SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)

CSE
(ARTIFICIAL INTELLIGENCE)

R23 Regulation

B. TECH.
COURSE STRUCTURE
AND SYLLABUS

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

INSTITUTE VISION

To emerge as one of the premier institutions through excellence in education and research, producing globally competent and ethically strong professionals and entrepreneurs.

INSTITUTE MISSION

M1: Imparting high-quality technical and management education through the state-of-the- art resources.

M2: Creating an eco-system to conduct independent and collaborative research for the betterment of the society

M3: Promoting entrepreneurial skills and inculcating ethics for the socio-economic development of the nation.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT VISION

To impart quality education and research in Computer Science and Engineering for producingtechnically competent and ethically strong IT professionals with contemporary knowledge.

DEPARTMENT MISSION

M1: Achieving academic excellence in computer science through effective pedagogy, modern curriculum and state-of-art computing facilities.

M2: Encouraging innovative research in Computer Science and Engineering by collaborating with Industry and Premier Institutions to serve the nation.

M3: Empowering the students by inculcating professional behavior, strong ethical values and leadership abilities

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide software solutions for arising problems in diverse areas with strong knowledge in innovative technologies of computer science.

PEO2: To serve as globally competent computer professionals and entrepreneurs or in pursuit of higher education and research, developing innovative solutions in multidisciplinary domains.

PEO3: To attain the professional etiquette, soft skills, leadership, teamwork, ethical values in computer science with a commitment for lifelong learning to serve for the society and environment.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: **Analysis & Design:**

Ability to design, develop and deploy customized applications in all applicable domains using various algorithms and programming languages.

PSO2: **Computational Logic:**

Ability to visualize and configure computational need in terms of hardware and software to provide solutions for various complex applications.

PSO3: **Software Development:**

Ability to apply standard procedures, tools and strategies for software development.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.TECH. CSE (ARTIFICIAL INTELLIGENCE)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga And Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation To All Branches -- Career Options, Tools, Etc.	MC	3-0-0-0
4	Orientation On Admitted Branch -- Corresponding Labs, Tools And Platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment On Basic Aptitude And Mathematical Skills	MC	2-0-3-0
7	Remedial Training In Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- Focus On Listening, Speaking, Reading, Writing Skills	BS	2-1-2-0
10	Concepts Of Programming	ES	2-0-2-0

I B. Tech. – I Semester (CAI)

S.No.	Course Code	Subject	L	T	P	Credits
1	23HS0810	Communicative English	2	0	0	2
2	23HS0801	Chemistry	3	0	0	3
3	23HS0830	Linear Algebra & Calculus	3	0	0	3
4	23CE0101	Basic Civil & Mechanical Engineering	3	0	0	3
5	23CS0501	Introduction to Programming	3	0	0	3
6	23HS0811	Communicative English Lab	0	0	2	1
7	23HS0802	Chemistry Lab	0	0	2	1
8	23ME0301	Engineering Workshop	0	0	3	1.5
9	23CS0502	Computer Programming Lab	0	0	3	1.5
10	23HS0813	Health and wellness, Yoga and Sports	0	0	1	0.5
Total			**14**	**0**	**11**	**19.5**

I B. Tech. – II Semester (CAI)

S.No.	Course Code	Subject	L	T	P/ Drg	Credits
1	23HS0840	Engineering Physics	3	0	0	3
2	23HS0831	Differential Equations & Vector Calculus	3	0	0	3
3	23EE0201	Basic Electrical and Electronics Engineering	3	0	0	3
4	23ME0302	Engineering Graphics	1	0	4	3
5	23CS0503	IT Workshop	0	0	2	1
6	23CS0504	Data Structures	3	0	0	3
7	23HS0841	Engineering Physics Lab	0	0	2	1
8	23EE0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	23CS0505	Data Structures Lab	0	0	3	1.5
10	23HS0812	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
Total			**13**	**0**	**15**	**20.5**

II B. Tech. – I Semester (CAI)

S.No.	Course Code	Subject	L	T	P	Credits
1	23HS0836	Discrete Mathematics & Graph Theory	3	0	0	3
2	23HS0814	Universal Human Values – Understanding Harmony and Ethical Human Conduct	2	1	0	3
3	23CS0901	Principles of Artificial Intelligence	3	0	0	3
4	23CS0507	Advanced Data Structures & Algorithm Analysis	3	0	0	3
5	23CS0508	Object Oriented Programming Through Java	3	0	0	3
6	23CS0509	Advanced Data Structures and Algorithm Analysis Lab	0	0	3	1.5
7	23CS0510	Object Oriented Programming through Java Lab	0	0	3	1.5
8	23CS0549	Python Programming	0	1	2	2
9	23HS0805	Environmental Science	2	0	0	0
Total			**16**	**2**	**8**	**20**

II B. Tech. – II Semester (CAI)

S.No.	Course Code	Subject	L	T	P	Credits
1	23HS0852	Optimization Techniques	2	0	0	2
2	23HS0838	Probability & Statistics	3	0	0	3
3	23CS0902	Machine Learning	3	0	0	3
4	23CS0512	Database Management Systems	3	0	0	3
5	23CS0506	Digital Logic and Computer Organization	3	0	0	3
6	23CS0903	Artificial Intelligence & Machine Learning Lab	0	0	3	1.5
7	23CS0515	Database Management Systems Lab	0	0	3	1.5
8	23CS0550	Full Stack Development-1	0	1	2	2
9	23HS0815	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
Mandatory Community Service Project/Internship of 08 weeks duration during summer vacation						

NOTE: L-Lecture, T-Tutorial, P-Practical, Drg-Drawing, C-Credit

III B. Tech. – I Semester (CAI)

S.No.	Course Code	Subject	L	T	P	C
1	23CS1401	Natural Language Processing for AI	3	0	0	3
2	23CS0905	System Software Programming	3	0	0	3
3	23CS0906	Computer Vision & Image Processing	3	0	0	3
4	23CS0519	Introduction To Quantum Technologies and Applications	3	0	0	3
Professional Elective Course (PEC) –I						
5	23CS0921	Data Visualization	3	0	0	3
	23CS0922	Soft Computing				
	23CS0923	Exploratory Data Analysis with Python				
	23CS0924	Computational Intelligence				
Open Elective (OE) – I						
6	23CE0150	Green Buildings	3	0	0	3
	23CE0151	Construction Technology and Management				
	23EE0261	Electrical Safety Practices and Standards				
	23ME0356	Sustainable Energy Technologies				
	23EC0406	Electronic Circuits				
	23HS0855	Mathematics for Machine Learning and AI				
	23HS0842	Materials Characterization Techniques				
	23HS0806	Chemistry of Energy Systems				
	23HS0821	English for Competitive Examinations				
	23HS0822	Entrepreneurship and New Venture Creation				
7	23CS1402	Computer Vision & NLP Lab	0	0	3	1.5
8	23CS0908	AI & System Programming Lab	0	0	3	1.5
Skill Enhancement course						
9	23CS0909	Full Stack Development-II	0	1	2	2
10	23EC0417	Tinkering Lab	0	0	2	1
11	23CS1403	Evaluation of Community Service Internship	0	0	0	2
Total			**18**	**1**	**10**	**26**

