



New Prince Shri Bhavani College of Engineering and Technology

(An Autonomous Institution)

CURRICULUM

&

SYLLABUS (1 to 8 SEM.)

(REGULATION 2023)

FOR

B.Tech. – INFORMATION TECHNOLOGY

(CHOICE BASED CREDIT SYSTEM)

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

DEPARTMENT OF INFORMATION TECHNOLOGY								
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	ES	U23EG101	Engineering Graphics	2	0	4	6	4
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	ES	U23EP101	Engineering Practices 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								25
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	BS	U23CY101	Engineering Chemistry	3	0	0	3	3
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 தொழில் நுட்பமும் / Tamils and Technology	1	0	0	1	1
PRACTICAL COURSES								
8	BS	U23PC101	Physics and Chemistry Laboratory	0	0	3	3	1.5
9	PC	U23CS202	Data Structures Laboratory	0	0	3	3	1.5
TOTAL CREDITS								24

Approved
(Signature)

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SEMESTER – III								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
THEORY COURSES								
1	BS	U23MA302	Discrete Mathematics	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	4	3
4	PC	U23CS302	Database Management Systems	3	0	0	3	3
5	PC	U23CS303	Object Oriented Programming	3	0	2	5	4
PRACTICAL COURSE								
6	PC	U23CS304	Data Science Laboratory	0	0	3	3	1.5
7	PC	U23CS305	Database management System Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSE								
8	EEC	U23EEC301	Employability Skills - I	0	0	2	2	1
TOTAL CREDITS								22
SEMESTER – IV								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
THEORY COURSES								
1	PC	U23CS401	Machine Learning Techniques	3	0	2	5	4
2	PC	U23CS402	Design and Analysis of 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	U23CS406	Software Engineering	3	0	0	3	3
6	MNC	U23MX01	Personal Values	2	0	0	2	0
PRACTICAL COURSE								
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 COURSE								
9	EEC	U23EEC401	Employability Skills - II	0	0	2	2	1
TOTAL CREDITS								21

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SEMESTER - V								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
THEORY COURSES								
1	PC	U23IT501	Mobile Computing	3	0	0	3	3
2	PC	U23IT502	Blockchain Architecture and Design	3	0	0	3	3
3	PC	U23CS602	Distributed Computing	3	0	0	3	3
4	PC	U23CS503	Object Oriented Analysis and Design	3	0	0	3	3
5	HS	U23MG501	Professional Ethics and IPR	2	0	0	2	2
6	PE	U23PEITXX	Professional Elective - I					3
7	PE	U23PEITXX	Professional Elective - II					3
8	MNC	U23MX02	Environmental Sciences and Sustainability	2	0	0	2	0
PRACTICAL COURSE								
9	PC	U23IT503	Mobile Application Development Laboratory	0	0	3	3	1.5
10	PC	U23CS505	Object Oriented Analysis and Design Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSE								
11	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	C
THEORY COURSES								
1	PC	U23AI502	Big Data Analytics	3	0	0	3	3
2	PC	U23CB501	Cyber Security	3	0	2	5	4
3	PC	U23CS601	Embedded System and IOT	3	0	2	5	4
4	PE	U23PEITXX	Professional Elective - III					3
5	PE	U23PEITXX	Professional Elective - IV					3
6	OE	U23OEXXX	Open Elective - I	3	0	0	3	3
7	HS	U23FLXX	Foreign Language Elective	3	0	0	2	2
EMPLOYABILITY ENHANCEMENT COURSES								
8	EEC	U23EEC601	Employability Skills - IV	0	0	2	2	1
9	EEC	U23EEC602	Internship	0	0	0	0	1
TOTAL CREDITS								24


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SEMESTER – VII								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
THEORY COURSES								
1	PC	U23CS701	Cloud Computing	3	0	0	3	3
2	PC	U23CS502	Cryptography and Network Security	3	0	0	3	3
3	HS	U23MG701	Project Management and Finance	2	0	0	2	2
4	PE	U23PEITXX	Professional Elective - V					3
5	PE	U23PEITXX	Professional Elective - VI					3
6	OE	U23OEXXX	Open Elective - II	3	0	0	3	3
PRACTICAL COURSE								
7	PC	U23CS702	Cloud Computing Laboratory	0	0	3	3	1.5
8	PC	U23CS504	Security Laboratory	0	0	3	3	1.5
EMPLOYABILITY ENHANCEMENT COURSE								
9	EEC	U23IT701	Mini Project	0	0	2	2	1
10	PC	U23IT702	Comprehensive Review	0	0	2	2	1
TOTAL CREDITS								22
SEMESTER – VIII								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
PRACTICAL COURSE								
1	EEC	U23IT801	Project Work	0	0	16	16	8
TOTAL CREDITS								8


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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Course Code	Vertical I	Course Code	Vertical II	Course Code	Vertical III	Course Code	Vertical IV	Course Code	Vertical V	Course Code	Vertical VI
	Full Stack Development		Data Science Frameworks		Machine Learning Techniques		Networking Frameworks		Media Technology		Cyber Security Services
U23PEIT01	Web Technologies	U23PEIT07	Data Exploration	U23PEIT13	Neural networks and Deep Learning	U23PEIT19	Network Engineering	U23PEIT25	CG Art and Technology	U23PEIT31	Secure Software Systems
U23PEIT02	Human Centered Design	U23PEIT08	Streaming Analytics	U23PEIT14	Reinforcement Learning	U23PEIT20	Network Analysis in social media	U23PEIT26	3D Printing Technology	U23PEIT32	Digital and Mobile Forensics
U23PEIT03	Software Quality Control	U23PEIT09	Generative Database	U23PEIT15	Natural Language Processing	U23PEIT21	Network Performance Analysis	U23PEIT27	Multimedia and Animation	U23PEIT33	Hacking Principles and Practices
U23PEIT04	Web Application Security	U23PEIT10	Business Intelligence	U23PEIT16	Computer Vision and Image Processing	U23PEIT22	Network Design and Programming	U23PEIT28	Visual Technologies	U23PEIT34	Malware Analysis and Detection
U23PEIT05	Cloud Data Management	U23PEIT11	Human Resource Analytics	U23PEIT17	Robotics and Automation	U23PEIT23	Modern Network Technologies	U23PEIT29	Compression Technology in Multimedia	U23PEIT35	Security in Web
U23PEIT06	Application Design and Development	U23PEIT12	Social Media Marketing	U23PEIT18	Data Visualization Techniques	U23PEIT24	Wireless Ad hoc and Sensor Networks	U23PEIT30	Foundations of Digital Editing	U23PEIT36	Security and Privacy in Cloud


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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: FULL STACK DEVELOPMENT								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT01	Web Technologies	2	0	2	4	3
2	PE	U23PEIT02	Human Centered Design	3	0	0	3	3
3	PE	U23PEIT03	Software Quality Control	3	0	0	3	3
4	PE	U23PEIT04	Web Application Security	3	0	0	3	3
5	PE	U23PEIT05	Cloud Data Management	3	0	0	3	3
6	PE	U23PEIT06	Application Design and Development	2	0	2	4	3

VERTICAL 2: DATA SCIENCE FRAMEWORKS								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT07	Data Exploration	3	0	0	3	3
2	PE	U23PEIT08	Streaming Analytics	2	0	2	3	3
3	PE	U23PEIT09	Generative Database	3	0	0	3	3
4	PE	U23PEIT10	Business Intelligence	3	0	0	3	3
5	PE	U23PEIT11	Human Resource Analytics	3	0	0	3	3
6	PE	U23PEIT12	Social Media Marketing	2	0	2	3	3


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VERTICAL 3: MACHINE LEARNING TECHNIQUES								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT13	Neural networks and Deep Learning	2	0	2	4	3
2	PE	U23PEIT14	Reinforcement Learning	3	0	0	3	3
3	PE	U23PEIT15	Natural Language Processing	3	0	0	3	3
4	PE	U23PEIT16	Computer Vision and Image Processing	2	0	2	4	3
5	PE	U23PEIT17	Robotics and Automation	3	0	0	3	3
6	PE	U23PEIT18	Data Visualization Techniques	2	0	2	4	3

VERTICAL 4: NETWORKING FRAMEWORKS								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT19	Network Engineering	3	0	0	3	3
2	PE	U23PEIT20	Network Analysis in Social Media	3	0	0	3	3
3	PE	U23PEIT21	Network Performance Analysis	2	0	2	4	3
4	PE	U23PEIT22	Network Design and Programming	2	0	2	4	3
5	PE	U23PEIT23	Modern Network Technologies	2	0	2	4	3
6	PE	U23PEIT24	Wireless Adhoc and Sensor Networks	3	0	0	3	3

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VERTICAL 5: MEDIA TECHNOLOGY								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT25	CG Art and Technology	2	0	2	4	3
2	PE	U23PEIT26	3D Printing Technology	3	0	0	3	3
3	PE	U23PEIT27	Multimedia and Animation	2	0	2	4	3
4	PE	U23PEIT28	Visual Technologies	3	0	0	3	3
5	PE	U23PEIT29	Compression Technology in Multimedia	3	0	0	3	3
6	PE	U23PEIT30	Foundations of Digital Editing	2	0	2	4	3

VERTICAL 6: CYBER SECURITY SERVICES								
S.No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	C
1	PE	U23PEIT31	Secure Software Systems	2	0	2	4	3
2	PE	U23PEIT32	Digital and Mobile Forensics	3	0	0	3	3
3	PE	U23PEIT33	Hacking Principles and Practices	2	0	2	4	3
4	PE	U23PEIT34	Malware Analysis and Detection	3	0	0	3	3
5	PE	U23PEIT35	Security in Web	3	0	0	3	3
6	PE	U23PEIT36	Security and Privacy in Cloud	2	0	2	4	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	U230E101	Algebra and Number Theory	3	0	0	3	3
2	U230E102	Probability and Queueing Theory	3	0	0	3	3
3	U230E103	Probability and Random Processes	3	0	0	3	3
4	U230E104	Linear Algebra	3	0	0	3	3
5	U230E105	Everyday Physics	3	0	0	3	3
6	U230E106	Consumer Awareness on Appliances	3	0	0	3	3
7	U230E107	Bio Physics	3	0	0	3	3
8	U230E108	Astrophysics	3	0	0	3	3
9	U230E109	Introduction to Nanoscience and Nanotechnology	3	0	0	3	3
10	U230E110	Green Technology	3	0	0	3	3
11	U230E111	The Environment and Society	3	0	0	3	3
12	U230E112	Industrial corrosion and Prevention	3	0	0	3	3
13	U230E113	English Through Media	3	0	0	3	3
14	U230E114	English for Employability Skills	3	0	0	3	3
15	U230E115	Inventions and Applications	3	0	0	3	3
16	U230E116	Public Policy and Governance	3	0	0	3	3
17	U230E117	Introduction to Mobile Communication	3	0	0	3	3
18	U230E118	Basics of Signals and its Processing	3	0	0	3	3
19	U230E119	Introduction to Communication Systems	3	0	0	3	3
20	U230E120	Drone Technologies	3	0	0	3	3
21	U230E121	Geographical Information System	3	0	0	3	3
22	U230E122	Fundamentals of Electric and Hybrid Vehicle	3	0	0	3	3
23	U230E123	Introduction to PLC Programming	3	0	0	3	3
24	U230E124	Energy Management and Auditing	3	0	0	3	3
25	U230E125	Fundamentals of Robotics	3	0	0	3	3
26	U230E126	Medical Instrumentation	3	0	0	3	3
27	U230E137	Applied Design Thinking	3	0	0	3	3
28	U230E138	Fire Safety Engineering	3	0	0	3	3
29	U230E139	Functional Materials	3	0	0	3	3
30	U230E140	Fundamentals of Aeronautical Engineering	3	0	0	3	3
31	U230E141	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	U230E201	Statistics and Numerical Methods	3	0	0	3	3
2	U230E202	Resource Management Techniques	3	0	0	3	3
3	U230E203	Graph Theory	3	0	0	3	3
4	U230E204	Operations Research	3	0	0	3	3
5	U230E205	Scientific Principles in Historical Monuments	3	0	0	3	3
6	U230E206	Non-Conventional Energy Sources	3	0	0	3	3
7	U230E207	Environmental Physics	3	0	0	3	3
8	U230E208	Entrepreneurship Development	3	0	0	3	3
9	U230E209	Basics of Bioenergy and Biofuels	3	0	0	3	3
10	U230E210	Food Science	3	0	0	3	3
11	U230E211	Fundamentals of Crop Production	3	0	0	3	3
12	U230E212	Water Pollution and Control Management	3	0	0	3	3
13	U230E213	Personality Development	3	0	0	3	3
14	U230E214	Workplace Communication	3	0	0	3	3
15	U230E215	English for Competitive Examinations	3	0	0	3	3
16	U230E216	English for Professional Excellence	3	0	0	3	3
17	U230E217	Tools for Computing and Design Platform	3	0	0	3	3
18	U230E218	Introduction to Sensors and Actuators	3	0	0	3	3
19	U230E219	Underwater Communication	3	0	0	3	3
20	U230E220	Consumer Electronics	3	0	0	3	3
21	U230E221	Basics of Embedded Systems and IoT	3	0	0	3	3
22	U230E222	Industrial Safety	3	0	0	3	3
23	U230E223	Renewable Energy Technologies	3	0	0	3	3
24	U230E224	Introduction to Smart Grid	3	0	0	3	3
25	U230E225	Basics of Power Plant Engineering	3	0	0	3	3
26	U230E226	Automotive Electronics	3	0	0	3	3
27	U230E237	Nanomaterials and applications	3	0	0	3	3
28	U230E238	Plastic Materials for Engineers	3	0	0	3	3
29	U230E239	Production and Operations Management for Entrepreneurs	3	0	0	3	3
30	U230E240	Quality Engineering	3	0	0	3	3
31	U230E241	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, 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.

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- 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, CO₂ 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:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	-	-	-	-	-	-	-	-	-	-
C02	2	2	-	-	-	-	-	-	-	-	-	-
C03	3	2	-	-	-	1	1	1	-	-	-	1
C04	2	2	-	-	-	-	-	-	-	-	-	-
C05	2	2	-	-	-	-	-	-	-	-	-	-

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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.

UNIT V

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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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 Electronics Engineering", 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, Pearson Education, 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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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, ஓயிலாட்டம், 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, கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. முனைவர் ஆ. பூபாலன் “தமிழர் மரபு”, வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 24 அண்ணா பல்கலைக்கழகம்.

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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, “பொருதை, 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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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:

- Demonstrating basic foundry operations.

GROUP B (ELECTRICAL AND ELECTRONICS)

PART III ELECTRICAL ENGINEERING PRACTICES

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

PART IV ELECTRONICS ENGINEERING PRACTICES

I. SOLDERING WORK:

- Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- Assembling and testing electronic components on a small PCB.

II. ELECTRONIC EQUIPMENT STUDY:

- Study an element of smart phone.
- Assembly and dismantle of LED TV.
- 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:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
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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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

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

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

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

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

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.

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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.

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- 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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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.

UNIT II 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.

UNIT III 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. CO₂ 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

COURSE OUTCOMES:

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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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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
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 hashing algorithms.
- 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 Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV

MULTIWAY SEARCH TREES AND GRAPHS

9

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graphs – Breadth – 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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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 பாணைத் தொழில்நுட்பம்**

3

சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் 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 - மாமல்லபுரம் 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, எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு - 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, “பொருதை, 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://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 Agriculture 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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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 ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) 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:

- C01** Calculate the Young's modulus by non-uniform bending, simple harmonic oscillations by Torsion Pendulum.
- C02** Calculate the thickness of a thin wire by air wedge and velocity of sound, compressibility of liquid using ultra sonic interferometer.
- C03** Calculate the wavelength, acceptance angle and numerical aperture using laser.
- C04** Estimate the amount of Hardness, chloride, alkalinity in water samples.
- C05** Estimate the amount of acid, iron content present in a given solution by using pH, conductivity and potentiometric titration.

CO - PO - PSO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	1	-	-	-	1	1	2	-	1
C02	3	2	1	1	-	-	-	1	1	2	-	1
C03	3	2	1	1	-	-	-	1	1	2	-	1
C04	3	3	1	3	-	-	-	1	1	2	-	1
C05	3	3	1	3	-	-	-	1	1	2	-	1

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U23CS202**DATA STRUCTURES LABORATORY**

L	T	P	C
0	0	3	1.5

Prerequisites: C Programming**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**

- C01** Apply Stack, Queue and List ADT's operations for solving a given problem
- C02** Solve various operations like traversal, insertion, deletion on tree data structure.
- C03** Solve various applications using graph algorithms.
- C04** Analyze various kinds of searching and sorting techniques
- C05** 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
C01	3	2	1	2	-	-	-	1	1	2	-	1	3	2
C02	3	2	1	2	-	-	-	1	1	2	-	1	3	2
C03	3	2	1	2	-	-	-	1	1	2	-	1	3	2
C04	3	3	2	2	-	-	-	1	1	2	-	1	3	2
C05	3	2	1	2	2	-	-	1	1	2	-	1	3	2



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U23MA302

DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

Pre requisites: Nil

COURSE OBJECTIVES:

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

UNIT I **LOGIC AND PROOFS** **12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II **COMBINATORICS** **12**

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

UNIT III **GRAPHS** **12**

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

UNIT IV **ALGEBRAIC STRUCTURES** **12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem.

UNIT V **LATTICES AND BOOLEAN ALGEBRA** **12**

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

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 C V Sastry, Rakesh Nayak, "A Textbook on Discrete Mathematics", John Wiley & Sons, 2020.
- 2 Kenneth H Rosen, "Discrete Mathematics and its Applications to", 8th Edition, Tata McGraw Hill, 2021.

REFERENCES:

- 1 R P Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education, 2019.

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- 2 S Lipschutz, Mark Lipson, "Schaum's Outline of Discrete Mathematics", 4th Edition, Tata McGraw Hill, 2021.
- 3 S Susanna, "Discrete Mathematics with Applications", 5th Edition, Cengage Learning India Private Limited, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/111104026>
- 2 <https://www.classcentral.com/course/udemy-master-discrete-mathematics-38403>
- 3 <https://www.coursera.org/learn/discrete-mathematics>

COURSE OUTCOMES:

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

- C01 Apply the concepts of logic theory to construct the truth table, mathematical arguments and different methods of proofs.
- C02 Apply the concepts of mathematical induction, pigeonhole principle, permutation and combination to solve the real life problems.
- C03 Analyze the definitions and different types of graphs.
- C04 Analyze the concepts and properties of algebraic structures.
- C05 Analyze the algebraic properties of lattices and Boolean algebra.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	2	1	2	-	-	-	-	-	-	-	-	1	-
C02	3	2	1	2	-	-	-	-	-	-	-	-	1	-
C03	3	3	2	2	-	-	-	-	-	-	-	-	1	-
C04	3	3	2	2	-	-	-	-	-	-	-	-	1	-
C05	3	3	2	2	-	-	-	1	-	-	-	1	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:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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_es54/preview

COURSE OUTCOMES:

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

- C01 Summarize the Data Science Process.
- C02 Explain the Python Libraries for Data Wrangling.
- C03 Describe Visualization Libraries in Python to interpret and explore data.
- C04 Explain the different types of data description for data science process.
- C05 Explain the relationships between data.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	-	3	2
C02	2	2	1	1	1	-	-	1	-	-	-	-	3	2
C03	2	2	1	1	1	-	-	1	-	-	-	-	3	2
C04	2	2	1	1	1	-	-	1	-	-	-	1	3	2
C05	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
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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
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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
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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
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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
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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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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 JAVA FX.

