakes and Synthetic Media – Immersive Storytelling – AI Tools in Design and Video Editing – Case Studies: MidJourney, Runway, DALL·E, Sora.

UNIT III IMMERSIVE AND INTERACTIVE MEDIA **9**

Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) – Extended Reality (XR) in Games and Storytelling – Haptics and Sensory Media – Metaverse Concepts and Applications – Virtual Production Techniques – Live and Interactive Media Experiences.

UNIT IV MEDIA ETHICS, OWNERSHIP, AND FUTURE ECONOMIES **9**

Digital Ethics and Copyright Challenges – Creator Rights in AI-Generated Content – NFTs and Blockchain in Media – Monetization Models (Streaming, Subscriptions, Tokenization) – Creator Economy – Responsible Innovation – Social and Cultural Impacts.

UNIT V FUTURE OUTLOOK AND CREATIVE POSSIBILITIES **9**

Predicting Future Media Formats – Adaptive and Smart Content – AI as a Co-Creator – Innovation in Film, Gaming, Music, and Journalism – Democratization of Media Tools – Global Trends and Opportunities – Creative Thinking for Future Media.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 James E. Young, "Creative Strategy in Direct Marketing", 4th Edition, Prentice Hall, 2022

2 Andrew B. Whitaker, "Creative Media Innovation: Digital Tools and Techniques", 1st Edition, Routledge publications,2022

REFERENCES:

1 Casey Reas & Chandler McWilliams, "Form Code in Design, Art, and Architecture", 1st Edition, Princeton Architectural Press, 2020.

2 Lina Gálvez-Muñoz, "Artificial Intelligence for Media: An Introduction to the Future of AI in Creative Industries",1st Edition, Springer publication,2023.

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ONLINE RESOURCES:

1 https://futureofstorytelling.org.

2 https://www.adobe.com/sensei.html.

3 https://xrsi.org (XR Safety Initiative).

COURSE OUTCOMES:

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

CO1 Explain the evolving landscape of creative media and digital content.

CO2 Analyze the impact of emerging technologies like AI and XR on media.

CO3 Evaluate ethical and legal issues surrounding innovation in creative industries.

CO4 Create interactive and immersive media experiences.

CO5 Develop future trends and opportunities in creative media.

CO – PO – PSO MAPPING:

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

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U23OE101	ALGEBRA AND NUMBER THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the student acquire sound knowledge of groups, rings, fields and polynomials which will be then used to solve the real life problems.
- To make the students to understand the basic concepts in number theory.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and studying in the subject

UNIT I **GROUPS AND RINGS** 9

Groups - Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT II **FINITE FIELDS AND POLYNOMIALS** 9

Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III **DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS** 9

Division algorithm – Base - b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT IV **DIOPHANTINE EQUATIONS AND CONGRUENCES** 9

Linear Diophantine equations – Congruence's – Linear Congruence's - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

UNIT V **CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS** 9

Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jordi Guardia, Nicusor Minculete, Diana Savin, Montserrat, "New Frontiers in Number Theory and Applications", 1st Edition, Birkhauser Verlag AG, 2024.
2. Richard Michael Hill, "Introduction to Number Theory", World Scientific Europe Ltd., 2018.

REFERENCES:

1. Steven Howard Weintraub, "An Introduction to Abstract Algebra", World Scientific Publishing Company, 1st Edition, 2022.
2. John Stillwell, "Algebraic Number Theory for Beginners: Following a Path from Euclid to Noether" Cambridge University Press, 2022.

3. Ian Stewart, David Tall, "Algebraic Number Theory and Fermat's Last Theorem", Taylor and Francis, 4th Edition, CRC Press, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111106131
2. https://nptel.ac.in/courses/111101137
3. https://nptel.ac.in/courses/111103020

COURSE OUTCOMES:

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

CO1 Analyze the notations and properties of algebraic structures such as groups, rings and fields.
CO2 Analyze the polynomial rings and irreducible polynomials over finite fields.
CO3 Apply the division algorithm and fundamental theorems on prime numbers.
CO4 Apply the congruence relation in number theory to solve the real life problems.
CO5 Analyze the concepts of multiplicative functions and classical theorems.

CO – PO MAPPING:

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

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U23OE102 **PROBABILITY AND QUEUEING THEORY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of probability, one and two dimensional random variables, and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concepts and significance of advanced queueing models and apply in engineering.

UNIT I **PROBABILITY AND RANDOM VARIABLES** **9**

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II **TWO DIMENSIONAL RANDOM VARIABLES** **9**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

UNIT III **RANDOM PROCESSES** **9**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV **QUEUEING MODELS** **9**

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT V **ADVANCED QUEUEING MODELS** **9**

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Venkatarama Krishnan, "Probability and Random Processes", 1st Edition, John Wiley & Sons, 2022.
2. Padma Prithivirajan, "Probability and Queueing Theory", 1st Edition, LAP Lambert Academic Publishing, 2022.

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REFERENCES:

1. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 5th Edition, Tata McGraw Hill, 2021.
2. Geoffrey Grimmett, David Stirzaker, "Probability and Random Processes", 4th Edition, OUP Oxford, 2020.
3. H A Taha, "Operations Research", 10th Edition, Pearson Education, 2019.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111103159
2. https://nptel.ac.in/courses/111106150
3. https://nptel.ac.in/courses/111103022

COURSE OUTCOMES:

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

CO1 Apply the concepts of probability and some standard distributions in real life problems.
CO2 Analyze the concepts of two dimensional random variables.
CO3 Apply the concept of random processes in Engineering disciplines.
CO4 Analyze the various queue models.
CO5 Apply the concepts of series queues and open Jackson networks in real life problems.

CO – PO MAPPING:

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

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U23OE103	PROBABILITY AND RANDOM PROCESSES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide necessary basics in probability that are relevant in applications such as random signals and linear systems in communication engineering.
- To understand the concepts of random processes which are widely used in communication networks.
- To understand the concept of correlation, spectral densities and significance of linear systems with random inputs.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability–Discrete and continuous random variables–Moments – Moment generating functions–Joint Distribution–Covariance and Correlation – Transformation of a random variable.

UNIT II RANDOM PROCESSES 9

Classification–Characterization – Cross correlation and Cross covariance functions – Stationary Random Processes – Markov process - Markov chain.

UNIT III SPECIAL RANDOM PROCESSES 9

Bernoulli Process – Gaussian Process – Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Venkatarama Krishnan, "Probability and Random Processes", 1st Edition, John Wiley & Sons, 2022.
2. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 5th Edition, Tata Mc Graw Hill, 2021.

REFERENCES:

1. Geoffrey Grimmett, David Stirzaker, "Probability and Random Processes", 4th Edition, Oxford University Press, 2020.
2. Hossein Pishro-Nik, "Introduction to Probability, Statistics, and Random Processes", Online Edition, Kappa Research, 2023.
3. Sheldon M. Ross, "Introduction to Probability Models", 13th Edition, Academic Press, 2021.

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ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/117/105/117105085/
2. https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/
3. https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/pages/part-iii-random-processes/

COURSE OUTCOMES:

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

CO1 Apply one- and two-dimensional random variables in engineering applications.
CO2 Apply the concept random processes in engineering disciplines.
CO3 Apply special random process to model the occurrences of events and the time points.
CO4 Analyze the concept of autocorrelation, cross correlation, power spectral density and its importance in communication Engineering.
CO5 Analyze the response of random inputs to linear time invariant systems.

CO – PO MAPPING:

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

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U23OE104	LINEAR ALGEBRA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of linear transformation, inner product spaces and orthogonalization.
- To utilize numerical methods to determine the eigenvalues of a matrix and execute matrix decomposition.

UNIT I **VECTOR SPACES** **9**

Vector spaces over Real and Complex fields – Subspace – Linear space – Linear independence and dependence – Basis and dimension.

UNIT II **LINEAR TRANSFORMATION** **9**

Linear transformation – Rank space and null space – Rank and nullity – Dimension theorem.

UNIT III **MATRIX REPRESENTATION OF LINEAR TRANSFORMATION** **9**

Matrix representation of linear transformation – Eigenvalues and eigenvectors of linear transformation –Diagonalization.

UNIT IV **INNER PRODUCT SPACES** **9**

Inner product and norms – Properties – Orthogonal, Orthonormal vectors – Gram Schmidt orthonormalization process – Least square approximation.

UNIT V **EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION** **9**

Eigen value Problems: Power method, Jacobi rotation method – Singular value decomposition – QR decomposition.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David C Lay, Steven R Lay, Judi J McDonald, "Linear Algebra and Its Applications", 6th Edition, Pearson Education, 2021.
2. Kenneth Hoffman, Ray Kunze, "Linear Algebra", 2nd Edition Reprint, Pearson Education, 2023.

REFERENCES:

1. Gilbert Strang, "Linear Algebra and Its Applications", 5th Edition, Cengage Learning, 2020.
2. Stephen H Friedberg, Arnold J Insel, Lawrence E Spence, "Linear Algebra", 4th Edition, Pearson Education, 2020.
3. Serge Lang, "Introduction to Linear Algebra", Revised Edition 2nd, Springer, 2021.

ONLINE RESOURCES:

1. https://www.coursera.org/learn/introduction-to-linear-algebra
2. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
3. https://onlinecourses.nptel.ac.in/noc22_ma45/preview

COURSE OUTCOMES:

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

CO1 Solve system of linear equations and test the consistency.
CO2 Analyze the basis and dimension of vector space.
CO3 Solve linear transformation and its matrix representation.
CO4 Solve orthonormal basis of inner product space and find least square approximation.
CO5 Evaluate the eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

CO – PO MAPPING:

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

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U23OE105	EVERYDAY PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop knowledge in the basic concepts of physics.
- To understand the application of Physics in everyday life.
- To know how the applications show impact in everyday life.

UNIT I **MECHANICS AND HEAT** **9**

Force – weight – work – energy – power – horsepower – centrifuge – washing machine – variation of boiling point with pressure – pressure cooker – cooling by expansion – refrigerator - air conditioner – Bernoulli principle – Bunsen burner, aero plane.

UNIT II **SOUND AND OPTICS** **9**

Sound waves – Doppler Effect - power of lens – long sight and short sight – microscope – telescope – binocular – camera.

UNIT III **ELECTRICAL AND ELECTRONIC APPLIANCES** **9**

Working of the tube light and fan – kilowatt hour – fuse and heating elements – microwave oven – electric heater – photoelectric effect – video camera.

UNIT IV **GEOPHYSICS AND MEDICAL PHYSICS** **9**

Earthquake – Richter scale – rainfall unit – lightning arrestors – cosmic showers – Coolidge tube – X – rays – ultrasound scan – CAT.

UNIT V **ENERGY SOURCES** **9**

Fission – energy release – principle of nuclear reactor – radiation dosimeter – hazards and protection – solar energy – photovoltaic cell.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D Halliday, R Rensick, J Walker, "Principles of Physics", 12th Edition , John Wiley & Sons, 2023.
2. P S Hemne, C L Arora, "Physics for B.Sc. students - Optics", S. Chand Publishing, 2022.

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REFERENCES:

1. N Ravi, "The Hindu Speaks on Scientific Facts" (Vol-1)", The Hindu Group, 2024.
2. John Christopher Draper, "A Text-book of Medical Physics", Legare Street Press, 2022.
3. Jahan Singh, "Fundamentals of Nuclear Physics", Pragati Prakashan, 2021.

ONLINE RESOURCES:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. http://onlinecourses.nptel.ac.in/
3. https://books.google.com/books/about/An_Introduction_to_Medical_Physics.html

COURSE OUTCOMES:

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

CO1 Describe the mechanical concepts in various appliances.
CO2 Apply the elementary mechanical concepts in sound and optics.
CO3 Explain the working of electrical and electronic appliances.
CO4 Summarize the basic concepts in Geo Physics and nuclear physics.
CO5 Apply the concepts of nuclear physics and space sciences in our daily life.

CO – PO MAPPING:

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

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U23OE106	CONSUMER AWARENESS ON APPLIANCES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge of the multiple gadgets and devices.
- To understand difference between products from multiple brands.
- To learn the basics of marketing of gadgets used in daily life.

UNIT I **POWER GADGETS AT HOME AND WORK** 9

The electric power grid – single and three phase connection – UPS – Voltage stabilizers – lighting – energy saving devices and techniques (fluorescent, CFL, LED, solar panels – household equipment: power consumption of devices (electric fan, air conditioner, refrigerator, washing machine).

UNIT II **COMMUNICATION AND ENTERTAINMENT ELECTRONICS** 9

Telephone – Facsimile – Cell phone – Photocopier – Scanner – microphones – CD/DVD/Blu-ray players – portable media players – use of headphones.

UNIT III **PRODUCT INFORMATION** 9

Brand name and brand mark – selection of good brand – Corporate brand and product brand – product guarantee and warranty – standardization – product servicing – after sales services.

UNIT IV **ONLINE RESOURCES** 9

Apps, cloud based resources – e-commerce and productivity tools – access patterns – Comparing products online – choosing websites and online stores – awareness on terms and conditions.

UNIT V **NETWORKING SITES AND SAFETY** 9

Significance of social networking sites, browsers and cookies – email scams – knowledge on complaint procedure and disputes settlement – security issues on payment portals.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pearson, "Principles of Marketing", 19th Edition, Dimensions, 2023.
2. Jobber and Elli, "Principles and Practices of Marketing", 9th Edition, Tata McGraw Hill, 2020.

REFERENCES:

1. Kleinert Eric, "Troubleshooting and Repairing Major Appliances", 3rd Edition, Atlantic Publishers, 2022.
2. K B Bhatia," Electrical appliances and devices", Khanna Publishers, 2024.
3. Charlie wing, "How Your House Works - A Visual Guide to understanding and Maintaining your Home", John Wiley & Sons, 2023.

ONLINE RESOURCES:

1. https://www.springer.com/series/13812
2. https://cloud.google.com/learn/training/networking-security
3. https://onlinecourses.nptel.ac.in/noc24_ph17/preview

COURSE OUTCOMES:

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

CO1 Describe the power gadgets and their maintenance.
CO2 Explain the devices used for communication and entertainment.
CO3 Explain the information about multiple brand products to make intelligent purchase decisions.
CO4 Summarize the online resources and awareness about their making policies.
CO5 Describe the significance of social networking sites, knowledge on complaint procedure and security issues.

CO – PO MAPPING:

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

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U23OE107	BIOPHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the knowledge about the physical forces in analysing the human body.
- To identify the necessity of diagnosis and therapy for various devices.
- To appreciate the effects of acoustics and ultrasonic in human body.

UNIT I **PHYSICAL FORCES EXEMPILIFIED IN MAN** 9

Introduction – mechanical forces – osmotic force – electric forces – bioelectric potentials – colloids – inter molecular forces – electromagnetic forces – generalized force.

UNIT II **HEAT ENERGY AND BIO - ENERGETICS** 9

Heat transfer – heat loss by the human body to the ambient air – radioactive heat transfer from the human body – Stefan – Boltzmann law – counter current heat exchange applications to vasculature of the human arm – concept of entropy in biological systems – fundamentals of energy cycle.

UNIT III **WAVES: SOUND AND ULTRASOUND** 9

Absorption – principle mechanism of absorption of matter waves – frictional resistance and elastic reactance of bulk tissue – Weber – Fechner law – physiological effects of intense matter waves and ultrasonic therapy - applications.

UNIT IV **FLUID FLOW** 9

Flow of frictionless fluids: Bernoulli's law – fluid flow in constricted tube – blood flow through a blood vessel with a partial blockage – angioplasty. Flow of viscous fluids: Analogy between fluid flow and electric current flow – fluid friction.

UNIT V **RADIATION** 9

Isotopes as tracers – labeling with isotopes – stable and radioactive isotopes – biological effects of radiation – internal radiation hazards – radiation units – Dosimetry.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. E J Casey, "Biophysics – concepts and mechanism", Alpha Edition, 2021.
2. William C Parke, "Biophysics - A Student Guide to the Physics of the Life Science and Medicine", Springer Nature Switzerland, 2021.

REFERENCES:

1. P Narayanan, " Essentials of Biophysics " 3rd Edition, New Age International Private Limited, 2023.
2. M A Subramanian, "Biophysics Principles and Techniques", MJP Publishers, 2021.
3. Paul Davidovits, "Physics in Biology and Medicine", 5th Edition, Elsevier Science Publishing Co Inc., 2024.

ONLINE RESOURCES:

1. https://www.fuw.edu.pl/~jantosi/booksonbiophysics/Introduction_of_Biophysics.pdf
2. https://archive.org/details/volkenshtein-biophysics-mir
3. https://ia801307.us.archive.org/29/items/biophysicsconcep00case/biophysicsconcep00case.pdf

COURSE OUTCOMES:

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

CO1 Summarize the knowledge about the physical forces exemplified in the human body.
CO2 Explain the importance of heat transfer in human body.
CO3 Describe the principle mechanism of matter waves and applications of ultrasound.
CO4 Apply the various laws of fluid flow in the study of human body.
CO5 Summarize the concepts of acoustic and radiation therapy.

CO – PO MAPPING:

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

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U23OE108 **ASTROPHYSICS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To elucidate the nature of the myriad objects and the universe as a whole.
- To understand the structure and the formation of myriad objects.
- To inculcate the ideas of discouraging our galaxies and their formation theories.

UNIT I **OPTICAL ASTRONOMY** 9

Electromagnetic spectrum and astronomical sources - emission and absorption spectra Doppler Effect - units of distances - distance measurements in astronomy stellar distances - Apparent - Absolute, Bolometric magnitudes - Luminosity.

UNIT II **STARS** 9

Spectral classification of stars - H-R diagram: binary and multiple stars visual, astrometry and eclipsing binaries - galactic and globular clusters - Stellar evolution - birth and death of a star - Sun - typical star - Structure of photosphere - sunspots.

UNIT III **MOON** 9

The moon's orbit relative to the earth - moon's distance - moon's phases - sidereal and synodic month - character of moon's surface - lunar eclipse - lunar tides - origin of moon.

UNIT IV **BETWEEN THE PLANETS** 9

Asteroids - meteoroids - meteors - comets - orbits of comets - spectrum of comets - formation of comet's tail.