III B. Tech. – II Semester (CAI)

S.No.	Course Code	Subject	L	T	P	C
1	23CS0911	Cloud Computing for AI	3	0	0	3
2	23CS0912	Big Data Analytics & AI Applications	3	0	0	3
3	23CS1404	Full Stack AI Development	3	0	0	3
Professional Elective course (PEC) – II						
4	23CS0925	Graph Neural Networks	3	0	0	3
	23CS0926	Recommender Systems				
	23CS0927	Predictive Analytics				
	23CS0928	Blockchain for AI				
Professional Elective course (PEC) – III						
5	23CS0929	Introduction to Quantum Computing	3	0	0	3
	23CS0930	AI for Finance				
	23CS0931	Social Network Analysis				
	23CS0932	Cybersecurity & AI-driven Threat Detection				
Open Elective (OE) – II						
6	23CE0152	Disaster Management	3	0	0	3
	23CE0153	Sustainability in Engineering Practices				
	23EE0262	Renewable Energy Sources				
	23ME0349	Automation and Robotics				
	23EC0441	Digital Electronics				
	23HS0853	Optimization Techniques for Engineers				
	23HS0858	Mathematical Foundation of Quantum Technologies				
	23HS0843	Physics Of Electronic Materials and Devices				
	23HS0807	Chemistry Of Polymers and Applications				
	23HS0823	Academic Writing and Public Speaking				
7	23CS0914	Big Data & Cloud Computing Lab	0	0	3	1.5
8	23CS1405	Full Stack AI Lab	0	0	3	1.5
Skill Enhancement course						
9	23HS0818	Soft skills	0	1	2	2
Audit Course						
10	23HS0816	Technical Paper Writing & IPR	2	0	0	0
Mandatory Industry Internship of 08 weeks duration during summer vacation						
Total			**20**	**1**	**08**	**23**

IV B. Tech. – I Semester (CAI)

S.No.	Course Code	Subject	L	T	P	C
1	23CS1406	Generative AI & Prompt Engineering	3	0	0	3
Management Course- II						
2	23HS0861	Business Ethics and Corporate Governance	2	0	0	2
	23HS0862	E-Business				
	23HS0863	Management Science				
Professional Elective course (PEC) – IV						
3	23CS0933	Explainable AI & Model Interpretability	3	0	0	3
	23CS0934	AI in Cybersecurity				
	23CS0935	AI-driven Software Engineering & DevOps				
	23CS1411	AI for Robotics				
Professional Elective course (PEC) – V						
4	23CS0937	MLOps& AI Model Deployment	3	0	0	3
	23CS0938	Data Wrangling				
	23CS1412	Healthcare AI				
	23CS0940	AI for Smart Cities & IoT Systems				
Open Elective (OE) – III						
5	23CE0154	Building Materials and Services	3	0	0	3
	23CE0155	Environmental Impact Assessment				
	23EE0263	Smart Grid Technologies				
	23ME0357	3D Printing Technologies				
	23EC0414	Microprocessors and Microcontrollers				
	23HS0856	Wavelet transforms and its Applications				
	23HS0844	Smart Materials And Devices				
	23HS0846	Introduction to Quantum Mechanics				
	23HS0808	Green Chemistry And Catalysis For Sustainable Environment				
	23HS0824	Employability Skills				
Open Elective (OE) – IV						
6	23CE0156	Geo-Spatial Technologies	3	0	0	3
	23CE0157	Solid Waste Management				
	23EE0264	Electric Vehicles				
	23ME0351	Total Quality Management				
	23EC0442	Transducers and Sensors				
	23HS0857	Financial Mathematics				
	23HS0845	Sensors and Actuators for Engineering Applications				
	23HS0809	Chemistry of Nanomaterials and Applications				
	23HS0825	Literary Vibes				
Skill Enhancement course						
7	23CS1407	Prompt Engineering	0	1	2	2

Audit Course						
8	23HS0820	Gender Sensitization	2	0	0	0
9	23CS1408	Evaluation of Industry Internship	0	0	0	2
Total			**19**	**1**	**2**	**21**

IV B. Tech. – II Semester (CAI)

S.No	Course Code	Title	L	T	P	C
1	23CS1409	Internship	-	-	-	4
2	23CS1410	Project	-	-	-	8
Total						12

Note: L-Lecture hours, T-Tutorial, P-Practical, C-Credit

TOTAL NO. OF CREDITS

Year	I		II		III		IV		TOTAL
SEM	I	II	I	II	I	II	I	II	
CREDICTS	19.5	20.5	20	21	26	23	21	12	163

COURSES OFFERED FOR HONOURS DEGREE IN CSE-CAI

S.No.	Course Title	L	T	P	Credits
1	Advanced Machine Learning & AI Systems	3	0	0	3
2	Deep learning & Neural Network Architectures	3	0	0	3
3	Reinforcement Learning & Decision Making	3	0	0	3
4	AI for Robotics & Automation	3	0	0	3
5	AI Ethics, Fairness & Explainability	3	0	0	3
6	AI & Machine Learning Lab	0	0	3	1.5
7	Robotics & Autonomous Systems Lab	0	0	3	1.5

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
List of Subjects

S.No.	Subject Code	Name of Subject
Core Subjects		
1	23CS1401	Natural Language Processing for AI
2	23CS1402	Computer Vision & NLP Lab
3	23CS1403	Evaluation of Community Service Internship
4	23CS1404	Full Stack AI Development
5	23CS1405	Full Stack AI Lab
6	23CS1406	Generative AI & Prompt Engineering
7	23CS1407	Prompt Engineering
8	23CS1408	Evaluation of Industry Internship
9	23CS1409	Internship
10	23CS1410	Project
Subjects offered by CSE and Allied Specializations		
11	23CS0501	Introduction to Programming
12	23CS0502	Computer Programming Lab
13	23CS0503	IT Workshop
14	23CS0504	Data Structures
15	23CS0505	Data Structures Lab
16	23CS0507	Advanced Data Structures & Algorithm Analysis
17	23CS0508	Object Oriented Programming Through Java
18	23CS0509	Advanced Data Structures and Algorithm Analysis Lab
19	23CS0510	Object Oriented Programming through Java Lab
20	23CS0512	Database Management Systems
21	23CS0506	Digital Logic and Computer Organization
22	23CS0515	Database Management Systems Lab
23	23CS0519	Introduction to quantum technologies and applications
24	23CS0901	Principles of Artificial Intelligence
25	23CS0902	Machine Learning
26	23CS0903	Artificial Intelligence & Machine Learning Lab
27	23CS0905	System Software Programming
28	23CS0906	Computer Vision & Image Processing