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: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVA FX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVA FX 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.

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- 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 JAVA FX 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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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

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

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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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

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	PS02
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", 4th 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", 4th 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

- C01** Analyze search, sort and string matching algorithms to compute their efficiency.
C02 Apply graph algorithms to solve problems and analyze their efficiency.
C03 Apply algorithm design techniques like divide & conquer, dynamic programming and greedy techniques to solve problems.
C04 Apply the state space tree method for solving problems.
C05 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
C01	3	3	2	2	1	-	-	1	1	2	-	-	2	2
C02	3	2	1	2	1	-	-	1	1	2	-	-	2	2
C03	3	2	1	2	1	-	-	1	1	2	-	-	2	2
C04	3	2	1	2	1	-	-	1	1	2	-	-	2	2
C05	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 9
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

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TEXT BOOKS:

1. 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. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 5th Edition, Pearson Education, 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:

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 algorithms.

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
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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

- C01** Summarize the basic layers and various application layer protocols.
C02 Comprehend the transport layer protocols, congestion control and avoidance techniques.
C03 Describe the switching techniques and various protocols on the network layer.
C04 Analyze various routing algorithms and protocols.
C05 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
C01	2	2	1	1	-	-	-	1	--	-	-	-	2	2
C02	2	2	1	1	-	-	-	1	1	-	-	1	3	3
C03	2	2	1	1	-	-	-	1	--	-	-	-	2	3
C04	1	2	3	2	2	-	-	1	1	-	-	1	3	3
C05	2	2	1	1	-	-	-	1	--	-	-	-	2	2

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Prerequisites : C Programming**COURSE OBJECTIVES:**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To learn the various software design methodologies, testing and maintenance measures

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing-basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management Identification, Projection - Risk Management-Risk Identification-RMMM Plan-Case Tools

TOTAL: 45 PERIODS**TEXT BOOKS:**

- 1 Roger S Pressman, "Software Engineering – A Practitioner's Approach", 7th Edition, Tata McGraw Hill, 2020.
- 2 Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2018.

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REFERENCES:

- 1 Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, Prentice Hall of India, 2019
- 2 Kelkar S A , "Software Engineering", 1st Edition , Prentice Hall of India, 2017.
- 3 Stephen R Schach, "Software Engineering", 3rd Edition, Tata McGraw Hill, 2019.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc20_cs68/preview
- 2 https://www.aicte-india.org/opportunities/students/resources_students
- 3 <https://archive.nptel.ac.in/courses/106/105/106105182/>

COURSE OUTCOMES:

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

- CO1** Summarize the Software process and Agile Development.
- CO2** Describe the Requirement process and their specifications.
- CO3** Comprehend systematic procedure for software design.
- CO4** Explain systematic procedure for software Testing, Deployment and Maintenance.
- CO5** Describe the Project Planning and Management 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	-	-	-	-	3	3
CO2	2	2	1	1	-	-	-	1	-	-	-	-	3	3
CO3	2	2	1	1	-	-	-	1	-	-	-	-	3	3
CO4	2	2	2	2	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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- C02** Acquire and express Personal Values, Spiritual values and fitness.
- C03** Practice simple physical exercise and breathing techniques.
- C04** Practice Yoga asana which will enhance the quality of life.
- C05** Practice Meditation and get benefitted.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	-	-	1	-	-	-	1
C02	-	-	-	-	-	-	-	1	-	-	-	1
C03	-	-	-	-	-	-	-	1	-	-	-	1
C04	-	-	-	-	-	-	-	1	-	-	-	1
C05	-	-	-	-	-	-	-	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.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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	3
CO2	3	3	3	3	1	-	-	1	1	1	-	1	2	3
CO3	3	3	3	3	1	-	-	1	1	1	-	1	2	3
CO4	3	3	3	3	1	-	-	1	1	1	-	1	2	3
CO5	3	3	3	3	1	-	-	1	1	1	-	1	2	3



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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
- 2 Capturing and trace route PDUs using a network protocol analyzer and examine.
- 3 Applications using TCP Sockets like a) Echo client and echo server, b) Chat
- 4 Implementation of Stop and Wait Protocol and Sliding Window Protocol.
- 5 Write a HTTP web client program to download a web page using TCP sockets.
- 6 Implementation of Remote Command Execution.
- 7 Simulation of DNS using UDP sockets.
- 8 Implementation of Remote Method Invocation
- 9 Write a code simulating ARP /RARP protocols.
- 10 Implementation of Subnetting.
- 11 Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
- 12 Simulation of Distance Vector/ Link State Routing algorithm.
- 13 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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U23IT501

MOBILE COMPUTING

L T P C

Prerequisite: Computer Networks

3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of mobile computing, Wireless LAN, Bluetooth and Wi-Fi Technologies.
- To learn various Wireless Technologies.
- To learn the basics of mobile telecommunication system and exposed to Ad-Hoc networks

UNIT I

INTRODUCTION

9

Introduction to Mobile Computing & its Applications- Introduction to Generations of Mobile Communication Technologies- MAC Protocols – Wireless MAC Issues-SDMA-TDMA- FDMA- CDMA.

UNIT II

MOBILE TELECOMMUNICATION SYSTEM

9

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture.

UNIT III

WIRELESS NETWORKS

9

LANs and PANs – IEEE 802.11 Standard – Architecture –Physical Layer- MAC sub layer- Services – Bluetooth- Wi-Fi – WiMAX.

UNIT IV

MOBILE NETWORK & TRANSPORT LAYER

9

Mobile IP –DHCP – Ad Hoc– Proactive and Reactive Routing Protocols – Multicast Routing Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security- Mobile TCP.

UNIT V

MOBILE APPLICATION LAYER

9

WAP – Architecture –WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Jochen Schiller, "Mobile Communications", 3rd Edition, Pearson Education, 2020.
- 2 Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", 2nd Edition, Prentice Hall of India, 2020.

REFERENCES:

- 1 Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems", 4th Edition, Cengage Learning, 2021.
- 2 Uwe Hansmann, Lothar Merk, Martin S Nicklons and Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer Publications, 2020.

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ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/117/102/117102062/>
- 2 <https://www.coursera.org/courses?query=mobile%20cloud%20computing>
- 3 https://onlinecourses-archive.nptel.ac.in/noc16_cs13/preview

COURSE OUTCOMES:

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

- CO1** Explain the basics of mobile telecommunication system
- CO2** Illustrate the Generation of telecommunication system and wireless network
- CO3** Summarize the architecture on wireless Lan technology
- CO4** Describe the functionality of network layer and identified the routing protocol for given ad hoc network
- CO5** Explain the functionality of transport and application 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	-	-	-	1	2	3
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	3
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	3
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	3
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	3

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U23IT502	BLOCKCHAIN ARCHITECTURE AND DESIGN	L T P C
Prerequisite: Data structures		3 0 0 3

COURSE OBJECTIVES:

- To understand the technology of Blockchain
- To gain knowledge of various Cryptocurrency
- To analyze the various applications of Blockchain

UNIT I BLOCKCHAIN INTRODUCTION 9

Cryptographic Hash Function - Properties of Hash Function – Digital Signature – Blockchain: Introduction – Types of Blockchain - Block in a Blockchain: Structure of a Block – Block Header – Transactions in a Block - Hash Pointer – Merkle Tree.

UNIT II BITCOIN AND CRYPTOCURRENCY 9

Basics of cryptocurrency - Creation of Coins – Sending Payments - Transaction in Bitcoin Network – Double Spending - Bitcoin Scripts - Hash cash PoW - Consensus in Bitcoin: Proof of Work (PoW) Proof of Stake – Mining in a Bitcoin network - Bitcoin Wallets.

UNIT III ETHEREUM AND SMART CONTRACTS 9

Ethereum Blockchain - Ethereum Virtual Machine - Ethereum Accounts - Transactions in Ethereum - Ethereum Wallets - Ethereum Gas - Gas Price - Gas Limit - Mining in Ethereum - Ether Tokens – ERC 20 -Solidity

UNIT IV HYPERLEDGER FABRIC 9

Introduction to Hyperledger - Hyperledger frameworks - Hyperledger Fabric Architecture - Hyperledger fabric transaction flow - Chain code in Hyperledger Fabric

UNIT V BLOCKCHAIN APPLICATIONS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:


- 1 Kumar Saurabh, Ashutosh Saxena, "Blockchain Technology concepts and applications", 1st Edition, John Wiley & Sons, 2020.
- 2 Antony Lewis, "The Basics of Bitcoins and Blockchains: An Introduction to Crypto currencies and the Technology that Powers Them", 1st Edition, Mango Media, 2020.

REFERENCES:

- 1 Xun (Brian) Wu, Chuánfeng Zhang, Andrew Zhang, "Hyperledger Cookbook: Over 40 recipes implementing the latest Hyperledger blockchain frameworks and tools", 1st Edition, Packt Publishing, 2020.
- 2 Andreas M Antonopoulos, Wood M, "Mastering Ethereum: Building Smart Contracts and Dapps", 1st Edition, O'Reilly Media, 2020.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/106104220/L01.html>
- 2 https://onlinecourses.nptel.ac.in/noc19_cs69/preview
- 3 <https://archive.nptel.ac.in/courses/106/105/106105184/>

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S. R. V.

COURSE OUTCOMES:

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

- C01** Summarize the basic concepts of blockchain.
- C02** Describe cryptocurrency and bitcoin.
- C03** Describe Ethereum network platform and consensus mechanism.
- C04** Apply Hyperledger fabric to implement blockchain applications.
- C05** Analyze the applications of blockchain.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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Prerequisite: Operating Systems

COURSE OBJECTIVES:

- To introduce the computation models and global state in distributed Systems.
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To summarize distributed shared memory and consensus recovery.

UNIT I DISTRIBUTED SYSTEMS BASICS AND COMPUTATION MODEL 9

Distributed System – Definition, Relation to computer system components, Motivation, Primitives for distributed communication, Design issues, Challenges and applications. A model of distributed computations – Distributed program, Model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communications.

UNIT II LOGICAL TIME, GLOBAL STATE AND TERMINATION DETECTION 9

Logical time – A framework for a system of logical clocks, Scalar time, Vector time. Leader election algorithm – Bully algorithm, Ring algorithm. Global state and snapshot recording algorithms – System model and definitions, Snapshot algorithm for FIFO channels – Chandy Lamport algorithm. Termination detection – System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, Spanning-tree-based algorithm.

UNIT III MUTEX AND DEADLOCK DETECTION 9

Distributed mutual exclusion algorithms – System model, Requirements of mutual exclusion algorithm. Lamport's algorithm, Ricart-Agrawala algorithm, Quorum-based mutual exclusion algorithms – Maekawa's algorithm. Token-based algorithm – Suzuki-Kasami's broadcast algorithm. Deadlock detection in distributed systems – System model, Deadlock handling strategies, Issues in deadlock detection, Models of deadlocks.

UNIT IV DISTRIBUTED SHARED MEMORY AND FAILURE RECOVERY 9

Distributed shared memory – Abstraction and advantages. Shared memory mutual exclusion – Lamport's bakery algorithm. Check pointing and rollback recovery – System model, consistent and inconsistent states, different types of messages, Issues in failure recovery, checkpoint-based recovery, log-based roll back recovery.

UNIT V CONSENSUS AND DISTRIBUTED FILE SYSTEM 9

Consensus and agreement algorithms – Assumptions, The Byzantine agreement and other problems, Agreement in (message-passing) synchronous systems with failures – Consensus algorithm for crash failures. Distributed file system – File service architecture, Case studies: Sun Network File System, Andrew File System, Google File System.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", 1st Edition, Cambridge Press, 2020.
- 2 Mukesh Singhal, Niranjana G Shivaratri, "Advanced Concepts in Operating systems", 1st Edition, McGraw Hill Publishers, 2020.

REFERENCES:

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- 1 George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2021.
- 2 Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", 2nd Edition, Prentice Hall of India, 2020.
- 3 Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", 2nd Edition, Pearson Education, 2020.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_cs87/preview
- 2 <https://www.coursera.org/courses?query=distributed%20computing>
- 3 <https://www.techtarget.com/whatis/definition/distributed-computing>

COURSE OUTCOMES:

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

- CO1** Explain the foundations of distributed systems
- CO2** Describe logical time, global state in distributed system
- CO3** Comprehend mutex algorithms and deadlock detection techniques.
- CO4** Describe shared memory techniques in distributed systems
- CO5** Summarize working model of consensus and file system of distributed systems

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	-	-	-	-	-	-	-	-	2	2
CO4	2	2	1	1	-	-	-	-	-	-	-	-	2	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	2

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COURSE OBJECTIVES:

- To understand the fundamentals of object modelling and differentiate Unified Process from other approaches
- To design with Static, Dynamic and Implementation of UML diagrams.
- To improve the software design with design patterns & to test the software against its requirements specification.

UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics - Unified Process - UML diagrams - Use Case - Case study - the Next Gen POS system, Inception - Use case Modelling - Relating Use cases - include, extend and generalization - When to use Use-cases.

UNIT II STATIC UML DIAGRAMS 9

Class Diagram - Elaboration - Domain Model - Finding conceptual classes and description classes - Associations - Attributes - Domain model refinement - Finding conceptual class Hierarchies - Aggregation and Composition - Relationship between sequence diagrams and use cases - When to use Class Diagrams.

UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams - UML interaction diagrams - System sequence diagram - Collaboration diagram - When to use Communication Diagrams - State machine diagram and Modelling - When to use State Diagrams - Activity diagram - When to use activity diagrams. Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams - When to use Component and Deployment diagrams

UNIT IV DESIGN PATTERNS 9

GRASP: Designing objects with responsibilities - Creator - Information expert - Low Coupling - High Cohesion - Controller. Design Patterns - creational - factory method - structural - Bridge - Adapter - behavioural - Strategy - observer - Applying GoF design patterns - Mapping design to code.

UNIT V TESTING 9

Object Oriented Methodologies - Software Quality Assurance - Impact of object orientation on Testing - Develop Test Cases and Test Plans.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2019.

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- 2 Stephen H Revell, "Object-Oriented Design & Programming", 4th Edition, Pearson Education, 2021.

REFERENCES:

- 1 Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", 3rd Edition, Addison-Wesley, 2021.
- 2 Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modelling Language", 3rd Edition, Addison Wesley, 2019.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105153/>
- 2 www.guru99.com/object-oriented-analysis-and-design/
- 3 <https://www.geeksforgeeks.org/object-oriented-analysis-and-design/>

COURSE OUTCOMES:

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

- CO1 Comprehend the Unified Process and Use case diagrams.
- CO2 Describe various Static UML Diagrams.
- CO3 Comprehend the Dynamic and Implementation of UML Diagrams.
- CO4 Describe UML based software design into Pattern based design using Design Patterns.
- CO5 Summarize the various testing methodologies for OO software.

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	1	2	2
CO2	2	2	1	1	-	1	-	1	-	1	1	1	2	2
CO3	2	2	1	1	-	1	-	1	-	1	1	1	2	2
CO4	2	2	1	1	-	1	-	1	-	1	1	1	2	2
CO5	2	2	1	1	-	1	-	1	-	1	1	1	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 issues – 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:

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- 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

- C01** Comprehend the core human values that shape the ethical behaviour of an Engineer.
- C02** Apply ethics in the profession.
- C03** Summarize the structure and function of state government and local bodies.
- C04** Apply safety, responsibility and rights in workplaces.
- C05** Summarize the global issues with regard to ethics.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	3	-	3	2	-	2	3
C02	-	-	-	-	-	3	-	3	2	-	2	3
C03	-	-	-	-	-	3	-	3	2	-	2	3
C04	-	-	-	-	-	3	-	3	2	-	2	3
C05	-	-	-	-	-	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 (OHSMS), 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 SUSTAINABILITY 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

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TEXT BOOKS:

- 1 Anubha Kaushik, C P Kaushik, "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
- 2 Benny Joseph, "Environmental Science and Engineering", 2nd Edition, Tata McGraw Hill, 2020.

REFERENCES:

- 1 Gilbert M Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2019.
- 2 R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", 2nd Edition, 2017.
- 3 Raja gopalan R, "Environmental Studies-From Crisis to Cure", 3rd Edition, Oxford University Press, 2015.

ONLINE WEB RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- 2 <https://www.coursera.org/courses?query=environmental%20studies>
- 3 https://onlinecourses.swayam2.ac.in/ini24_es01/preview

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	PSO1	PSO2
CO1	1	-	-	-	-	1	3	1	-	-	-	1	1	1
CO2	1	-	-	-	-	1	3	1	-	-	-	1	1	1
CO3	1	-	-	-	-	1	3	1	-	-	-	1	1	1
CO4	1	-	-	-	-	1	3	1	-	-	-	1	1	1
CO5	1	-	-	-	-	1	3	1	-	-	-	1	1	1

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U23IT503 MOBILE APPLICATION DEVELOPMENT LABORATORY**L T P C****Prerequisite:** Computer Networks**0 0 3 1.5****COURSE OBJECTIVES:**

- To understand the components and structure of mobile application development frameworks for Android and windows OS-based mobiles
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.

LIST OF EXPERIMENTS

- 1 Study and installation of Flutter/Kotlin multi-platform environment
- 2 Develop an application that uses Widgets, GUI components, Fonts, and Colors.
- 3 Develop a native calculator application.
- 4 Develop a gaming application that uses 2-D animations and gestures.
- 5 Develop a movie rating application (similar to IMDB)
- 6 Implement an application that creates an alert upon receiving a message.
- 7 Develop a simple shopping application.
- 8 Develop an application that makes use of Notification Manager.
- 9 Develop a native application that uses GPS location information
- 10 Implement an application that writes data to the SD card.
- 11 Mini Projects involving Flutter/Kotlin multi-platform

TOTAL: 45 PERIODS**COURSE OUTCOMES:****Upon the completion of the course, the students will be able to**

- C01** Design and build simple mobile applications supporting multiple platforms.
- C02** Apply various programming techniques and patterns to build mobile applications.
- C03** Write and implement the program for real-time mobile applications Society/environment.
- C04** Write and implement the program for gaming and multimedia based mobile applicatio
- C05** Create and execute the mini projects using Flutter/Kotlin platform.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	3	3	3	2	-	-	1	1	1	-	1	2	1
C02	3	2	1	2	2	-	-	1	1	1	-	1	1	2
C03	3	3	3	3	2	-	-	1	1	1	-	1	2	1
C04	3	3	3	3	2	-	-	1	1	1	-	1	2	1
C05	3	3	3	3	2	-	-	1	1	1	-	1	1	1

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U23CS505 OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY L T P C
Prerequisites: Object Oriented Programming 0 0 3 1.5

COURSE OBJECTIVES:

- To capture the requirements specification for an intended software system.
- To draw the UML diagrams for the given specification.
- To improve the design by applying appropriate design patterns

Draw standard UML diagrams using an UML modelling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

LIST OF EXPERIMENTS

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR CASE STUDY:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Credit card processing
8. e-book management system
9. Library management system
10. Student information system

TOTAL: 45 PERIODS

Software Download Links:

- https://github.com/argouml-tigris-org/argouml/releases/tag/VERSION_0_34
- <https://gambas.soft112.com/>

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COURSE OUTCOMES:

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

- CO1** Explain Object Oriented analysis and design concept for a given problem specification.
- CO2** Describe the basic software requirements in UML mapping
- CO3** Analyze the interactions between objects and represent them using UML Sequence and Collaboration Diagrams for the given scenario.
- CO4** Analyze software quality using design patterns.
- CO5** Analyze the modified system and test it for various scenarios.