UNIT V **DISCOVERING OUR GALAXIES** 9

The Milky Way Structural Feature Galaxies - Galaxies and universe: shape of galaxies - distance of galaxies big bang and steady state theory - galactic rotation - cluster of galaxies - cosmology.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K S Krishna Swamy, "Astrophysics", New Age International Private Limited, 2022.
2. Wolfgang Demtroder, "Astrophysics", Springer, 2023.

REFERENCES:

1. Minn Carleton College, "Astronomy", Legare Street Press, 2023.
2. Camille Flammarion, "Astronomy", Legare Street Press, 2023.
3. Maggie Aderin-Pocock , "The sky at night: The art of stargazing", BBC books, 2023.

Y6599yfrONLINE RESOURCES:

1. https://www.uu.edu/societies/inklings/books/scienceandfaith/Chapter4.pdf
2. https://www.britannica.com/science/stellar-classification
3. https://openstax.org/books/astronomy-2e/pages/5-6-the-doppler-effect

COURSE OUTCOMES:

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

CO1 Apply physics principles to the interpretation of a broad range of astrophysical Observations.

CO2 Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories.

CO3 Summarize the basic properties of the Sun.

CO4 Describe the features of objects in the Solar System, giving details of similarities and differences between these objects.

CO5 Describe the main features of formation theories of various types of observed galaxies.

CO – PO MAPPING:

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

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U23OE109	INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain about nanomaterials, their importance and their dimensions.
- To study about the synthetic methods of nanomaterials.
- To develop skills about the structure, function and application of nanomaterials.

UNIT I **INTRODUCTION** 9

Nanoscale Science and Technology- Introduction, Classifications of nanostructured materials - nano particles- quantum dots, nanowires ultra-thinfilms-multi layered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

UNIT II **GENERAL METHODS OF PREPARATION** 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, Sputtering, Evaporation, Molecular Beam Epitaxy, Electrochemical deposition.

UNIT III **NANOMATERIALS** 9

Nanometal oxides-ZnO, TiO2, MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, Ferrites, Quantum wires, Quantum dots. Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- Synthesis, structure-property Relationships and applications, Nanocomposites – FRP synthesis, property and its application.

UNIT IV **CHARACTERIZATION TECHNIQUES** 9

Xray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques, AFM, SPM, STM, SNOM, ESCA, SIMS.

UNIT V **APPLICATIONS** 9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)-Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. R L Snyder, R W Kelsall, D L Jones, "Nanotechnology: A Hands-On Approach", 2nd Edition , John Wiley & Sons, 2023.
2. M C Roco, W S Bainbridge, B E Tonn, G M Whitesides, "Nanotechnology Research Directions for Societal Needs in 2025", Springer, 2024.

REFERENCES:

1. C Binns, "Introduction to Nanoscience and Nanotechnology", 2nd Edition, Wiley- Blackwell, 2021.
2. T Pradeep, "Atomically Precise Metal Nanoclusters", Elsevier, 2022.
3. C Anandharamakrishnan, "3D Printing of Foods", John Wiley & Sons, 2024.

ONLINE RESOURCES:

1. https://www.classcentral.com/course/electronics-purdue-university-fundamentals-of-nan-40243
2. https://www.classcentral.com/course/swayam-chemistry-of-nanomaterials-269673.
3. https://www.classcentral.com/course/introduction-to-the-modern-nanotechnology-22238.

COURSE OUTCOMES:

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

CO1 Explain the basic concepts of Nanoscience and Nanotechnology and their impact in various fields, types of nanomaterials, dimensions and their properties.

CO2 Summarize the various techniques involved in synthesizing nanomaterials for engineering and technology applications.

CO3 Describe the various forms of nanomaterials with their structure- property relationship and applications.

CO4 Explain the structure of nanomaterials using various characterization techniques.

CO5 Analyse the application of nano materials in medical, electronic and engineering fields.

CO – PO MAPPING:

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

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U23OE110	GREEN TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of green technology through understanding the basics of eco-system and Biodiversity.
- To learn different types of environmental acts and analyse the green tax incentives, rebates, business redesign and its models.
- To extend knowledge of the importance of life cycle assessment.

UNIT I **INTRODUCTION** 9

The concept of green technology – its origin and historical evolution – nature, scope, significance, and multi-disciplinary approaches – classification of green technologies (e.g., clean energy, sustainable materials, carbon capture) – developing theoretical frameworks to understand green innovation – green technology initiatives and policies in India.

UNIT II **SUSTAINABILITY AND ENVIRONMENT** 9

Organizational environment - internal and external environment - Indian corporate structure and environment - how to go green - spread the concept in organization - environmental and sustainability issues.

UNIT III **ECOSYSTEM ECONOMICS** 9

Approaches - ecological economics - indicators of sustainability - ecosystem services and their sustainable use; bio-diversity - Indian perspective - alternate theories - Steady-state economics – circular economy.

UNIT IV **LAWS OF GREEN TECHNOLOGY** 9

Laws - Environmental reporting standards and compliance mechanisms – ISO 14001 - green finance - financial initiative by United Nations Environment Programme (UNEP). Environmental Management Systems – principles, certification process, and organizational impact – ISO 14064.

UNIT V **GREEN ECONOMICS** 9

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. WIPO, "Green Technology Book: Solutions for Climate Change Mitigation", 2nd Edition, World Intellectual Property Organization, 2023.
2. S J Arceivala, "Green Technologies", 1st Edition, Tata McGraw Hill, 2023.

REFERENCES:

1. P Oksen, "Green Technology Book: Solutions for Climate Change Adaptation", 1st Edition, World Intellectual Property Organization, 2022.
2. A Kumar, S Singh, 'Renewable Energy and Green Technology: Principles and Practices", Routledge, 2023.
3. M N O Sadiku, "Emerging Green Technologies" CRC Press, 2022.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102195/
2. https://onlinecourses.nptel.ac.in/noc20_ce57/preview
3. https://archive.nptel.ac.in/courses/105/107/105107176/

COURSE OUTCOMES:

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

CO1 Summarize the concepts of green technologies in a project.

CO2 Explain the importance of environment and sustainability and their classes and issues.

CO3 Apply Eco-system concepts for sustainable.

CO4 Explain the Environmental laws and regulations for green technology.

CO5 Apply the green tax incentives and rebates and Eco-commerce models for greener economics.

CO – PO MAPPING:

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

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U23OE111	THE ENVIRONMENT AND SOCIETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the complexity of environmental and social impacts of industry.
- To analyze about personal responsibilities and roles in environmental and social problems.
- To acquire new ideas for better integrating industry, environment, and equity.

UNIT I ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY 9

Introduction to Environment- Ecosystem and its types- Biodiversity- Types of biodiversity. Importance of biodiversity-Loss of Biodiversity- Conservation of Biodiversity.

UNIT II ENVIRONMENT AND THE HUMAN INTERACTION 9

Types of Anthropogenic Activities-Anthropogenic Activities and Their Impacts on the Environment-Ways to Mitigate the Negative Impacts of Anthropogenic Activities on the Environment-Mitigation Measures for Anthropogenic Impacts.

UNIT III ISSUES IN ENVIRONMENTALISM 9

Significant global environmental issues such as acid rain, climate change, and resource depletion; historical developments in cultural, social and economic issues related to land, forest, and water management in a global context; interface between environment and society.

UNIT IV THREATS TO ENVIRONMENT 9

Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs).

UNIT V ENVIRONMENT AND SUSTAINABLE DEVELOPMENT 9

Causes and effects of Depletion of Natural Resources - Impact of environmental degradation-Need for Sustainable development, Strategies for Achieving Sustainability, Sustainable Development in India, Role of Individuals and Communities.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. A Sabban, "Advances in Green Electronics Technologies in 2023", 1st Edition, IntechOpen, 2023.
2. R Dogra, "Renewable Energy and Green Technology", 1st Edition; Brillion Publishing, 2023.

REFERENCES:

1. P Robbins, L Hintz, M Moore, "Environment and Society: A Critical Introduction", 3rd Edition, Wiley- Blackwell, 2022.
2. P Frankopan, "The Earth Transformed: An Untold History. Allen Lane", Bloomsbury publisher, 2023.
3. M A Ali, M Kamraju, "Natural Resources and Society: Understanding the Complex Relationship Between Humans and the Environment" Springer Cham, 2023.

ONLINE RESOURCES:

1. http://www.who.int/topics/environmental_pollution/en/
2. http://edugreen.teri.res.in/explore/explore.htm
3. https://onlinecourses.swayam2.ac.in/nou20_ag12/preview

COURSE OUTCOMES:

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

CO1 Describe the environment ecosystem, importance of biodiversity and its conservation.

CO2 Analyze the various anthropogenic activities, its impact on environment and mitigation measures.

CO3 Describe the various global environmental issues.

CO4 Analyse the ecological degradation, environmental pollution issues owing to developmental activities.

CO5 Apply the green tax incentives and rebates and Eco-commerce models for greener economics.

CO – PO MAPPING:

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

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U23OE112	INDUSTRIAL CORROSION AND PREVENTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart Knowledge on fundamental concepts of corrosion.
- To know the various types of corrosion.
- To create corrosion prevention plans in various industries.

UNIT I INTRODUCTION TO CORROSION 9

Introduction and importance, Forms of corrosion - uniform corrosion, pitting, crevice corrosion, inter granular corrosion, stress corrosion cracking and prevention of corrosion.

UNIT II CORROSION CONTROL IN POWER INDUSTRIES 9

Introduction, Frequent forms of corrosion, environment, case studies and prevention methodology and corrosion resistance materials.

UNIT III CORROSION CONTROL IN PETROCHEMICAL INDUSTRIES 9

Introduction, regular forms of corrosion, environment, case studies, prevention strategies – inhibitors and surface engineering - corrosion resistance materials

UNIT IV CORROSION CONTROL IN MARINE INDUSTRIES 9

Introduction, Metallurgical properties influencing corrosion. Common forms of corrosion, environment, Passivity – design of corrosion resistant alloys, case studies, and corrosion resistance materials.

UNIT V CORROSION CONTROL IN FERTILIZER INDUSTRIES 9

Introduction, frequent forms of corrosion, environment, case studies and corrosion resistance materials.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mars G Fontana, "Corrosion Engineering", 3rd Edition, Tata McGraw Hill, 2019.
2. D B David, M Bastidas David, "Corrosion and protection of Metals", Metals, 2020.

REFERENCES:

1. Savas Kaya, Ime Bassey Obot, Demet Özkir, Goncagül Serdaroglu, Ambrish Singh, "Corrosion Science: Theoretical and Practical Applications", Apple Academic Press, 2024.

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2. E J David, Talbot D R James, Talbot, "Corrosion Science and Technology", CRC Press, 2020.
3. E I Younes, Kacimi, Savas Kaya, Rachid Touir, "New Challenges and Industrial Applications for Corrosion Prevention and Control", IGI Global, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/113108051
2. https://www.corrosionclinic.com/corrosion_courses/corrosion_control_prevention_5-day.htm
3. https://www.ampp.org/technical-research/what-is-corrosion/corrosion-reference-library

COURSE OUTCOMES:

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

CO1 Describe the basic principles of corrosion and its types.

CO2 Explain about corrosion damage in the power, petroleum, marine, and fertilizer industries.

CO3 Analyze the corrosion prevention techniques in the industries.

CO4 Summarize theory behind the fabrication of a corrosion-resistant alloy.

CO5 Explain the causes and remedies for corrosion

CO – PO MAPPING:

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

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U23OE113 **ENGLISH THROUGH MEDIA** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To enhance students' ability to read & write efficiently while developing information ethically.
- To cultivate students' proficiency in developing listening, thinking, advertising & persuasive writing.
- To equip their proficiency with phonetics, accents, group discussions in real life situations as well as visual and verbal media.

UNIT I **READING AND WRITING SKILLS** 9

Reading for information – Skimming & Scanning; Importance of Language: Subjective & Objective Language. Writing – Use of Language to manipulate information; writing feature stories – Presentation and Structure.

UNIT II **LISTENING AND INTERVIEWING SKILLS** 9

Listening to talks – conversational strategies. Interviewing Skills – Agreeing and Disagreeing – Asserting and Negotiating.

UNIT III **REPORTING SKILLS – ORAL AND WRITTEN** 9

Critical Thinking: Problem Solving Skills –conversation Etiquette – Politeness Strategies. Online Writing: Netiquette – Analytical report, Brevity in advertising, persuasive writing.

UNIT IV **PRESENTATION SKILLS** 9

Purpose and features of presentation – Narrating Consumer Oriented Marketing of products, Group Discussion on culture, tradition, values.

UNIT V **ANALYZING AND EVALUATING SKILLS** 9

Vocabulary – Collocations & Slangs – Referencing – welcoming, conducting Programmes. Reviewing & Commenting – Expressing through visual & verbal media – Authentic conversation based on real – life situations.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. "English for Engineers & Technologists", 2020 Edition, Orient Blackswan Private Ltd., 2020.
2. Veena Selvam, Sujatha Priyadarshini, Deepa Mary Francis, K N Shoba , Lourdes Joevani, "English for Science & Technology", Cambridge University Press, 2021.

REFERENCES:

1. James Curran, Joanna Redden, "Understanding Media: Communication, Power and Social Chang", Pelican Publishing, 2024.
2. Soma Mahesh Kumar, "Soft Skills: Enhanching Personal and Professional Success", 1st Edition, Tata McGraw Hill, 2023.
3. Rodney H Jones, Sylvia Jaworska, "Erhan Aslan; Language and Media- A Resource Book for Students", e-book, Routledge, 2020.

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ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20hs32/preview
2. https://www.coursera.org/learn/working-with-the-media
3. https://www.udemy.com/course/political-candidate-media-and-public-speaking-training/

COURSE OUTCOMES:

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

CO1 Apply reading and writing skills by exploring the language used in media.
CO2 Apply listening skills to communicate effectively in their area of specialization.
CO3 Apply soft skills in both oral and written communication.
CO4 Apply speaking skills in a variety of mediums including live communication.
CO5 Analyze different types of texts in different media like online, print, and social media.

CO – PO MAPPING:

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

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U23OE114 **ENGLISH FOR EMPLOYABILITY SKILLS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the students to skills necessary for getting, keeping and being successful in a profession.
- To understand the importance of communication and enhance self-confidence.
- To develop and nurture the Employability skills of the students through individual and group activities.

UNIT I **COMMUNICATION SKILLS** 9

Communication: An Introduction; Formal and Informal English; Description, Narration and Demonstration; Methods of Communication, Verbal Communication, Non-verbal Communication; Importance of feedbacks, Basics of Effective Communication; Writing Skills - Parts of Speech and Sentences; Soft Skills for Employers and Employees.

UNIT II **RESUME WRITING** 9

Resume, Curriculum vitae, how to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter.

UNIT III **PRESENTATION SKILLS** 9

Presentation Techniques – Time Management Techniques – Body language – Managerial Skills –Making Effective Presentation, Professional presentation- planning, preparing and delivering presentation.

UNIT IV **GROUP DISCUSSION AND PUBLIC SPEAKING** 9

Introduction to Group Discussion – Understanding Group Dynamics – Group Discussion Strategies–Activities to Improve GD Skills – Public Speaking Techniques – Public Speaking Activities.

UNIT V **INTERVIEW SKILLS** 9

Listening to Interviews; Types of Interviews; Preparation for the Interview – Interview Techniques and Etiquettes – Mock Interview – Online Interview Techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Prashant Sharma, "Soft Skills: Personality Development for Life Success", 1st Edition, BPB Publications, 2022.

2 Rajendran, Jayanthi, Jeya Santhi V, Nagalakshmi B, "The Art of English Communication: A Practical Approach", Notionpress.com, 2025.

REFERENCES:

1. Grant, Adam. "Think Again: The Power of Knowing What You Don't Know", Penguin Random House, 2021.
2. Harrison, Ryan. "How To Talk To Anybody: 14 Speaking Techniques To Instantly Connect with Anyone", LearnWell Books, 2022.
3. Gloria J Galanes, Katherine Adams, Carrisa S Hoelscher, Stephen A Spates, "Effective Group Discussion: Theory and Practice", Tata McGraw Hill, 2023.

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ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_hs15/preview
2. https://www.coursera.org/learn/verbal-communications-and-presentation-skills
3. The Complete Guide to Resume Formats: Chronological, Functional, and Hybrid | UseResume.ai

COURSE OUTCOMES:

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

- **CO1** Apply Employment Skills In Their Environment
- **CO2** Write Resume Writing & Job Application.
- **CO3** Apply The Fundamental Inputs Of Communication Skills In Making Speech Delivery.
- **CO4** Apply Various Group Discussion Skills To Take Part In Effective Discussions In A Professional Context.
- **CO5** Analyze Various Interview Formats For Job Interviews.

CO – PO MAPPING:

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

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U23OE115 **INVENTIONS AND APPLICATIONS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To analyse the engineering principles underlying major scientific inventions and their technological evolution.
- To apply scientific inventions in solving real-world engineering problems.
- To design innovative, sustainable, and ethical engineering solutions inspired by emerging technologies.

UNIT I FOUNDATIONS OF INVENTION AND INNOVATION 9

Definition and scope of invention vs. discovery – Drivers of scientific progress – Case studies of transformative inventions (printing press, steam engine, electricity, semiconductor devices) – Innovation models: TRIZ, disruptive innovation, and design thinking – Intellectual property rights and patents.

UNIT II COMMUNICATION AND INFORMATION TECHNOLOGY 9

Evolution of telecommunication systems – From telegraph to 5G networks – Internet architecture, cloud computing, IoT, AI, machine learning, and quantum computing – Applications in governance, smart cities, and cyber-physical systems – Limitations and challenges in scalability and security.

UNIT III ENERGY AND TRANSPORTATION SYSTEMS 9

Engineering design of combustion engines, power plants, and aerodynamics of flight – Advancements in electric vehicles, high-speed rail, and autonomous transport – Renewable energy technologies: photovoltaic cells, wind turbines, hydrogen fuel cells, bioenergy – Integration into smart grids – Case studies on sustainable energy transitions.

UNIT IV INVENTIONS IN MEDICINE AND BIOTECHNOLOGY 9

Medical imaging innovations (X-ray, MRI, PET, CT) – Engineering of biomedical devices, artificial organs, prosthetics, and implants – Nanomaterials in drug delivery and diagnostics – Genetic engineering, CRISPR, and synthetic biology – Role of AI and big data in precision healthcare.