29	23CS0908	AI & System Programming Lab
30	23CS0911	Cloud Computing for AI
31	23CS0912	Big Data Analytics & AI Applications
32	23CS0914	Big Data & Cloud Computing Lab
Professional Elective Course (PEC)		
33	23CS0921	Data Visualization
34	23CS0922	Soft computing
35	23CS0923	Exploratory Data Analysis with Python
36	23CS0924	Computational Intelligence
37	23CS0925	Graph Neural Networks
38	23CS0926	Recommender Systems
39	23CS0927	Predictive Analytics
40	23CS0928	Blockchain for AI
41	23CS0929	Introduction to Quantum Computing
42	23CS0930	AI for Finance
43	23CS0931	Social Network Analysis
44	23CS0932	Cybersecurity & AI-driven Threat Detection
45	23CS0933	Explainable AI & Model Interpretability
46	23CS0934	AI in Cyber Security
47	23CS0935	AI-driven Software Engineering & DevOps
48	23CS1411	AI for Robotics
49	23CS0937	MLOps & AI Model Deployment
50	23CS0938	Data Wrangling
51	23CS1412	Healthcare AI
52	23CS0940	AI for Smart Cities & IoT Systems
Open Electives from Other Departments		
53	23CE0150	Green Buildings
54	23CE0151	Construction Technology and Management
55	23EE0261	Electrical Safety Practices and Standards
56	23ME0356	Sustainable Energy Technologies
57	23EC0406	Electronic Circuits
58	23HS0855	Mathematics for Machine Learning and AI
59	23HS0842	Materials Characterization Techniques
60	23HS0806	Chemistry of Energy Systems
61	23HS0821	English for Competitive Examinations
62	23HS0822	Entrepreneurship and New Venture Creation

63	23CE0152	Disaster Management
64	23CE0153	Sustainability in Engineering Practices
65	23EE0262	Renewable Energy Sources
66	23ME0349	Automation and Robotics
67	23EC0441	Digital Electronics
68	23HS0853	Optimization Techniques in Engineering
69	23HS0858	Mathematical Foundation of Quantum Technologies
70	23HS0843	Physics Of Electronic Materials and Devices
71	23HS0807	Chemistry Of Polymers and Applications
72	23HS0823	Academic Writing and Public Speaking
73	23CE0154	Building Materials and Services
74	23CE0155	Environmental Impact Assessment
75	23EE0263	Smart Grid Technologies
76	23ME0357	3D Printing Technologies
77	23EC0414	Microprocessors and Microcontrollers
78	23HS0856	Wavelet transforms and its applications
79	23HS0844	Smart Materials and Devices
80	23HS0846	Introduction to Quantum Mechanics
81	23HS0808	Green Chemistry and Catalysis for Sustainable Environment
82	23HS0824	Employability Skills
83	23CE0156	Geo-Spatial Technologies
84	23CE0157	Solid Waste Management
85	23EE0264	Electric Vehicles
86	23ME0351	Total Quality Management
87	23EC0442	Transducers and Sensors
88	23HS0857	Financial Mathematics
89	23HS0845	Sensors and Actuators for Engineering Applications
90	23HS0809	Chemistry of Nanomaterials and Applications
91	23HS0825	Literary Vibes
Management Course- II		
92	23HS0861	Business Ethics and Corporate Governance
93	23HS0862	E-Business
94	23HS0863	Management Science
Subjects from Other Departments		
95	23HS0810	Communicative English
96	23HS0801	Chemistry

97	23HS0830	Linear Algebra & Calculus
98	23CE0101	Basic Civil & Mechanical Engineering
99	23HS0811	Communicative English Lab
100	23HS0802	Chemistry Lab
101	23ME0301	Engineering Workshop
102	23HS0813	Health and wellness, Yoga and Sports
103	23HS0840	Engineering Physics
104	23HS0831	Differential Equations & Vector Calculus
105	23EE0201	Basic Electrical and Electronics Engineering
106	23ME0302	Engineering Graphics
107	23HS0841	Engineering Physics Lab
108	23EE0202	Electrical and Electronics Engineering Workshop
109	23HS0812	NSS/NCC/Scouts & Guides/Community Service
110	23HS0836	Discrete Mathematics & Graph Theory
111	23HS0814	Universal Human Values – Understanding Harmony and Ethical Human Conduct
112	23HS0805	Environmental Science
113	23HS0852	Optimization Techniques
114	23HS0838	Probability & Statistics
115	23HS0815	Design Thinking & Innovation
116	23EC0417	Tinkering Lab
Skill Enhanced Courses		
117	23CS0549	Python Programming
118	23CS0550	Full Stack Development-I
119	23CS0909	Full Stack Development -II
120	23HS0818	Soft skills
121	23CS1407	Prompt Engineering
Non-Credit Courses		
122	23HS0816	Technical Paper Writing & IPR
123	23HS0820	Gender Sensitization

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I B.Tech – I Sem.

L	T	P	C
2	0	0	2

(23HS0810) COMMUNICATIVE ENGLISH
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Understand the context, topic, and pieces of specific information from social or Transactional dialogues.*
2. *Apply grammatical structures to formulate sentences and correct word forms.*
3. *Analyze discourse markers to speak clearly on a specific topic in informal discussions.*
4. *Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.*
5. *Create a coherent paragraph, essay, and resume.*
6. *Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively.*

UNIT – I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT – II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure

talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT – III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words,

Vocabulary: Collocations

UNIT – IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes.

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT – V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

TEXTBOOKS

1. *Pathfinder: Communicative English for Undergraduate Students*, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3).
2. *Empowering with Language* by Cengage Publications, 2023 (Units 4 & 5).

REFERENCES

1. Dubey, Sham Ji & Co. *English for Engineers*, Vikas Publishers, 2020.
2. Bailey, Stephen. *Academic writing: A Handbook for International Students*., Routledge, 2014.
3. Murphy, Raymond, *English Grammar in Use,* Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman, *Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary*, Anchor, 2014.

ONLINE LEARNING RESOURCES

GRAMMAR:

1. www.bbc.co.uk/learningenglish.
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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I B.Tech – I Sem.