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	1	-	1	2	2
CO2	2	2	1	1	2	-	-	1	1	1	-	1	2	2
CO3	3	3	2	2	2	-	-	1	1	1	-	1	2	2
CO4	3	3	2	2	2	-	-	1	1	1	-	1	2	2
CO5	3	3	2	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.

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U23AI502

BIG DATA ANALYTICS

L T P C

Prerequisites: Data Mining and warehousing

3 0 0 3

COURSE OBJECTIVES:

- To understand big data and Hadoop.
- To learn and use NoSQL big data management and map reduce 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 – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

TOTAL:45 PERIODS

TEXT BOOKS:

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- 1 Michael Minelli, Michelle Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, John Wiley & Sons, 2013.
- 2 Eric Sammer, "Hadoop Operations", 1st Edition, O'Reilly Media, 2012.

REFERENCES:

- 1 E. Capriolo, D. Wampler, J Rutherglen, "Programming Hive", 1st Edition, O'Reilly Media, 2012.
- 2 Lars George, "HBase: The Definitive Guide", 1st Edition, O'Reilly Media, 2011.
- 3 Alan Gates, "Programming Pig", 1st Edition, O'Reilly Media, 2011.

ONLINE RESOURCES:

- 1 <https://www.digimat.in/nptel/courses/video/106104189/L07.html>
- 2 <https://www.coursera.org/specializations/big-data>
- 3 <https://archive.nptel.ac.in/courses/106/104/106104189/>

COURSE OUTCOMES:

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

- CO1 Describe big data and Hadoop introduction.
- CO2 Summarize NoSQL big data management and Cassandra
- CO3 Design, configure and run Hadoop and HDFS..
- CO4 Solve 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	-	1	-	1	2	2
CO2	2	2	1	1	1	-	-	1	-	1	-	1	2	2
CO3	3	2	1	1	1	-	-	1	-	1	-	1	2	2
CO4	3	2	1	1	1	-	-	1	-	1	-	1	2	2
CO5	2	2	1	1	1	-	-	1	-	1	-	1	2	2

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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

- C01** Explain the concept of Cyber security and issues and challenges associated with it.
C02 Explain cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
C03 Apply various privacy and security concerns on online Social media.
C04 Apply concepts related cyber security aspects to E-Commerce and digital payments.
C05 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
C01	2	2	1	1	-	1	-	2	1	1	-	1
C02	2	2	1	1	-	1	-	2	1	1	-	1
C03	3	2	1	2	1	1	-	2	1	1	-	1
C04	3	2	1	2	1	1	-	2	1	1	-	1
C05	3	2	1	2	1	1	-	2	1	1	-	1

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U23CS601

EMBEDDED SYSTEMS AND IOT

L T P C

Prerequisites: Digital Principles and Computer Organization

3 0 2 4

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded Processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).

UNIT I 8-BIT EMBEDDED PROCESSOR 9

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

UNIT II EMBEDDED C PROGRAMMING 12

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

UNIT III IOT AND ARDUINO PROGRAMMING 8

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 IOT COMMUNICATION AND OPEN PLATFORMS 8

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

UNIT V APPLICATIONS DEVELOPMENT 8

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

45 PERIODS

PRACTICAL EXERCISES:

- 1 Write 8051 Assembly Language experiments using simulator
- 2 Perform ALU operations.
- 3 Write Basic and arithmetic Programs Using Embedded C.
- 4 Introduction to Arduino platform and programming
- 5 Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)

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- 6 a) Introduction to Raspberry PI platform and python programming
b) Log Data using Raspberry PI and upload to the cloud platform
- 7 Design an IOT based system

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2019.
- 2 Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 3rd Edition, CISCO Press, 2017.

REFERENCES:

- 1 Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", 2nd Edition, Elsevier, 2018.
- 2 Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", 1st Edition, Elsevier, 2020.

ONLINE WEB RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc20_ee98/preview
- 2 <https://nptel.ac.in/courses/108102045>
- 3 <https://www.scribd.com/document/784454385/IOT-cho>

COURSE OUTCOMES:

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

- C01 Explain the architecture of embedded processors
- C02 Write embedded C programs.
- C03 Design simple embedded applications.
- C04 Design the communication models in IOT
- C05 Design IoT applications using Arduino/Raspberry Pi /open platform.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	-	-	-	-	1	2	3	3	2	1
C02	2	1	3	2	2	-	-	-	1	2	2	3	2	1
C03	2	3	3	2	1	-	-	-	1	2	1	1	3	1
C04	2	3	3	2	1	-	-	-	1	2	2	3	3	2
C05	2	3	3	2	2	-	-	-	1	3	3	2	2	2

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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.

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U23CS701

CLOUD COMPUTING

L T P C
3 0 0 3

Prerequisites: Computer Networks

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, model, infrastructure, concepts of Virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure, explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Identity and Access Management (IAM) - IAM Challenges - IAM Architecture.

TOTAL:45 PERIODS

TEXT BOOKS:

- 1 Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kaufmann Publishers, 2018.
- 2 Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, "Mastering Cloud Computing ", 2nd Edition, Tata McGraw Hill, 2023

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REFERENCES:

- 1 James E Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", 2nd Edition, Elsevier, 2005.
- 2 Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", 2nd Edition, O'Reilly Media, 2009.
- 3 James Turnbull, "The Docker Book", 2nd Edition, O'Reilly Media, 2018.

ONLINE RESOURCES:

- 1 <https://aws.amazon.com/what-is/virtualization>
- 2 <https://archive.nptel.ac.in/courses/106/105/106105167/>
- 3 <https://www.coursera.org/specializations/cloud-computing>

COURSE OUTCOMES:

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

- CO1** Comprehend the principles behind cloud architecture and design challenges.
- CO2** Describe the concepts of virtualization and its types..
- CO3** Analyze Virtualization in hardware resources and Docker.
- CO4** Analyze various Cloud services and setup a cloud environment.
- CO5** Explain various security challenges in cloud environment.

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	2
CO2	2	2	1	1	1	-	-	1	-	1	-	1	2	2
CO3	3	2	1	1	1	-	-	1	-	1	-	1	2	2
CO4	3	2	1	1	1	-	-	1	-	1	-	1	2	2
CO5	2	2	1	1	1	-	-	1	-	1	-	1	2	2

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U23CS502

CRYPTOGRAPHY AND NETWORK SECURITY

L T P C

Prerequisites: Computer Networks, Probability and Queuing Theory. **3 0 0 3**

COURSE OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
- To understand the operation of a Message Authentication and Integrity

UNIT I

INTRODUCTION

9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis..

UNIT II

SYMMETRIC KEY CRYPTOGRAPHY

9

Mathematics of symmetric key cryptography: Algebraic structures - Modular arithmetic- Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution

UNIT III

PUBLIC KEY CRYPTOGRAPHY

9

Mathematics of asymmetric key cryptography: Primes – Primarily Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV

MESSAGE AUTHENTICATION AND INTEGRITY

9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT V

SECURITY PRACTICE AND SYSTEM SECURITY

9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - system security: Intruders – Malicious software – viruses – Firewalls.

TOTAL:45 PERIODS

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TEXT BOOKS:

- 1 William Stallings, "Cryptography and Network Security: Principles and Practice", 3rd Edition, Prentice Hall of India, 2021.
- 2 Behrouz A Foruzan, "Cryptography and Network Security", 4th Edition, Tata McGraw Hill, 2022.

REFERENCES:

- 1 C K Shyamala, N Harini, T R Padmanabhan: "Cryptography and Network Security", 2nd Edition, John Wiley & Sons, 2019.
- 2 Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: PRIVATE communication in a PUBLIC World", 2nd Edition, Prentice Hall of India, 2020.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105162>
- 2 <https://www.ibm.com/docs/en/zos/2.4.0?topic=services-managing-data-integrity-message-authentication>
- 3 <https://www.synopsys.com/blogs/software-security/cryptography-best-practices.html>

COURSE OUTCOMES:

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

- CO1** Summarize the fundamentals of Networks security, Security Architecture, threats and Vulnerabilities
- CO2** Apply the different cryptographic operations of DES, SDES, AES and RC4 symmetric cryptographic algorithms.
- CO3** Apply the different cryptographic operations by using Chinese Remainder Theorem, Euler's totient and Fermat's theorem for RSA and Key distributions in public key cryptography.
- CO4** Apply the various Authentication schemes MAC, HASH, HMAC, CMAC, SHA and Digital Signature to simulate different applications.
- CO5** Describe the various Security practices and Stds of Email, IP, PGP, S/MIME and Firewalls.

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	3	2	1	2	-	1	-	-	1	1	-	1	2	1
CO3	3	2	1	2	-	1	-	1	1	1	-	1	2	1
CO4	3	2	1	2	2	1	-	1	1	1	-	1	2	1
CO5	2	2	1	1	-	1	-	1	1	1	-	1	2	1

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- 1 Gopalakrishnan P, Ramamoorthy V E, "Textbook of Project Management", 7th Edition, Trinity Press, 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, Tata McGraw-Hill, 2010.
- 3 Sadhan Choudhury, "Project Management", 1st Edition, Tata McGraw-Hill, 2007.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/110/104/110104073>
- 2 <https://www.udemy.com/course/beginning-project-management-project-management-level-one>
- 3 <https://www.coursera.org/learn/financial-markets-global>

COURSE OUTCOMES:

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

- C01** Explain the concept of operational and project management.
- C02** Define the scope of a project and develop the project plan.
- C03** Evaluate the technical, business and social environment related to the project.
- C04** Explain team formulation and successful team management.
- C05** Design projects using tools and techniques.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	-	3	-	3	2	-	3	3	-	-
C02	-	-	-	-	-	3	-	3	2	-	3	3	-	-
C03	-	-	-	-	-	3	-	3	2	-	3	3	-	-
C04	-	-	-	-	-	3	-	3	2	-	3	3	-	-
C05	-	-	-	-	-	3	-	3	2	-	3	3	-	-

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U23CS702

CLOUD COMPUTING LABORATORY

L T P C

Prerequisites: Computer Networks Lab

0 0 3 1.5

COURSE OBJECTIVES:

- To install and use Virtual box/VMware/ Equivalent open source cloud Workstation that can be used as different flavours of Linux or Windows OS
- To install Google App Engine and develop web application GAE Launch and simulate a Cloud environment to implement scheduling algorithm using CloudSim.
- To install Hadoop and run simple applications & Creating, Executing and run Container Using Docker.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware/ Equivalent open-source cloud Workstation with different flavors of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- CO1** Apply Virtual box/VMware/ Equivalent open source cloud Workstation that can be used in Linux or Windows OS.
- CO2** Apply Google App Engine and develop web application GAE Launch
- CO3** Design cloud environment to implement scheduling algorithm using CloudSim.
- CO4** Apply Hadoop to run simple applications.
- CO5** Create, Execute and run Container Using Docker.

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WARRANGAL, ANDHRA PRADESH

CO - PO - PSO MAPPING:

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

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COURSE OBJECTIVES:

- To implement the different cipher techniques
- To implement the algorithms DES, RSA, MD5, SHA-1
- To learn and use network security tools and vulnerability Assessment tools

LIST OF EXPERIMENTS

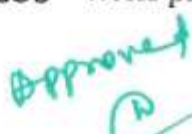
1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
 - a) Caesar Cipher
 - b) Playfair Cipher
 - c) Hill Cipher
 - d) Vigenere Cipher
 - e) Rail fence – row & Column Transformation
2. Implement the TRANSPOSITION TECHNIQUE Rail fence - row & Column Transformation.
3. Apply DES Algorithm for practical applications
4. Apply AES Algorithm for practical applications
5. Implement RSA algorithm using HTML and Javascript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other software.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

TOTAL: 45 PERIODS**Software Download Links:**

- Visual Studio Code: <https://code.visualstudio.com/download>
- Snort - <https://www.snort.org/downloads>
- N-Stalker - <https://www.nstalker.com/products/editions/free/download/>
- JAVA - <https://www.java.com/en/download/>

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

- CO1** Write encryption and decryption programs using substitution and transposition Techniques
- CO2** Apply AES and DES algorithm for key generation and encryption
- CO3** Write programs for authentication algorithms.

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CO4 Write programs for signature scheme using digital signature standard.

CO5 Apply vulnerability Assessment tools

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	-	-	3	2
CO2	3	2	1	2	-	-	-	1	1	1	-	1	3	2
CO3	3	3	3	3	-	-	-	1	1	1	-	1	3	2
CO4	3	3	3	3	1	-	-	1	1	1	-	1	3	3
CO5	3	2	1	2	1	1	-	1	1	1	-	1	3	3

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U23PEIT01 **WEB TECHNOLOGIES** **L T P C**

Prerequisites: Object Oriented Programming, Computer Networks **2 0 2 3**

COURSE OBJECTIVES:

- To understand the basic concepts of web programming and internet protocols and also demonstrate the uses of scripting languages.
- To learn how the client side and server-side processing and scripting works.
- To summarize the concepts of java servlets and the java data base connectivity concepts and java server pages.

UNIT I WEBSITE BASICS 6

Internet Overview - Fundamental computer network concepts - Web Protocols - URL - Domain Name- Web Browsers and Web Servers- Working principle of a website - Creating a Website - Client-side and server-side scripting

UNIT II WEB DESIGNING 6

HTML - Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING 6

JavaScript Introduction - Variables and Data Types-Statements - Operators - Literals- Functions- Objects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers.

UNIT IV SERVER-SIDE PROCESSING AND SCRIPTING - PHP 6

PHP - Working principle of PHP - PHP Variables - Constants - Operators - Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading - Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Databases with PHP.

UNIT V SERVLETS, DATABASE CONNECTIVITY AND JSP 6

Servlets: Java Servlet Architecture - Servlet Life cycle- Form GET and POST actions - Sessions - Cookies - Database connectivity - JDBC- Simple database applications. JSP: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP- JavaBeans Classes and JSP-Tag Libraries and Files

30 PERIODS

PRACTICAL EXERCISES:

- 1 Creation of interactive web sites - Design using HTML and authoring tools
- 2 Form validation using JavaScript
- 3 Creation of simple PHP scripts
- 4 Handling multimedia content in web sites
- 5 Write programs in Java using Servlets:
 - i)To invoke servlets from HTML forms
 - ii)Session Tracking
- 6 Creation of information retrieval system using web, PHP and MySQL
- 7 Write programs in Java to create three-tier applications using JSP and Databases
 - i)For conducting on-line examination.

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ii) For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Terry Felke Morris, "Web Development and Design Foundations", 8th Edition, Pearson Education, 2022.
- 2 Jon Duckett, "HTML and CSS: Design and Build Websites", 2nd Edition, John Wiley & Sons, 2020.

REFERENCES:

- 1 Jonathan Petersen, Richard Petersen, "Web Applications: Concepts and Real-World Design", 2nd Edition, Pearson Education, 2020.
- 2 Wendy Willard, "Web Design: A Beginner's Guide", 5th Edition, Tata McGraw-Hill, 2020.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/106106156/L09.html>
- 2 <https://www.nptelvideos.com/video.php?id=2143&c=27>
- 3 <https://www.geeksforgeeks.org/web-technology/>

COURSE OUTCOMES:

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

- CO1** Explain the basic concepts of Web.
- CO2** Apply HTML and CSS to design an interactive web page.
- CO3** Apply JavaScript to make interactive and dynamic web pages.
- CO4** Design Server-side processing using PHP.
- CO5** Design server-side pages using JSP and establish database connectivity

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	-	1	1	2
CO2	3	2	1	2	-	-	-	1	2	2	-	-	1	2
CO3	3	2	1	2	2	-	-	1	2	2	-	-	2	2
CO4	3	3	3	3	2	-	-	1	2	2	-	-	2	3
CO5	3	3	3	3	1	-	-	1	2	2	-	1	2	3

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U23PEIT02

HUMAN CENTERED DESIGN

L T P C

Prerequisite: Software Engineering

3 0 0 3

COURSE OBJECTIVES:

- To learn a sound knowledge in UI & UX
- To understand the need for UI and UX
- To analyze the various Research Methods used in Design

UNIT I

FOUNDATIONS OF DESIGN

9

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

9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviours and Principles – Branding - Style Guides

UNIT III

FOUNDATIONS OF UX DESIGN

9

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

9

Sketching Principles - Sketching Red Routes - Responsive Design – Wire framing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mock-up's - 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

9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Joel Marsh, "UX for Beginners", 1st Edition, O'Reilly Media, 2022.
- 2 Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", 1st Edition, O'Reilly Media, 2021.

REFERENCES:

- 1 Steve Schoger, Adam Wathan, "Refactoring UI", 1st Edition, New Riders Publishers, 2020.
- 2 David Travis, Philip Hodgson, "Think Like a UX Researcher", 1st Edition, CRC Press, 2020.

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ONLINE RESOURCES:

- 1 <https://enine.digimat.in/nptel/courses/video/124107008/L08.html>
2 <https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ar02>
3 <https://www.coursera.org/specializations/ui-ux-design>


COURSE OUTCOMES:

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

- | | |
|------------|--|
| C01 | Explain UI for user Applications |
| C02 | Evaluate UX design of any product or application |
| C03 | Demonstrate UX Skills in product development |
| C04 | Apply Sketching principles |
| C05 | Create Wireframe and Prototype |

CO – PO – PSO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO1	2	2	1	1	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	-	2	2
CO4	3	2	1	2	-	-	-	1	-	-	-	-	2	2
CO5	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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U23PEIT03

SOFTWARE QUALITY CONTROL

L T P C

Prerequisite: Software Engineering

3 0 0 3

COURSE OBJECTIVES:

- To comprehend the Importance of Automated Testing
- To understand Test Automation Frameworks
- To learn Automated Test Scripts, Troubleshooting and Debugging Automated Tests

UNIT I FOUNDATIONS OF SOFTWARE TESTING 9

Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V- model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II FOUNDATIONS OF UI DESIGN 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Mark Collin, "The Selenium Guidebook", 4th Edition, Pearson Education, 2024.
- 2 Ravi Das, Greg Johnson, "Testing and Securing Web Applications" ,1stEdition, Taylor & Francis Group, 2020.

REFERENCES:

- 1 Andrew L Pollner, "Test Automation Engineering: A Handbook for Software Developers and Testers", 1st Edition, CRC Press, 2024.
- 2 Unmesh Gundecha, "Selenium WebDriver 4 Practical Guide: Master the Art, of Automated Web Testing Using Selenium and Java", 1stEdition, Packt Publishing, 2024.