UNIT V FRONTIER TECHNOLOGIES AND ETHICAL DIMENSIONS 9

3D printing and additive manufacturing – Robotics and autonomous systems – Space exploration technologies (rocketry, satellites, reusable launch systems) – Environmental engineering innovations (carbon capture, water purification, climate engineering) – Ethical, social, and sustainability considerations of emerging technologies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Vasant Gowariker, Science and Technology for Sustainable Development in India, 1st Edition, Sage Publications, 2020.
2. Rakesh Rathi, Nanotechnology and Smart Materials: Recent Advances and Applications, 1st Edition, CRC Press, 2021.

REFERENCES:

1. Cristiano Antonelli, Innovation and Technological Change: An Evolutionary Perspective, 2nd Edition, Routledge, 2020.
2. Pradeep Fulay and Mohammad Islam, Materials Science and Engineering: An Introduction to Concepts, 2nd Edition, CRC Press, 2021.
3. Debmalya Barh (Ed.), Genomic and Precision Medicine: Engineering and Applications, Academic Press, Elsevier, 2020.

ONLINE RESOURCES:

1. https://www.technologyreview.com
2. https://technology.nasa.gov
3. https://spectrum.ieee.org

COURSE OUTCOMES:

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

CO1 Analyse the principles and historical context of major inventions and innovations.

CO2 Evaluate the engineering design and technological basis of inventions across domains.

CO3 Apply scientific principles to assess the efficiency, scalability, and limitations of technologies.

CO4 Design innovative solutions by integrating interdisciplinary knowledge from engineering and science.

CO5 Critically assess ethical, environmental, and societal implications of emerging technologies.

CO – PO MAPPING:

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

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U23OE116	PUBLIC POLICY AND GOVERNANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart Knowledge on public policy-making processes and governance structures.
- To know the role of government institutions, stakeholders, and societal actors in shaping public policies.
- To explore the cchallenges and opportunities for global policy cooperation.

UNIT I INTRODUCTION TO PUBLIC POLICY AND GOVERNANCE 9

Public Policy - Definition and scope, Theories of policy-making (e.g., rational choice, incrementalism, advocacy coalition framework), Models of governance (e.g., hierarchical, network, collaborative)

UNIT II POLICY ANALYSIS AND EVALUATION 9

Policy analysis - Methods and tools for policy analysis (e.g., cost-benefit analysis, policy modeling, stakeholder analysis) Criteria for evaluating policy effectiveness, efficiency, and equity Case studies of policy success and failure.

UNIT III ACTORS AND INSTITUTIONS IN PUBLIC POLICY 9

Role of government agencies, legislatures, and courts in policy-making Influence of interest groups, advocacy coalitions, and the media on policy agendas Comparative analysis of governance structures and processes in different political systems.

UNIT IV POLICY IMPLEMENTATION AND MANAGEMENT 9

Challenges and strategies in policy implementation - the role of public administration, bureaucracies, and public-private partnerships tools for monitoring, evaluation, and adaptive management of policies.

UNIT V POLICY ISSUES AND CONTEMPORARY CHALLENGES 9

Current debates and controversies in public policy (e.g., healthcare reform, climate change, immigration) Emerging policy issues (e.g., digital governance, artificial intelligence, global pandemics)

TOTAL: 45 PERIODS

TEXT BOOKS:

1. James A. Stimson, Michael B. Macken, and Robert S. Erikson, Dynamic Representation: Policy, Public Opinion, and Democracy, 2nd Edition, Cambridge University Press, 2022.
2. Thomas R. Dye., "Understanding Public Policy", 15th Edition, Pearson Publishing Co., 2021.

REFERENCES:

1. Christopher M. Weible and Paul A. Sabatier (Eds.), Theories of the Policy Process, 5th Edition, Routledge, 2022.
2. Michael E. Kraft and Scott R. Furlong., "Public Policy: Politics, Analysis, and Alternatives", 6th Edition, CQ Press, 2020.
3. B. Guy Peters, Advanced Introduction to Public Policy, 2nd Edition, Edward Elgar Publishing, 2021.

ONLINE RESOURCES:

1. https://www.brookings.edu
2. https://www.rand.org/topics/public-sector-governance.html
3. https://www.pewresearch.org/topic/politics-policy

COURSE OUTCOMES:

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

CO1 Understand the concepts and theories of public policy and governance.

CO2 Analyze the interplay between government, civil society, and the private sector in policymaking processes.

CO3 Evaluate the impact of public policies on different stakeholders and societal outcomes.

CO4 Develop skills in policy analysis, advocacy, and stakeholder engagement.

CO5 Apply theoretical frameworks to real-world policy issues and case studies. Understand the concepts and theories of public policy and governance.

CO – PO MAPPING:

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

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U23OE117	INTRODUCTION TO MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basics of wireless transmission systems.
- Know about the fundamentals of GSM and 3G Services, its protocols and application.
- Understand about evolution of 4G Networks, its architecture and applications.

UNIT I INTRODUCTION TO WIRELESS TRANSMISSION 9

Introduction to mobile computing, Frequencies for radio transmission, Generations of Mobile Communication, Signals, Antennas ranges, Signal propagation, Multiplexing, Modulation, cellular systems.

UNIT II WIRELESS MOBILE NETWORKS 9

WLAN System and Protocol architecture, IEEE 802.11a, IEEE 802.11b, HIPERLAN1/2, Bluetooth, WPAN-802.15.4, Wireless USB, Zigbee, 6LoWPAN, LoRaWAN, WiMAX.

UNIT III MOBILE NETWORK AND TRANSPORT LAYER 9

Mobile IP, Registration, Tunnelling and encapsulation, IPv6, DHCP, Adhoc Routing Protocols, Multicast Routing, Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks, VANET, IoT.

UNIT IV GSM AND 3G COMMUNICATIONS SYSTEMS 9

Introduction to GSM, Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, GPRS, UMTS Architecture, LMDS, MMDS.

UNIT V 4G AND BEYOND 9

4G Network- Introduction, vision, features, challenges and applications, 4G Technologies-Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO Systems, Software Defined Radio, Cognitive Radio, LTE, advanced LTE, Introduction to 5G Networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2012.

2 Vijay Garg, "Wireless Communications and networking", 1st Edition, Elsevier, 2007.

REFERENCES:

1 Rappaport. T. S, "Wireless Communications", 2nd Edition, Pearson Education, 2010.

2 Simon Haykin, Michael Moher, David Koilpillai, "Modern Wireless Communications", 1st Edition Pearson Education, 2013.

3 Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2nd Edition, Academic Press, 2008.

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ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc24_ee72/preview

2 https://onlinecourses.nptel.ac.in/noc21_ee66/preview

3 https://www.coursera.org/learn/wireless-communications

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

CO1 Explain wireless transmission techniques.

CO2 Describe various wireless mobile networking technologies.

CO3 Explain mobile network and transport layers techniques and protocols.

CO4 Describe fundamentals of GSM and 3G Services, its protocols and applications.

CO5 Explain the evolution of 4G Networks, its architecture and applications.

CO – PO – PSO MAPPING:

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

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U23OE118	BASICS OF SIGNALS AND ITS PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of signals, types and its properties.
- To learn about the continuous time signals by using Fourier transform and Laplace transform.
- To understand the discrete time signals in the Discrete time Fourier and Z transform domain.

UNIT I INTRODUCTION TO SIGNALS 9

Introduction to Signals, Types of time signals, Continuous and discrete signal representation, Characteristics of Signals, Standard signals- Step, Ramp, Pulse, Impulse, Real and complex, Exponentials and Sinusoids, Energy of a Signal, Power of a signal, Problems, Different types of Signal Processing..

UNIT II CLASSIFICATION OF SIGNALS 9

Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & A periodic signals, Deterministic & Random signals, Causal and Non causal Signals, Problems.

UNIT III PROPERTIES OF SIGNALS 9

Properties of Continuous and discrete time signals: Reflection, Shifting, Scaling, Reversal, Periodic composite signals, Signal and noise, Frequency spectrum and Bandwidth, Problems.

UNIT IV FREQUENCY DOMAIN REPRESENTATION OF CT SIGNALS 9

Fourier Series for periodic signals, Fourier Transform, Properties of CTFT, Gibbs Phenomena, Dirichlet Conditions, Laplace Transforms, Properties of Laplace Transforms.

UNIT V FREQUENCY DOMAIN REPRESENTATION OF DT SIGNALS 9

Baseband signal Sampling, Discrete Time Fourier Series, Discrete Time Fourier Transform, Properties of DTFT, Z Transform, and Properties of Z Transform.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Hwei P. Hsu, "Schaum's Outlines of Signals and Systems", 3rd Edition, Tata Mc Graw Hill, 2002.
2 Alan V Oppenheim, Wilsky S, Nawab S H, "Signals and Systems", Pearson Education, 2015.

REFERENCES:

1 B P Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 2009.
2 R E Zeimer, W H Tranter, R D Fannin, "Signals & Systems - Continuous and Discrete", Pearson Education, 2007.
3 John Alan Stuller, "An Introduction to Signals and Systems", Cengage Learning, 2007.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc21_ee20/preview

2 https://nptel.ac.in/courses/117102060

3 https://www.coursera.org/learn/dsp1

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

CO1 Understand the fundamental concept of signals.

CO2 Understand the different classification of signals.

CO3 Explain the various properties of signals.

CO4 Describe the various properties of continuous time signals and its frequency domain representation.

CO5 Explain the various properties of Discrete time signals and its frequency domain representation.

CO – PO – PSO MAPPING:

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

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U23OE119 **INTRODUCTION TO COMMUNICATION SYSTEMS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce concept of basic analog and digital communication systems.
- To understand the various modulation techniques for analog and digital communication systems.
- To study the wired channel on communication systems.

UNIT I **ANALOG COMMUNICATION** 9

Amplitude modulation – DSBFC, square law modulator, envelope detection, Hilbert transform, SSB – frequency and phase shift methods of SSB generation – coherent detection.

UNIT II **ANGLE MODULATION** 9

Frequency Modulation, narrowband and wideband signals, Bessel functions, Carson's rule – bandwidth, Direct and indirect FM generation, demodulation using Phase-locked loop.

UNIT III **DIGITAL COMMUNICATION** 9

Nyquist sampling theorem – Pulse amplitude modulation, Pulse code modulation – Quantization – quantization noise, delta modulation, DPCM, Multiplexing and Multiple Access Techniques – FDM and FDMA, TDM and TDMA, CDMA.

UNIT IV **DIGITAL MODULATION TECHNIQUES** 9

Binary Phase Shift Keying – Binary Frequency Shift Keying, On-Off Keying, Optimum receiver structures for digital communication – matched filtering, correlation detection, probability of error.

UNIT V **MOBILE CELLULAR COMMUNICATION** 9

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G – Cellular network components – Components of a mobile phone – setting up a call process – Making a call process – Receiving a call process – Spectrum allocation: Policies and strategies, Role of TRAI.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Theodore S Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2010.

2 Haykin S, "Communication Systems", 5th Edition, John Wiley & Sons, 2009.

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REFERENCES:

1 Sklar B, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2016.

2 B P Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.
3 Hwei P Hsu, "Schaum Outline Series - Analog and Digital Communications", Tata McGraw Hill, 2006.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc20_ee16/preview
2 https://www.mooc-list.com/tags/communication-systems
3 https://www.coursera.org/learn/communication

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

CO1 Explain the basic concepts of analog communication systems.

CO2 Apply the modulation techniques for analog communication.

CO3 Apply the modulation techniques for digital communication.

CO4 Explain the concepts of sampling and quantization techniques.

CO5 Analyse the performance of wireless channels.

CO – PO – PSO MAPPING:

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

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U23OE120	DRONE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of drone concepts.
- To learn and understand the fundaments of design, fabrication and programming drone.
- To know about the various applications of drone.

UNIT I **INTRODUCTION TO DRONE TECHNOLOGY** **9**

Drone Concept – Vocabulary Terminology- History of drone – Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses – Drone business through entrepreneurship – Opportunities applications for entrepreneurship and employability.

UNIT II **DRONE DESIGN, FABRICATION AND PROGRAMMING** **9**

Classifications of the UAV – Overview of the main drone parts – Technical characteristics of the parts – Function of the component parts – Assembling a drone – The energy sources – Level of autonomy – Drones configurations – The methods of programming drone – Download program Install program on computer – Running Programs – Multi rotor stabilization – Flight modes – Wi-Fi connection.

UNIT III **DRONE FLYING AND OPERATION** **9**

Concept of operation for drone – Flight modes – Operate a small drone in a controlled Environment – Drone controls Flight operations – management tool – Sensors – On-board storage capacity – Removable storage devices – Linked mobile devices and applications.

UNIT IV **DRONE COMMERCIAL APPLICATIONS** **9**

Choosing a drone based on the application – Drones in the insurance sector – Drones in delivering mail, parcels and other cargo – Drones in agriculture – Drones in inspection of transmission lines and power distribution – Drones in filming and panoramic picturing.

UNIT V **FUTURE DRONES AND SAFETY** **9**

The safety risks – Guidelines to fly safely – Specific aviation regulation and standardization – Drone license – Miniaturization of drones – Increasing autonomy of drones – The use of drones in swarms.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Daniel Tal, John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, 2021.

2 Terry Kilby, Belinda Kilby, "Make: Getting Started with Drones ", Maker Media, Inc., 2016.

REFERENCES:

1 John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
2 Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.
3 Sachi Nandan Mohanty, J V R Ravindra, Ġ Surya Narayana, "Drone Technology: Future Trends and Practical Applications", John Wiley & Sons, 2023.

ONLINE RESOURCES:

1 https://www.classcentral.com/subject/drones
2 https://onlinecourses.nptel.ac.in/noc22_ce05/preview
3 https://www.coursera.org/learn/drones-for-environmental-science

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

CO1 Explain about various types of drone technology, drone fabrication and programming.
CO2 Analyse the suitable operating procedures for functioning a drone.
CO3 Analyse the appropriate sensors and actuators for Drones.
CO4 Design a drone mechanism for specific applications.
CO5 Write the programs for various drones.

CO – PO – PSO MAPPING:

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

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U23OE121 **GEOGRAPHICAL INFORMATION SYSTEM** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamentals and components of Geographic Information System.
- To understand the types and models of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.

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, 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

Concept of operation for drone – Flight modes – Operate a small drone in a controlled Environment – Drone controls Flight operations – management tool – Sensors – On-board storage capacity – Removable storage devices – Linked mobile devices and applications.

UNIT IV **DATA QUALITY AND STANDARDS** 9

Data quality – Basic aspects – completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability – OGC – Spatial Data Infrastructure

UNIT V **DATA MANAGEMENT AND OUTPUT** 9

Import/Export – Data Management functions – Raster to Vector and Vector to Raster Conversion – Data Output – Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS – distributed GIS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Kang - Tsung Chang, "Introduction to Geographic Information Systems", 2nd Edition, Tata McGraw Hill, 2011.

2 Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems", 2nd Edition, Pearson Education, 2007.

REFERENCES:

1 Lo C P, Albert K W Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India, 2006.

2 Jonathan Campbell, Michael Shin, "Essentials of Geographic Information Systems", Saylor Foundation, 2011.

3 Michael N DeMers, "Fundamentals of Geographic Information Systems", 4th Edition, John Wiley & Sons, 2009.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/105/102/105102015/

2 https://bhuvan.nrsc.gov.in/bhuvan_links.php

3 https://nptel.ac.in/courses/105/107/105107155/

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

CO1 Explain the basics about the fundamentals of GIS.

CO2 Describe the types of data models.

CO3 Explain about data input and topology.

CO4 Apply various spatial analysis tools for deriving GIS based outcome.

CO5 Explain data management functions and data output

CO – PO – PSO MAPPING:

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

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U23OE122 FUNDAMENTALS OF ELECTRIC AND HYBRID VEHICLE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand a comprehensive overview of Electric and Hybrid Electric Vehicles.
- To understand about different aspects of drive train topologies and components in HV & EV.
- To understand and advance in battery management and case studies.

UNIT I INTRODUCTION TO HYBRID ELECTRIC VEHICLES 9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, the impact of modern drive-trains on energy supplies, types of HV and EV, advantages over conventional vehicles, limitations of EV and HV, impact on the environment of EV and HV technology, disposal of battery cell and hazardous material and their impact on the environment.

UNIT II BASIC CONCEPT OF HYBRID TRACTION 9

Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis, braking fundamentals and regenerative braking in EVs.

UNIT III ELECTRIC COMPONENTS USED IN HYBRID AND ELECTRIC VEHICLES 9

Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives, configuration and control of Permanent Magnet Motor Drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV POWER MANAGEMENT AND ENERGY SOURCES OF EV & HV 9

Power and Energy management strategies and its general architecture of EV and HV, various battery sources, energy storage, battery based energy storage and simplified models of battery, Battery Management Systems (BMS), fuel cells, their characteristics and simplified models, Super capacitor based energy storage, its analysis and simplified models, flywheels and their modelling for energy storage in HV/BEV, hybridization of various energy storage devices, Selection of the energy storage technology.

UNIT V APPLICATIONS OF EV & HV 9

Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV), Electric Vehicle Adoption in Urban Mobility, Electric Vehicle Integration with Renewable Energy

TOTAL: 45 PERIODS

REFERENCES:

1. Iqbal Hussain, "Electric and Hybrid Vehicles Design Fundamentals", 2nd Edition, CRC Press, 2011.
2. Chris Mi, M Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", 1st Edition, John Wiley &Sons, 2011.

3. Lino Guzzella, Antonio Sciarretta, Modern Electric, "Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press, 2009.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain about the social and environmental significance, and impact of modern hybrid and electric vehicle

CO2 Describe Enhanced EV performance through diverse drives, efficiency analysis, and regenerative braking.

CO3 Explain the Improved efficiency and control in various motor drive configurations enhance performance.

CO4 Summarize on Efficient power management, battery technology understanding, and storage selection optimization

CO5 Explain about the Efficient vehicle designs, urban mobility, and renewable energy integration optimization.

CO – PO MAPPING:

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

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U23OE123	INTRODUCTION TO PLC PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand basic PLC terminologies, digital principles, PLC architecture.
- Familiarize different programming languages of PLC.
- Develop PLC logic for simple applications using ladder logic

UNIT I **INTRODUCTION TO PLC** **9**

Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC - PLC Construction: What is a PLC, PLC Memories, PLC I/O, , PLC Special I/O, PLC Types.