L	T	P	C
3	0	0	3

(23HS0801) CHEMISTRY
(Common to EEE, ECE, CSE, CSIT, CSM, CIC, CAD, CCC & CAI branches)

COURSE OBJECTIVES

The objectives of this course

1. *To familiarize engineering chemistry and its applications*
2. *To train the students on the principles and applications of electrochemistry and polymers*
3. *To introduce instrumental methods, molecular machines and switches.*

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Acquire the knowledge on the behaviour and interactions between matter and energy at both the atomic and molecular levels.*
2. *Analyze and demonstrate the applications of modern engineering materials in real world.*
3. *Impart the knowledge on the essential aspects of electrochemical cells, emf and applications of emf measurements*
4. *Gain the knowledge about construction and applications of batteries and sensors,*
5. *Impart knowledge on the essential aspects of Principles and comprehend idea about the synthesis and engineering applications of polymers.*
6. *Analyse the molecular transitions of Electromagnetic radiation (EMR) with matter in various spectroscopic techniques.*

UNIT – I Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT- II Modern Engineering Materials

Semiconductors – Introduction, basic concept, application.

Super Conductors - Introduction basic concept, applications.

Super Capacitors - Introduction, Basic Concept, Classification – Applications.

Nano Materials - Introduction, classification, properties and applications of Fullerenes, Carbon nano tubes and Graphines nano particles.

UNIT- III Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT - IV Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting Polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT - V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. High pressure Liquid Chromatography (HPLC) Classification, Principle, Instrumentation and Applications.

TEXTBOOKS

1. Jain and Jain, *Engineering Chemistry*, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, *Atkins' Physical Chemistry*, 10/e,Oxford University Press, 2010.

REFERENCES

1. S koog and West, *Principles of Instrumental Analysis*, 6/e, Thomson, 2007.
2. J .D. Lee, *Concise Inorganic Chemistry*, 5th Edition, Wiley Publications, Feb.2008
3. Fred W. Billmayer Jr, *Textbook of Polymer Science*, 3rd Edition.

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I B.Tech – I Sem.

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(23HS0830) LINEAR ALGEBRA & CALCULUS
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES (COs)

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

1. *Develop and use of matrix algebra techniques that are needed by engineers for practical applications.*
2. *Identify different matrix techniques to find the inverse and powers of the matrix.*
3. *Understanding the concepts of continuity and differentiability of functions defined on intervals*
4. *Estimate the series expansions of algebraic and transcendental functions.*
5. *Analyze the functions of several variables which is useful in optimization.*
6. *Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.*

UNIT I

Matrices

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II

Eigen values, Eigenvectors and Orthogonal Transformation

Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III

Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV

Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V

Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS

1. B. S. Grewal, *Higher Engineering Mathematics,* Khanna Publishers, 2017, 44th Edition
2. Erwin Kreyszig, *Advanced Engineering Mathematics,* John Wiley & Sons, 2018, 10th Edition.

REFERENCES

1. George B. Thomas, Maurice D. Weir and Joel Hass, *Thomas Calculus*, Pearson Publishers, 2018, 14th Edition.
2. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 2021 5th Edition(9th reprint).
3. Glyn James, *Advanced Modern Engineering Mathematics*, Pearson publishers, 2018, 5th Edition.
4. Micheael Greenberg, *Advanced Engineering Mathematics*, Pearson publishers, 9th edition
5. H. K Das, Er. Rajnish Verma, *Higher Engineering Mathematics*, S. Chand Publications,2014, Third Edition (Reprint 2021)

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I B.Tech – I Sem.

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(23CE0101) BASIC CIVIL & MECHANICAL ENGINEERING
(Common to all branches of Engineering)

PART A: BASIC CIVIL ENGINEERING

COURSE OBJECTIVES

The objectives of this course

1. *Get familiarized with the scope and importance of Civil Engineering sub-divisions.*
2. *Introduce the preliminary concepts of surveying.*
3. *Acquire preliminary knowledge on Transportation and its importance in nation's economy.*
4. *Get familiarized with the importance of quality, conveyance and storage of water*
5. *Introduction to basic civil engineering materials and construction techniques.*

COURSE OUTCOMES (COs)

After the completion of the course, student should be able to

1. *Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.*
2. *Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.*
3. *Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation and understand the process of water storage and its supply to the public.*

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society - Various Disciplines of Civil Engineering - Structural Engineering - Geo-technical Engineering - Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering - Scope of each discipline - Building Construction and Planning - Construction Materials - Cement - Aggregate - Bricks - Cement concrete - Steel. Introduction to Prefabricated construction Techniques

UNIT II

Surveying: Objectives of Surveying - Horizontal Measurements - Angular Measurements - Introduction to Bearings - Levelling instruments used for levelling - Simple problems on levelling and bearings - Contour mapping.

UNIT III

Transportation Engineering: Importance of Transportation in Nation's economic development - Types of Highway Pavements - Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering

Water Resources and Environmental Engineering: Introduction, Sources of water - Quality of water - Specifications - Introduction to Hydrology – Rainwater Harvesting - Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

TEXT BOOKS

1. M.S.Palanisamy, *Basic Civil Engineering,* Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition, 2011.
2. S.S. Bhavikatti, *Introduction to Civil Engineering,* New Age International Publishers, First Edition, 2022.
3. Satheesh Gopi, *Basic Civil Engineering*, Pearson Publications, First Edition, 2009

REFERENCES

1. S.K. Duggal, *Surveying, Vol- I and Vol-II,* Tata McGraw Hill Publishers, Fifth Edition, 2019
2. Santosh Kumar Garg, *Hydrology and Water Resources Engineering,* Khanna Publishers, Delhi, 2016
3. Santosh Kumar Garg, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, Delhi, 38th Edition, 2023
4. S.K.Khanna, C.E.G. Justo and Veeraraghavan*, Highway Engineering*, Nemchand and Brothers Publications, 10th Edition, 2019
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES

The objectives of this course

1. *Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.*
2. *Explain different engineering materials and different manufacturing processes.*
3. *Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.*

COURSE OUTCOMES

After the completion of the course, student should be able to

1. *Understand the role of mechanical engineering and materials in the manufacturing and automotive industries*
2. *Explain the basics of manufacturing processes and thermal engineering and its applications.*
3. *Describe the working of different power plants. Mechanical power transmission systems and the applications of robotics in industrial sector.*

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

TEXTBOOKS

1. V.Ganesan, *Internal Combustion Engines*, Tata McGraw Hill publications (India) Pvt. Ltd.
2. S.S. Rattan, *A Tear book of Theory of Machines* Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. Jonathan Wicker and Kemper Lewis, *An introduction to Mechanical Engineering,* Cengagelearning India Pvt. Ltd.

REFERENCE BOOKS

1. Appuu Kuttan KK, *Robotics*, I.K. International Publishing House Pvt. Ltd. Volume-I
2. L. Jyothish Kumar, Pulak M Pandey, *3D printing & Additive Manufacturing Technology*, Springer publications
3. Mahesh M Rathore, *Thermal Engineering*, Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, *Basic Civil and the Mechanical Engineering*, TataMcGraw Hill publications (India) Pvt. Ltd.