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ONLINE RESOURCES:

- 1 <http://digimat.in/nptel/courses/video/106105150/L01.html>
- 2 <http://www.digimat.in/nptel/courses/video/106101163/L01.html>
- 3 <https://archive.nptel.ac.in/courses/106/101/106101163>

COURSE OUTCOMES:

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

- C01** Explain the basic concepts of software testing and the need for software testing
- C02** Summarize Test planning and different activities involved in test planning
- C03** Apply effective test cases that can uncover critical defects in the application
- C04** Summarize how to Carry out advanced types of testing
- C05** Explain test Automation and tools of software testing

CO – PO – PSO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C02	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C03	3	2	1	2	-	-	-	-	-	-	-	-	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23PEIT04	WEB APPLICATION SECURITY	L	T	P	C
Prerequisites: Software Engineering, Computer Networks		3	0	0	3

COURSE OBJECTIVES:

- To understand Web Security Concepts
- To explain Secure Communication Protocols
- To learn about secure APIs, To Learn Security Testing and Vulnerability Assessment

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM).

UNIT III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

TOTAL:45 PERIODS

TEXT BOOKS:

- 1 Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", 1st Edition, O'Reilly Media, 2020.
- 2 Neil Madden, "API Security in Action", 1st Edition, Manning Publishers, 2020.

REFERENCES:

- 1 Ravi Das, Greg Johnson, "Testing and Securing Web Applications", 1st Edition, Taylor & Francis Group Publishers, 2020.
- 2 Malcom McDonald, "Web Security for Developers", 1st Edition, No Starch Press, 2020.

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ONLINE RESOURCES:

- 1 <http://sdnbvc.digimat.in/nptel/courses/video/128108018/L13.html>
- 2 <https://www.geeksforgeeks.org/securing-web-applications/>
- 3 <http://sdnbvc.digimat.in/nptel/courses/video/106106156/L25.html>

COURSE OUTCOMES:

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

- C01** Explain the basic concepts of web application security and the need for it
- C02** Describe the process for secure development and deployment of web applications
- C03** Summarize Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- C04** Explain acquire the skill to design and develop Secure Web Applications that use Secure APIs
- C05** Summarize Acquire the skill to think like a hacker and to use hackers tool sets

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23PEIT05	CLOUD DATA MANAGEMENT	L	T	P	C
Prerequisite: Operating Systems		3	0	0	3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To explain the concepts of virtualization and virtual machines.
- To summarize various Cloud deployment environments.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL:45 PERIODS

TEXT BOOKS:

- 1 Thomas Erl, "Cloud Computing: Concepts Technology & Architecture", 2nd Edition, Packt Publishing, 2020.
- 2 Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2nd Edition, Tata McGraw Hill, 2021.

REFERENCES:

- 1 David Hill, Lee Chao, "Cloud Computing: A Managerial Approach", 2nd Edition, Pearson Education, 2020.
- 2 Jaydip Sen, "Cloud Computing: Architecture and Applications", 2nd Edition, John Wiley & Sons, 2020.

ONLINE RESOURCES:

- 1 <https://www.geeksforgeeks.org/cloud-management-in-cloud-computing/>
- 2 <https://www.simplilearn.com/tutorials/cloud-computing-resources>
- 3 <https://skillsbuild.org/students/course-catalog/cloud-computing>

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COURSE OUTCOMES:

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

- C01** Explain the design challenges in the cloud.
C02 Apply the concept of virtualization and its types.
C03 Comprehend virtualization of hardware resources and Docker.
C04 Summarize services on the cloud and set up a cloud environment.
C05 Describe security challenges in the cloud environment.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C02	3	2	1	2	-	-	-	-	-	-	-	-	2	2
C03	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C04	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	-	-	-	-	1	2	2

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U23PEIT06 APPLICATION DESIGN AND DEVELOPMENT L T P C

Prerequisites: Computer Networks, Operating Systems **2 0 2 3**

COURSE OBJECTIVES:

- To develop applications with location and data storage capabilities with database access
- To explain cross-platform applications with event handling
- To learn development of native applications with basic GUI Components

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 6

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, what is Progressive Web App, Responsive Web design.

UNIT II NATIVE APP DEVELOPMENT USING JAVA 6

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT 6

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 6

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 6

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

- 1 Using react native, build a cross-platform application for a BMI calculator.
- 2 Build a cross-platform application for a simple expense manager which allows entering and income on each day and displays category wise weekly income and expense.
- 3 Develop a cross-platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
- 4 Design and develop a cross-platform application for day-to-day task (to-do) management.
- 5 Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
- 6 Design and develop an android application using Apache Cordova to find and display the current location of the user.

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- 7 Write programs using Java to create Android application having Databases
- For a simple library application.
 - For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Chris Stewart, Kristin Marciano, "Android Programming: The Big Nerd Ranch Guide", 4th Edition, Pearson Education, 2022.
- 2 Christian Keur, Aaron Hillegass, "iOS Programming: The Big Nerd Ranch Guide", 7th Edition, Big Nerd Ranch Guides, 2022.
- 3 Barry Burd, "Android Application Development All-in-One for Dummies", 2nd Edition, John Wiley & Sons, 2020.

REFERENCES:

- 1 John Horton, "Android Programming with Kotlin for Beginners", 1st Edition, Packet Publishing, 2024
- 2 Craig Grummitt, "iOS Development with Swift", 2nd Edition, Apress, 2020.

ONLINE RESOURCES:

- 1 <https://terna.digimat.in/nptel/courses/video/106106156/L28.html>
- 2 <https://gec.digimat.in/nptel/courses/video/106106222/L32.html>
- 3 <http://sdnbvc.digimat.in/nptel/courses/video/106106222/L03.html>

COURSE OUTCOMES:

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

- CO1** Describe the Foundations of Mobile and Web Development
- CO2** Explain Intuitive User Interfaces (UI)
- CO3** Analyze Hybrid App Development Concepts
- CO4** Design and implement reusable, responsive, and platform-consistent user interface components using React Native.
- CO5** Analyze the Framework's Compliance with Industry Standards

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	2	2	1	1	1	-	-	1	-	-	-	1	2	2
CO3	3	3	2	2	1	-	-	1	-	-	-	1	2	2
CO4	3	3	3	3	2	-	-	1	-	-	-	1	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	1	2	3

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U23PEIT07

DATA EXPLORATION

L T P C

Prerequisites: Foundation of Data science, Database management systems **3 0 0 3**

COURSE OBJECTIVES:

- To understand an overview of exploratory data analysis and to implement data visualization using Matplotlib.
- To apply univariate and bivariate data exploration and analysis.
- To apply Data exploration and visualization techniques for multivariate and time series data

UNIT I INTRODUCTION TO EDA 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 - Analysing 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 Thomas Haslwanter, "An Introduction to Statistics with Python: With Applications in the Life Sciences", 2nd Edition, Springer Publications, 2022.
- 3 K A R S Santhosh, S P R Venkatesh, "Multivariate Data Analysis: Concepts and Applications", 1st Edition, John Wiley & Sons, 2021.

REFERENCES:

- 1 Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", 2nd Edition, O' Reilly Media, 2022.

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- 2 Claus O Wilke, "Fundamentals of Data Visualization", 1st Edition, O' Reilly Media, 2020.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/106/106106212/>
- 2 https://onlinecourses.swayam2.ac.in/ntr24_ed70/preview
- 3 <https://www.coursera.org/learn/transforming-exploratory-data-analysis-with-ai?msockid=18b0725c71a26cda0c156764700f6d7e>

COURSE OUTCOMES:

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

- C01** Summarize the fundamentals of data science and exploratory data analysis.
- C02** Solve the data visualization using Matplotlib.
- C03** Apply univariate data exploration and analysis.
- C04** Apply bivariate data exploration and analysis.
- C05** Solve 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
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	1	2	3
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	3


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U23PEIT08

STREAMING ANALYTICS

L T P C

Prerequisite: Database management system

2 0 2 3

COURSE OBJECTIVES:

- To learn definition & concepts of data systems and to define different types of Data Processing
- To understand the concepts of Real-time Data processing and to select appropriate structures for designing and running real-time data services in a business environment
- To illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I FOUNDATIONS OF DATA SYSTEMS 6

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 6

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 6

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many-to-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 6

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 6

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.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Install MongoDB
- 2 Design and Implement Simple application using MongoDB
- 3 Query the designed system using MongoDB
- 4 Create a Event Stream with Apache Kafka
- 5 Create a Real-time Stream processing application using Spark Streaming
- 6 Build a Micro-batch application
- 7 Real-time Fraud and Anomaly Detection

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

- 1 Hubert Dulay, Ralph Matthias Debusmann, "Streaming Databases: Unifying Batch and Stream Processing", 1st Edition, O'Reilly Media, 2024.
- 2 Fabian Hueske, Vasiliki Kalavri, "Stream Processing with Apache Flink Fundamentals, Implementation and Operation of Streaming Applications", 1st Edition, O'Reilly Media, 2020.

REFERENCES:

- 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, 2020.
- 2 Shilpi Saxena, Saurabh Gupta, "Practical Real-time Data Processing and Analytics: Distributed Computing and Event Processing using Apache Spark, Flink, Storm, and Kafka", 1st Edition, Packt Publishing, 2020.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/127/101/106101224/>
- 2 https://onlinecourses.swayam2.ac.in/ntr24_ed70/preview
- 3 <http://www.digimat.in/nptel/courses/video/106107220/106107220.html>


COURSE OUTCOMES:

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

- CO1** Summarize the applicability and utility of different streaming algorithms
- CO2** Describe and apply current research trends in data-stream processing.
- CO3** Analyze the suitability of stream mining algorithms for data stream systems.
- CO4** Design stream processing systems, services and applications
- CO5** Solve problems in real-world applications that process data streams

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	-	1	2	2
CO2	2	2	1	1	1	-	-	1	1	1	-	1	2	2
CO3	3	3	2	2	1	-	-	1	1	1	-	1	2	2
CO4	3	3	3	3	2	-	-	1	1	1	-	1	3	2
CO5	3	2	1	2	2	-	-	1	1	1	-	1	3	2

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U23PEIT09

GENERATIVE DATABASE

L T P C

Prerequisite: Database management system

3 0 0 3

COURSE OBJECTIVES:

- To understand the working principles and query processing of distributed databases
- To distinguish the different types of NoSQL databases
- To learn about information retrieval and web search.

UNIT I

DISTRIBUTED DATABASES

9

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

UNIT II

SPATIAL AND TEMPORAL DATABASES

9

Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications -- Mobile Databases: Location and Handoff Management, Mobile Transaction Models – Deductive Databases - Multimedia Databases.

UNIT III

NOSQL DATABASES

9

NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding–Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – Orient DB Graph database – Orient DB Features.

UNIT IV

XML DATABASES

9

Structured, semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery.

UNIT V

INFORMATION RETRIEVAL AND WEB SEARCH

9

IR concepts – Retrieval Models – Queries in IR system – Text Preprocessing – Inverted Indexing – Evaluation Measures – Web Search and Analytics – Current trends.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 M Tamer Ozsu, Patrick Valduriez, "Principles of Distributed Database Systems", 4th Edition, Springer Publications, 2020.
- 2 Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, 2020.

REFERENCES:

- 1 R Elmasri, S B Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2020.
- 2 Guy Harrison, "Next Generation Databases, NoSQL, NewSQL and Big Data", 1st Edition, Apress publishers, 2020.

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ONLINE RESOURCES:

- 1 <https://digimat.in/nptel/courses/video/106105175/L01.html>
- 2 https://onlinecourses.swayam2.ac.in/cec19_cs05/preview
- 3 <https://archive.nptel.ac.in/courses/106/106/106106093/>

COURSE OUTCOMES:

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

- C01** Explain the working principles and query processing of distributed databases
- C02** Describe the basics of spatial, temporal and mobile databases and their applications
- C03** Summarize the different types of NoSQL databases.
- C04** Design XML database systems and validate with XML schema
- C05** Apply knowledge of information retrieval concepts on web databases.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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U23PEIT10

BUSINESS INTELLIGENCE

L T P C

Prerequisites: Database Management system, Foundation of data science **3 0 0 3**

COURSE OBJECTIVES:

- To understand the Analytics Life Cycle and to comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting and to model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions.

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 S Christian Albright, Wayne L Winston, "Business Analytics: Data Analysis and Decision Making with Mind Tap", 7th Edition, Cengage Learning India Pvt. Ltd, 2022.
- 2 VSP RAO, "Human Resource Management", 3rd Edition, Excel Books, 2020.

REFERENCES:

- 1 R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, John Wiley & Sons, 2020.
- 2 Philip Kotler and Kevin Keller, "Marketing Management", 15th Edition, Prentice Hall of India, 2020.

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ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/110/105/110105089/>
- 2 https://onlinecourses.nptel.ac.in/noc24_cs65/preview
- 3 <http://kcl.digimat.in/nptel/courses/video/110107492/L02.html>

COURSE OUTCOMES:

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

- C01** Explain the analytic life cycle and business problems.
C02 Summarize the business processes for extracting Business Intelligence
C03 Apply predictive analytics for business fore-casting
C04 Apply analytics for HR, supply chain and logistics management
C05 Apply analytics for marketing and sales.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C02	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C03	3	2	1	2	-	-	-	-	-	-	-	-	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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U23PEIT11

HUMAN RESOURCE ANALYTICS

L T P C

Prerequisites: Database Management system, Foundation of data science **3 0 0 3**

COURSE OBJECTIVES:

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To learn the different types of HR metrics and understand their respective impact and application and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I INTRODUCTION TO HR ANALYTICS 9

People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business – HR metrics and KPIs.

UNIT II HR ANALYTICS - RECRUITMENT 9

Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.

UNIT III HR ANALYTICS - TRAINING AND DEVELOPMENT 9

Training & Development Metrics: Percentage of employees trained- Internally and externally trained -Training hours and cost per employee - ROI.

UNIT IV HR ANALYTICS - EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION 9

Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V HR ANALYTICS- WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics: Employees per manager – Workforce age profiling - Workforce service profiling - Churn over index - Workforce diversity index - Gender mix.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Martin Edwards, Kirsten Edwards, Daisung Jang, "Predictive HR Analytics: Mastering the HR Metric ", 3rd Edition, Kogan Page, 2024.
- 2 Dipak Kumar Bhattacharyya, "HR Analytics, Understanding Theories and Applications, 2nd Edition, John Wiley & Sons, 2023.

REFERENCES:

- 1 Dr. Michael J Walsh, "HR Analytics Essentials You Always Wanted to Know", 1st Edition, Vibrant Publishers, 2021.
- 2 Bharti Motwani, "HR Analytics: Practical Approach Using Python", 1st Edition, John Wiley & Sons, 2021.

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ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc24_hs126/preview
- 2 https://onlinecourses.swayam2.ac.in/imb25_mg65/preview
- 3 <http://kcl.digimat.in/nptel/courses/video/110107492/L01.html>

COURSE OUTCOMES:

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

- CO1** Comprehend HR metrics that are aligned with the overall business strategy.
- CO2** Summarize about one type of HR analytics - Recruitment
- CO3** Describe about one type of HR analytics- Training and Development
- CO4** Summarize about one type of HR analytics- Employee Engagement and Career Progression
- CO5** Summarize about one type of HR analytics – Workforce diversity 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	2
CO2	2	2	1	1	-	-	-	1	-	-	-	-	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	-	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23PEIT12

SOCIAL MEDIA MARKETING

L T P C

Prerequisites: Software Engineering, Computer Networks

2 0 2 3

COURSE OBJECTIVES:

- To analyze the role and importance of digital marketing in today's rapidly changing business environment.
- To explain how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, social media and Blogs.

UNIT I

INTRODUCTION TO ONLINE MARKET

6

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II

SEARCH ENGINE OPTIMISATION

6

Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III

E- MAIL MARKETING

6

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with social media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

UNIT IV

SOCIAL MEDIA MARKETING

6

Social Media Marketing - Social Media Channels- Leveraging social media for brand conversations and buzz. Successful /benchmark social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V

DIGITAL TRANSFORMATION

6

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

30 PERIODS

PRACTICAL EXERCISES:

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

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

- 1 Tracy L Tuten, Michael R Solomon, "Social Media Marketing: Principles and Strategies", 3rd Edition, Sage Publications, 2021.
- 2 Dave Chaffey, PR Smith, "Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing", 5th Edition, Routledge, 2020.

REFERENCES:

- 1 Puneet Singh Bhatia, "Fundamentals of Digital Marketing", 1st Edition, Pearson Education, 2020.
- 2 Barker, Bormann, Neher, "Social Media Marketing: A Strategic Approach", 3rd Edition, Cengage Learning, 2020.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc24_cs04/preview
- 2 <https://www.coursera.org/learn/emailmarketing?msockid=26f710ee9c926a193321054b9d3f6b39>
- 3 https://onlinecourses.swayam2.ac.in/imb24_mg43/preview

COURSE OUTCOMES:

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

- CO1** Analyze the role and importance of digital marketing in today's business environment.
- CO2** Explain how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- CO3** Describe the essential components of a digital marketing strategy.
- CO4** Analyze the effectiveness of social media campaign.
- CO5** Summarize advanced digital marketing tools such as SEO, SEM, social media and Blogs.

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	1	-	-	1	1	1	1	2	2	2
CO4	3	3	2	2	1	-	-	1	1	1	1	2	2	2
CO5	2	2	1	1	2	-	-	1	1	1	1	2	2	2

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U23PEIT13 NEURAL NETWORKS AND DEEP LEARNING L T P C

Pre Requisites: Problem Solving and Python Programming, Machine Learning Techniques **2 0 2 3**

COURSE OBJECTIVES:

- To understand various learning problems and algorithms used neural networks.
- To understand the concepts to select the Learning Networks in modelling real world systems.
- To understand the concepts of use an efficient algorithm for Deep Models and apply optimization strategies for large scale applications.

UNIT I ARTIFICIAL NEURAL NETWORKS 6

Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network, Associative Memory Networks, Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT II UNSUPERVISED LEARNING NETWORK 6

Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT III DEEP LEARNING 6

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other differentiation Algorithms

UNIT IV REGULARIZATION FOR DEEP LEARNING 6

Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT V OPTIMIZATION FOR TRAIN DEEP MODELS 6

Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second- Order Methods, Optimization Strategies and Meta-Algorithms

30 PERIODS

PRACTICAL EXERCISES:

- 1 Setting up the Spyder IDE Environment and Executing a Python Program
- 2 Installing Keras, Tensorflow and Pytorch libraries and making use of them
- 3 Applying the Convolution Neural Network on computer vision problems
- 4 Image classification on MNIST dataset (CNN model with Fully connected layer)

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- 5 Applying the Deep Learning Models in the field of Natural Language Processing
- 6 Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
- 7 Applying the Auto encoder algorithms for encoding the real-world data

30 PERIODS

TOTAL :60 PERIODS

TEXT BOOKS:

- 1 Christopher M Bishop, Hugh Bishop, "Deep Learning: Foundations and Concepts", 1st Edition, Springer Publications, 2023.
- 2 Charu C Aggarwal, "Neural Networks and Deep Learning: A Textbook", 1st Edition, MIT Press Publisher, 2023.