UNIT II **PLC INSTRUCTIONS** **9**

PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays- Interlock examples- Timers, Counters, Examples.

UNIT III **PLC PROGRAMMING** **9**

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV **COMMUNICATION OF PLC AND SCADA** **9**

Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures.

UNIT V **APPLICATIONS OF PLC** **9**

Stepper Motor Control- Elevator Control - CNC Machine Control- conveyor control- Interlocking Problems.

TOTAL:45 PERIODS

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REFERENCES:

1 Madhuchhanda Mitra , Samerjit Sengupta, "Programmable Logic Controllers Industrial Automation", 1st Edition, Penram International Publishing, 2019.

2 J R Hackworth , F D Hackworth, "Programmable Logic Controllers Principles and Applications", 2nd Edition, Pearson Education, 2020.

3 Ojula, "PLC Programming & Implementation" 1st Edition, Publish Drive Publications, 2022.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain basics of PLC and PLC types.

CO2 Analyse PLC basic instructions and timers.

CO3 Analyse PLC module addressing, different types of functions.

CO4 Explain communication protocol and architecture.

CO5 Analyze PLC programming in different motors.

CO – PO MAPPING:

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

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U23OE124	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To enable the students to understand the concept of Energy Management
- To know the electrical load management techniques and power trading marketing
- To understand the basics of Energy audit and its economic analysis

UNIT I ENERGY SCENARIO AND BASICS OF ENERGY 9

Types of Energy Sources – Life of Energy Sources - Energy Scenario in India – Energy vs Economic Growth - Linkage between Energy Use and Environment - Need for Energy Conservation Work, Energy and Power – Electricity Basics – Energy Units.

UNIT II LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards

UNIT III METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques.

UNIT IV SHORT-TERM POWER TRADE MARKET 9

Electricity Act 2003- Yearly Trends in Short-term Transactions of Electricity- Time of the Day Variation in Volume and Price of Electricity Transacted through Traders and Power Exchanges-Trading Margin Charged by Trading Licensees-Open Access Consumers on Power Exchanges-Effect of Congestion on the Volume of Electricity Transacted through Power Exchanges.

UNIT V ENERGY AUDIT 9

Energy Audit Definition – Need for Energy Audit – Types of Energy Audit and Approaches – Understanding Energy Costs - Energy Performance

TOTAL: 45 PERIODS

REFERENCES

1. Arry C White, Philip S Schmidt, David R Brown, "Industrial Energy Management Systems", 10th Edition, Hemisphere Publishing, 2023.
2. Albert Thumann, "Fundamentals of Energy Engineering", 3rd Edition, Prentice Hall of India, 2022.
3. A S Pabla, "Electrical Power distribution", 5th Edition, Tata McGraw Hill, 2018.

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COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1	Summarize the Energy Scenario and Basics of Electrical Energy
CO2	Explain the working and optimizing of Lightning System
CO3	Describe different meters and its necessity in Energy Management
CO4	Summarize the Short-Term Power Trade Market
CO5	Summarize the types of Energy Audit Approaches

CO – PO MAPPING:

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

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U23OE125	FUNDAMENTALS OF ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand and gain the knowledge of robotics.
- To understand and gain the knowledge of working principles of sensors and drives.
- To understand the social economical aspects and applications

UNIT I **INTRODUCTION** 9

Introduction to Principles & Strategies of Automation, Types & Levels of Automation, Need of Automation, Brief History, Basic Concepts of Robotics such as Definition, Three Laws, Elements of Robotic Systems i.e. Robot Anatomy, DoF, Misunderstood Devices etc., Classification of Robotic Systems on the Basis of Various Parameters such as Work Volume, etc., Associated Parameters i.e. Resolution, Accuracy, Repeatability, Dexterity, Compliance, RCC Device etc.

UNIT II **GRIPPERS AND TRANSMISSION SYSTEMS** 9

Grippers for Robotics - Types of Grippers, Guidelines for Design for Robotic Gripper, Force Analysis for Various Basic Gripper System, Degrees of Freedom - Determination of Degrees of Freedom for Four & Five Bar Mechanism, Slider Crank Mechanism, Stanford Robot and SCARA ROBOT using Grubler - Kutzbach Equation.

UNIT III **SENSORS AND DRIVES** 9

Sensors: - Classification and Applications of Sensors, Characteristics of Sensing Devices, Selections of Sensors. Need for Sensors and Vision Systems in the Working and Control of a Robot. Desirable Features and Working of Tactile, Proximity and Range Sensors, Position Sensors, Velocity Sensors, Acceleration Sensors. Drives: Type of Drive, Actuators- Pneumatic, Hydraulic, Electrical and its Selection while Designing a Robot System.

UNIT IV **ROBOT PROGRAMMING AND LANGUAGES** 9

Programming, WAIT, SIGNAL and DELAY Commands, Subroutines, Programming Languages: Generations of Robotic Languages, Introduction to Various Types such as VAL, RAIL, AML, python, ROS etc..

UNIT V **SOCIO-ECONOMIC ASPECTS AND APPLICATIONS** 9

Socio-Economic Aspect of Robotization. Economical Aspects for Robot Design, Safety for Robot and Standards, Introduction to Artificial Intelligence, AI Techniques, Need and Application of AI. Industrial Applications of Robot in Material Transfer, Manufacturing, Inspection and Assembly

TOTAL: 45 PERIODS

REFERENCES

1. Ashitava Ghosal, "Robotics: Fundamental Concepts and Analysis", 2nd Edition, Oxford Publishers, 2008.

2. Guruprasad K R, "Robotics: Mechanics And Control", 1st Edition, Prentice Hall of India, 2019.
3. K S Fu, Ralph Gonzalez, C S G Lee, "Robotics: Control, Sensing, Vision and Intelligence", 1st Edition, Tata McGraw Hill, 2017.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain the robot anatomy and terminologies related to Robotics technology

CO2 Describe the gripper force and transmission systems used in robotics.

CO3 Explain the various types, selection and need of sensors

CO4 Explain robot programming techniques and common programming commands

CO5 Describe socio-economic aspects, AI techniques and robot applications in the area of robotics.

CO – PO MAPPING:

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

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U23OE126	MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand basic concepts of bio signals and bio potential electrodes
- To understand various electrode configurations.
- To understand concepts and types of bio amplifiers.

UNIT I **BIO POTENTIAL ELECTRODES** **9**

Origin of Bio potential and its propagation. Electrode-Electrolyte interface, electrode skin interface, half-cell potential, impedance, polarization effects of electrode-non polarizable electrodes. Types of electrodes-surface, needle and micro electrodes and their equivalent circuits. Recording problems-measurement with two electrodes.

UNIT II **ELECTRODE CONFIGURATIONS** **9**

Bio signal characteristics- frequency and amplitude ranges ECG – Einthoven's triangle, standard 12 lead system, EEG-10-20 electrode system, unipolar, bipolar and average mode. EMG, ERG and EOG –unipolar and bipolar mode.

UNIT III **BIO AMPLIFIER** **9**

Need for bio-amplifier- single ended bio amplifier, differential bio amplifier-right leg driven ECG amplifier. Band pass filtering, isolation amplifiers-transformer and optical isolation-isolated DC amplifier and AC carrier amplifier. Chopper amplifier-Power line interference.

UNIT IV **MEASUREMENT OF NON ELECTRICAL PARAMETER** **9**

Temperature, respiration rate and pulse rate measurements. Blood Pressure and indirect-methods-Auscultatory-method-Oscillometric-method,direct -methods, Electronic manometer. Pressure amplifiers-systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement. Indicator dilution, Thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V **BIOCHEMICAL MEASUREMENT** **9**

Biochemical sensors-pH,pO2 and pCO2,Ion selective Field Effective Transistor(ISFET)Immunologically sensitive FET (IMFET),Blood Glucose sensors-Blood Gas Analyzers, Calorimeter, Flame Photometer, Spectrophotometer, Blood cell counter, Auto Analyzer(simplified schematic description).

TOTAL: 45 PERIODS

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REFERENCES:

1 R Khandpur, "Biomedical Instrumentation Technology and Applications", 4th Edition, Tata McGraw Hill, 2021.
2 Raghbir Singh Khandpur, "Compendium of Biomedical Instrumentation", 1st Edition, John Wiley & Sons, 2020.
3 John G Webster, "Medical Instrumentation: Application and Design", 5th Edition, John Wiley & Sons , 2020.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain the characteristics of bio-signals and their importance in medical diagnosis

CO2 Describe various electrode configurations and its working methods.

CO3 Comprehend concepts and types of bio amplifiers in medical instrumentation.

CO4 Explain different measurement methods of non- electrical parameters in medical instrumentation.

CO5 Summarize concepts about different biochemical measurements.

CO – PO MAPPING:

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

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U23OE137	APPLIED DESIGN THINKING	L	T	P	C
		3	0	0	3

Course Objectives:

- Introduce tools & techniques of design thinking for innovative products.
- Development Illustrates customer-centric product innovation using simple.
- Describe system thinking principles as applied to complex systems.

UNIT I 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 II END USER-CENTRIC INNOVATION 9

Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit.

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 CONCEPT GENERATION 9

Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts.

UNIT V SYSTEM THINKING 9

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Maurício Vianna, Ysmar nVianna, Brenda Lucena, Beatriz Russo, "Design thinking: Business innovation", 1st Edition, MJV Technologies and innovation press, 2021.
2. George E Dieter, "Engineering design", 4th Revised edition, Tata McGraw Hill, 2019.

REFERENCES:

1. Len Bass, Ingo Weber, Liming Zhu G, DevOps, "A Software Architect's Perspective", 1st Edition, Addison-Wesley Professional, 2019.
2. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 2nd Edition, Harper Business, 2019.
3. Stephen Fleming, Pravin, "Introduction of DevOps Resource Management", 1st Edition, Create space Independent Publication, 2021.

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ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/112/105/112105316/

2 https://www.shutterstock.com/video/search/design-thinking

3 https://onlinecourses.nptel.ac.in/noc22_mg32/preview

COURSE OUTCOMES:

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

CO1 Design 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 Apply the critical thinking, analysing, storytelling & pitching.

CO4 Apply system thinking in a real-world scenario.

CO5 Create the right prototype with Assess capability with solution concept.

CO – PO - PSO MAPPING:

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

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U23OE138	FIRE SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable the students to acquire knowledge of Fire and Safety Studies.
- To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance.
- To learn about fire areas, fire stopped areas and different types of fire-resistant doors

UNIT I **INHERENT SAFETY CONCEPTS** **9**

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within buildings and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behaviour of non-structural materials on fire- plastics, glass, textile fibres and other household materials.

UNIT II **PLANT LOCATIONS** **9**

Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements standard heating condition, Indian standard test method, performance criteria.

UNIT III **WORKING CONDITIONS** **9**

Fire separation between building- principles of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors.

UNIT IV **FIRE SEVERITY AND REPAIR TECHNIQUES** **9**

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V **WORKING AT HEIGHTS** **9**

Safe Access - Requirement for Safe Work Platforms- Stairways - Gangways and Ramps- Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs -Work Permit Systems-Accident Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Roytman M Y,"Principles of fire safety standards for building construction", 1st Edition, Amerind Publishing Co. Pvt. Ltd., 2018.
2. John A Purkiss,"Fire safety engineering design of structures", 2nd Edition, Butter worth Heinemann, 2019.

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REFERENCES:

1. Smith E E, and Harmathy T Z,"Design of buildings for fire safety", 1st Edition, ASTM Special Publication, 2018.
2. Jain V K,"Fire safety in buildings", 1st Edition, New Age International Pvt. Ltd., 2020.
3. Hazop & Hazan,"Identifying and Assessing Process Industry Hazards", 4th Edition, CRC Press, 2019.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102176/
2. https://3danimation.in/projects/safety-animation-fire-safety-video/
3. https://onlinecourses.nptel.ac.in/noc20_ce09/preview

COURSE OUTCOMES:

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

CO1 Describe the effect of fire on materials used for construction.

CO2 Describe the method of test for non-combustibility and fire resistance.

CO3 Describe the design concept of fire walls, fire screens, local barriers and fire doors and able to select to prevent fire spread.

CO4 Apply the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.

CO5 Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

CO – PO - PSO MAPPING:

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

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U23OE139	FUNCTIONAL MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart an insight in differentiating among various functional properties
- To describe the selection of appropriate material for certain functional applications.
- To study about the analysis of the nature and potential of functional materials.

UNIT I **INTRODUCTION** **9**

Historical Perspectives, Lessons from the Nature, Engineering the Functions, Tuning the functions, Multiscale Modelling and Computation, Classification of Functional Materials, Functional Diversity of Materials, Hybrid Materials, Technological Relevance, Societal Impact.

UNIT II **MOLECULAR SELF ASSEMBLY** **9**

Molecular Organization, Self-Assembly in Biology, Energetics of self-Organization, A few case studies, Synthetic Protocols and challenges, Solvent assisted self-assembly, Directed assembly-Langmuir-Blodgett and Langmuir-Schaefer techniques, Technological applications of SAMs.

UNIT III **BIO-INSPIRED MATERIALS** **9**

Bio-inspired materials, Classification, Biomimicry, Spider Silk, Lotus Leaf, Gecko feet, Synovial fluid, 'Bionics'-Bio-inspired Information Technologies, Artificial Sensory Organs, Biomineralization- En route to Nanotechnology.

UNIT IV **SMART OR INTELLIGENT MATERIALS** **9**

Criteria for Smartness, Significance of Smart Materials, Representative Examples like Smart Gels and Polymers, Electro/Magneto Rheological Fluids, Smart Electro ceramics, Technical Limitations and Challenges, Functional Nanocomposites, Polymer-carbon nanotube composites.

UNIT V **MATERIALS FOR POLYMER ELECTRONICS** **9**

Polymers for Electronics, Organic Light Emitting Diodes, Working Principle of OLEDs, Illustrated Examples, Organic Field-Effect Transistors Operating Principle, Design Considerations, Polymer FETs vs Inorganic FETs, Liquid Crystal Displays, Engineering Aspects of Flat Panel Displays, Intelligent Polymers for Data Storage, Polymer-based Data Storage-Principle, Magnetic Vs. Polymer-based Data Storage.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Vijayamohanan K Pillai, Meera Parthasarathy, "Functional Materials: A chemist's perpective", 1st Edition, Universities Press, 2018.

2 Deborah D L Chung, "Functional Materials: Electrical, Dielectric, Electromagnetic, Optical and Magnetic applications", 1st Edition, World Scientific Publishing, 2020.

REFERENCES:

1 Stephen Manne, "Biomimetic Materials Chemistry", 1st Edition, Wiley-VCH, 2018.
2 S Banerjee, A K Tyagi, "Functional Materials: Preparation, Processing and Applications," 1st Edition, Elsevier Science, 2018.
3 Dipti Ranjan Sahu, "Functional Materials," 1st Edition, Intech Open, 2019.
4 Mohsen Shahinpoor, "Fundamentals of Smart Materials," 1st Edition, Royal Society of Chemistry, 2020.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc23_ph34/preview
2 https://royalsociety.org/news-resources/projects/animate-materials/
3 https://nptel.ac.in/courses/112104173

COURSE OUTCOMES:

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

CO1 Explain Multi-scale Modelling and Computation and classify the functional materials.
CO2 Explain the molecular self-assembly and technological applications of SAMs.
CO3 Apply the various bio inspired materials, artificial sensory organs and nano technology in bio mineralization.
CO4 Describe the applications of smart materials, nano composites and nano-tube composites.
CO5 Apply the concept polymer electronics in Organic and Light Emitting Diodes, transistors and LEDs.

CO – PO – PSO MAPPING:

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

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U23OE140	FUNDAMENTALS OF AERONAUTICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire the knowledge on the Historical evaluation of Airplanes.
- To learn the different component structures, construction, systems and functions.
- To study about the analysis of the nature and potential of functional materials.

UNIT I HISTORY OF FLIGHT 9

Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS AND ITS CONTROLS 9

Different types of flight vehicles, classifications-Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

UNIT III BASICS OF AERODYNAMICS 9

Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

UNIT IV BASICS OF AIRCRAFT STRUCTURES 9

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams- elastic constants-Factor of Safety.

UNIT V BASICS OF PROPULSION 9

Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production- Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Anderson J D, "Introduction to Flight", 8th Edition, Tata McGraw-Hill, 2018.

2 Rathakrishnan E, "Introduction to Aerospace Engineering: Basic Principles of Flight", 1st Edition, John Wiley & sons, 2021.

REFERENCES:

1 Stephen A Brandt, "Introduction to aeronautics: A design perspective", 2nd Edition, AIAA Education Series, 2019.

2 Sadhu Singh, "Internal Combustion Engines and Gas Turbine", 1st Edition, SS Kataraia & Sons, 2018.

3 Shevell, "Fundamentals of Flight", 2nd Edition, Pearson Education, 2018.

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ONLINE RESOURCES:

1 http://digimat.in/nptel/courses/video/101106033/L01.html

2 http://www.digimat.in/nptel/courses/video/101101083/L20.html

3 http://www.digimat.in/nptel/courses/video/101101001/A01.html

COURSE OUTCOMES:

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

CO1 Describe the history of aircraft & developments over the years.

CO2 Describe the types & classifications of components and control systems.

CO3 Explain the basic concepts of flight & Physical properties of Atmosphere.

CO4 Explain the types of fuselage and constructions.

CO5 Describe the types of Engines and the Rocket.

CO – PO - PSO MAPPING:

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

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U23OE141	INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

- Outline Fundamental concepts in UI & UX and Introduce the principles of Design and Building an mobile app.
- Illustrate the use of CAD in product design Outline the choice and use of prototyping tools.
- Understanding design of electronic circuits and fabrication of electronic devices.

UNIT I **UI/UX** **9**

Fundamental concepts in UI & UX - Tools - Fundamentals of design principles - Psychology and Human Factors for User Interface Design - Layout and composition for Web, Mobile and Devices - Typography - Information architecture - Color theory - Design process flow, wireframes, best practices in the industry -User engagement ethics - Design alternatives.

UNIT II **APP DEVELOPMENT** **9**

SDLC - Introduction to App Development - Types of Apps - web Development understanding Stack -Frontend - backend - Working with Databases - Introduction to API Introduction to Cloud services - Cloud environment Setup- Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III **INDUSTRIAL DESIGN** **9**

Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modelling - Basic 3D Modelling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing.