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(23CS0501) INTRODUCTION TO PROGRAMMING
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To introduce students to the fundamentals of computer programming.*
2. *To provide hands-on experience with coding and debugging.*
3. *To foster logical thinking and problem-solving skills using programming.*
4. *To familiarize students with programming concepts such as data types, control structures, functions, and arrays.*
5. *To encourage collaborative learning and teamwork in coding projects.*

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Understand basics of computers, the concept of algorithm and algorithmic thinking.*
2. *Analyse a problem and develop an algorithm using control structures & arrays*
3. *Analyse a problem and develop an algorithm to solve it using strings*
4. *Understand and implement the problems using pointers*
5. *Apply modular approach for solving the problem*
6. *Design and implement problem-solving using structures, unions and files.*

UNIT - I

Introduction to Programming and Problem Solving: History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT - II

Control Structures: Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

UNIT - III

Arrays and Strings: Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT - IV

Pointers & User Defined Data types: Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT - V

Functions & File Handling: Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

TEXTBOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language, 2nd edition, 2015*.
2. Pradip Dey Manas Ghosh‖ Programming in C –First edition, Oxford University Press, 2018.

REFERENCES

1. Balagurusamy, E, *Computing fundamentals and C Programming*, McGraw-Hill Education, 2019.
2. Rema Theraja, *Programming in C*, Oxford, 2016, 2nd edition
3. Forouzan, Gilberg, Prasad, *C Programming, A Problem Solving Approach*, CENGAGE, 3rd edition

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(23HS0811) COMMUNICATIVE ENGLISH LAB
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Understand the different aspects of the English language proficiency with emphasis on LSRW skills.*
2. *Apply communication skills through various language learning activities.*
3. *Analyze the English speech sounds, stress, rhythm, and syllable division for better listening and speaking comprehension.*
4. *Evaluate and exhibit professionalism in participating in debates and group discussions.*
5. *Become active participants in the learning process and acquire proficiency in spoken English.*
6. *Speak with clarity and confidence thereby enhances employability skills.*

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

1. Walden Infotech 2. Young India Films

REFERENCES

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013.

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(23HS0802) CHEMISTRY LAB
(Common to EEE, ECE, CSE, CSIT, CSM, CIC, CAD, CCC & CAI branches)

COURSE OBJECTIVES
The objectives of this course

1. *Verify the fundamental concepts with experiments.*

COURSE OUTCOMES (COs)
After the completion of the course student should be able to

1. *Determine the cell constant and conductance of solutions.*
2. *Prepare advanced polymer Bakelite materials.*
3. *Measure the strength of an acid present in secondary batteries.*
4. *Analyse the IR spectra of some organic compounds.*
5. *Able to understand about the fundamental concepts of analytical instruments*
6. *Calculate strength of acid in Pb-Acid battery.*

LIST OF EXPERIMENTS

1. Measurement of 10Dq by spectro photometric method
2. Conduct ometric titration of strong acid vs. strong base
3. Conduct ometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Note: Any Ten experiments may be conducted

REFERENCE

1. J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar, *Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition,* Pearson Publications

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(23ME0301) ENGINEERING WORKSHOP
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course is to

1. *Familiarize with the different types of wood and carpentry joints.*
2. *Develop Tapered Tray and Conical funnel using sheet metal.*
3. *Acquire practical knowledge on different types of fittings.*
4. *Provides hands-on training in the trades of House-Wiring .*
5. *Overview of metal cutting processes, foundry, Welding and plumbing, is provided through live demonstrations.*
6. *Acquire practical skills by performing the experiments in different shops of workshop.*

COURSE OUTCOMES

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

1. *Describe the different types of wood and carpentry joints.*
2. *Produce Tapered Tray and Conical funnel using sheet metal.*
3. *Understands about Fitting and their types.*
4. *Explain the method of preparation of various House-Wiring.*
5. *Apply basic techniques in foundry, Welding and plumbing.*
6. *Estimate the amount of material required for various models.*

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

TEXT BOOKS

1. Felix W, *Basic Workshop Technology: Manufacturing Process*, Independently Published, 2019.
2. Bruce J. Black, *Workshop Processes, Practices and Materials*; Routledge publishers, 5th Edn. 2015.
3. B.S. Raghuwanshi*, A Course in Workshop Technology Vol I. & II*, Dhanpath Rai & Co., 2015 & 2017.

REFERENCES

1. S. K. Hajra Choudhury & Others, *Elements of Workshop Technology, Vol. I* , Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. H. S. Bawa, Workshop Practice, Tata-McGraw Hill, 2004.
3. Soni P.M. & Upadhyay P.A., Wiring Estimating, Costing and Contracting; Atul Prakashan, 2021-22

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I B.Tech – I Sem.

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(23CS0502) COMPUTER PROGRAMMING LAB
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *The course aims to give students hands – on experience and train them on the concepts of the C- programming language.*

COURSE OUTCOMES (COs)

1. *Read, understand, and trace the execution of programs written in C language.*
2. *Select the right control structure for solving the problem.*
3. *Develop C programs which utilize memory efficiently using programming constructs like pointers.*
4. *Develop Debug and Execute programs to demonstrate the applications of arrays in C.*
5. *Develop Debug and Execute programs to demonstrate the applications of functions in C.*
6. *Implement the C programs using File handling Concepts.*

UNIT I

WEEK 1 - Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

- **i)** Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- **ii)** Exposure to Turbo C, gcc
- **iii)** Writing simple programs using printf(), scanf()

WEEK 2 - Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs

- **i)** Sum and average of 3 numbers
- **ii)** Conversion of Fahrenheit to Celsius and vice versa
- **iii)** Simple interest calculation

WEEK 3 - Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

- **i)** Finding the square root of a given number
- **ii)** Finding compound interest
- **iii)** Area of a triangle using heron's formulae
- **iv)** Distance travelled by an object

UNIT II

WEEK 4 - Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial 4: Operators and the precedence and as associativity:

Lab 4: Simple computational problems using the operator' precedence and associativity

- **i)** Evaluate the following expressions. a. A+B*C+(D*E) + F*G b. A/B*C-B+A*D/3 c. A+++B---A d. J= (i++) + (++i)
- **ii)** Find the maximum of three numbers using conditional operator
- **iii)** Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5 - Objective: Explore the full scope of different variants of ―if construct‖ namely if-else, nullelse, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for ―if construct‖.

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

- **i)** Write a C program to find the max and min of four numbers using if-else.
- **ii)** Write a C program to generate electricity bill.
- **iii)** Find the roots of the quadratic equation.
- **iv)** Write a C program to simulate a calculator using switch case.
- **v)** Write a C program to find the given year is a leap year or not.