REFERENCES:

- 1 Ian Goodfellow, Yoshua Bengio, Aaron Courville "Deep Learning", 1st Edition, MIT Press Book, 2021.
- 2 Francois Chollet, "Deep Learning with Python", 2nd Edition, John Wiley & Sons, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/111103021>
- 2 <https://drmcet.digimat.in/nptel/courses/video/106105152/L13.html>
- 3 https://onlinecourses.swayam2.ac.in/imb25_mg45/preview

COURSE OUTCOMES:

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

- CO1** Comprehend the basic concepts of Neural Network.
CO2 Summarize the concepts to select the Learning Networks.
CO3 Summarize the basic concept of Deep Learning.
CO4 Apply an efficient algorithm for Deep Models.
CO5 Apply optimization strategies for large scale applications.

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	2	2
CO2	2	2	1	2	1	-	-	1	1	2	-	1	2	2
CO3	2	2	1	2	1	-	-	1	1	2	-	1	2	2
CO4	3	2	1	2	1	-	-	1	1	2	-	1	2	2
CO5	3	2	1	2	1	-	-	1	1	2	-	1	2	2

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U23PEIT14

REINFORCEMENT LEARNING

L T P C

Pre Requisite: Machine Learning techniques

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of reinforcement Learning RL Framework and Markov Decision Process.
- To analysing ning through the use of Dynamic Programming and Monte Carlo.
- To understand the concept of TD (0) algorithm, TD (λ) algorithm.

UNIT I

INTRODUCTION

9

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sub linear regret, UCB algorithm, KL-UCB, Thompson Sampling.

UNIT II

MARKOV DECISION PROBLEM

9

Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration.

UNIT III

REINFORCEMENT LEARNING PROBLEM

9

The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation

UNIT IV

BOOTSTRAPPING

9

Bootstrapping; TD (0) algorithm; Convergence of Monte Carlo and batch TD (0) algorithms; Model-free control: Q-learning, Sarsa, Expected Sarsa.

UNIT V

MATHEMATICAL OPTIMIZATION

9

n-step returns; TD (λ) algorithm; Need for generalization in practice; Linear function approximation and geometric view; Linear TD(λ). Tile coding; Control with function approximation; Policy search; Policy gradient methods; Experience replay; Fitted Q Iteration; Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Sutton, Richard S, Andrew G Barto, "Reinforcement learning: An introduction," 1st Edition, MIT press, 2020.
- 2 Sugiyama, Masashi, "Statistical reinforcement learning: modern machine learning approaches", 1st Edition, CRC Press, 2020.

REFERENCES:

- 1 Lattimore T, C Szepesvari, "Bandit algorithms," 1st Edition, Cambridge University Press, 2020.
- 2 Alexander Zai, Brandon Brown, "Deep Reinforcement Learning in Action", 1st Edition, Manning Publications, 2020.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc19_cs55/
- 2 <https://neptune.ai/blog/best-reinforcement-learning-tutorials-examples-projects-and-courses>
- 3 <https://archive.nptel.ac.in/courses/106/106/106106143/>

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COURSE OUTCOMES:

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

- CO1** Comprehend the basics of Reinforcement Learning.
- CO2** Apply RL Framework and Markov Decision Process.
- CO3** Analyse Reinforcement Learning problem and prediction.
- CO4** Analyse ning through the use of Dynamic Programming and Monte Carlo.
- CO5** Summarize the concept of TD (0) algorithm, TD (λ) algorithm.

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	3	2	2	-	-	-	1	-	-	-	1	2	2
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23ITPE15	NATURAL LANGUAGE PROCESSING	L	T	P	C
Pre Requisites: Machine Learning techniques, Data structures		3	0	0	3

COURSE OBJECTIVES:

- To learn the foundation of Human Computer Interactions.
- To understand the design technologies for individuals and persons with disabilities and also about the awareness of Mobile HCI.
- To understand the concept of Web interfacing.

UNIT I FINDING THE STRUCTURE OF WORDS AND DOCUMENTS 9

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

UNIT II SYNTAX ANALYSIS 9

Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT III SEMANTIC PARSING 9

Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT IV PREDICATE-ARGUMENT STRUCTURE 9

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT V LANGUAGE MODELING 9

Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Muskan Garg, Sandeep Kumar, Abdul Khader Jilani Saudagar, "Natural Language Processing and Information Retrieval Principles and Applications", John Wiley & Sons, 2023.
- 2 Kuei-Hu Chang, "Natural Language Processing: Recent Development and Applications", CRC press, 2023.

REFERENCES:

- 1 Dr. Samit Bhattacharya, "Human Computer Interaction-User centric computing for Design", 1st Edition, Tata McGraw-Hill, 2020.
- 2 Sulabh Bansal, Prakash Chandra Sharma, Abhishek Sharma, Jieh-Ren Chang, "Applied Intelligence in Human-Computer Interaction", 1st Edition, CRC Press, 2023.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc23_cs45/
- 2 <https://nptel.ac.in/courses/106105158>
- 3 https://onlinecourses.nptel.ac.in/noc20_cs87/

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COURSE OUTCOMES:

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

C01 Comprehend the basic concepts of Human Computer Interaction.

C02 Comprehend about the designing and processing of software.

C03 Summarize the models and theories involved in human computer interaction.

C04 Comprehend Mobile Human Interaction and its applications.

C05 Summarize the concepts of web interface designing.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C03	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C04	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	-	2	2

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U23PEIT16

COMPUTER VISION AND IMAGE PROCESSING

L T P C

Pre Requisites: Machine Learning Techniques, Foundation of Data Science **2 0 2 3**

COURSE OBJECTIVES:

- To understand the basics of computer vision, including image processing, feature extraction, object recognition and the various deep learning techniques used for computer vision.
- To learn the use of popular computer vision libraries and frameworks such as OpenCV and Pillow.
- To implement the real-world applications-based projects by applying computer vision techniques.

UNIT I INTRODUCTION TO COMPUTER VISION AND IMAGE PROCESSING 6

Overview of computer vision and its applications, Image processing techniques, Image representation and manipulation, Popular computer vision and image processing libraries: OpenCV and Pillow.

UNIT II FEATURE EXTRACTION AND MATCHING 6

Feature detection and description, Keypoint matching and correspondence, Applications of feature extraction and matching.

UNIT III IMAGE SEGMENTATION AND CLUSTERING 6

Segmentation, Semantic Segmentation, Instance Segmentation, Segmentation Algorithms, Clustering for image analysis and classification, Applications of image segmentation and clustering.

UNIT IV OBJECT RECOGNITION AND DETECTION 6

Object Detection, Object recognition algorithms, Object detection using sliding windows and region-based methods, Convolutional neural networks for object detection, Tools for object detection: Roboflow, and Landing AI.

UNIT V ADVANCED TOPICS IN COMPUTER VISION 6

Tracking and motion analysis, 3D computer vision, and Applications of computer vision in robotics and autonomous vehicles.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Image Processing Techniques: Implementing basic image processing techniques such as image filtering, edge detection, and thresholding using OpenCV.
- 2 Feature Extraction: Implementing feature extraction techniques such as Harris corner detector, SIFT, and SURF using OpenCV
- 3 Object Detection: Implementing object detection techniques such as Haar cascades and YOLO using OpenCV, TensorFlow/Pytorch.
- 4 Object Tracking: Implementing object tracking techniques such as KCF and MOSSE using OpenCV.
- 5 Segmentation: Implementing image segmentation using semantic and instance segmentation.

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- 6 Stereo Vision: Implementing stereo vision algorithms such as SGBM and BM using OpenCV.
- 7 Tools for Computer Vision: Implementing end-to-end computer vision projects using Roboflow and Landing AI.

30 PERIODS

TOTAL :60 PERIODS

TEXT BOOKS:

- 1 Richard Szeliski, "Computer Vision: Algorithms and Applications", 1st Edition, John Wiley & Sons, 2022.
- 2 Richard O Duda, Peter E Hart, David G Stork, "Pattern Recognition, an Indian Adaptation ", 2nd Edition, John Wiley & Sons, 2021.

REFERENCES:

- 1 Muges S, "Hands-on ML Projects with OpenCV: Master computer vision and Machine Learning using OpenCV and Python ",1st Edition, Orange Education Pvt Ltd, 2022.
- 2 Wilhelm Burger, Mark J Burge, "Digital Image Processing: An Algorithmic Introduction Using Java", 3rd Edition, Springer Publications, 2022.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc23_cs77/preview
- 2 <https://www.youtube.com/watch?v=5qxrzD60DHc>
- 3 <https://www.youtube.com/watch?v=3qJ6wgezA>

COURSE OUTCOMES:

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

- CO1** Comprehend the fundamentals concepts of computer vision.
- CO2** Apply various computer vision techniques for image processing.
- CO3** Summarize the concept of segmentation and clustering techniques
- CO4** Apply computer vision models using deep learning techniques.
- CO5** Apply computer vision techniques to real-world problems such as robotics and autonomous vehicles.

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	2	-	-	1	1	2	-	1	2	2
CO3	2	2	1	1	1	-	-	1	-	-	-	1	2	2
CO4	3	2	1	2	2	-	-	1	1	2	-	1	2	2
CO5	3	2	1	2	2	-	-	1	1	2	-	1	2	2


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U23PEIT17

ROBOTICS AND AUTOMATION

L T P C

Pre Requisite: Machine Learning.

3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of robotic system and study about how the robots are intelligently planning and working.
- To learn about the process automation in robots.
- To understand the concept involved in deployment and maintenance of robotic automation.

UNIT I

INTRODUCTION TO ROBOTICS

9

Robotics -History - Classification and Structure of Robotic Systems - Basic components -Degrees of freedom - Robot joints coordinates- Reference frames - workspace- Robot languages- Robotic sensors- proximity and range sensors, ultrasonic sensor, touch and slip sensor.

UNIT II

ROBOT INTELLIGENCE AND PLANNING

9

Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis -problem solving -robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics

UNIT III

ROBOTIC PROCESS AUTOMATION

9

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 IV

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, UiExplorer, Handling Events

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 Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", 1st Edition, A press publications, 2020.
- 2 A Gerardus Blokdyk, "Robotic Process Automation Rpa a Complete Guide",1st Edition, 5 starCooks, 2020.

REFERENCES:

- 1 John Craig, "Introduction to Robotics", 4th Edition, Pearson Education, 2022.

Jisu Elsa Jacob, Manjunath N, "An Illustrative Guide to Learn Fundamentals of Robotics, Including Kinematics, Motion Control, and Trajectory Planning", 1st Edition, Robotics Simplified Publishers, 2022.

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ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_me32
- 2 <https://www.youtube.com/watch?v=AsxvuSTXhbw>
- 3 <https://www.uipath.com/rpa/robotic-process-automation>

COURSE OUTCOMES:

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

- CO1** Summarize the history and components of Robots
CO2 Comprehend about intelligence and planning of Robots.
CO3 Comprehend the automation process of Robots.
CO4 Summarize the activities involved in automation process.
CO5 Comprehend about the deployment and maintenance activities of Robots.

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	-	-	-	1	-	-	-	-	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	2

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U23PEIT18	DATA VISUALIZATION TECHNIQUES	L	T	P	C
Pre requisites: Foundation of Data Science, Machine Learning Techniques		2	0	2	3

COURSE OBJECTIVES:

- To understand the concept of Foundation of data and visualization.
- To understand the concept of various data visualization techniques.
- To study about advancement in virtualization techniques and its research directions.

UNIT I INTRODUCTION AND DATA FOUNDATION 6

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 6

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 6

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

UNIT IV ADVANCED VISUALIZATION TECHNIQUES 6

Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT V RESEARCH DIRECTIONS IN VIRTUALIZATIONS 6

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.

30 PERIODS

PRACTICAL EXERCISES:

- 1 A/B Testing: Compare two different visualization formats to see which is more effective in conveying a message.
- 2 Interactive Visualization: Create an interactive visualization that allows users to explore data on their own.
- 3 Comparative Visualization: Compare data from multiple sources or over time periods to identify trends and patterns.
- 4 Multivariate Analysis: Analyze multiple variables to determine correlations and interdependencies.
- 5 Social Media Analytics: Analyze social media data to identify trends and insights.
- 6 Machine Learning Visualization: Visualize machine learning algorithms to better understand how they work.
- 7 Natural Language Processing: Use natural language processing to Analyze text data and visualize the results.

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30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Punit Goel, Srikanthudu Avancha, Bipin Gajbhiye Digneshkumar Khatri, "Insights of Data Visualization: Techniques and Tools", 1st Edition, Raveena Prakashan Opc Private Limited, 2024.
- 2 Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", 2nd Edition, John Wiley & Sons, 2024.

REFERENCES:

- 1 Claus O Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st Edition, O'Reilly Media, 2020.
- 2 Stephanie Evergreen, "Effective Data Visualization: The Right Chart for the Right Data", 1st Edition, Sage Publications, 2020.

ONLINE RESOURCES:

- 1 <https://www.youtube.com/watch?v=UjYzNhBVIvY>
- 2 <http://kcl.digimat.in/nptel/courses/video/106106179/L11.html>
- 3 <https://www.kaggle.com/learn/data-visualization>

COURSE OUTCOMES:

- CO1** Comprehend the basic concepts of data foundation and visualization.
- CO2** Apply various virtualization stages and taxonomies for data processing.
- CO3** Apply various visualization techniques for spatial, geospatial data
- CO4** Apply advanced virtualization techniques in multivariate data.
- CO5** Evaluate and critique research in visualization.

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	2	-	1	2	3
CO2	3	2	1	2	2	-	-	1	1	2	-	1	2	3
CO3	3	2	1	2	2	-	-	1	1	2	-	1	2	3
CO4	3	2	1	2	2	-	-	1	1	2	-	1	2	3
CO5	3	3	2	3	1	-	-	1	1	2	-	1	2	3

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U23PEIT19	NETWORK ENGINEERING	L	T	P	C
Prerequisite: Computer Networks		3	0	0	3

COURSE OBJECTIVES:

- To provide an introduction to the principles and practices of Network Engineering.
- To understand the architecture of the network devices.
- To explore the emerging technologies in network engineering.

UNIT I FOUNDATIONS OF NETWORKING 9

Communication Networks –Network Elements –Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model –Datagrams and Virtual Circuits –Multiplexing–Switching –Error and Flow Control –Congestion Control – Layered Architecture –Network Externalities –Service Integration.

UNIT II QUALITY OF SERVICE 9

Traffic Characteristics and Descriptors –Quality of Service and Metrics –Best Effort model and guaranteed Service Model –Limitations of IP networks –Scheduling and Dropping Policies for BE and GS models –Traffic Shaping Algorithms–End to End Solutions –Laissez Faire Approach –Possible improvements in TCP –Significance of UDP in Inelastic Traffic.

UNIT III HIGH PERFORMANCE NETWORKS 9

Integrated Services Architecture –Components and Services –Differentiated Services Networks –Per Hop Behavior –Admission Control–MPLS Networks –Principles and Mechanisms –Label Stacking– RSVP–RTP/RTCP.

UNIT IV NETWORK DEVICE ARCHITECTURE 9

Network Devices –Switch–Router–Hardware Components–Software –Configuration– Routing Concepts–Static Routing –Dynamics Routing –Routing Information Protocol – Configuration –Open Shortest Path First Protocol –Configuration –Access Control List – Standard –Extended –Named. Multiplexers, Modems and Internet Access Devices – Switching and Routing Devices–Router Structure –Configuring EGP –RIP –OSPF –IS-IS– Hub –Bridges –Routers –Link Virtualization –Multicast Architecture.

UNIT V SOFTWARE DEFINED NETWORKING 9

Evolution of SDN -Control Plane - Control and data plane separation - Network Virtualization - Data Plane - Programming SDNs - Verification and Debugging - open flow networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Kaveh Pahlavan, " Understanding Communications Networks – for Emerging Cybernetics Applications ", 1st Edition, River Publishers, 2021.
- 2 Larry L Peterson, Carmelo Cascone, Brian O'Connor, Thomas Vachuska, Bruce Davie, "Software Defined networks: A Systems Approach", 1st Edition, Pearson Education, 2020.

REFERENCES:

- 1 Tanenbaum, "Computer Networks", 6th Edition, Pearson Education, 2022.

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

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_cs94/preview
- 2 <http://digimat.in/nptel/courses/video/106105183/L03.html>
- 3 https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

COURSE OUTCOMES:

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

- CO1** Explain the Principles and practices of network engineering.
CO2 Comprehend the QoS Methodologies in network.
CO3 Summarize emerging technologies in network engineering
CO4 Explain the architecture of the network devices.
CO5 Explain the need for SDN and its data plane operations.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23PEIT20

NETWORK ANALYSIS IN SOCIAL MEDIA

L T P C
3 0 0 3

Prerequisite: Computer Networks

COURSE OBJECTIVES:

- To understand the concept of semantic web and related applications.
- To understand human behavior in social web and related communities.
- To learn visualization of social networks.

UNIT I

INTRODUCTION

9

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

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

9

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

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS

9

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

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES

9

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

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

9

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

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1 John McLevey, John Scott, Peter J, "The SAGE Handbook of Social Network Analysis", 2nd Edition, SAGE Publication, 2023.
- 2 Tanmoy Chakraborty, "Social Network Analysis", 1st Edition, John Wiley & Sons, 2021.

REFERENCES:

- 1 Ratandeep Kaur, "An Extended Approach Pertaining to Privacy Preserving Data Mining PPDM in Social Networking", 1st Edition, Blurb, 2022.
- 2 Moussa Pourya Asl, Pantea Keikhosrokiani, "Opinion Mining and Text Analytics on Literary Works and Social Media", 1st Edition, Business Science Reference Publisher, 2022.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105167/>
- 2 <https://www.digimat.in/nptel/courses/video/106105167/L01.html>
- 3 https://onlinecourses.nptel.ac.in/noc22_cs117/preview

COURSE OUTCOMES:

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

- CO1** Comprehend the cloud concepts and fundamentals for Virtualization.
CO2 Analyze the security challenges in the cloud.
CO3 Explain cloud policy and Identity and Access Management.
CO4 Analyze various designs patterns involved in cloud security.
CO5 Analyze various risks and audit and monitoring mechanisms in the cloud.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO5	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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U23PEIT21**NETWORK PERFORMANCE ANALYSIS****L T P C****Pre requisites:** Computer Networks, Mobile Computing**2 0 2 3****COURSE OBJECTIVES:**

- To understand the mathematical basis for analyzing the performance of networks.
- To analyze model traffic control protocols, and error control protocols using these concepts.
- To analyze performance of wired and wireless MAC such as 802.3, 802.11 and 802.16.

UNIT I**MARKOV CHAINS BASICS****6**

Overview of Random Processes, Markov Chains – Markov matrices, State transition matrix, Markov chains at equilibrium – steady state distribution vector.

UNIT II**REDUCIBLE AND PERIODIC MARKOV CHAINS****6**

Reducible Markov chain – Transition matrix, Reducible Composite Markov chain, Transient analysis, Steady state, Periodic Markov chain – Transition matrix, canonical form, Strongly and weakly periodic Markov chains, Queuing Analysis – M/M/1 queues, M/M/1/B queues, D/M/1/B Queues, performance, communicating Markov chains.

UNIT III**TRAFFIC CONTROL, ERROR CONTROL AND MAC MODELING****6**

Modeling traffic control protocols – Modeling leaky bucket and token bucket algorithms- Stop and wait, Modeling media access control protocols – 802.1p, ALOHA, 802.3.