UNIT IV **MECHANICAL RAPID PROTOTYPING** **9**

Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing.

UNIT V **ELECTRONIC RAPID PROTOTYPING** **9**

Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Peter Fiell, "Charlotte Fiell, Industrial Design A-Z", 1st Edition, TASCHEN, 2018.
2. Madou M J, "Fundamentals of micro fabrication", 1st Edition, CRC Press, 2019.

REFERENCES:

1. Jaeger R C, "Introduction to microelectronic Fabrication", 1st Edition, Addision Wesley Publishing Co., 2020.
2. Amstead B H, Ostwald Phylips, Bageman R, "Manufacturing Processes", 1st Edition, John Wiley & Sons, 2018.
3. Serope Kalpakjian, "Manufacturing Engineering and Technology", 3rd Edition, Addison Wesley Publishing Co., 2019.

ONLINE RESOURCES:

1. http://www.digimat.in/nptel/courses/video/112107217/L20.html
2. https://onlinecourses.nptel.ac.in/noc22_mm33/preview
3. https://archive.nptel.ac.in/courses/112/104/112104265/

COURSE OUTCOMES:

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

CO1 Create quick UI/UX prototypes for customer needs.

CO2 Create web application to test product traction / product feature.

CO3 Design a 3D models for prototyping various product ideas.

CO4 Create prototypes using Tools and Techniques in a quick iterative methodology.

CO5 Describe the electronic rapid prototyping.

CO – PO - PSO MAPPING:

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

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U23OE201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To acquaint the knowledge of testing of hypothesis for small and large samples and design of experiments which plays an important role in real life applications.
- To introduce the basic concepts of solving algebraic and transcendental equations and introduce the numerical techniques of interpolation in various intervals and to solve differentiation and integration.
- To understand the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9

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

UNIT II DESIGN OF EXPERIMENTS 9

One way and two – way classifications – Completely randomized design –Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

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

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1 B S Grewal, J S Grewal, "Numerical Methods in Engineering and Science", 11th Edition, Khanna Publishers, 2021.

2 R A Johnson, I Miller, J Freund "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, 2017.

REFERENCES:

1. Chaitanya Kumar, Harindejit Kaur Chawla, Indarpal Singh, "A text book on Numerical Methods and Analysis", Sultan Chand & Sons, 2024.
2. P Sivaramakrishna Das, C Vijayakumari, "Statistics and Numerical Methods", 9th Edition, Pearson Education, 2020.
3. S C Gupta , V K Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, 2020.

ONLINE RESOURCES:

1. https://swayam.gov.in/nd2_cec20_ma01/preview
2. https://www.coursera.org/learn/intro-to-numerical-analysis
3. https://www.mooc-list.com/tags/numerical-methods

COURSEOUTCOMES:

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

CO1 Analyze the concepts of sampling, mean and variance using various statistical tests.
CO2 Analyze the concepts of design of experiments using ANOVA.
CO3 Solve the algebraic and numerical equations by numerical techniques.
CO4 Evaluate the numerical integration and differentiation using different methods.
CO5 Solve the first order differential equations by various methods.

CO-PO MAPPING:

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

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U23OE202	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn to formulate linear programming problems and solve LPP using simple algorithm.
- Learn to solve networking problems.
- Learn to formulate and solve integer programming problems.

UNIT I **LINEAR PROGRAMMING** **9**

Principal components of decision problem – Modeling phases – 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 OPTIMISATION THEROY** **9**

Unconstrained external problems, Newton – Ralphson method – Equality constraints –Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V **OBJECTS SCHEDULING** **9**

Network diagram representation – Critical path method – Time charts and resource leveling – PERT

TOTAL: 45 PERIODS

TEXT BOOKS:

1. H A Eiselt, Carl Louis Sandblom, "Operation Research", Springer, 2022.
2. Girish G.Pathak, "Operation Research", Tech Knowledge Publications, 2021.

REFERENCES:

1. Pundir S K, "Operation Research", CBS, 2020.
2. Bhupander Singh, S K Pundir, Amardeep, "Operation Research", A Pragati Edition, 2020.
3. S Hillier Frederick, J Lieberman Gerald, Nag Bodhibroto, Basu Preetam, "Introduction to Operation Research" Tata McGraw Hill, 2021.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112106134
2. https://nptel.ac.in/courses/112106134
3. https://archive.nptel.ac.in/courses/111/104/111104027/

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COURSEOUTCOMES:

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

CO1 Solve LPP using simple algorithm
CO2 Solve networking problems.
CO3 Solve integer programming problems.
CO4 Solve Non Linear programming problems.
CO5 Solve project management problems.

CO – PO MAPPING:

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

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U23OE203	GRAPH THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand and apply the fundamental concepts in graph theory.
- Able to demonstrate their knowledge of algorithms by solving concrete problems.
- To apply graph theory based tools in solving practical problems.

UNIT I **INTRODUCTION** **9**

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planar graphs – Different representation of a planar graph.

UNIT II **TREES, CONNECTIVITY& PLANARITY** **9**

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets Properties of cut set – All cut sets – Fundamental circuits and cut sets Connectivity and separability – 1-Isomorphism – 2-Isomorphism –Combinational and geometric graphs – Planar graphs – Different representation of a planar graph.

UNIT III **MATRICES, COLOURING & COVERING** **9**

Incidence matrix – Sub matrices – Circuit Matrix - Fundamental circuit matrix – Cut set, Path, Adjacency Matrix - Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four colour problem .

UNIT IV **DIRECTED GRAPH** **9**

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs – Trees with Directed edges – Matrices of Digraphs.

UNIT V **GENERATING FUNCTIONS & RECURRENCE RELATIONS** **9**

Generating functions - Partitions of integers - Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations –Method of generating functions.

TOTAL: 45PERIODS

TEXT BOOKS:

1. N P Shrimal, Nita H Shah,"Recent Advancements in Graph Theory ", CRC Press, 2020.
2. S B Singh, "Combinatorics and Graph Theory ", Khanna Publishing House, 2022.

REFERENCES:

1. Harun Pirim, "Recent Applications in Graph Theory", Intechopen, 2022.
2. Mark Anderson, Jonathan L Gross, Jay Yellen, "Graph Theory and its Applications", CRC Press, 2024.
3. Karin R Saoup, "Graph Theory", Chapman and Hall/CRC, 2021.

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ONLINE RESOURCES:

1 https://swayam.gov.in/nd1_noc20_ma05/preview
2 https://dzone.com/articles/the-top-13-resources-for-understandinggraph-theory
3 http://www.nitttrc.edu.in/nptel/courses/video/106104170/L22.html

COURSE OUTCOMES:

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

CO1 Explain concepts of graph theory that is walk, path, isomorphism etc.
CO2 Apply various substructures of trees and investigate the planarity of graphs.
CO3 Apply the concepts of Colouring, matching and chromatic number in theorems.
CO4 Explain digraphs and Euler graphs.
CO5 Solve recurrence relations using generating functions.

CO - PO MAPPING:

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

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U23OE204 **OPERATIONS RESEARCH** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand different methods involved in linear programming models, transportation and assignment models.
- To appropriately formulate various OR models and apply optimization techniques and algorithms to solve decision theory and project scheduling.
- To enhance the students to acquire the knowledge about inventory controls and queuing models.

UNIT I **LINEAR PROGRAMMING MODELS** 9

Introduction – Mathematical formulation of LPP – graphical solution – simplex method – duality.

UNIT II **TRANSPORTATION AND ASSIGNMENT MODELS** 9

Mathematical formulation of transportation problem – Methods for finding initial basic feasible solution – optimum solution – degeneracy – mathematical formulation of assignment models – Hungarian Algorithm – Travelling salesman problem.

UNIT III **DECISION THEORY AND PROJECT SCHEDULING** 9

Decision trees – Game theory – two people zero sum – mixed strategies – 2xn and mx2 games. Project scheduling: CPM and PERT – crashing networks and cost considerations – resource levelling and resource smoothening.

UNIT IV **SEQUENCING AND INVENTORY MODELS** 9

Sequencing model – 2 machines n jobs, m machines n jobs – n jobs 2 machines. Inventory model – deterministic and probabilistic models.

UNIT V **QUEUEING MODELS** 9

Queuing models – Poisson arrival and exponential service times – single & multi-server models.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. H A Eiselt ,Carl Louis Sandblom, "Operation Research", Springer, 2022.
2. Girish G Pathak, "Operation Research", Tech Knowledge Publications, 2021.

REFERENCES:

1. S Hillier Frederick, J Lieberman Gerald, Nag Bodhibroto, Basu Preetam, "Introduction to Operation Research", Tata McGraw Hill, 2021.
2. Bhupander Singh, Pundir S K, Amardeep, "Operation Research", A Pragati Edition, 2020.
3. Pundir S.K, "Operation Research", CBS, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111/105/111105100/
2. https://nptel.ac.in/courses/112/106/112106134/
3. https://freevideolectures.com/course/2678/advanced-operations research

COURSE OUTCOMES:

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

CO1 Solve linear programming models.
CO2 Apply the concepts of transportation and assignment models in real life applications.
CO3 Analyze the project schedule and the cost-time trade-offs in the context of a project network and optimal decisions using graphical approach.
CO4 Estimate the total elapsed time for the problems of multiple jobs and machines in a production line and understand the various selective inventory control techniques and its applications.
CO5 Analyze the quantitative metrics of performance for queuing systems.

CO- PO MAPPING:

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

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U23OE205	SCIENTIFIC PRINCIPLES IN HISTORICAL MONUMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To recall the historical background of the monuments.
- To recognize the different scientific principles in the maintenance of historical monuments.
- To identify the knowledge of construction techniques used in historical period.

UNIT I **CHARACTERISTICS OF MONUMENTS** 9

Definition - Materials used - Purpose-Functions - Types: religious, secular, palaces, forts, tombs, bridges - irrigation systems - need for conservation.

UNIT II **HISTORY OF CONSTRUCTION TECHNOLOGIES** 9

Chronological development - Ancient civilizations - Ancient period - Medieval construction-construction in the modern period - technical achievements.

UNIT III **BASIC PHYSICS PRINCIPLES** 9

Stability and equilibrium: leaning tower of Pisa – Tension, stress and strain: bridges – Overcoming forces: sledges, pulleys and elevators.

UNIT IV **TECHNIQUES OF CONSTRUCTION** 9

Mechanical energy to move large stones –use of counter weights and counter ramps.

UNIT V **ANCIENT TECHNIQUES** 9

Hydraulic transport of building material –use of levers and pivot walking.

TEXT BOOKS:

1 Halliday , Resnick, "Principles of Physics", 12th Edition , John Wiley & Sons, 2023.
2 Mila Powers, "Conservation science for Cultural Heritage", Willford Press, 2022.

REFERENCES:

1. Paula Pires, Joao Mascarenhas, "History of Construction Cultures", Taylor & Francis, 2021.
2. Claire Smith, "Encyclopedia of Global Archaeology", Springer, 2021.
3. Paul G Hewitt, "Conceptual Physics", 13th Edition, Pearson Education, 2024.

ONLINE RESOURCES:

1 https://doi.org/10.1038/s40494-025-01640-y

2 https://orcid.org/0000-0003-0049-8171

3 https://doi.org/10.70102/afts.2024.1631.036

COURSE OUTCOMES:

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

CO1 Summarize the characteristics of historical monuments.

CO2 Summarize the different scientific principles in designing and construction of historical monuments.

CO3 Apply the basic physics principles in maintenance of historical monuments.

CO4 Describe the history of construction technologies in various era.

CO5 Explain the techniques of construction used in olden days.

CO – PO MAPPING:

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

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U23OE206	NON-CONVENTIONAL ENERGY SOURCES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To compare different forms of energy.
- To acquire knowledge of different methods of harvesting energy.
- To recognize the use of alternate sources of energy.

UNIT I **SOLAR ENERGY** **9**

Sun Earth radiation spectra – Solar Radiation Data – Measurement of Solar Radiation data – Solar collectors – Solar water Heater – Solar cookers – Solar Greenhouse effect – Solar Cell fundamentals – a typical solar electric installation for home (solar panels, battery and inverter)

UNIT II **WIND ENERGY** **9**

Origin of wind – Nature of wind – Wind Turbine Siting – Major Applications of Wind Power – Main components of the horizontal axis wind turbine – Wind Energy Conversion systems – Wind – Diesel Hybrid System.

UNIT III **BIOMASS ENERGY** **9**

Introduction – Photosynthesis Process – Biofuels – Biomass Resources – Biomass conversion technologies – Urban Waste to Energy Conversion – Biomass Gasification – Biomass to Ethanol production – Biogas Production from Waste Biomass.

UNIT IV **CHEMICAL ENERGY SOURCES** **9**

Fuel cells – design and principle of operation of a fuel cell – Classification of fuel cells – Types of Fuel cells – Hydrogen and fossil fuel cell – Advantages and disadvantages of fuel cells.

UNIT V **DIFFERENT TYPES OF BATTERY** **9**

Batteries : Basic battery theory – Different types of battery arrangement – classification of batteries – Lead – Acid battery – Nickel cadmium battery – Li-ion battery – batteries used in portable devices (laptops, cell phones, pace makers).

TOTAL:45 PERIODS

TEXT BOOKS:

1. B H Khan , "Non-Conventional Energy Resources", Tata McGraw Hill, 2024.
2. G D Rai , "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2023.

REFERENCES:

1. D P Kothari, K C Singal, Rakesh Ranjan, "Renewable energy sources and emerging technologies", 3rd Edition, Prentice Hall of India, 2022.
2. Mehmet Kanoglu, Yunus A Cengel, John M Imbala, "Fundamentals and Applications of Renewable Energy", 2nd Edition, Tata McGraw Hill, 2023.
3. G S Sawhney, "Non-Conventional Energy Resources", Prentice Hall of India, 2024.

ONLINE RESOURCES:

1. https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-7-Wind-Energy-1.pdf
2. https://archive.nptel.ac.in/content/storage2/courses/108108078/pdf/S
3. https://ebooks.inflibnet.ac.in/esp07/chapter/biomass-as-an-energy-source/

COURSE OUTCOMES:

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

CO1 Explain the fundamentals of different forms of solar energy.
CO2 Describe the origin, nature and applications of wind energy.
CO3 Explain the process involved in production and conversion of biomass energy.
CO4 Describe the design and principles of fuel cells.
CO5 Explain the basic theory and types of batteries.

CO – PO MAPPING:

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

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U23OE207 **ENVIRONMENTAL PHYSICS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To relate the connection between physics and human environment.
- To recognize the structure, composition of the atmosphere and the global weather conditions.
- To identify the use of renewable energy resources.

UNIT I **PHYSICS IN HUMAN ENVIRONMENT** 9

Laws of thermodynamics – thermodynamics and the human body – Energy and metabolism - Energy transfers: Concepts of Conduction, Convection, Radiation and Evaporation – Survival in cold and hot climates.

UNIT II **THE URBAN ENVIRONMENT** 9

Townscape – Energy in the city – Transportation – Water for urban environment – Lighting – Urban pollution – Smog – Acid rain – Car as an urban pollutant – Noise pollution.

UNIT III **ENERGY FOR LIVING** 9

World energy demand – World energy supplies – Basic concepts of Energy sources: Fossil fuels – Wind energy – Solar energy – Tidal energy.

UNIT IV **GEOTHERMAL AND HYDRO ENERGY** 9

Geothermal Resources – Geothermal Technologies – Hydro Energy: Hydropower resources – hydropower technologies – environmental impact of hydro power sources.

UNIT V **RADIATION PROTECTION** 9

Nuclear radiation: exposure rate, dose rate, equivalent dose rate, population dose – quantitative effects of radiation on the human species – calculation – nuclear reactor – shielding.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Abel Rodrigues, Gabriel Pita, Raul Albuquerque Sardinha, "Fundamental Principles of Environmental Physics", Springer, 2022.

2 Pranav Kumar, "Fundamentals of Ecology and Environment" , 2nd Edition, Pathfinder Publication, 2021.

REFERENCES:

1 Khan B H, "Non-Conventional Energy Resources", Tata McGraw Hill, 2024.

2 Kyle Forinash, "Foundations of Environmental Physics", Island Press, 2022.

3 C Francesco, "Advances in Environmental Applied Physics", MDPI, 2023.

ONLINE RESOURCES:

1 http://en.wikipedia.org/wiki/Renewable_energy

2 https://www.uprm.edu/aret/docs/Ch_3_Ocean.pdf

3 https://ebooks.inflibnet.ac.in/esp07/chapter/applications-of- solar- energy/

COURSE OUTCOMES:

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

CO1 Explain the different laws related to human environment.
CO2 Describe the importance of physics in urban living.
CO3 Summarize the basic concepts of energy sources.
CO4 Apply the basic concepts of geothermal and hydro energy on environmental impact.
CO5 Explain about the radiation protection and dosage measurements.

CO – PO MAPPING:

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

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U23OE208	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To equip and develop the learners entrepreneurial skills and qualities essential to undertake business.
- To Gain knowledge on innovation, its types, role of technology in innovation, patents and licensing.
- To be able to prepare a business plan.

UNIT I **INTRODUCTION** **9**

The Entrepreneur – Definition – Characteristics of Successful entrepreneur. Entrepreneurial scene in India; MSME; Analysis of entrepreneurial growth in different communities – Case histories of successful entrepreneurs. Similarities and Differences between Entrepreneur and Intrapreneur.

UNIT II **INNOVATION IN BUSINESS** **9**

Types of Innovation – Creating and Identifying Opportunities for Innovation – Design Thinking- The Technological Innovation Process – Creating New Technological Innovation and Intrapreneurship – Licensing – Patent Rights – Innovation in Indian Firms.

UNIT III **NEW VENTURE CREATION** **9**

Identifying Opportunities for New Venture Creation: Environment Scanning – Generation of New Ideas for Products and Services. Creating, Shaping, Recognition, Seizing and Screening of Opportunities. Feasibility Analysis: Technical Feasibility of Products and Services – Marketing Feasibility: Marketing Methods – Pricing Policy and Distribution Channels.

UNIT IV **BUSINESS PLAN PREPARATION** **9**

Benefits of a Business Plan – Elements of the Business Plan – Developing a Business Plan – Guidelines for preparing a Business Plan – Format and Presentation; Start-ups and ecommerce Start-ups. Business Model Canvas.