WEEK 6 - Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

- **i)** Find the factorial of given number using any loop.
- **ii)** Find the given number is a prime or not.
- **iii)** Compute sine and cos series
- **iv)** Checking a number palindrome
- **v)** Construct a pyramid of numbers.

UNIT III

WEEK 7 - Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

- **i)** Find the min and max of a 1-D integer array.
- **ii)** Perform linear search on1D array.
- **iii)** The reverse of a 1D integer array
- **iv)** Find 2's complement of the given binary number.
- **v)** Eliminate duplicate elements in an array.

WEEK 8 - Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

- **i)** Addition of two matrices
- **ii)** Multiplication two matrices
- **iii)** Sort array elements using bubble sort
- **iv)** Concatenate two strings without built-in functions
- **v)** Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9 - Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereferences.

- **i)** Write a C program to find the sum of a 1D array using malloc()
- **ii)** Write a C program to find the total, average of n students using structures
- **iii)** Enter n students data using calloc() and display failed students list
- **iv)** Read student name and marks from the command line and display the student details along with the total.
- **v)** Write a C program to implement realloc()

WEEK 10 - Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bit fields, Self-Referential Structures, Linked lists

Lab10: Bit fields, linked lists Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bit fields.

iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11 - Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration.

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent.

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12 - Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.

ii) Write a recursive function to find the LCM of two numbers.

iii) Write a recursive function to find the factorial of a number.

iv) Write a C Program to implement Ackermann function using recursion.

v) Write a recursive function to find the sum of series.

WEEK 13 - Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14 - Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

TEXTBOOKS

1. Ajay Mittal, *Programming in C: A practical approach*, Pearson.
2. Byron Gottfried, *Schaum' s Outline of Programming with C*, McGraw Hill

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, PrenticeHall of India
2. Forouzan, Gilberg, Prasad, *C Programming, A Problem-Solving Approach,* CENGAGE

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(AUTONOMOUS)

I B.Tech – I Sem.

L	T	P	C
0	0	1	0.5

(23HS0813) HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to all branches of Engineering)

COURSE OBJECTIVES

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Understand the importance of yoga and sports for Physical fitness and sound health*
2. *Demonstrate an understanding of health-related fitness components.*
3. *Compare and contrast various activities that help enhance their health.*
4. *Assess current personal fitness levels.*
5. *Develop Positive Personality.*
6. *Apply various activities for holistic development.*

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.

Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

REFERENCE BOOKS:

1. Gordon Edlin, Eric Golanty. *Health and Wellness*, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. *The Heart of Yoga: Developing a Personal Practice*
3. Archie J.Bahm. *Yoga Sutras of Patanjali*, Jain Publishing Company, 1993
4. Wiseman, John Lofty, *SAS Survival Handbook: The Ultimate Guide to SurvivingAnywhere*, Third Edition, William Morrow Paperbacks, 2014
5. *The Sports Rules Book/ Human Kinetics with Thomas Hanlon.* - 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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(AUTONOMOUS)

I B.Tech – II Sem.

L	T	P	C
3	0	0	3

(23HS0840) ENGINEERING PHYSICS
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc., enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Analyze the intensity variation of light due to polarization, interference and diffraction.*
2. *Familiarize with the basics of crystals and their structures.*
3. *Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.*
4. *Summarize various types of polarization of dielectrics and classify the magnetic materials.*
5. *Explain the basic concepts of Quantum Mechanics and the band theory of solids.*
6. *Identify the type of semiconductor using Hall Effect.*

UNIT – I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X- ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications

TEXTBOOKS

1. M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, *A Text book of Engineering Physics,* S. Chand Publications, 11th Edition 2019.
2. D.K.Bhattacharya and Poonam Tandon*, Engineering Physics,* Oxford press (2015).

REFERENCES

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics,* Cengage Learning 2021.
2. Shatendra Sharma, Jyotsna Sharma, *Engineering Physics,* Pearson Education, 2018.
3. M.R. Srinivasan, *Engineering Physics,* New Age international publishers (2009).

ONLINE LEARNING RESOURCES

1. https://www.loc.gov/rr/scitech/selected-internet/physics.html

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I B.Tech – II Sem.

L	T	P	C
3	0	0	3

(23HS0831) DIFFERENTIAL EQUATIONS & VECTOR CALCULUS
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To enlighten the learners in the concept of differential equations and multivariable calculus.*
2. *To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.*

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Solve the differential equations related to various engineering fields.*
2. *Create basic application problems described by second order linear differential equations with constant coefficients.*
3. *Understand basic properties of standard partial differential equations.*
4. *Identify solution methods for partial differential equations that model physical processes.*
5. *Interpret the physical meaning of different operators such as gradient, curl and divergence.*
6. *Estimate the work done against a field, circulation and flux using vector calculus.*

UNIT I

Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II

Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III

Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV

Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V

Vector integration

LWithoutegral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

TEXT BOOKS

1. B. S. Grewal, *Higher Engineering Mathematics,* Khanna Publishers, 2017, 44th Edition
2. Erwin Kreyszig, *Advanced Engineering Mathematics,* John Wiley & Sons, 2018, 10th Edition.

REFERENCES

1. George B. Thomas, Maurice D. Weir and Joel Hass, *Thomas Calculus*, Pearson Publishers, 2018, 14th Edition.
2. Dennis G. Zill and Warren S. Wright, Jones and Bartlett, *Advanced Engineering Mathematics*, 2018.
3. Glyn James, *Advanced Modern Engineering Mathematics*, Pearson publishers, 2018, 5th Edition.
4. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. B. V. Ramana, *Higher Engineering Mathematics*, McGraw Hill Education, 2017.

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I B.Tech –II Sem.

L	T	P	C
3	0	0	3

(23EE0201) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to all branches of Engineering)

COURSE OBJECTIVES
The objectives of this course

1. *To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.*
2. *This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.*

COURSE OUTCOMES (COs)
At the end of the course, the student will be able to

1. *Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.*
2. *Understand the problem-solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations*
3. *Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.*
4. *Demonstrate the characteristics by analyzing the behaviour of electronic devices.*
5. *Develop applications using electronic devices.*
6. *Understand the number systems, codes, Boolean algebra, logic gates, and functioning of logic circuits.*

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits
DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of ―unit‖ used for consumption of electrical energy, two- part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

TEXT BOOKS

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

REFERENCES

1. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering,* Mc Graw Hill, 2019, Fourth Edition
2. V.K. Mehtha, *Principles of Power Systems,* S.Chand Technical Publishers, 2020
3. T. K. Nagsarkar and M. S. Sukhija, *Basic Electrical Engineering,* Oxford University Press, 2017
4. S. K. Bhatacharya, *Basic Electrical and Electronics Engineering,* Person Publications, 2018, Second Edition.