UNIT IV**WIFI AND WIMAX PERFORMANCE****6**

Modeling 802.11 protocol – Basic DCF modeling, RTS/CTS modeling, Modeling 802.11e, Performance, and 802.11e HCCA Performance. Modeling 802.16 protocol – system and user performance.

UNIT V**NETWORK TRAFFIC AND SCHEDULING****6**

Modeling network traffic – Flow traffic models – Discrete time modeling, Pareto traffic distribution, Destination traffic. Scheduling algorithms – Analysis.

30 PERIODS**PRACTICAL EXERCISES:**

1. Use the Gprof (GNU Profiler) to analyze the performance and statistics of a program
2. Data analysis using WEKA tool.
3. Introduction to Network simulator (NS2) and its various utilities NAM, XGraph etc. Creation of Wired and Wireless Network Scenarios and simulation of various protocols.
4. Wired and Wireless Network Performance Analysis using AWK and Python
5. Simulation of various queues in NS2 and analyzing their performances on various performance metrics such as throughput, average delay and packet.
6. Model computer systems using Markov Chain Theory and Perform Steady State Analysis.

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30 PERIODS**TOTAL: 60 PERIODS**

TEXT BOOKS:

1. Thomas Bonald, Mathieu Feuillet, "Network Performance Analysis", 2nd Edition, John Wiley & Sons, 2021.
2. Mor Harchol-Balter, "Performance Modeling and Design of Computer Systems: Queueing Theory in Action", 2nd Edition, Cambridge University Press, 2021.

REFERENCES:

1. Ross, Sheldon M, "Introduction to Probability Models", 12th Edition, Elsevier Publications, 2020.
2. Jean Walrand, Pravin Varaiya, "High-Performance Communication Networks", 3rd Edition, Elsevier Publications, 2020.

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/106/106/106106048/>
2. https://onlinecourses.nptel.ac.in/noc24_ee58/preview
3. https://onlinecourses.swayam2.ac.in/ntr25_ed44/preview

COURSE OUTCOMES:

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

- CO1** Explain the mathematical basis for analyzing the performance of networks.
- CO2** Apply Markov chain models and analyze the behavior of network systems.
- CO3** Analyze the flow control and error control using algorithm.
- CO4** Analyze the performance in Wi-Fi and WiMAX using protocols.
- CO5** Apply algorithm to analyze the network traffic and scheduling.

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	-	1	2	2
CO2	3	2	1	2	1	-	-	1	1	1	-	1	2	2
CO3	3	3	2	2	1	-	-	1	1	1	-	1	2	2
CO4	3	3	2	2	1	-	-	1	1	1	-	1	2	2
CO5	3	2	1	2	1	-	-	1	1	1	-	1	2	2

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U23PEIT22

NETWORK DESIGN AND PROGRAMMING

L T P C

Prerequisites: Computer Networks, Mobile Computing

2 0 2 3

COURSE OBJECTIVES:

- To understand the basic networking principles.
- To study two novel networking technologies: SDN and DTN
- To learn network programming in UNIX C

UNIT I

NETWORKING PRINCIPLES

6

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals
Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching
Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics
Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions.

UNIT II

PHYSICAL NETWORK DESIGN

6

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – topologies – Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks.

UNIT III

LOGICAL DESIGN AND MANAGEMENT

6

IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSM and CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN –RMON and SNMP.

UNIT IV

INNOVATIVE NETWORKS

6

Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers – Network Function Virtualization – Needs of the Data Centres – SDN solutions for data centres - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing.

UNIT V

NETWORK PROGRAMMING IN UNIX C

6

Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets – socket, connect, bind, listen, accept and close functions – TCP client and server – Elementary UDP sockets –recvfrom and sendto functions – Raw sockets – Client-server design alternatives – Iterative and Concurrent servers

30 PERIODS

PRACTICAL EXERCISES:

1. Develop a C program that demonstrates inter process communication.
2. Develop a TCP and UDP client/server application
3. Develop a multiprotocol server with TCP and UDP and 2 clients
4. Develop a Socket based application in Python
5. Build client applications for major APIs (Amazon S3, Twitter etc) in Python
6. Develop an application that interacts with e-mail servers in python.
7. Develop applications that work with remote servers using SSH, FTP etc in Python.

30 PERIODS

TOTAL :60 PERIODS

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CHENNAI - 600033.

TEXT BOOKS:

- 1 Mohamed Boucadair, Christian Jacquenet, "Design Innovation and Network Architecture for the Future Internet", 1st Edition, Business Science Reference, 2021.
- 2 Shyam Varan Nath, Ananya Simlai, Oğuzhan Kara, "Mastering 5G Network Design, Implementation and Operations", 1st Edition, Packt Publishing, 2023.

REFERENCES:

- 1 Scott S Lowe, Matt Oswalt, Jason Edelman, "Network Programmability and Automation: Skills for the Next-Generation Network Engineer", 2nd Edition, O'Reilly Media, 2023.
- 2 Lewis Van Winkle, "Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code", 2nd Edition, O'Reilly Media, 2023.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105183/>
- 2 <https://www.digimat.in/nptel/courses/video/106106243/L29.html>
- 3 https://onlinecourses.swayam2.ac.in/ntr25_ed64/preview

COURSE OUTCOMES:

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

- CO1** Apply the networking principles to design a network
- CO2** Analyze the various networking devices and protocols required for network design and management.
- CO3** Apply some protocol to design and manage the IPv4 and IPv6.
- CO4** Apply SDN in computing paradigms like Cloud Computing and Internet of Things.
- CO5** Develop applications using socket programming.

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	1	1	-	1	2	2
CO2	3	3	2	2	1	-	-	1	1	1	-	1	2	2
CO3	3	2	1	2	1	-	-	1	1	1	-	1	2	2
CO4	3	2	1	2	1	-	-	1	1	1	-	1	2	2
CO5	3	3	3	3	1	-	-	1	1	1	-	1	2	2

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U23PEIT23

MODERN NETWORK TECHNOLOGIES

L T P C

Prerequisites: Computer Networks, Mobile Computing

2 0 2 3

COURSE OBJECTIVES:

- To understand the principles required for network design
- To explore various technologies in the wireless domain
- To study about 3G and 4G cellular networks

UNIT I

SCALABILITY AND CLUSTERING

6

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Switched networks – End to end semantics – Connection less, Connection oriented, Wireless Scenarios –Applications, Quality of Service- LAN cabling topologies – Ethernet Switches, Routers, Firewalls and L3 switches – Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP – Core networks, and distribution networks.

UNIT II

WIRELESS NETWORKS

6

IEEE 802.16 and WiMAX – Advanced 802.16 Functionalities – Mobile WiMAX – 802.16e – Network Infrastructure – WLAN – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security.

UNIT III

CELLULAR NETWORKS

6

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS– UTRAN –Core and Radio Network Mobility Management – UMTS Security.

UNIT IV

RADIO NETWORKS

6

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced - 4G Networks and Composite Radio Environment– Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G.

UNIT V

SOFTWARE DEFINED NETWORKS

6

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1. Build a simple WLAN Topology using ns-3 scripting or CORE GUI
2. Performance Analysis of MANET Routing Protocols using ns3 or INET Framework
3. 5G NR Network Simulation using Simu 5G or 5G-LENA
4. Describe some problems with Wi-Fi access for an apartment building and explain how it can be rectified.
5. Study error and throughput varies in a wireless LAN network changes as the distance between the Access Point and the wireless nodes is varied with NetSim or any Simulation tool.

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

- 1 Ltd Huawei Technologies, "4 Data Communications and Network Technologies", 1st Edition, Springer Publisher, 2022.
- 2 Christopher Cox, "Introduction to 5G: A Practical Approach", 1st Edition, Wiley, 2022.

REFERENCES:

- 1 Mahbub Hassan, "Wireless and Mobile Networking", 1st Edition, CRC Press Publishers, 2022.
- 2 Larry L Peterson, Carmelo Cascone, Brian O'Connor, Thomas Vachuska, Brucxe Davie, "Software Defined networks: A Systems Approach", 1st Edition, Wiley, 2020.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/108/106/106106167/>
- 2 https://onlinecourses.swayam2.ac.in/ntr25_ed44/preview
- 3 <http://www.digimat.in/nptel/courses/video/106106243/L32.html>

COURSE OUTCOMES:

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

- C01** Summarize the components required for designing a network
C02 Design a network at a high-level using different networking technologies
C03 Analyze the various protocols of wireless and cellular networks
C04 Discuss the features of 4G and 5G networks
C05 Analyze the software defined networks experiments

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	1	-	-	1	1	1	-	1	2	2
C02	3	3	3	3	1	-	-	1	1	1	-	1	2	2
C03	3	3	2	2	1	-	-	1	1	1	-	1	2	2
C04	3	3	2	2	1	-	-	1	1	1	-	1	2	2
C05	3	3	2	2	1	-	-	1	1	1	-	1	2	2

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U23PEIT24

WIRELESS ADHOC AND SENSOR NETWORKS

L T P C

Prerequisites: Computer Networks, Mobile Communication

3 0 0 3

COURSE OBJECTIVES:

- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

UNIT I

MAC & ROUTING IN AD HOC NETWORKS

9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

UNIT II

TRANSPORT & QOS IN AD HOC NETWORKS

9

TCP's challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model.

UNIT III

MAC & ROUTING IN WIRELESS SENSOR NETWORKS

9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

UNIT IV

TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS

9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

UNIT V

SECURITY IN AD HOC AND SENSOR NETWORKS

9

Security Attacks Intrusion Detection – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 C Siva Ram Murthy, B S Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", 1st Edition, Pearson Education, 2020.
- 2 Pawan Singh, Sudesh Kumar, Sachin Kumar Gupta, Abhay Kumar Rai, Abdu Gumae, "Wireless Ad-hoc and Sensor Networks: Architecture, Protocols, and Applications", 1st Edition, CRC Publisher, 2024.

REFERENCES:

- 1 Shashikant V Athawale, "Adhoc and wireless sensor network", 1st Edition, Pearson Education, 2022.
- 2 Hossam Mahmoud Ahmad Fahmy, "Wireless Sensor Networks: Energy Harvesting and Management for Research and Industry", 1st Edition, Springer Publishers, 2020.

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ONLINE RESOURCES:

- 1 <http://digimat.in/nptel/courses/video/106106169/L01.html>
- 2 <https://nptel.ac.in/courses/106106239>
- 3 <https://www.classcentral.com/course/swayam-wireless-ad-hoc-and-sensor-networks-7888>

COURSE OUTCOMES:

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

- C01** Explain the working of MAC and routing protocol in adhoc.
- C02** Describe the transport layer protocols and their QOS in adhoc.
- C03** Describe the issues and challenges of MAC and routing protocol in sensor network.
- C04** Summarize the transport layer protocols and QOS in sensor.
- C05** Explain the security issues in adhoc and sensor networks.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	1	3	3
C02	2	2	1	1	-	-	-	1	-	-	-	1	3	3
C03	2	2	1	1	-	-	-	1	-	-	-	1	3	3
C04	2	2	1	1	-	-	-	1	-	-	-	1	3	3
C05	2	2	1	1	-	-	-	1	-	-	-	1	3	3

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U23PEIT25

CG Art and Technology

L	T	P	C
2	0	2	3

Pre requisites: Programming in C

COURSE OBJECTIVES:

- To understand illumination and color models.
- To understand two-dimensional, three-dimensional graphics and their transformations.
- To learn various software programs used in the creation and implementation of multi-media.

UNIT I ILLUMINATION AND COLOR MODELS 6

Light sources - basic illumination models - halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

UNIT II OUTPUT PRIMITIVES 6

Points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms- Pixel addressing and object geometry, filled area primitives. Attributes of Output Primitives: Line Attributes - Curve Attributes - Color and Gray scale levels- Area fill Attributes - Character Attributes - Bundled Attributes - Inquiry Functions.

UNIT III TWO-DIMENSIONAL GRAPHICS 6

Two dimensional geometric transformations - Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing - viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations - point, line, and polygon clipping algorithms.

UNIT IV THREE-DIMENSIONAL GRAPHICS 6

Three dimensional concepts- Three-dimensional object representations - Polygon surfaces Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations - Bezier curves and surfaces -B-Spline curves and surfaces.

UNIT V TRANSFORMATION AND VIEWING 6

Three dimensional geometric and modelling transformations - Translation, Rotation, Scaling, composite transformations- Three-dimensional viewing - viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Implementation of Algorithms for drawing 2D Primitives - Line (DDA, Bresenham) - all slopes Circle (Midpoint)
- 2 2D Geometric transformations - Translation Rotation Scaling Reflection Shear Window-Viewport
- 3 Composite 2D Transformations
- 4 Line Clipping.

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- 5 3D Transformations - Translation, Rotation, Scaling.
- 6 3D Projections – Parallel, Perspective
- 7 Creating 3D Scenes.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Sumanta Guha, Computer Graphics through OpenGL: From Theory to Experiments, 4th Edition, CRC Press, 2023.
- 2 Karsten Lehn, Merijam Gotzes, and Frank Klawonn, Introduction to Computer Graphics Using OpenGL and Java, 3rd Edition, Springer Publications, 2023.

REFERENCES:

- 1 Eric Lengyel, Mathematics for 3D Game Programming and Computer Graphics, 3rd Edition, Cengage Learning, 2020.
- 2 Donald Hearn, Pauline Baker M, "Computer Graphics", 1st Edition, Prentice Hall of India, 2020.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/106102065/L01.html>
- 2 https://onlinecourses.swayam2.ac.in/ntr24_ed38/preview
- 3 https://onlinecourses.swayam2.ac.in/ntr23_ed11/preview

COURSE OUTCOMES:

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

- CO1** Describe the concepts of illumination and color model techniques.
CO2 Analyze two-dimensional geometric transformation and clipping techniques.
CO3 Apply three dimensional transformations and viewing techniques.
CO4 Summarize different types of multimedia file format.
CO5 Design basic 3D Scenes using Blender Graphics.

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	-	1	2	2
CO2	3	3	2	2	2	-	-	1	1	1	-	1	2	2
CO3	3	2	1	2	2	1	-	1	1	1	-	1	2	2
CO4	2	2	1	1	1	-	-	1	1	1	-	1	2	2
CO5	3	3	3	3	2	-	-	1	1	1	-	1	2	2

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U23PEIT26

3D PRINTING TECHNOLOGY

L T P C

Pre-requisite: Computer Graphics

3 0 0 3

COURSE OBJECTIVES:

- To Summarize basics of 3D printing.
- To Understand the principles of 3D printing technique and illustrate inkjet technology.
- To Learn and illustrate laser technology and discuss the applications of 3D printing.

UNIT I

INTRODUCTION

9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing -3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.

UNIT II

PRINCIPLE

9

Processes – Extrusion, Wire, Granular, Lamination, Photo polymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.

UNIT III

INKJET TECHNOLOGY

9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continuous jet, Multijet; Powder based fabrication – Colour jet.

UNIT IV

LASER TECHNOLOGY

9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow– Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V

INDUSTRIAL APPLICATIONS

9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL: 45 PERIODS

TEXTBOOKS:

- 1 Louis Gomera, "3D Printing: A Comprehensive Guide for Beginners to Learning 3D Printing Projects and Techniques", 2nd Edition, Springer Publications, 2020.
- 2 R. K. Gupta, Amit Kumar, P. K. Jain, "Additive Manufacturing and 3D Printing Technology: Principles and Applications", 1st Edition, Woodhead Publishing, 2020.

REFERENCES:

- 1 Christopher Barnatt, "3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform", 2nd Edition, Explaining The Future.com, 2018.
- 2 Ian M. Hutchings, Graham D. Martin, "Inkjet Technology for Digital Fabrication", 1st Edition, John Wiley & Sons, 2018.

ONLINE RESOURCES

1. https://jlc3dp.com/?from=VBS_3DCustom&msclkid=6fc59e26ef4e1fcaccd7fbc767504eda
2. <https://weareprintlab.com/>
3. <https://www.3dsourced.com/rankings/sites-for-stl-files-3d-printer-models-files/>

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COURSE OUTCOMES:

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

C01 Summarize the basic concepts of 3D printing technology.

C02 Describe 3D printing workflow.

C03 Explain and categories the concepts and working principles of 3D printing using inkjet Technique.

C04 Explain and categories the working principles of 3D printing using laser technique.

C05 Explain various method for designing and modeling for industrial applications

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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U23PEIT27

MULTIMEDIA AND ANIMATION

L T P C

Pre-requisite: Computer Graphics

2 0 2 3

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION TO MULTIMEDIA 6

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

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS 6

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORIZING 6

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

UNIT IV ANIMATION 6

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Key frame, Morphing, Inverse Kinematics, Hand 165 Drawn, Character rigging, vector animation, stop motion, motion graphics, Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS 6

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

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

- 1 Working with Image Editing tools: Install tools like GIMP/ InkScape / Krita / Pencil and perform editing operations: Use different selection and transform tools to modify or improve an image Create logos and banners for home pages of websites.
- 2 Working with Audio Editing tools: Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fadein or fade-out etc., Perform audio compression by choosing a proper codec.
- 3 Working with Video Editing and conversion tools: Install tools like OpenShot / Cinelerra / HandBrake for editing video content. Edit and mix video content, remove noise, create special effects, add captions. Compress and convert video file format to other popular formats.
- 4 Working with web/mobile authoring tools: Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ NetBeans / WordPress /Expression Web: Design simple

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Home page with banners, logos, tables quick links etc Provide a search interface and simple navigation from the home page to the inside pages of the website. Design Responsive web pages for use on both web and mobile interfaces.

- 5 Working with Animation tools: Install tools like, Krita, Wick Editor, Blender: Perform a simple 2D animation with sprites Perform simple 3D animation with keyframes, kinematics Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,
- 6 Working with E-Learning authoring tools: Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStudio/Ampache, VideoLAN: Demonstrate screen recording and further editing for e-learning content. Ø Create a simple E-Learning module for a topic of your choice.
- 7 Creating VR and AR applications: Any affordable VR viewer like Google Cardboard and any development platform like Openspace 3D / ARCore etc

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", 3rd Edition, Springer Publications, 2021.
- 2 Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", 1st Edition, Springer Publications, 2021.

REFERENCES:

- 1 Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
- 2 John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, 3rd Edition, CRC press, 2016.

ONLINE RESOURCES

- 1 <https://itsfoss.com/> 2. <https://www.ucl.ac.uk/slade/know/3396>
- 2 <https://opensource.com/article/18/2/open-source-audio-visual-production-tools>
- 3 <https://camstudio.org/>
- 3 <https://developer.android.com/training/animation/overview>

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

- CO1** Summarize the Fundamental Concepts of Multimedia Elements and Systems.
- CO2** Describe Multimedia File Formats and Standards.
- CO3** Analyze the Process of Authoring Multimedia Presentations.
- CO4** Explain the Techniques of Animation in 2D and 3D and for Mobile AI.
- CO5** Describe Different Applications of Multimedia.