UNIT V **FINANCING THE NEW VENTURE** **9**

Capital structure and working capital Management: Financial appraisal of new project, Role of Banks – Credit appraisal by banks. Institutional Finance to Small Industries – Incentives – Institutional Arrangement and Encouragement of Entrepreneurship.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 R D Hisrich, "Entrepreneurship", 11th Edition, Tata McGraw Hill, 2020.

2 C B Gupta, "Entrepreneurship – Text and Cases", Sultan Chand & Sons, 2023.

REFERENCES:

1 Desai V, "Small Scale Industries and Entrepreneurship", Himalaya Publishing House, 2018.
2 Bruce R Barringer, R Duane Ireland "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, 2018.
3 Roy R, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011.

ONLINE RESOURCES:

1 http://www.cengage.com/highered
2 https://roadmapresearch.com/entrepreneurship-beyond-curriculum
3 https://onlinecourses.swayam2.ac.in/cec20_mg19/preview

COURSE OUTCOMES:

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

CO1 Explain about growth of entrepreneurship in India..

CO2 Describe about innovation, its types, role of technology in innovation, patents and licensing.

CO3 Summarize the concepts of new venture.

CO4 Design a business plan.

CO5 Comprehend the various types of financing available for new ventures.

CO – PO – PSO MAPPING:

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

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U23OE209	BASICS OF BIOENERGY AND BIOFUELS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of biofuels and bio based products.
- To recognize the advancement of biofuels and illustrate the chemistry involved in converting them.
- To impart the knowledge about bioenergy and biofuel technology and its applications.

UNIT I **INTRODUCTION** **9**

Bio power, Bio heat, Biofuel, advanced liquid fuels, drop-in fuels, bio based products.

UNIT II **BIOMASS** **9**

Harvested Feed stocks: First generation biofuels, second generation biofuels, and third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and industrial waste.

UNIT III **PROCESSING TECHNIQUES** **9**

Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermo chemical conversion – Combustion, Gasification, Pyrolysis

UNIT IV **BIOFUELS** **9**

Pros and cons of Biofuels, Algal biofuels, Cyanobacteria and producers of biofuels, Bioethanol, Biomethane, biohydrogen, biobutanol, metabolic engineering of fuel molecules, Engineering aspects of biofuels.

UNIT V **BIO ENERGY SUSTAINABILITY** **9**

Environmental Sustainability, bio energy sustainability, emissions of biomass to power generation applications, emissions from biofuels. Carbon footprint, Advanced low carbon fuels.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R William Oswald, "Introduction to Bioenergy", Springer, 2023.
2. A K S R Reddy, "Principles and Practice", 2nd Edition , CRC Press, 2022.

REFERENCES:

1. Ashok Pandey, R C Kuhad, Vinod Kumar "Biofuels: Biochemistry and Biotechnology", 2nd Edition , Springer, 2023.
2. Anuj Kumar, R K Singh, S K Saha, "Bioenergy and Biofuels: Advanced Biorefineries for sustainable production", 1st Edition , Elsevier, 2022.

3. L David klass, M John Farewell, "Fundamentals of Bioenergy and Biofuels", 1st Edition, Academic Press (Elsevier), 2022.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_bt16/preview
2. https://www.renewableinstitute.org/training/biomass-course/
3. https://www.eesi.org/topics/bioenergy-biofuels-biomass/description

COURSE OUTCOMES:

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

CO1 Summarize the concept of bioenergy.
CO2 Evaluate the value of biomass.
CO3 Describe the chemistry involved in the production of bioenergy.
CO4 Explain the principle of biofuel technologies on a small and large scale.
CO5 Describe the use of biofuels in a sustainable manner.

CO – PO MAPPING:

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

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U23OE210	FOOD SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- This course will enable the students with good scientific and engineering knowledge so as to create new food products and design equipment's for food industries.
- This is necessary for effective understanding of a detailed study of food processing and technology subjects.
- This course will enable students to appreciate the importance of food with respect to the producer, manufacturer and consumer.

UNIT I FOOD PROCESS ENGINEERING OPERATIONS 9

Materials and Energy Balances - Fluid flow applications, Heat transfer applications, Drying, Evaporation, Equilibrium stage process, leaching and Extractions - Application of Mechanical separations and Mixing, in Diary, Meat Industry, Oil and Fat Industry, Cereal processing.

UNIT II FOOD WASTES IN VARIOUS PROCESSES 9

Waste disposal-solid and liquid waste - rodent and insect control - use of pesticides – ETP - selecting and installing necessary equipment.

UNIT III FOOD PRESERVATION AND ITS IMPORTANCE 9

Introduction: Food safety and food poisoning - reasons for food poisoning and its effects. Deterioration and spoilage of processed foods - Shelf life of food products - Types of food based on its perishability. Food Preservation: Preservation methods - Thermal Methods - Pasteurization - Dehydrofreezing -Dosimetry - Transport of food and Preservation Strategies.

UNIT IV DEVELOPMENTS IN FOOD PROCESSING 9

Food Constituents and processing Food emulsions - Food Rheology, Advances in thermal Operation, Extrusion, cooking Spray dryer design - Energy expenditure and Saving Food for developing countries - Food Detoxification - Production of Sweeteners - Starch, Microbial Polysaccharides, Amino acid, Rice bran Tocopherols.

UNIT V FOOD HYGIENE AND QUALITY CONTROL 9

Quality Control in Food Industry - Dose Response Relationship, Health Problem, Chemical and Micro biological aspects - Food analysis, Instruments and Enzymatic Analysis - Food Safety. Food laws and standards.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. A David Ledford, "Food Science", 8th Edition, Springer International Publishing, 2023.
2. Owen R Fennema, Srinivasan Damodaran, "Food Chemistry", 7th Edition, CRC Press, 2022.

REFERENCES:

1. Srilakshmi B, "Food Science", 8th Edition, New Age International Publishers, 2023.
2. Sanjeev Kumar Sharma, Harshad Kiran Kalwit, "Objective Food Science", 12th Edition, Jain Brothers Publication, 2023.
3. P R Ashoh Kumar, K Suresh Babu, "Food Processing Technology: Principles and practice", 3rd Edition, CRC Press, 2022.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/103107088
2 https://archive.nptel.ac.in/courses/126/105/126105015/
3 https://onlinecourses.nptel.ac.in/noc21_ag01/preview

COURSE OUTCOMES:

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

CO1 Summarize the food constituents and their energy levels.
CO2 Explain the food waste disposal in various processes.
CO3 Describe the preservative techniques to improve the shelf life of food products.
CO4 Explain the various methods of food processing and storage.
CO5 Describe the food quality control and its importance.

CO – PO MAPPING:

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

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U23OE211	FUNDAMENTALS OF CROP PRODUCTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The goal of the course is to provide knowledge about the fundamentals of agricultural production.
- Students will learn about influence of weather on crop growth, soil-water-plant relationships, disease and crop weed management.
- Outlining the function of agricultural engineers in connection to different methods of crop production

UNIT I **INTRODUCTION** **9**

Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture -Factors affecting crop growth and production. Benefits of agriculture - economic benefits, environmental benefits, social and cultural benefits, health, nutrition and food accessibility benefits.

UNIT II **CROP SELECTION AND SETTLEMENT** **9**

Regional and seasonal selection of crops - Systems of crop production - Competition among crop plants - Spacing and arrangement of crop plants - Field preparation for crops including systems of tillage - Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.

UNIT III **HORTICULTURAL CROPS PRODUCTION** **9**

Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops -Cultivation practices of representatives of each group - Special features of production of horticultural crops - green house cultivation.

UNIT IV **MODERN CONCEPTS** **9**

Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops.

UNIT V **AGRICULTURAL WASTE MANAGEMENT** **9**

Concept, scope and maintenance of waste management - recycle of organic waste, garden wastes- solid waste management - scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr Rajendra Prasad, "Textbook of Field Crops Production Food Grains Crops", 2020.
2. Alok Kumar, Abhishek Pratap Singh, Abhishek Sonkar, Mohit Pal, Chahak Tandon, "Text Book on Production Technology of Fruit Crops", 2022.

REFERENCES:

1. Dr Panda S C, "Modern concepts and advance principles of crop production", M/s AGROBIOS (INDIA), 2023.
2. Beena Nair, K P Singh, P Chand, "Fundamentals of Vegetable Crop Production", Scientific Publishers, 2019.
3. S R Reddy , C Nagamani, "Principles of Crop Production", Kalyani Publishers, 2019.

ONLINE RESOURCES:

1. https://www.classcentral.com/course/youtube-agriculture-crop-production-fundamentals-bcpp-47529
2. https://onlinecourses.nptel.ac.in/noc24_ag08/preview
3. https://onlinecourses.nptel.ac.in/noc23_ag08/preview

COURSE OUTCOMES:

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

CO1 Summarize the principles behind crop production and various parameters that influence the crop growth on roof tops.
CO2 Explain the methods of land preparation.
CO3 Evaluate weed establishment and its management.
CO4 Describe crop water requirement and irrigation water management on roof tops.
CO5 Describe the concept of waste management on roof tops.

CO – PO MAPPING:

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

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U23OE212	WATER POLLUTION AND CONTROL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The goal of the course is to provide knowledge about the fundamentals of water pollution.
- To impart knowledge on the causes, effects and control or prevention measures of water pollution.
- Outlining the function of agricultural engineers in connection to different methods of water treatments.

UNIT I **SOURCES OF WATER** **9**

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II **WATER POLLUTION** **9**

Water Pollution: Classification of Water Pollution - Pathogenic organisms, oxygen demanding Substance - plant nutrients - toxic organics, inorganic chemicals, radioactive substance – thermal pollution – steam pollution. Sources of contamination: Water borne diseases and health effects.

UNIT III **PROCESSES OF WATER TREATMENT** **9**

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation - sand filters - Disinfection - –Construction, Operation and Maintenance aspects.

UNIT IV **ADVANCED WATER TREATMENT** **9**

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange – Membrane Systems - Iron and Manganese removal - Defluoridation – Construction, Operation and Maintenance aspects.

UNIT V **LAWS AND ACTS** **9**

Centre ground - water board and organizational set up – guidelines for water abstraction, clearance for ground water abstraction - national water policy – Tamil Nadu ground water authority and its function. River linking projects – National and International conflicts and issues. Water act 1974 and rules 1983, act 1977 and rules 1978.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S K Gupta, I C Gupta, "Water Pollution and Quality Management", Scientific Publishers, 2023.
2. Margaret Barton, "Water Pollution: Effects, control and Treatment", 2nd Edition, Larsen and Keller Education Publishers, 2020.

REFERENCES:

1. Neha Saxena, M D Merajul Islam, Deepa Sharma, "Water Pollution and Remediation: A Gobal Concern", Springer, 2024.
2. G L Asawa, "Irrigation and Water Resources Engineering", New Age International Publishers, 2024.
3. O P Gupta, "Elements of Water Pollution Control Engineering", Khanna Publisher, 2019.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105107207
2. https://archive.nptel.ac.in/courses/105/104/105104102
3. https://archive.nptel.ac.in/courses/105/105/105105201

COURSE OUTCOMES:

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

CO1 Explain the sources of water and their characteristics.
CO2 Summarize the various pollutants present in water.
CO3 Describe the Principles, functions and design of a water treatment plant.
CO4 Explain the different methods of water purification process.
CO5 Describe the guidelines for water abstraction.

CO – PO MAPPING:

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

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U23OE213	PERSONALITY DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify their own potentials and accept their own limitations.
- To overcome their limitations and move towards self-esteem.
- To maximize their own potential in enabling a holistic development.

UNIT I **INTRODUCTION TO PERSONALITY DEVELOPMENT** 9

Personality-meaning-Definition-Determinants of personality - The concept of personality – Dimensions and Significance of personality development - Becoming aware of strengths and weaknesses, talents and problems, emotions and ideas - the concept of success and failure, factors responsible for success - What is failure and causes of failure.

UNIT II **ATTITUDE, MOTIVATION AND SELF - MOTIVATION** 9

Attitude - Concept - Significance - Positive attitude – Advantages –Negative attitude-Disadvantages Concept of motivation - Significance – Internal and external motives - Importance of self-motivation-Factors leading to de-motivation Managing change, confusion and uncertainty Socializing the individual.

UNIT III **EMPLOYABILITY QUOTIENT** 9

Memory – Art of listening, learning and writing guidelines – Note making – Seminar presentation, Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

UNIT IV **ASPECTS OF PERSONALITY DEVELOPMENT** 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.

UNIT V **INTEGRATED PERSONALITY DEVELOPMENT** 9

Different dimension personality – Physical, Intellectual, Emotional, Moral, Social and Spiritual and Cultural - Learning the Development process - Tools and Skills - Helping to maximize one's potentials - Enhancing one's self image, self-esteem and self- confidence.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Ark, "Personality Development and Character Building" Finger print Publishing, 2024.

2 Prashant Sharma, "Soft Skills: Personality Development for Life Success", 1st Edition, BPB Publications, 2022.

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REFERENCES:

1 Soma Mahesh Kumar, "Soft Skills: Enhanching Personal and Professional Success" 1st Edition, Tata McGraw Hill, 2023.

2 Sabharwal. D P, "Personality Developmen", Finger print Publishing, 2021.

3 Jeff Butterfield, "Soft Skills for Everyone", 2nd Edition, Cengage India Private Limited 2020.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc22_hs77/preview

2 https://old podcast.com/best-free-ebooks-personal-development

3 https://www.sircicai.org/images/cabf/Soft%20Skills%20&%20Personality%20Development.pdf

COURSE OUTCOMES:

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

CO1 Describe the significance of personality and its development.
CO2 Analyze the different facets of personality development.
CO3 Apply employability skills of resume, job application and presentation.
CO4 Apply the aspects of personality development in their jobs.
CO5 Apply the technique and skills of personality development to improve their progress.

CO – PO MAPPING:

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

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U23OE214 **WORKPLACE COMMUNICATION** L T P C

3 0 0 3

COURSE OBJECTIVES:

- To develop in students the competence to select the appropriate language and strategies for effective communication in daily workplace contexts.
- To View real-world facets of challenges faced when communicating in the workplace.
- To Learn how to work in different business environments.

UNIT I **IDENTIFY WORKPLACE PERSONALITIES** 9

Communication process; Analysis of purpose, audience, information and context; Strategies for verbal and nonverbal communication; Selection of communication channels - How communication should be developed, assignment - Studying types of personalities.

UNIT II **NEW MEDIA IN COMMUNICATION** 9

Impact of Technology, Enabled Communication Types: Internet, Blogs, E-mail; social media - Facebook, Twitter and What's App -Advantages & Disadvantages.

UNIT III **WORKPLACE CORRESPONDENCE** 9

Business Letter Writing, Email Writing, Principles of Effective Letter Writing, Email Writing, Four C's of Communication – Correctness, Completeness, Conciseness, Courtesy Parts of a Business Letter, Letter of Recommendation, Letter of Appointment, Letter of Acceptance of Job Offer, Letter of Appreciation, & Letter of Resignation.

UNIT IV **COMMUNICATION AT THE WORKPLACE** 9

Education and Training, Motivation, Persuasion, Raising Morale, Order and Instruction, Warning, Advice, Business Etiquette Office Etiquette, Internet Etiquette/Netiquette, Business Card Etiquette, Handshake Etiquette, Mobile Phone Etiquette and How to Overcome Them.

UNIT V **WORKPLACE CHALLENGES** 9

Working With Others : Leaders And Followers; Managing Your Emotions : Negative Emotions ; Challenging Conversations : Challenging Opposing Views, Sharing Bad News, Dealing With An Angry Customer Or Colleague; Personal Development Planning, Presentations; Telephone Skills; Job Interviews. Group Communication, Planning And Decision Making.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tena Crews, Cara Norton.,"Professional Communication", Good heart-Willcox Publisher, 2023.
2. Jeanne Marquardt Elmhorst Ronald B. Adler, Jeanne Marquardt Elmhorst "ISE Communicating at Work"., Tata McGraw Hill, 2022.

REFERENCES:

1. Bovee, L Courtland, Thill, V John , Raina, Lal Rosha, "Business Communication Today" 15th Edition, Pearson Education, 2021.
2. James W Williams, communication Skills Training Series", Alakai Publishing, 2021.
3. McKinsey Company "Building workforce skills at scale to thrive during and after the COVID-19 crisis." 2021.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_hs15/preview
2. https://www.coursera.org/learn/challenges-of-leading-individuals-in-the-tech-industry
3. https://www.udemy.com/course/business-english-writing/

COURSE OUTCOMES:

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

CO1 Apply The Basic Knowledge Of Workplace Communication.
CO2 Apply Different Types Of Media Communication.
CO3 Write Effective Letters Related To Workplace Environment.
CO4 Apply Various Types Of Workplace Etiquette.
CO5 Explain The Strategies Of Overcoming Challenges In The Workplace.

CO – PO MAPPING:

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

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U23OE215	ENGLISH FOR COMPETITIVE EXAMINATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.

UNIT I **BASIC VOCABULARY** **9**

Orientation on different formats of competitive exams - Vocabulary – Verbal ability – Verbal reasoning - Exploring the world of words – Essential words – Meaning and their usage – Synonyms-antonyms – Word substitution – Word analogy – Idioms and phrases – Commonly confused words – Spellings – Word expansion – New words in use.

UNIT II **GRAMMAR AND USAGE** **9**

Grammar – Sentence improvement –Sentence completion – Rearranging phrases into sentences – Error identification –Tenses – Prepositions – Adjectives – Adverbs – Subject-verb agreement – Voice – Reported speech – Articles – Clauses – Speech patterns.

UNIT III **EFFECTIVE READING** **9**

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

UNIT IV **WRITING VARIOUS TEXT** **9**

Writing – Pre-writing techniques – Mind Map - Describing pictures and facts -Paragraph structure – organizing points – Rhetoric writing – Improving an answer – Drafting, writing and developing an argument – Focus on cohesion – Using cohesive devices –Analytic writing – Structure and types of essay – Mind maps – Structure of drafts, letters, memos, emails – Statements of Purpose – Structure, Content and Style.

UNIT V **INTERACTIVE LISTENING** **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 –Sentence stress – Speaking on a topic – Giving opinions – Giving an oral presentation – Telling a story or a personal anecdote – Talking about oneself - Utterance – Speech acts- Brainstorming ideas – Group discussion.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr. Veena Selvam, "English for Science and Technology", Cambridge University Press, 2021.
2. Wren, Martin, "English for Competitive Examinations", S Chand Publishing, 2020.