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

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I B.Tech – II Sem.

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1	0	4	3

(23ME0302) ENGINEERING GRAPHICS
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course is to

1. *Enable the students with various concepts like dimensioning, conventions and standards relate to Engineering Drawing*
2. *Impart knowledge on the projection of points, lines and plane surfaces.*
3. *Improve the visualization skills for better understanding of projection of solids.*
4. *Develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.*
5. *Make the students understand the viewing perception of a solid object in Isometric and Perspective projections.*

COURSE OUTCOMES (COs)

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

1. *Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.*
2. *Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.*
3. *Understand and draw projection of solids in various positions in first quadrant.*
4. *Elucidate the basic principles of sections of solids and true shapes*
5. *Explain principles behind development of surfaces.*
6. *Prepare isometric and perspective sections of simple solids.*

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods. Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves. Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in **simple positions:** Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

TEXT BOOK

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

REFERENCES

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

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I B.Tech – II Sem.

L	T	P	C
0	0	2	1

(23CS0503) IT WORKSHOP
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables*
2. *To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS*
3. *To teach basic command line interface commands on Linux.*
4. *To teach the usage of Internet for productivity and self-paced life-long learning*
5. *To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.*

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Perform Hardware troubleshooting.*
2. *Understand Hardware components and inter dependencies.*
3. *Safeguard computer systems from viruses/worms.*
4. *Document/ Presentation preparation.*
5. *Perform calculations using spread sheets.*
6. *Understand and Analyse the concepts of Prompt Engineering, Language Translation and Creative Writing using AI Tools*

LIST OF EXPERIMENTS

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1: Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spread sheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

REFERENCES

1. Vikas Gupta, *Comdex Information Technology course tool kit*, WILEY Dream tech, 2003.
2. Cheryl A Schmidt, *The Complete Computer upgrade and repair book*, WILEY Dream tech, 2013, 3rd edition
3. *Introduction to Information Technology*, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. Kate J. Chase, *PC Hardware - A Handbook*, PHI (Microsoft)
5. Leslie Lamport, *LaTeX Companion*, PHI/Pearson.
6. David Anfins on and Ken Quamme, *IT Essentials PC Hardware and Software Companion Guide*, – CISCO Press, Pearson Education, 3rd edition
7. Patrick Regan, *IT Essentials PC Hardware and Software Labs and Study Guide*, CISCO Press, Pearson Education, 3rd edition.

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I B.Tech – II Sem.

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3	0	0	3

(23CS0504) DATA STRUCTURES
(Common to CSE, CSIT, CSM, CIC, CAD, CCC & CAI branches)

COURSE OBJECTIVES

1. *To provide the knowledge of basic data structures and their implementations.*
2. *To understand importance of data structures in context of writing efficient programs.*
3. *To develop skills to apply appropriate data structures in problem solving.*

COURSE OUTCOMES (COs)

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

1. *Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.*
2. *Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.*
3. *Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.*
4. *Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.*
5. *Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.*
6. *Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.*

UNIT - I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures.

Searching Techniques: Linear & Binary Search.

Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

UNIT - II

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal, AVL Trees

Graphs: Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Applications of graphs.

TEXTBOOKS

1. Mark Allen Weiss, *Data Structures and algorithm analysis in C*, Pearson, 2nd Edition.
2. Reema Thareja **–***Data Structures using C*,Third Edition,Oxford University,2023

REFERENCES

1. Kurt Mehlhorn and Peter Sanders, *Algorithms and Data Structures: The Basic Toolbox*
2. Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft, *C Data Structures and Algorithms.*
3. Brad Miller and David Ranum, *Problem Solving with Algorithms and Data Structures*.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms.,*
5. Robert Sedgewick, *Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms*

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I B.Tech – II Sem.

L	T	P	C
0	0	2	1

(23HS0841) ENGINEERING PHYSICS LAB
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Operate optical instruments like travelling microscope and spectrometer.*
2. *Estimate the wavelengths of different colours using diffraction grating.*
3. *Plot the intensity of the magnetic field of circular coil carrying current with distance.*
4. *Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.*
5. *Calculate the band gap of a given semiconductor*
6. *Identify the type of semiconductor using Hall Effect.*

LIST OF EXPERIMENTS

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using HallEffect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.

15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any **TEN** of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

REFERENCES

1. S. Balasubramanian, M.N. Srinivasan, *A Textbook of Practical Physics,* S. Chand Publishers, 2017.

ONLINE LEARNING RESOURCES

1. www.vlab.co.in
2. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototyp

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

I B.Tech – II Sem.

L	T	P	C
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(23EE0202) ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP
(Common to all branches of Engineering)

COURSE OBJECTIVES*:*

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

COURSE OUTCOMES:

1. *Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.* usage *of electronic measuring instruments.*
2. *Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.*
3. *Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.*
4. *Demonstrate knowledge of different electronic devices and measuring instruments.*
5. *Plot and discuss the characteristics and applications of various electron devices.*
6. *Verify the functions of logic gates and flip-flops.*

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.

3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

REFERENCE BOOKS

1. D. C. Kulshreshtha, *Basic Electrical Engineering,* Tata McGraw Hill, 2019, First Edition
2. P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, *Power System Engineering,* Dhanpat Rai & Co, 2013
3. Rajendra Prasad, *Fundamentals of Electrical Engineering,* PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

LIST OF EXPERIMENTS

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

REFERENCES

1. R. L. Boylestad & Louis Nashlesky, *Electronic Devices & Circuit Theory*, Pearson Education, 2021.
2. R. P. Jain, *Modern Digital Electronics*, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, *Introductory Electronic Devices & Circuits – Conventional Flow Version*, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software

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I B.Tech. – II Sem.

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(23CS0505) DATA STRUCTURES LAB

COURSE OBJECTIVES

The objectives of this course

1. *The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem.*
2. *It enables them to gain knowledge in practical applications of data structures.*

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.*
2. *Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.*
3. *Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.*
4. *Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges.*
5. *Implement the concepts of Binary Search Trees in Linked List*
6. *Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.*

LIST OF EXPERIMENTS:

Exercise 1: Array Manipulation

i) Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques – Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

i) Implement a singly linked list and perform insertion and deletion operations.
ii) Develop a program to reverse a linked list iteratively and recursively.
iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

i) Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.
iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

i) Implement a doubly linked list and perform various operations to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

i) Implement a stack using arrays and linked lists.
ii) Write a program to evaluate a postfix expression using a stack.
iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

i) Implement a queue using arrays and linked lists.
ii) Develop a program to simulate a simple printer queue system.
iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

i) Use a stack to evaluate an infix expression and convert it to postfix.
ii) Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

i) Implementing a BST using Linked List.
ii) Traversing of BST.