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	1	-	1	2	2
CO2	2	2	1	1	2	-	-	1	1	1	-	1	2	2
CO3	3	3	2	2	2	-	-	1	1	1	-	1	2	2
CO4	2	2	1	1	2	-	-	1	1	1	-	1	2	2
CO5	2	2	1	1	3	1	-	1	2	2	-	1	2	2

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U23PEIT28

VISUAL TECHNOLOGIES

L T P C

Pre-requisite: Computer Graphics and Multimedia

3 0 0 3

COURSE OBJECTIVES:

- To understand basic idea on animation principles and techniques
- To learn CGI, color and light elements of VFX
- To understand popular compositing techniques

UNIT I ANIMATION BASICS 9

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

UNIT II CGI, COLOR, LIGHT 9

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

UNIT III SPECIAL EFFECTS 9

Special Effects – props, scaled models, animatronics, pyrotechniques, Schufftan process, Particle effects – wind, rain, fog, fire.

UNIT IV VISUAL EFFECTS TECHNIQUES 9

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

UNIT- V COMPOSITING 9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL :45 PERIODS

TEXT BOOKS:

- 1 Chris Roda, Real Time Visual Effects for the Technical Artist, 1st Edition, CRC Press, 2022.
- 2 Steve Wright, Digital Compositing for film and video, 5th Edition, Routledge, 2024.

REFERENCES:

- 1 Jon Gress, "Digital Visual Effects and Compositing", 1st Edition, New Riders Press, 2014.
- 2 Luiz Velho, Bruno Madeira, "Introduction to Visual Effects: A Computational Approach", 1st Edition, Routledge, 2023.

ONLINE RESOURCES:

- 1 <http://www.nptelvideos.com/lecture.php?id=6268>
- 2 <https://www.blender.org/features/vfx>
- 3 <http://elearn.psgcas.ac.in/nptel/courses/video/106106090/106106090.html>

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COURSE OUTCOMES:

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

C01 Apply animation in 2D / 3D following the principles and techniques

C02 Apply CGI, color and light elements in VFX applications.

C03 Design special effects using any of the state-of-the-art tools

C04 Apply popular visual effects techniques using advanced tools

C05 Apply compositing tools for creating VFX for a variety of applications

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	2	-	-	-	-	-	-	-	-	3	3
C02	3	3	2	2	-	-	-	-	-	-	-	-	2	2
C03	3	3	3	3	-	-	-	-	1	2	1	-	2	2
C04	3	3	2	2	-	-	-	-	-	-	-	2	2	3
C05	3	3	2	2	-	-	-	-	1	2	2	3	2	3

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U23PEIT29 COMPRESSION TECHNOLOGY IN MULTIMEDIA**L T P C****Prerequisite:** Computer Graphics and Multimedia**3 0 0 3****COURSE OBJECTIVES:**

- To understand the basics of compression techniques.
- To learn the modalities of text, image and video compression algorithms
- To understand the concepts of data streaming services.

UNIT I BASICS OF DATA COMPRESSION 9

Introduction --Lossless and Lossy Compression- Basics of Huffman coding- Arithmetic coding Dictionary techniques- Context based compression – Applications

UNIT II IMAGE COMPRESSION 9

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

UNIT III VIDEO COMPRESSION 9

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2-H.263

UNIT IV DATA PLACEMENT ON DISKS 9

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

UNIT- V DISK SCHEDULING METHODS 9

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

- 1 Yun-Qing Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards", 3rd Edition, CRC Press, 2021.
- 2 Mihaela Schaar, Deepak S. Turaga, Thomas Stockhammer "MPEG-4 Beyond Conventional Video Coding", 2nd Edition, Morgan & Claypool, 2022.

REFERENCES:

- 1 Ze-Nian Li, Mark S. Drew "Fundamentals of Multimedia", 3rd Edition, Springer Publisher, 2021.
- 2 Richard E. Mayer, Logan Fiorella "Handbook of Multimedia Learning ", 3rd Edition, Cambridge University Press, 2022.

ONLINE RESOURCES:

- 1 <http://elearn.psgcas.ac.in/nptel/courses/video/106102064/L19.html>
- 2 <https://www.blender.org/features/vfx>
- 3 <http://elearn.psgcas.ac.in/nptel/courses/video/106102064/106102064.html>

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COURSE OUTCOMES:

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

- C01** Describe the basics of text, Image and Video compression
C02 Summarize the various compression algorithms for multimedia content
C03 Apply the applications of various compression techniques
C04 Apply the knowledge on multimedia storage on disks
C05 Summarize the scheduling methods for request streams

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	2	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	2	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	2	2	3
C05	2	2	1	1	-	-	-	1	-	-	-	3	2	2

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U23PEIT30	FOUNDATIONS OF DIGITAL EDITING	L	T	P	C
Pre-requisite: Visual technology, Animation		2	0	2	3

COURSE OBJECTIVES:

- To understand the perspective of linear and nonlinear editing concepts
- To learn audio and video recording and different media tools
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT I FUNDAMENTALS 6

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

UNIT II STORYTELLING 6

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

UNIT III USING AUDIO AND VIDEO 6

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO 6

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

UNIT V WORKING WITH AVID XPRESS DV 4 6

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

30 PERIODS

PRACTICAL EXERCISES

- 1 Write a Movie Synopsis and Script/Storyboard Writing
- 2 Present team stories in class.
- 3 Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts and agreements
- 4 Production: Single camera production personnel & equipment, Documentary Production
- 5 The Final Proposal: Overview, Media Treatments, Summary, Pitching and Documentary and Animation Treatment.
- 6 Post-productions: Editing, Sound design, Finishing

30 PERIODS

TOTAL :60 PERIODS

TEXTBOOKS:

- 1 Blain Brown, "Basics of Filmmaking: Screenwriting, Producing, Directing, Cinematography, Audio, & Editing", 1st Edition, A Focal Press, 2020.
- 2 Sonja Schenk, "The Digital Filmmaking Handbook", 7th Edition, Long Ben Publisher, 2021.

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REFERENCES:

- 1 Charles Roberts, "Digital Video Editing with Final Cut Express: The Real-World Guide to Set Up and Workflow", 1st Edition, Focal Press, 2023
- 2 Dancyger Ken, "The Technique of Film and Video Editing – History, Theory and Practice", 5th Edition, Focal Press, 2013

ONLINE RESOURCES

- 1 <https://www.veed.io/tools/video-editor>
- 2 <https://www.visme.co/video-maker/>
- 3 <https://clipchamp.com/en/video-editor/>

COURSE OUTCOMES:

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

- CO1** Describe the strengths and limitations of Nonlinear editing.
CO2 Summarize the infrastructure and significance of storytelling.
CO3 Apply suitable methods for recording to CDs and VCDs.
CO4 Analyze the core issues of advanced editing and training techniques.
CO5 Design and develop projects using AVID XPRESS DV 4.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	2	1	1	1	-	-	-	1	2	3	2	3	1
CO2	2	2	1	1	1	-	-	-	1	2	2	1	1	1
CO3	3	2	1	2	2	-	-	-	3	1	1	1	2	1
CO4	3	3	2	2	2	-	-	-	3	2	1	1	2	2
CO5	3	3	3	3	2	-	-	-	3	2	1	2	2	2


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U23PEIT31

SECURE SOFTWARE SYSTEMS

L T P C

Pre requisites: Software Engineering, Computer Networks

2 0 2 3

COURSE OBJECTIVES:

- To understand the importance and need for software security and to know about the various attacks.
- To Learn about secure software design and risk management techniques in software development.
- To understand the concepts and working of tools related to software security.

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

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

UNIT II SECURE SOFTWARE DESIGN 6

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

UNIT III SECURITY RISK MANAGEMENT 6

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

UNIT IV SECURITY TESTING 6

Traditional Software Testing – Secure Software Development Life Cycle – Risk Based Security Testing – Prioritizing Security Testing with Threat Modeling – Penetration Testing– Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation -Exploits and Client-Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection- Tools for Penetration Testing

UNIT V SECURE PROJECT MANAGEMENT 6

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

30 PERIODS

PRACTICAL EXERCISES:

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Perform Penetration testing on a web application to gather information about the system, then Initiate XSS and SQL injection attacks using tools like Kali Linux.
5. Develop and test the secure test cases
6. Penetration test using kali Linux

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Anand Handa, Rohit Negi, Sandeep Kumar Shukla, "Implementing Enterprise Cybersecurity with Opensource Software and Standard Architecture", 1st Edition, River Publishers, 2021.
2. Neha Kaul, "Software Security: Building Secure Software Applications", 1st Edition, Archer Press, 2020.

REFERENCES:

- 1 Erik Fretheim, Marie Deschene, "Secure Software Systems", 2nd Edition, O'Reilly Media, 2023.
- 2 Diana Kelley, Ed Moyle, "Practical Cybersecurity Architecture ", 2nd Edition, Packt Publishing, 2023.

ONLINE RESOURCES:

- 1 <https://tkiet.digimat.in/nptel/courses/video/106106234/L04.html>
- 2 <https://www.digimat.in/nptel/courses/video/106105150/L01.html>
- 3 <https://archive.nptel.ac.in/courses/110/104/110104073/>


COURSE OUTCOMES:

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

- CO1** Comprehend about various vulnerabilities related to memory attacks.
- CO2** Apply security principles in software development.
- CO3** Evaluate Security risk management.
- CO4** Apply various testing methodologies.
- CO5** Apply software security tools.

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	3
CO2	3	2	1	2	1	-	-	1	2	2	-	1	2	3
CO3	3	3	2	2	1	-	-	1	2	2	-	1	2	3
CO4	3	3	2	2	1	-	-	1	2	2	-	1	2	3
CO5	3	3	2	2	1	-	-	1	2	2	-	1	2	3


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U23PEIT32

DIGITAL AND MOBILE FORENSICS

Pre Requisites: Mobile Computing, Cyber security

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand basic digital forensics, techniques, digital crime and investigation.
- To learn about how to be prepared for digital forensic readiness.
- To learn about how to use forensics tools for iOS devices and Android devices.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Andre Arnes, "Digital Forensics", 1st Edition, Wiley, 2020.
- 2 Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", 1st Edition, CRC Press, 2022.

REFERENCES:

- 1 Chuck Easttom, "Digital Forensics, Investigation, and Response", 4th Edition, Jones & Bartlett Learning, 2021.
- 2 Greg Gogolin, "Digital Forensics Explained", 2nd Edition, CRC Press, 2021.

ONLINE RESOURCES:

- 1 https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
- 2 <https://nptel.ac.in/courses/106106178>
- 3 <https://nptel.ac.in/courses/106106178>

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COURSE OUTCOMES:

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

- C01** Comprehend the basic concepts of digital forensics
- C02** Summarize about digital crimes and their investigations.
- C03** Comprehend the concepts of digital forensic readiness.
- C04** Comprehend about Ios Forensics
- C05** Comprehend about android forensics.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1		-	-	-	2	3
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C03	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	3
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	3

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U23PEIT33

HACKING PRINCIPLES AND PRACTICES

L T P C
2 0 2 3

Pre Requisites: Computer Networks, Cyber Security

COURSE OBJECTIVES:

- To understand the basics of Ethical hacking and OSI layers
- To understand the concept of Foot Printing, scanning networks, Enumeration and vulnerability analysis.
- To understand the basics of system Hacking and network production systems.

UNIT I

INTRODUCTION

6

Ethical Hacking Overview - Role of Security and Penetration Testers- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Network and Computer Attacks - Malware - Protecting Against Malware Attacks- Intruder Attacks - Addressing Physical Security.

UNIT II

FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS

6

Foot printing Concepts – Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence – Foot printing through Social Engineering – Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III

ENUMERATION AND VULNERABILITY ANALYSIS

6

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities- Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

UNIT IV

SYSTEM HACKING

6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT V

NETWORK PROTECTION SYSTEMS

6

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots

30 PERIODS

PRACTICAL EXERCISES:

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.
4. Information gathering using tools like Robtex.
5. Scan the target using tools like Nessus
6. View and capture network traffic using Wireshark.

30 PERIODS

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Daniel Graham, "Ethical Hacking", 1st Edition, No Starch Press, 2021
2. J Thomas, "Mastering Ethical Hacking", 1st Edition, Code Academy, 2023.

REFERENCES:

1. J Clarke, "Ethical Hacking - A Hand's on Guide to Career Based Hacking", 1st Edition, Code Academy, 2024.
2. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", 2nd Edition, John Wiley & Sons, 2025.
3. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2025.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_cs13/preview
- 2 <https://archive.nptel.ac.in/courses/106/105/106105217/>
- 3 <https://www.digimat.in/nptel/courses/video/106105217/L33.html>

COURSE OUTCOMES:

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

- CO1** Comprehend the basic concepts of Networks and Ethical Hacking
- CO2** Apply the concepts of foot printing, reconnaissance and scanning methods
- CO3** Analyze enumeration and vulnerability methods.
- CO4** Apply hacking options available in Web and wireless applications
- CO5** Comprehend the knowledge on the options for network protection

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	3
CO2	3	2	1	2	1	-	-	1	2	2	-	-	2	3
CO3	3	3	2	2	1	-	-	1	2	2	-	-	2	3
CO4	3	2	1	2	1	-	-	1	2	2	-	-	2	3
CO5	2	2	1	1	1	-	-	1	2	2	-	1	2	3


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U23PEIT34	MALWARE ANALYSIS AND DETECTION	L	T	P	C
Pre Requisites: Computer Networks, Cyber security		3	0	0	3

COURSE OBJECTIVES:

- To understand fundamentals of malware, types and its effects.
- To learn to identify and analyse various malware types by static analysis.
- To learn detection, analysis, understanding, controlling, and eradication of malware.

UNIT I INTRODUCTION AND BASIC ANALYSIS 9

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing.

UNIT II ADVANCED STATIC ANALYSIS 9

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

UNIT III ADVANCED DYNAMIC ANALYSIS 9

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Exception Handling, Patching.

UNIT IV MALWARE FUNCTIONALITY 9

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching-Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

UNIT V ANDROID MALWARE ANALYSIS 9

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abhijit Mohanta, Anoop Saldanha, "Malware Analysis and Detection Engineering: A Comprehensive Approach to Detect and Analyze Modern Malwar", 1st Edition, Apress, 2020.
2. Michael Sikorski, Andrew Honig, "Practical Malware Analysis", 2nd Edition, No Starch Press, 2022.

REFERENCES:

1. Daniel G Graham," Ethical Hacking: A Hands-on Introduction to Breaking In", 1st Edition, No Starch Press, 2021
2. Rafay Baloch," Web Hacking Arsenal: A Practical Guide to Modern Web Pentesting", 2nd Edition, CRC Press, 2024.

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ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105217/>
- 2 <https://www.digimat.in/nptel/courses/video/106106248/L40.html>
- 3 <https://www.digimat.in/nptel/courses/video/106106248/L42.html>

COURSE OUTCOMES:

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

- C01** Describe the various concepts of malware analysis and their technologies used.
- C02** Comprehend the independent analysis of modern malware samples using static analysis techniques
- C03** Summarize the modern malware samples using dynamic analysis techniques
- C04** Analyze debug and disassemble any malicious software by malware analysis
- C05** Describe the concept of Android malware analysis their architecture, and App development

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	3
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C03	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C04	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	3

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U23PEIT35

SECURITY IN WEB

L T P C

Pre Requisites: Computer Networks, Cyber security

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of Cloud Security concepts and secure development and deployment process.
- To learn about access control and identity management.
- To learn about the design patterns of cloud security and the process of monitoring, auditing and management.

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys, OAuth2-Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", 1st Edition, O'Reilly Media, Inc., 2020.
2. Neil Madden, "API Security in Action", 1st Edition, Manning Publications, 2020.

REFERENCES:

1. Ravi Das and Greg Johnson, "Testing and Securing Web Applications", 1st Edition, Taylor & Francis Group, 2021.
2. Prabath Siriwardena, "Advanced API Security", 1st Edition, Apress Media, 2020

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/128106006>
- 2 <http://digimat.in/nptel/courses/video/106106178/L12.html>
- 3 <https://archive.nptel.ac.in/courses/106/105/106105217/>

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COURSE OUTCOMES:

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

- C01** Comprehend the basic concepts of web security.
- C02** Summarize various development and deployment models used for securing web.
- C03** Summarize various Secure Web Applications that use Secure APIs
- C04** Apply Vulnerability assessment and Penetration testing.
- C05** Comprehend about various hacking techniques and tools.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	3
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C03	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C04	2	2	1	1	-	-	-	1	-	-	-	-	2	3
C05	2	2	1	1	1	-	-	1	-	-	-	1	2	3

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U23PEIT36

SECURITY AND PRIVACY IN CLOUD

L	T	P	C
2	0	2	3

Pre Requisites: Cyber Security, Cloud Computing

COURSE OBJECTIVES:

- To understand the fundamentals of Cloud Security concepts and secure development and deployment process.
- To learn about access control and identity management.
- To learn about the design patterns of cloud security and the process of monitoring, auditing and management.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 6

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 6

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 6

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 6

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 6

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing - Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

30 PERIODS

PRACTICAL EXERCISES:

1. Implement any encryption algorithm to protect the images
2. Implement any image obfuscation mechanism
3. Implement a role-based access control mechanism in a specific scenario
4. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
5. simulate a secure file sharing using a cloud sim

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6. implement an attribute-based access control mechanism based on a particular scenario
7. Develop a log monitoring system with incident management in the cloud

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing: Foundations and Applications Programming", 1st Edition, Morgan Kaufmann Publishers, 2020.
2. T Ananth Kumar, T S Arun Samuel, R Dinesh Jackson Samuel, M Niranjana Murthy, "Privacy and Security Challenges in Cloud Computing- A Holistic Approach", 2nd Edition, CRC Press, 2024.

REFERENCES:

1. D Lakshmi, Amit Tyagi, "Emerging Technologies and Security in Cloud Computing", Information Science Reference, 1st Edition, IGI Global Publishers, 2024.
2. Brij B Gupta, "Cloud Security: Concepts, Applications and Perspectives", Cyber Ecosystem and Security, 2nd Edition, CRC Press, 2021.

ONLINE RESOURCES:

- 1 <http://acl.digimat.in/nptel/courses/video/106105167/L28.html>
- 2 <http://digimat.in/nptel/courses/video/106106178/L12.html>
- 3 <https://archive.nptel.ac.in/courses/106/105/106105217/>

COURSE OUTCOMES:

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

- CO1** Apply the basic concepts of cloud and security.
- CO2** Illustrate the security challenges in the cloud.
- CO3** Apply cloud policy and Identity and Access Management.
- CO4** Analyze various risks and audit and monitoring mechanisms in the cloud
- CO5** Analyze various architectural and design considerations for security in the cloud.

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	2	-	1	2	3
CO2	3	2	1	2	1	-	-	1	2	2	-	-	2	3
CO3	3	2	1	2	2	-	-	1	2	2	-	-	2	3
CO4	3	3	2	2	2	-	-	1	2	2	-	-	2	3
CO5	3	3	2	2	2	-	-	1	2	2	-	1	2	3

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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 - 2×2 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.