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REFERENCES:

1. Bovee, Courtland L, Thill, John V Raina, Lal Roshan, "Business Communication Today", 15th Edition, Pearson Education: Upper Saddle River, 2021.
2. Disha, " General English for Competitive Exams" Disha Publication, 2021.
3. Yashpal,Sharma, "Easy to learn General English" Agrawal Group Of Publications (Agrawal Examcart), 2020.

ONLINE RESOURCES:

1. http://www.examenglish.com/, http://www.ets.org/ , http://www.bankxams.com/
2. http://civilservicesmentor.com/, http://www.educationobserver.com
3. http://www.cambridgeenglish.org/in/

COURSE OUTCOMES:

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

CO1 Apply the intricacies of vocabulary in order to develop language skills.
CO2 Analyze the technique of grammar to face competitive examination
CO3 Apply the basic ideas and strategies of reading.
CO4 Write different types of reconstructing passages, report writing and essay writing.
CO5 Apply interactive communication skills in listening texts.

CO – PO MAPPING:

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

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U23OE216 **ENGLISH FOR PROFESSIONAL EXCELLENCE** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To enhance students' ability to listen and speak professionally related to workplace concerns and interactions.
- To improve articulation and comprehension through motivational texts, technical articles, and leadership talks.
- To enable students to write reviews, emails, reports, resumes with cover letters and projects.

UNIT I **FOUNDATIONS OF PROFESSIONAL COMMUNICATION** 9

Listening to concerns and complaints – Responding with thought-provoking solutions – Reading short motivational anecdotes to improve pronunciation – Writing paragraphs based on motivational ideas and proverbial expressions.

UNIT II **EXPRESSIVE AND PERSUASIVE COMMUNICATION** 9

Listening to famous motivational speeches – Practice short speeches like welcome address, vote of thanks and farewell address – Reading technical articles with intonation - Writing reviews and reflections on travel, books or current topics.

UNIT III **WORKPLACE COMMUNICATION AND ETIQUETTE** 9

Listening workplace conversations and discussions – Simulate meetings and practice giving polite instructions– Reading workplace memos and notices – Writing professional emails and reports.

UNIT IV **COMMUNICATION FOR COLLABORATION AND LEADERSHIP** 9

Listening to interview recordings and career talks – Practice introducing yourself and mock interviews – Reading job postings – Drafting resumes and cover letter.

UNIT V **CAREER COMMUNICATION AND PERSONAL BRANDING** 9

Listening to panel discussions – Practice group discussions – Reading leadership talks – Project writing and formal presentation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajendran, Jayanthi, Jeya Santhi V, Nagalakshmi B, "The Art of English Communication: A Practical Approach", https://notionpress.com, 2025.
2. Horine, Greg, "Project Management Absolute Beginner's Guide" (Updated Edition), Que Publishing, 2023.

REFERENCES:

1. Bryan A. Garner, "HBR Guide to Better Business Writing", Harvard Business Review Press, 2021.
2. Nair, Bhaskaran, P. "Functioning in English" (A Multi-skill Language Course for Undergraduate Programmes), Emerald Publishers, 2018.
3. Enelow, Wendy, Louise Kursmark, "Modernize Your Resume: Get Noticed... Get Hired" (3rd Edition), Emerald Career Publishing, 2023.

ONLINE RESOURCES:

1. https://reedsy.com/discovery/blog/book-review-examples
2. https://www.indeed.com › Career Guide › Interviewing
3. https://nevonprojects.com/project-ideas/

COURSE OUTCOMES:

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

CO1 Apply listening and reading skills to enhance clarity in writing.
CO2 Analyze and internalize motivational speech techniques to develop their oral and written communication proficiency.
CO3 Apply professional communication strategies and compose effective emails and reports.
CO4 Analyze career-oriented communication and draft resumes and cover letter.
CO5 Design engaging formats to present their prepared projects.

CO – PO MAPPING:

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

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U23OE217	TOOLS FOR COMPUTING AND DESIGN PLATFORM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basics of electronic circuit assembly, ARM, DSP and embedded processors.
- Study about the Xilinx ISE design suite for programming and simulation of HDL designs and the implementation of VHDL and simulation using Altera Quartus.
- Understand the role of cloud in the design development of IC and IOT based embedded system.

UNIT I **TINKERCAD** **9**

Create a breadboard circuit, Circuit build, Virtual circuit design, programming, simulation, Arduino electronic circuits, Programme your Arduino, Test your Arduino circuit and code, 3D Design

UNIT II **XILINX ISE DESIGN SUITE** **9**

Synthesis and analysis of HDL designs, enabling the developer to synthesize ("compile") their designs, perform timing analysis, examine RTL diagrams, simulation, Spartan family of FPGAs, CPLDs.

UNIT III **CODE COMPOSER STUDIO IDE** **9**

Implementation of VHDL and Verilog for hardware description, visual edition of logic circuits and vector waveform simulation. Cyclone family of FPGAs, MAX family of CPLDs.

UNIT IV **GSM AND 3G COMMUNICATIONS SYSTEMS** **9**

IDE for developing applications for Texas Instruments embedded processors. Texas Instruments embedded processors include DSPs, ARM based devices, MSP430.

UNIT V **ROLE OF THE CLOUDS IN ELECTRONIC DESIGN** **9**

History of high-performance computing, Cloud service model basics - user's interest, service type, service providers, Cloud concerns, Pros and Cons with electronics design - on-premises, all cloud, Hybrid cloud, Cadence Cloud in IC design.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Shaun C. Bryant, "Tinkercad For Dummies", John Wiley & Sons, 2018.

2 Michael J Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", John Wiley & Sons, 2014.

REFERENCES:

1 ISE In-Depth Tutorial, https://www.xilinx.com/support/documentation/ sw_manuals /xilinx13_3/ ise_tutorial_ug695.pdf

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2 Code-Composer-Studio-v6.0-for-MSP430-Users-Guide, https://www.ti.com/lit/ug /slau157as/slau157as.pdf?ts=1707371916957

3 Introduction to Quartus II Software, http:// www. ee.ic.ac.uk /cheung /teaching /ee2_ digital/R2_3%20 quartus 2 introduction.pdf.

ONLINE RESOURCES:

1 https://archive.nptel.ac.in/courses/117/108/117108040/

2 https://www.tinkercad.com/learn

3 https://elearn.nptel.ac.in/shop/iit-workshops/completed/digital-controller-for-power-applications/

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

CO1 Analyze the fundamentals electronic circuit build, Arduino board programming and simulation.

CO2 Describe the concepts of HDL design, Spartan family of FPGA and CPLD.

CO3 Analyze VHDL and Verilog programming.

CO4 Analyze the IDE for the Texas Instruments processors, ARM and embedded processors.

CO5 Describe the latest evolution cloud in the development of IOT based embedded system.

CO – PO – PSO MAPPING:

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

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U23OE218 **INTRODUCTION TO SENSORS AND ACTUATORS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study different types of sensors and actuators.
- To gain knowledge on type of optical sensors to be used for practical applications.
- To understand the design concepts of micro sensors and micro actuators and packaging and characterization of MEMS/NEMS.

UNIT I **STRAIN, PRESSURE AND TEMPERATURE** 9

Introduction, Stress & Pressure sensors: Resistance strain gauge, piezoelectric strain gauge, characteristics. Fiber-optic sensor, Pressure gauges. Temperature Sensors: Bimetallic strip, thermocouples, Resistance thermometers, thermistors, bolometer, Pyroelectric detector.

UNIT II **OPTICAL SENSORS** 9

Colour temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber optic sensors, electro optic sensors & fiber-optic applications, light transducer, solid-state transducers and liquid crystal devices.

UNIT III **MICRO SENSORS** 9

Acoustic sensor – Quartz crystal microbalance, surface acoustic wave, Flexural plate wave, shear horizontal; Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors.

UNIT IV **MICRO ACTUATORS** 9

Electrostatic actuators – parallel plate capacitor, Interdigitated finger capacitor, piezoelectric actuators, Thermal actuators, Actuators using shape memory alloys; Micro grippers, Micro motors, Micro valves, Micro pumps

UNIT V **PACKAGING AND CHARACTERIZATION** 9

Micro / nano systems packaging, Essential packaging technologies, Selection of packaging materials; SEM, TEM, AFM, STM, Spectroscopic techniques for Nano characterization.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", 1st Edition, Tata McGraw Hill, 2002.

2 Ian R Sinclair, "Sensors and Transducers", 3rd Edition, Newnes publishers, 2001.

REFERENCES:

1 Vinod Kumar Khanna, "Nanosensors: Physical, Chemical, and Biological", 1st Edition, CRC Press, 2012.

2 Doebelin E O, "Measurement Systems, Application and Design", 5th Edition, Tata McGraw Hill, 2004.
3 Chang Liu, "Foundations of MEMS", 2nd Edition, Pearson Education, 2006.

ONLINE RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc21_ee32/preview
2 https://www.udemy.com/course/exploring-sensors-and-actuators-theory-and-practice/
3 https://www.coursera.org/learn/internet-of-things-sensing-actuation

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

CO1 Explain the measurement of physical variables for real time applications using sensors.
CO2 Analyse optical sensors for electronic applications.
CO3 Analyse micro sensors for electronic applications.
CO4 Apply actuators for engineering applications.
CO5 Describe the packaging and characterization requirements.

CO – PO – PSO MAPPING:

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

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U23OE219 **UNDERWATER COMMUNICATION** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the properties of underwater acoustic signal and the characteristics of noises in sea.
- To understand the principles of SONAR and acoustic modem.
- To understand the challenges in underwater signal processing and sensor networks.

UNIT I FUNDAMENTALS OF UNDERWATER ACOUSTICS 9

The Ocean acoustic environment, measuring sound level, Sources and receivers, relevant units, sound velocity in sea water, typical vertical profiles of sound velocity, Sound propagation in the Ocean, Sound attenuation in sea water, Bottom Loss, Surface bottom and volume scattering, Snell's law for range dependent ocean.

UNIT II UNDERWATER NOISE IN THE SEA 9

Sources of ambient noise-introduction, different frequency bands of ambient noise, spatial Coherence of underwater noise, directional characteristics of underwater noise, intermittent sources of noise – biological & non biological (rain, earthquakes, explosions and volcanos).

UNIT III CHARACTERISTICS OF SONAR SYSTEMS 9

Sonar systems, active and passive sonar equations, transducers and their directivities, Sensor, array characteristics – array gain, receiving directivity index, beam patterns, adaptive beamforming.

UNIT IV ACOUSTIC MODEM 9

Underwater Wireless Modem- Sweep spread carrier signal – transmission characteristics in shallow water channel-separation of time varying multipath arrivals – Typical acoustics modems – characteristics and specifications – Applications, Acoustic Releases-Real time wireless current monitoring system.

UNIT V UNDERWATER SENSOR NETWORK 9

Underwater Networking – Ocean Sampling Networks, Pollution Monitoring, Environmental Monitoring and Tactical surveillance systems, Major challenges in the design of Underwater Sensor Networks, Factors that affect the UWSN.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Yi Lou, Niax Ahmed, "Underwater Communications and Networks", 1st Edition, Springer, 2021.

2 William S Burdic, "Underwater Acoustic Systems", Prentice Hall of India, 2002.

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REFERENCES:

1 Rahul Sharma, "Deep Sea Mining Handbook", 1st Edition, Springer, 2017

2 Robert J Urick, "Principles of Underwater Sound", 3rd Edition, Peninsula Publishing, 2013.
3 L M Brekhovskikh, Yu P Lysanov, "Fundamentals of ocean acoustics", 3rd Edition, Springer, 2003

ONLINE RESOURCES:

1 https://www.everand.com/book/324344346/Digital-Underwater-Acoustic-Communications
2 https://edfuturetech.com/courses/from-sonar-to-satellite-a-deep-dive-into-underwater-communication-systems-and-their-uses/
3 https://www.youtube.com/watch?v=VExBwR2Gs24

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

CO1 Summarize the properties of underwater acoustic signal.

CO2 Explain the characteristics of noises in sea.

CO3 Explain the principles of SONAR and acoustic modem.

CO4 Explain the concepts of adaptive modem.

CO5 Analyse the challenges in underwater signal processing and sensor networks.

CO – PO – PSO MAPPING:

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

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U23OE220 **CONSUMER ELECTRONICS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To Understand the fundamental concepts of consumer electronics.
- To Learn the basics and operations of home appliances.
- To learn the operation of various audio, video & recording systems.

UNIT I CONSUMER ELECTRONICS FUNDAMENTALS 9

History of Electronic Devices, Semiconductor Devices, Diodes, Rectifiers, Transistors, Integrated Circuits, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT II ENTERTAINMENT ELECTRONICS 9

Audio systems – Construction and working principle of Microphone, Loud speaker, AM and FM receiver, Stereo, 2.1 home theatre, 5.1 home theatre, Display systems – CRT, LCD, LED, Graphics displays, Video Players, DVD, Blue RAY Recording Systems – Digital Cameras and Camcorders.

UNIT III SMART HOME 9

Technology involved in Smart home, Home Virtual Assistants – Alexa and Google Home, Home Security Systems – Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT IV HOME APPLIANCES 9

Home Enablement Systems – RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Microwave Owen, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT V COMMUNICATION SYSTEMS 9

Cordless Telephones, Fax Machines, PDAs – Tablets, Smart Phones and Smart Watches, Introduction to Smart OS-Android and iOS, Video Conferencing Systems – Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Mitchel E Schultz, "Basic Electronics", McGraw Hill Publishers, 10th Edition, 2017.
2 Bali S P, "Consumer Electronics", Pearson Education Asia Pvt. Ltd., 2008.

REFERENCES:

1 Thomas L Floyd, "Electronic Devices", 10th Edition Pearson Education, 2018.
2 Thomas M Coughlin, "Digital Storage in Consumer Electronics", Springer, 2017.
3 Jordan Frith, "Smartphones as Locative Media", John Wiley & Sons, 2014.

ONLINE RESOURCES:

1 https://www.edx.org/learn/electronics
2 https://www.coursera.org/learn/electronics
3 https://archive.nptel.ac.in/courses/117/105/117105144

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

CO1 Apply the fundamentals of electronics to construct the audio and video systems.

CO2 Explain working of various colour television system.

CO3 Analyze the technology for smart home.

CO4 Describe the working principles of various home appliances.

CO5 Describe the basic functional blocks of home based communication systems.

CO – PO – PSO MAPPING:

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

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U23OE221 **BASICS OF EMBEDDED SYSTEMS AND IOT** L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor.
- Learn the concepts of IoT and embedded programming.

UNIT I **INTRODUCTION TO EMBEDDED SYSTEM** 9

Complex systems and microprocessors– Embedded system design process – Design methodologies – Design flows – Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques–Design example: Model train controller.

UNIT II **BASICS OF ARM ARCHITECTURE AND PERIPHERAL INTERFACING** 9

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU

UNIT III **EMBEDDED PROGRAMMING CONCEPTS** 9

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques – Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing

UNIT IV **INTRODUCTION TO IoT** 9

Functional blocks of an IoT system - Basics of Physical and logical design of IoT – IoT enabled domains – Difference between IoT – Passive and active sensors - Different applications of sensors – IoT front-end hardware Case Studies – Smart Parking, Air Pollution Monitoring.

UNIT V **COMMUNICATION PROTOCOLS FOR EMBEDDED AND IoT** 9

Embedded Networking: Introduction-Serial/Parallel Communication – Serial communication protocols – RS485 – Synchronous Serial Protocols – Serial Peripheral Interface (SPI) – Inter-Integrated Circuit (I2C), IoT Infrastructure - 6LowPAN - IPv6 – Wi-Fi, Bluetooth, ZigBee.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities Press Pvt. Ltd., India, 2015.

2 Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

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REFERENCES:

1 Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", 1st Edition, John Wiley & Sons, 2014.

2 Peter Waher, "Learning Internet of Things", 1st Edition, Packt Publishing Ltd., UK, 2015.

3 Raj Kamal, "Internet of Things, Architecture and Design Principles", Tata McGraw Hill, 2017.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/108102045

2 https://www.udemy.com/course/embedded-system-for-internet-of-things-pna/

3 https://www.coursera.org/learn/iot

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

CO1 Explain the embedded System Design Process.

CO2 Describe the architecture and programming of ARM processor.

CO3 Explain the concepts of embedded system programming

CO4 Explain the basic concepts of IOT.

CO5 Describe model networked systems with basic protocols

CO – PO – PSO MAPPING:

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

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U23OE222	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the Introduction and basic Terminologies safety.
- To provide wide exposure to the students about various legislation applicable to an industrial unit.
- To enable students to Conduct and participate in various Safety activities in the Industry and through various Risk Assessment Techniques.

UNIT I **SAFETY TERMINOLOGIES** **9**

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II **STANDARDS AND REGULATIONS** **9**

FACTORIES ACT – 1948

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare – special provisions – penalties and procedures-

Tamil Nadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948 - Tamil Nadu safety officer rules 2005.

ENVIRONMENT ACT – 1986

General powers of the central government, prevention, control and abatement of environmental pollution Biomedical waste (Management and handling Rules), 1989- The noise pollution (Regulation and control) Rules, 2000- The Batteries (Management and Handling Rules)

UNIT III **OTHER ACTS AND RULES** **9**

Indian Boiler (Amendments) Act 2007, static and mobile pressure vessel rules (SMPV), motor vehicle rules, the Mines and Minerals (Development & Regulation) Amendment Act, 2015, workman compensation act, rules – electricity act and rules – hazardous wastes (management, handling and transboundary) rules, 2008 - the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules 2016, Explosives Act 1884 - Pesticides Act – E waste (management) rules 2016.

UNIT IV **SAFETY ACTIVITIES** **9**

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site

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Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT V **HAZARD IDENTIFICATION TECHNIQUES** **9**

Job Safety 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

REFERENCES:

1 Frank P Lees, "Loss Prevention in Process Industries", 4th Edition, Butterworth Heinemann Publications, 2012.
2 John Ridley, John Channing, "Safety at Work", 7th Edition, BH Publications, 2008.
3 Dan Petersen, "Techniques of Safety Management: A System Approach", 4th Edition, Amer Society of Safety Engineers, 2003.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain the basic concept of safety.

CO2 Summarize important legislation related to health, Safety and Environment.