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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

- C01** Analyze the notations and properties of algebraic structures such as groups, rings and fields.
- C02** Analyze the polynomial rings and irreducible polynomials over finite fields.
- C03** Apply the division algorithm and fundamental theorems on prime numbers.
- C04** Apply the congruence relation in number theory to solve the real life problems.
- C05** Analyze the concepts of multiplicative functions and classical theorems.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	2	2	-	-	-	-	-	-	-	-
C02	3	3	2	2	-	-	-	-	-	-	-	-
C03	3	2	1	2	-	-	-	-	-	-	-	-
C04	3	2	1	2	-	-	-	-	-	-	-	-
C05	3	3	2	2	-	-	-	1	-	-	-	1


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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

- C01** Apply the concepts of probability and some standard distributions in real life problems.
- C02** Analyze the concepts of two dimensional random variables.
- C03** Apply the concept of random processes in Engineering disciplines.
- C04** Analyze the various queue models.
- C05** 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
C01	3	2	1	2	-	-	-	-	-	-	-	-
C02	3	3	2	2	-	-	-	-	-	-	-	-
C03	3	2	1	2	-	-	-	-	-	-	-	-
C04	3	3	2	2	-	-	-	1	-	-	-	1
C05	3	2	1	2	-	-	-	-	-	-	-	-

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U230E103

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.

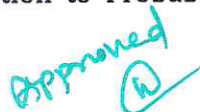
TOTAL: 45 PERIODS

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

- C01** Apply one- and two-dimensional random variables in engineering applications.
C02 Apply the concept random processes in engineering disciplines.
C03 Apply special random process to model the occurrences of events and the time points.
C04 Analyze the concept of autocorrelation, cross correlation, power spectral density and its importance in communication Engineering.
C05 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
C01	3	2	1	2	-	-	-	1	-	-	-	1
C02	3	2	1	2	-	-	-	1	-	-	-	1
C03	3	2	1	2	-	-	-	1	-	-	-	1
C04	3	3	2	2	-	-	-	1	-	-	-	1
C05	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.

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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

- C01** Solve system of linear equations and test the consistency.
C02 Analyze the basis and dimension of vector space.
C03 Solve linear transformation and its matrix representation.
C04 Solve orthonormal basis of inner product space and find least square approximation.
C05 Evaluate the eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	1	-	-	-	1	-	-	-	1
C02	3	3	2	2	-	-	-	-	-	-	-	1
C03	3	2	1	1	-	-	-	1	-	-	-	1
C04	3	2	1	1	-	-	-	-	-	-	-	1
C05	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 Resnick, 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

- C01 Describe the mechanical concepts in various appliances.
C02 Apply the elementary mechanical concepts in sound and optics.
C03 Explain the working of electrical and electronic appliances.
C04 Summarize the basic concepts in Geo Physics and nuclear physics.
C05 Apply the concepts of nuclear physics and space sciences in our daily life.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	3	2	1	2	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	-
C05	3	2	1	2	-	-	-	-	-	-	-	-

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U230E106

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.

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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

- C01** Describe the power gadgets and their maintenance.
C02 Explain the devices used for communication and entertainment.
C03 Explain the information about multiple brand products to make intelligent purchase decisions.
C04 Summarize the online resources and awareness about their making policies.
C05 Describe the significance of social networking sites, knowledge on complaint procedure and security issues.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	-
C05	2	2	1	1	-	-	-	-	-	-	-	-

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U230E107

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 EXEMPLIFIED 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.

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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

- C01 Summarize the knowledge about the physical forces exemplified in the human body.
- C02 Explain the importance of heat transfer in human body.
- C03 Describe the principle mechanism of matter waves and applications of ultrasound.
- C04 Apply the various laws of fluid flow in the study of human body.
- C05 Summarize the concepts of acoustic and radiation therapy.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	1
C04	3	2	1	2	-	-	-	-	-	-	-	-
C05	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.

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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

- C01** Apply physics principles to the interpretation of a broad range of astrophysical Observations.
- C02** Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories.
- C03** Summarize the basic properties of the Sun.
- C04** Describe the features of objects in the Solar System, giving details of similarities and differences between these objects.
- C05** Describe the main features of formation theories of various types of observed galaxies.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	2	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	-
C05	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: nanoprobe 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.

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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

- C01** Describe the environment ecosystem, importance of biodiversity and its conservation.
- C02** Analyze the various anthropogenic activities, its impact on environment and mitigation measures.
- C03** Describe the various global environmental issues.
- C04** Analyse the ecological degradation, environmental pollution issues owing to developmental activities.
- C05** 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
C01	2	2	1	1	-	2	3	-	2	-	-	2
C02	3	3	2	2	-	2	3	-	2	-	-	2
C03	2	2	1	1	-	2	3	-	2	-	-	2
C04	3	3	2	2	-	2	3	-	2	-	-	2
C05	3	2	1	2	-	2	3	-	2	-	-	2

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U230E112	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 Tourir, "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

- C01** Apply reading and writing skills by exploring the language used in media.
C02 Apply listening skills to communicate effectively in their area of specialization.
C03 Apply soft skills in both oral and written communication.
C04 Apply speaking skills in a variety of mediums including live communication.
C05 Analyze different types of texts in different media like online, print, and social media.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	-	-	-	-	-	-	2	-	2	-	-
C02	3	-	-	-	-	-	-	2	-	2	-	-
C03	3	-	-	-	-	-	-	2	-	2	-	-
C04	3	-	-	-	-	-	-	2	-	2	-	-
C05	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

- C01** Apply Employment Skills In Their Environment
- C02** Write Resume Writing & Job Application.
- C03** Apply The Fundamental Inputs Of Communication Skills In Making Speech Delivery.
- C04** Apply Various Group Discussion Skills To Take Part In Effective Discussions In A Professional Context.
- C05** Analyze Various Interview Formats For Job Interviews.

CO - PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	-	-	-	-	-	-	3	3	3	-	1
C02	3	-	-	-	-	-	-	3	3	3	-	1
C03	3	-	-	-	-	-	-	3	3	3	-	1
C04	3	-	-	-	-	-	-	3	3	3	-	1
C05	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

Approved
(Signature)

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>

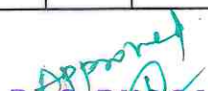
COURSE OUTCOMES:

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 challenges 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.

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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

- C01** Understand the concepts and theories of public policy and governance.
- C02** Analyze the interplay between government, civil society, and the private sector in policymaking processes.
- C03** Evaluate the impact of public policies on different stakeholders and societal outcomes.
- C04** Develop skills in policy analysis, advocacy, and stakeholder engagement.
- C05** Apply theoretical frameworks to real-world policy issues and case studies.
- Understand the concepts and theories of public policy and governance.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	2	-	2	2	-	2	-
C02	3	3	2	2	-	2	-	2	2	-	2	-
C03	3	3	2	3	-	2	-	2	2	-	2	-
C04	3	3	3	3	-	2	-	2	2	-	2	-
C05	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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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 & Aperiodic 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.


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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

- C01** Understand the fundamental concept of signals.
- C02** Understand the different classification of signals.
- C03** Explain the various properties of signals.
- C04** Describe the various properties of continuous time signals and its frequency domain representation.
- C05** 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
C01	2	2	1	1	2	-	-	-	-	-	-	1
C02	2	2	1	1	2	-	-	-	-	-	-	1
C03	2	2	1	1	2	-	-	-	-	-	-	1
C04	2	2	1	1	2	-	-	-	-	-	-	1
C05	2	2	1	1	2	-	-	-	-	-	-	1

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U23OE119

INTRODUCTION TO COMMUNICATION SYSTEMS

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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.

REFERENCES:

- 1 Sklar B, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2016.

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- 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

- C01** Explain the basic concepts of analog communication systems.
- C02** Apply the modulation techniques for analog communication.
- C03** Apply the modulation techniques for digital communication.
- C04** Explain the concepts of sampling and quantization techniques.
- C05** Analyse the performance of wireless channels.

CO – PO – PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	2	3	-	3	-	-	-	-	-	1
C02	3	2	2	3	-	3	-	-	-	-	-	1
C03	3	2	2	3	-	3	-	-	-	-	-	1
C04	3	2	2	3	-	3	-	-	-	-	-	1
C05	3	2	2	3	-	3	-	-	-	-	-	1

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COURSE OBJECTIVES:

- To understand the basics of drone concepts.
- To learn and understand the fundamentals of design, fabrication and programming drone.
- To know about the various applications of drone.

UNIT I	INTRODUCTION TO DRONE TECHNOLOGY	9
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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
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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
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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
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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
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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.

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REFERENCES:

- 1 John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
- 2 Zavrnsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.
- 3 Sachi Nandan Mohanty, J V R Ravindra, G 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

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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.

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- 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.
Chris Mi, M Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives" 1st Edition, John Wiley & Sons, 2011.

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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

- C01** Explain about the social and environmental significance, and impact of modern hybrid and electric vehicle
- C02** Describe Enhanced EV performance through diverse drives, efficiency analysis, and regenerative braking.
- C03** Explain the Improved efficiency and control in various motor drive configurations enhance performance.
- C04** Summarize on Efficient power management, battery technology understanding, and storage selection optimization
- C05** 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
C01	2	2	1	1	-	-	1	-	-	-	-	1
C02	2	2	1	1	-	-	1	-	-	-	-	1
C03	2	2	1	1	-	-	1	-	-	-	-	1
C04	2	2	1	1	-	-	1	-	-	-	-	1
C05	2	2	1	1	-	-	1	-	-	-	-	1

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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

- C01** Explain basics of PLC and PLC types.
- C02** Analyse PLC basic instructions and timers.
- C03** Analyse PLC module addressing, different types of functions.
- C04** Explain communication protocol and architecture.
- C05** Analyze PLC programming in different motors.

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	1	1	-	-	-	-	-	-	-	1
C02	3	3	1	2	-	-	-	-	-	-	-	1
C03	3	3	1	2	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	1
C05	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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U230E125

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

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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

Signature

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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 Raghubir 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, 2020.

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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

- C01** Design various hypotheses to mitigate the inherent risks in product innovations.
- C02** Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
- C03** Apply the critical thinking, analysing, storytelling & pitching.
- C04** Apply system thinking in a real-world scenario.
- C05** 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
C01	3	3	3	3	-	-	-	1	-	-	-	-	2	1
C02	3	3	3	3	-	-	-	1	-	-	-	-	2	1
C03	3	2	1	2	-	-	-	1	-	-	-	-	2	1
C04	3	2	1	2	-	-	-	1	-	-	-	-	2	1
C05	3	3	3	3	-	-	-	1	-	-	-	-	2	1


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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 Vijayamohan K Pillai, Meera Parthasarathy, "Functional Materials: A chemist's perspective", 1st Edition, Universities Press, 2018.

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- 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 3	T 0	P 0	C 3
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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 Kataria & 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 3	T 0	P 0	C 3
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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 9 UI/UX

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 9 APP DEVELOPMENT

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 9 INDUSTRIAL DESIGN

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 9 MECHANICAL RAPID PROTOTYPING

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 9 ELECTRONIC RAPID PROTOTYPING

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.


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REFERENCES:

- 1 Jaeger R C, "Introduction to microelectronic Fabrication", 1st Edition, Addison 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.

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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>

COURSE OUTCOMES:

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 THEORY 9

Unconstrained external problems, Newton – Raphson 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

- C01** Solve LPP using simple algorithm
- C02** Solve networking problems.
- C03** Solve integer programming problems.
- C04** Solve Non Linear programming problems.
- C05** Solve project management problems.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	1	-	-	-	2	-	-	-	-
C02	3	2	1	1	-	-	-	1	-	-	-	-
C03	3	2	1	1	-	-	-	1	-	-	-	-
C04	3	2	1	1	-	-	-	1	-	-	-	-
C05	3	2	1	1	-	-	-	1	-	-	-	-

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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: 45 PERIODS**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 Saou, "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

- C01** Explain concepts of graph theory that is walk, path, isomorphism etc.
C02 Apply various substructures of trees and investigate the planarity of graphs.
C03 Apply the concepts of Colouring, matching and chromatic number in theorems.
C04 Explain digraphs and Euler graphs.
C05 Solve recurrence relations using generating functions.

CO - PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	3	2	1	2	-	-	-	1	-	-	-	-
C03	3	2	1	2	-	-	-	1	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	1
C05	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 – $2 \times n$ and $m \times 2$ 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.

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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

- C01** Solve linear programming models.
- C02** Apply the concepts of transportation and assignment models in real life applications.
- C03** Analyze the project schedule and the cost-time trade-offs in the context of a project network and optimal decisions using graphical approach.
- C04** 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.
- C05** Analyze the quantitative metrics of performance for queuing systems.

CO- PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	1	1	-	-	-	-	-	-	-	1
C02	3	2	1	2	-	-	-	-	-	-	-	1
C03	3	3	2	2	-	-	-	1	-	-	-	-
C04	3	3	2	3	-	-	-	1	-	-	-	1
C05	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.

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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

- C01** Summarize the characteristics of historical monuments.
- C02** Summarize the different scientific principles in designing and construction of historical monuments.
- C03** Apply the basic physics principles in maintenance of historical monuments.
- C04** Describe the history of construction technologies in various era.
- C05** Explain the techniques of construction used in olden days.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	3	2	1	2	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	-
C05	2	2	1	1	-	-	-	-	-	-	-	-

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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.

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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

- C01** Explain the fundamentals of different forms of solar energy.
C02 Describe the origin, nature and applications of wind energy.
C03 Explain the process involved in production and conversion of biomass energy.
C04 Describe the design and principles of fuel cells.
C05 Explain the basic theory and types of batteries.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	1
C04	2	2	1	1	-	-	-	-	-	-	-	-
C05	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

GEOHERMAL 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.

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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

- C01** Explain the different laws related to human environment.
C02 Describe the importance of physics in urban living.
C03 Summarize the basic concepts of energy sources.
C04 Apply the basic concepts of geothermal and hydro energy on environmental impact.
C05 Explain about the radiation protection and dosage measurements.

CO – PO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	-	-	-	-	-	-	-
C02	2	2	1	1	-	-	-	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	-
C04	3	2	1	2	-	-	-	-	-	-	-	1
C05	2	2	1	1	-	-	-	-	-	-	-	-

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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:

Approved
(N)

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- 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

- C01** Explain about growth of entrepreneurship in India..
- C02** Describe about innovation, its types, role of technology in innovation, patents and licensing.
- C03** Summarize the concepts of new venture.
- C04** Design a business plan.
- C05** 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
C01	2	2	1	1	-	1	-	2	-	-	2	2	2	2
C02	2	2	1	1	-	1	-	2	-	-	2	2	2	2
C03	2	2	1	1	-	1	-	2	-	-	2	2	2	2
C04	2	2	1	1	-	1	-	2	-	-	2	2	2	2
C05	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.

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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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U230E210

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 Dairy, 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.

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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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U230E212	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

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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 Global 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:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	2	2	1	1	-	1	3	-	-	-	-	1
C02	2	2	1	1	-	1	3	-	-	-	-	1
C03	2	2	1	1	-	1	3	-	-	-	-	1
C04	2	2	1	1	-	1	3	-	-	-	-	1
C05	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: Enhancing Personal and Professional Success" 1st Edition, Tata McGraw Hill, 2023.
- 2 Sabharwal. D P, "Personality Development", 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://oldpodcast.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:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	-	-	-	-	-	-	-	3	3	3	-	1
C02	-	-	-	-	-	-	-	3	3	3	-	1
C03	-	-	-	-	-	-	-	3	3	3	-	1
C04	-	-	-	-	-	-	-	3	3	3	-	1
C05	-	-	-	-	-	-	-	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.

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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.

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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

- C01 Apply listening and reading skills to enhance clarity in writing.
- C02 Analyze and internalize motivational speech techniques to develop their oral and written communication proficiency.
- C03 Apply professional communication strategies and compose effective emails and reports.
- C04 Analyze career-oriented communication and draft resumes and cover letter.
- C05 Design engaging formats to present their prepared projects.

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	-	-	-	-	-	-	3	-	3	-	1
C02	3	-	-	-	-	-	-	3	-	3	-	1
C03	2	-	-	-	-	-	-	3	-	3	-	2
C04	3	-	-	-	-	-	-	3	-	3	-	2
C05	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%20quartus 2 introduction.pdf](http://www.ee.ic.ac.uk/cheung/teaching/ee2_digital/R2_3%20quartus%20introduction.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

- C01** Analyze the fundamentals electronic circuit build, Arduino board programming and simulation.
- C02** Describe the concepts of HDL design, Spartan family of FPGA and CPLD.
- C03** Analyze VHDL and Verilog programming.
- C04** Analyze the IDE for the Texas Instruments processors, ARM and embedded processors.
- C05** 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
C01	3	3	3	3	3	1	-	-	-	-	-	1
C02	3	3	3	3	3	1	-	-	-	-	-	1
C03	3	3	3	3	3	1	-	-	-	-	-	1
C04	3	3	3	3	3	1	-	-	-	-	-	1
C05	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.

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- 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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U230E219

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, Niaz Ahmed, "Underwater Communications and Networks", 1st Edition, Springer, 2021.
- 2 William S Burdic, "Underwater Acoustic Systems", Prentice Hall of India, 2002.

REFERENCES:

- 1 Rahul Sharma, "Deep Sea Mining Handbook", 1st Edition, Springer, 2017

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- 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 Oven, 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.

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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

- C01** Apply the fundamentals of electronics to construct the audio and video systems.
- C02** Explain working of various colour television system.
- C03** Analyze the technology for smart home.
- C04** Describe the working principles of various home appliances.
- C05** 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
C01	3	2	2	3	1	3	-	-	-	-	-	1
C02	3	2	2	3	2	3	-	-	-	-	-	1
C03	3	2	2	3	2	3	-	-	-	-	-	1
C04	3	2	2	3	2	3	-	-	-	-	-	1
C05	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.

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.

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- 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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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 benefits AMI 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.



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- 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

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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.

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- 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

- C01** Comprehend the layout, construction and working of the components inside a thermal power plant.
- C02** Summarize the process of diesel, gas turbine and combined cycle power plants.
- C03** Explain the different nuclear reactors.
- C04** Summarize the environmental and economic issues of using renewable energy sources compared to fossil fuels.
- C05** Describe the various power plant instrumentation and control techniques.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	1	1	-	-	1	-	-	-	-	-
C02	2	2	1	1	-	-	1	-	-	-	-	-
C03	2	2	1	1	-	-	-	-	-	-	-	-
C04	2	2	1	1	-	-	1	-	-	-	-	-
C05	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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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 alkanooates (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.

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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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U230E239	PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS	L 3	T 0	P 0	C 3
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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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(Signature)

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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, Prentice 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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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-105 and MIL- STD-414E&IS2500 standards.

TOTAL : 45 PERIODS**TEXT BOOKS:**

- 1 Douglass C Montgomery, "Introduction to Statistical Quality Control", 7th Edition, John Wiley & sons, 2018.
- 2 Krishnaiah K, "Applied Statistical Quality Control and Improvement", 1st Edition, Prentice 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

- C01** Describe the quality of processes using control charts for variables in manufacturing industries.
- C02** Describe the occurrence of defective products and the defects in manufacturing companies.
- C03** Describe the occurrence of defects in services.
- C04** Analyze the statistical and process capability study.
- C05** 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
C01	2	2	1	1	-	-	-	1	-	-	-	-	2	1
C02	2	2	1	1	-	-	-	1	-	-	-	-	2	1
C03	2	2	1	1	-	-	-	1	-	-	-	-	2	1
C04	3	3	2	2	-	-	-	1	-	-	-	-	2	1
C05	3	3	3	3	-	-	-	1	-	-	-	-	2	1

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U23OE241

REVERSE ENGINEERING

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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

9

IDENTIFICATION

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.

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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, Kluwer 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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