CO3 Explain various legislation applicable to an industrial unit

CO4 Describe the safety Activities of the Working Place and to prepare onsite and offsite emergency plans

CO5 Explain the Risk Assessment Techniques

CO – PO MAPPING:

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

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U23OE223	RENEWABLE ENERGY TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the various solar energy and Wind technologies and its applications.
- To explore the various biomass energy technologies and fuel cell.
- To study the ocean and geothermal technologies.

UNIT I **ENERGY SCENARIO** **9**

Control System: Open Loop and Closed Loop – Feedback Control System Characteristics – First Principle Modeling: Mechanical, Electrical and Electromechanical Systems – Transfer Function Representations: Block Diagram and Signal Flow Graph.

UNIT II **SOLAR ENERGY** **9**

Solar Thermal – Flat Plate and Concentrating Collectors – Solar Thermal Power Plant – Solar Photovoltaic Conversion – Solar Cells – PV Applications.

UNIT III **WIND ENERGY** **9**

Basic Components of Wind Energy Conversion System (WECS) - Classification Of WECS - Horizontal Axis - Single, Double And Multi-Blade System. Vertical Axis - Savonius and Darrieus Types.

UNIT IV **BIOMASS ENERGY AND FUEL CELL** **9**

Biomass Direct Combustion – Biomass Gasifier – Biogas Plant – Cogeneration – Biomass Applications - Fuel Cell.

UNIT V **OCEAN AND GEOTHERMAL ENERGY** **9**

Tidal Energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro – Geothermal Energy - Types of Geothermal Power Plants.

TOTAL: 45 PERIODS

REFERENCES

1. John Twidell, "Renewable Energy Resources", 4th Edition, Routledge Publishers, 2021.
2. Bent Sorensen, "Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning", 5th Edition, Academic Press, 2017.
3. Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future",3rd Edition, Oxford University Press, 2012.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Explain the Environmental aspects of energy utilization and Renewable energy scenario.

CO2 Describe the concepts and applications of solar energy systems.

CO3 Describe the concepts and applications of wind energy systems.

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CO4 Summarize the processes of biomass and Fuel Cell.

CO5 Explain on other possible renewable energy sources.

CO – PO MAPPING:

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

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U230E224	INTRODUCTION TO SMART GRID	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the power industry to observe and control parts of the system at higher resolution in time and space
- To purposes of the smart grid is real time information exchange to make operation as efficient as possible
- To know how to improve reliability of the Electricity networks and make the grid amenable to renewable energy inputs through distributed generation.

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid – Concept - Definitions and Need for Smart Grid- Smart grid drivers - functions - opportunities - challenges and benefits- Difference between conventional & Smart Grid- National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers - Smart energy resources- Smart substations - Substation Automation - Feeder Automation -Transmission systems: EMS - FACTS and HVDC - Wide area monitoring- Protection and control- Distribution systems: DMS- Volt/VAR control- Fault Detection- Isolation and service restoration-

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters- Advanced Metering infrastructure (AMI) drivers and benefitsAMI protocols- standards and initiatives- AMI needs in the smart grid- Phasor Measurement Unit (PMU)- Intelligent Electronic Devices(IED)& their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid- Power Quality issues of Grid connected Renewable Energy Sources- Power Quality Conditioners for Smart Grid- Web based Power Quality monitoring- Power Quality Audit.

UNIT V CONTROLLERS AND THEIR COORDINATION 9

Introduction and role of SCADA in smart grid - Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broad band over Power line (BPL) - IP based Protocols- Basics of Web Service, CLOUD Computing - and Cyber Security Issues.

TOTAL: 45 PERIODS

REFERENCES:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", 1st Edition, CRC Press, 2017.
2. James A Momoh, "Smart Grid: Fundamentals of Design and Analysis", 1st Edition, John Wiley & Sons, 2012.

3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", 1st Edition, John Wiley & Sons, 2012.

COURSE OUTCOMES:

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

CO1 Explain the concepts of Smart Grid and its present developments.

CO2 Describe about the different smart grid technologies.

CO3 Explain about the different smart meters and apply them in advanced metering infrastructure.

CO4 Analyze power quality management in smart grid.

CO5 Summarize LAN, WAN and cloud computing for smart grid.

CO – PO MAPPING:

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

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U230E225	BASICS OF POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on the operation of thermal power plant and the subsystems including fuel Preparation and handling, boiler types.
- To impart knowledge on layout and operation of diesel and gas turbine power plants and nuclear power plants.
- To educate the environmental and cost economics of using renewable energy sources compared to fossil fuels and to introduce the importance of instrumentation, measurement and control techniques in power plants.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Layout of modern coal power plant, Supercritical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle – Analysis & Optimization. Components of Diesel and Gas Turbine power plants.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium – Uranium reactor (CANDU), Safety measures for Nuclear Power plants.

UNIT IV ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants.

UNIT V POWER PLANT INSTRUMENTATION AND CONTROL 9

Plant Automation, Plant Optimization, Safety & Protection, Instrumentation & Controls. Importance of measurement and instrumentation in power plants, measurement of water purity, CO2 measurements, measurement of smoke and dust.

TOTAL: 45 PERIODS

REFERENCES:

1 P K Nag, "Power Plant Engineering", 4th Edition, Tata McGraw Hill, 2020.

2 M M El Wakil, "Power Plant Technology", 3rd Edition, Tata McGraw Hill, 2021.

3 Arora, Domkundwar, "A Course in Power Plant Engineering", 3rd Edition, Dhanpat Rai & Co, 2019.

4 R S Khurmi, J K Gupta, "Thermal Engineering", 3rd Edition, S Chand Publishing, 2021.

COURSE OUTCOMES:

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

CO1 Comprehend the layout, construction and working of the components inside a thermal power plant.

CO2 Summarize the process of diesel, gas turbine and combined cycle power plants.

CO3 Explain the different nuclear reactors.

CO4 Summarize the environmental and economic issues of using renewable energy sources compared to fossil fuels.

CO5 Describe the various power plant instrumentation and control techniques.

CO – PO MAPPING:

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

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U230E226	AUTOMOTIVE ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge on the operation of thermal power plant and the subsystems including fuel Preparation and handling, boiler types.
- To impart knowledge on layout and operation of diesel and gas turbine power plants and nuclear power plants.
- To educate the environmental and cost economics of using renewable energy sources compared to fossil fuels and to introduce the importance of instrumentation, measurement and control techniques in power plants.

UNIT I **INTRODUCTION** **9**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II **IGNITION AND INJECTION SYSTEMS** **9**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III **SENSOR AND ACTUATORS IN AUTOMOTIVES** **9**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, and vacuum operated actuator.

UNIT IV **ENGINE CONTROL SYSTEMS** **9**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V **CHASSIS AND SAFETY SYSTEMS** **9**

Traction control system – Cruise control system – electronic control of automatic transmission – anti-lock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL: 45 PERIODS

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REFERENCES:

1 James D Halderman, "Automotive Electricity & Electronics", 6th Edition, Pearson Education, 2021.

2 James E Duffy, "Automotive Electricity & Electronics", 7th Edition, GW Publishers, 2021.

3 William B Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, 2019.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1 Comprehend the importance of emission standards in automobiles.

CO2 Explain the electronic fuel injection/ignition components and their function

CO3 Summarize the sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.

CO4 Describe the chassis and vehicle safety system.

CO5 Explain the various methods of power system earthing.

CO – PO MAPPING:

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

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U23OE237 NANOMATERIALS AND APPLICATIONS	L	T	P	C
	3	0	0	3

Course Objectives:

- To understand about the nanomaterials, synthesis and its characterization.
- To describe the fabrication of nano composites and nano structures for advanced devices.
- To study about the application of nano materials in various fields of Engineering.

UNIT I BASICS OF NANOTECHNOLOGY 9

Introduction–Scientific revolutions–Time and length scale in structures –Definition of a nano system –Dimensionality and size-dependent phenomena –Surface to volume ratio - Fraction of surface atoms – Surface energy and surface stress – surface defects – Properties at nanoscale (optical, mechanical, electronic and magnetic).

UNIT II SYNTHESIS OF NANOMATERIALS 9

Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III NANO COMPOSITES 9

Definition- importance of nanocomposites- nano composite materials-classification of composites- metal/metal oxides, metal-polymer- thermoplastic based, thermoset based and elastomer based- influence of size, shape and role of interface in composites applications.

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES 9

Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice- clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.

UNIT V APPLICATIONS OF NANO MATERIALS 9

Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mick Wilson, Kamali Kannangara, Burkhard Raguse, " Nano Technology: Basic Science & Engineering Technology", 1st Edition, Overseas Press, 2018.
2. G Cao, "Nanostructures & Nanomaterials: Synthesis, Properties &Applications", 1st Edition, Imperial College Press, 2019.

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REFERENCES:

1. William A Goddard, "Handbook of Nanoscience, Engineering and Technology", 3rd Edition, CRC Taylor and Francis group, 2018.
2. R H J Hannink, A J Hill, "Nanostructure Control", 1st Edition, Wood Head Publishing Ltd., 2016.
3. Ivor Brodie, Julius J Muray, 'The physics of Micro/Nano – Fabrication", 1st Edition, Springer International Edition, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/118104008
2. https://onlinecourses.nptel.ac.in/noc22_mm33/preview
3. https://link.springer.com/book/10.1007/978-981-10-6214-8

COURSE OUTCOMES:

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

CO1 Describe the basic properties such as structural, physical, chemical properties of nano materials and their applications.

CO2 Explain the knowledge about the different types of nano material synthesis.

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

CO4 Describe the different characterization techniques for nanomaterials.

CO5 Explain the application of nanomaterials in different fields.

CO – PO - PSO MAPPING:

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

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U23OE238	PLASTIC MATERIALS FOR ENGINEERS	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the advantages, disadvantages and general classification of plastic materials, manufacturing, sources, and applications of engineering thermoplastics.
- Understand the basics as well as the advanced applications of various plastic materials in the industry.
- To understand the preparation methods of thermosetting materials, Select suitable specialty plastics for different end applications.

UNIT I INTRODUCTION TO PLASTIC MATERIALS 9

Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behaviour, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP).

UNIT II ENGINEERING THERMOPLASTICS AND APPLICATIONS 9

Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, actual resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU).

UNIT III THERMOSETTING PLASTICS 9

Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV MISCELLANEOUS PLASTICS FOR END APPLICATIONS 9

Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications.

UNIT V PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS 9

Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, Bio plastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Marianne Gilbert, Brydson's, "Plastics Materials", 8th Edition, Elsevier, 2018.

2 J A Brydson, "Plastics Materials", 7th Edition, Butterworth Heinemann. 2019.

REFERENCES:

1. Manas Chanda, Salil K Roy, "Plastics Technology Handbook", 4th Edition, CRC press, 2018.
2. A Brent Strong, "Plastics: Materials and Processing", 3rd Edition, Pearson Prentice Hall of India, 2019.
3. Olagoke Olabisi, Kolapo Adewale, "Handbook of Thermoplastics", 2nd Edition, CRC press, 2018.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/112/103/112103279/
2. https://nptel.ac.in/courses/112107221
3. https://www.sciencedirect.com/materials-science/engineering-plastic

COURSE OUTCOMES:

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

CO1 Describe the importance, advantages and classification of plastic materials.

CO2 Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics.

CO3 Describe the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins.

CO4 Explain the manufacturing properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU.

CO5 Describe the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers.

CO – PO - PSO MAPPING:

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

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U23OE239	PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS	L	T	P	C
		3	0	0	3

Course Objectives:

- Discuss the basic concept and function of Production and Operation Management for entrepreneurship.
- Understand the Production process and planning.
- Describe the Production and Operations Management Control for business owners

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT **9**

Functions of Production Management - Relationship between production and other functions – Production management and operations management, Characteristics of modern production and operation management, organisation of production function, recent trends in production /operations management - production as an organisational function, decision making in production Operations research.

UNIT II PRODUCTION & OPERATION SYSTEMS **9**

Production Systems- principles – Models - CAD and CAM- Automation in Production - Functions and significance- Capacity and Facility Planning: Importance of capacity planning- Capacity measurement – Capacity Requirement Planning (CRP) process for manufacturing and service industry.

UNIT III PRODUCTION & OPERATIONS PLANNING **9**

Facility Planning – Location of facilities – Location flexibility – Facility design process and techniques – Location break even analysis-Production Process Planning: Characteristic of production process systems – Steps for production process- Production Planning Control Functions – Planning phase- Action phase- Control phase - Aggregate production planning.

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS **9**

Process selection with PLC phases- Process simulation tools- Work Study – Significance – Methods, evolution of normal/ standard time – Job design and rating - Value Analysis - Plant Layout: meaning – characters -- Plant location techniques - Types- MRP and Layout Design - Optimisation and Theory of Constraints (TOC)– Critical Chain Project Management (CCPM)- REL (Relationship) Chart – Assembly line balancing- – Plant design optimisation -Forecasting methods.

UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT **9**

Material requirement planning (MRP)- Concept- Process and control - Inventory control systems and techniques – JIT and Lean manufacturing - Network techniques - Quality Management: Preventive Vs Breakdown maintenance for Quality – Techniques for measuring quality - Control Chart (X , R , p , np and C chart) - Cost of Quality, Continuous improvement (Kaizen) - Quality awards - Supply Chain Management - Total Quality Management - 6 Sigma approach and Zero Defect Manufacturing.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. Mikell P Groover, "Automation Production Systems, and Computer-Integrated Manufacturing", 1st Edition, Pearson Education, 2018.
2. Amitabh Raturi, "Production and Inventory Management", 1st Edition, Tata McGraw Hill Publications, 2018.

REFERENCES:

1. Adam Jr Ebert, "Production and Operations Management", 1st Edition, Prientice Hall of India Publication, 2020.
2. Muhlemann, Okland, Lockyer, "Production and Operation Management", 1st Edition, Macmillan, 2019.
3. Chary S N, "Production and Operations Management", 1st Edition, Tata McGraw Hill Publications, 2019.

ONLINE RESOURCES:

1. https://openstax.org/books/introduction-business/pages/10-1-production-and- operations-management-an-overview
2. https://onlinecourses.nptel.ac.in/noc20_mg06/preview
3. https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf

COURSE OUTCOMES:

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

- **CO1** Explain the basics and functions of Production and Operation Management for owners.
- **CO2** Summarize the concept of the Production & Operation Systems.
- **CO3** Explain the Production & Operations Planning Techniques followed by entrepreneurs in Industries.
- **CO4** Describe the Production & Operations Management Processes in organisations.
- **CO5** Explain the techniques of controlling, Production and Operations in industries.

CO – PO - PSO MAPPING:

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

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U23OE240	QUALITY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- Developing a clear knowledge in the basics of various quality concepts.
- Facilitating the students in understanding the application of control charts and its techniques.
- Analysing and understanding the process capability study.

UNIT I **INTRODUCTION** **9**

Quality Dimensions–Quality definitions–Inspection-Quality control–Quality Assurance– Quality planning-Quality costs–Economics of quality– Quality loss function.

UNIT II **CONTROL CHARTS** **9**

Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X , R and S charts, attribute control charts - p, np, c and u- Construction and application.

UNIT III **SPECIAL CONTROL PROCEDURES** **9**

Warning and modified control limits, control chart for individual measurements, multi- vari chart, Xchart with a linear trend, chart for moving averages and ranges, cumulative- sum and exponentially weighted moving average control charts.

UNIT IV **STATISTICAL PROCESS CONTROL** **9**

Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V **ACCEPTANCE SAMPLING** **9**

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables,MIL-STD-105DandMIL- STD-414E&IS2500 standards.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Douglus C Montgomery, "Introduction to Statistical Quality Control", 7th Edition, Jone Wiley & sons, 2018.
2. Krishnaiah K, "Applied Statistical Quality Control and Improvement", 1st Edition, Prientice Hall of India, 2020.

REFERENCES:

1. Amitava Mitra, "Fundamentals of Quality Control and Improvement", 3rd Edition, John Wiley& sons, 2018.
2. Eugene L Grant and Richard S. Leaven Worth, "Statistical Quality Control", 7th Edition, Tata McGraw- Hill, 2019.
3. Manohar Mahajan, "Statistical Quality Control", 1st Edition, Dhanpal Rai & Sons, 2021.

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ONLINE RESOURCES:

1 https://nptel.ac.in/courses/116102019

2 https://github.com/johnros/qualityEngineering/blob/master/Class_notes/notes.pdf

3 https://archive.nptel.ac.in/courses/112/107/112107259/

COURSE OUTCOMES:

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

CO1 Describe the quality of processes using control charts for variables in manufacturing industries.

CO2 Describe the occurrence of defective products and the defects in manufacturing companies.

CO3 Describe the occurrence of defects in services.

CO4 Analyze the statistical and process capability study.

CO5 Create the acceptance sampling procedures for incoming raw material.

CO – PO - PSO MAPPING:

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

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U23OE241	REVERSE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- Applying the fundamental concepts and principles of reverse engineering in product design and development.
- Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Analysing the various legal aspects and applications of reverse engineering in product design and development and discuss about 3D scanning hardware & software operations and procedure to generate 3D models.

UNIT I INTRODUCTION & GEOMETRIC FORM 9

Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.

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 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.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert W Messler, "Reverse Engineering: Mechanisms, Structures, Systems & Materials", 1st Edition, Tata McGraw-Hill Education, 2019.
2. Wego Wang, "Reverse Engineering Technology of Reinvention", 1st Edition, CRC Press, 2019.

REFERENCES:

1 Scott J Lawrence, "Principles of Reverse Engineering", 1st Edition, Kindle, 2022.

2 Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", 1st Edition, Prentice Hall of India, 2019.

3 Linda Wills, "Reverse Engineering", 1st Edition, Kluver Academic Publishers, 2020.

ONLINE RESOURCES:

1 https://nptel.ac.in/courses/112104265

2 https://archive.nptel.ac.in/courses/112/104/112104265/

3 http://www.digimat.in/nptel/courses/video/112104230/L49.html

COURSE OUTCOMES:

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

CO1 Explain the fundamental concepts and principles of reverse engineering in product design and development.

CO2 Apply the concept of material characteristics, part durability and life limitation in reverse engineering of product design and development.

CO3 Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.

CO4 Describe the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.

CO5 Summarize the various legal aspect and Applications of reverse engineering in product design and development.

CO – PO - PSO MAPPING:

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

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