Exercise 9: Graph

i) Write a program for finding the Depth First Search of a graph.
ii) Write a program for finding the Breadth First Search of a graph.

TEXTBOOKS

2. Mark Allen Weiss, *Data Structures and algorithm analysis in C,* Pearson, 2nd Edition.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, *Fundamentals of data structures in C,* Silicon Press, 2008

REFERENCES

1. Kurt Mehlhorn and Peter Sanders, *Algorithms and Data Structures: The Basic Toolbox,*
2. Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft, *C Data Structures and Algorithms.*
3. Brad Miller and David Ranum, *Problem Solving with Algorithms and Data Structures*.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms.,*
5. Robert Sedgewick, *Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms.*

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I B.Tech – II Sem.

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(23HS0812) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
(Common to all branches of Engineering)

COURSE OBJECTIVES

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES (COs)

After the completion of the course student should be able to

1. *Understand the importance of discipline, character and service motto.*
2. *Solve some societal issues by applying acquired knowledge, facts, and techniques.*
3. *Explore human relationships by analyzing social problems.*
4. *Determine to extend their help for the fellow beings and downtrodden people.*
5. *Develop leadership skills and civic responsibilities.*
6. *Focus on awareness programmes that build community service*

UNIT I

Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II

Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III

Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems- helping them to solve via media-authorities-experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

REFERENCE BOOKS

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme*
   Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. ―Introduction to Environmental Engineering and Science‖, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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II B.Tech – I Sem.

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3	0	0	3

(23HS0836) DISCRETE MATHEMATICS & GRAPH THEORY
(Common to All Branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To enable students to understand the fundamentals of set, relation and recurrence relation.*
2. *To enable students to understand the fundamental concepts of graph theory and its applications in computer science.*

COURSE OUTCOMES (COs)

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

1. *Apply mathematical logic to solve problems.*
2. *Understand the concepts and perform the operations related to sets, relations and functions. Gain the conceptual background needed and identify structures of algebraic nature.*
3. *Apply basic counting techniques to solve combinatorial problems.*
4. *Formulate problems and solve Binomial, Multinomial problems*
5. *Formulate problems and solve recurrence relations.*
6. *Apply Graph Theory in solving computer science problems*

UNIT - I

Mathematical Logic:

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT - II

Set theory:

The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

UNIT III

Elementary Combinatorics:

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

UNIT IV

Recurrence Relations

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous, Recurrence Relations.

UNIT V

Graphs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs.

TEXTBOOKS

1. J.P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*,Tata McGrawHill,2002.
2. Kenneth H.Rosen, *Discrete Mathematics and its Applications with Combinatorics and GraphTheory*,7thEdition,McGraw Hill Education(India)Private Limited.

REFERENCES

1. JoeL.Mott, Abraham Kandel and The odore P.Baker, *Discrete Mathematics for Computer Scientists & Mathematicians,*2nd Edition, Pearson Education.
2. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science.*

ONLINE LEARNING RESOURCES

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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II B.Tech – I Sem.

L	T	P	C
2	1	0	3

(23HS0814) UNIVERSAL HUMAN VALUES UNDERSTANDING HARMONYAND ETHICAL HUMAN CONDUCT
(Common to All Branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.*
2. *To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.*
3. *To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.*

COURSE OUTCOMES (COs)

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

1. *Define the terms like Natural Acceptance, Happiness and Prosperity*
2. *Identify oneself, and one's surroundings (family, society nature)*
3. *Apply what they have learnt to their own self in different day-to-day settings in real life*
4. *Relate human values with human relationship and human society.*
5. *Justify the need for universal human values and harmonious existence*
6. *Develop as socially and ecologically responsible engineers*

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT - I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT - II

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT V

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

TEXTBOOKS

1. R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCES

1. *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff (Book).*
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting. Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

ONLINE LEARNING RESOURCES

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-
7. S2A%20Und%20Nature-Existence.pdf
8. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
9. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
10. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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II B.Tech – I Sem.

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(23CS0901) PRINCIPLES OF ARTIFICIAL INTELLIGENCE
(Common to CSM & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *The student should be made to study the concepts of Artificial Intelligence.*
2. *The student should be made to learn the methods of solving problems using Artificial Intelligence.*
3. *The student should be made to introduce the concepts of Expert Systems.*
4. *To understand the applications of AI, namely game playing, theorem proving, and machine learning.*
5. *To learn different knowledge representation techniques*

COURSE OUTCOMES (COs)

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

1. *Understand foundations of AI and history*
2. *Illustrate various searching algorithms*
3. *Describe knowledge representation issue and predicate logic*
4. *Explain Reasoning under uncertainty and review of probability*
5. *Understand various logic concepts*
6. *Describe Architecture of expert systems and Roles of expert systems*

UNIT - I

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT - II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempstershafer theory.

UNIT IV

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT V

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

TEXTBOOKS

1. S. Russel and P. Norvig, *Artificial Intelligence – A Modern Approach*, 2nd Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., *Artificial Intelligence* (SIE), Mc Graw Hill

REFERENCES

1. David Poole, Alan Mackworth, Randy Goebel,*Computational Intelligence: a logical approach*, Oxford University Press.
2. G. Luger, *Artificial Intelligence: Structures and Strategies for complex problem solvin*", Fourth Edition, Pearson Education.
3. J. Nilsson, *Artificial Intelligence: A new Synthesis*, Elsevier Publishers.
4. SarojKaushik, *Artificial Intelligence*, CENGAGE Learning.

ONLINE LEARNING RESOURCES

1. https://ai.google/
2. https://swayam.gov.in/nd1_noc19_me71/preview

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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II B.Tech – I Sem.

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(23CS0507) ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS
(Common to CSE, CSIT & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *provide knowledge on advance data structures frequently used in Computer Science domain*
2. *Develop skills in algorithm design techniques popularly used*
3. *Understand the use of various data structures in the algorithm design*

COURSE OUTCOMES (COs)

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

1. *Illustrate the working of the advanced tree data structures and their applications.*
2. *Understand the Graph data structure, traversals and apply them in various contexts.*
3. *Use various data structures in the design of algorithms.*
4. *Analyze the efficiency of Greedy and Dynamic Programming design techniques to solve the optimization problems.*
5. *Recommend appropriate data structures based on the problem being solved.*
6. *Analyze algorithms with respect to space and time complexities.*

UNIT - I

Introduction: Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees: Creation, Insertion, Deletion operations and Applications

B-Trees: Creation, Insertion, Deletion operations and Applications

UNIT - II

Heap Trees (Priority Queues): Min and Max Heaps, Operations and Applications

Graphs: Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT III

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT IV

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT V

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

TEXTBOOKS

1. Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, *Fundamentals of Data Structures in C++,* 2ndEdition Universities Press
2. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, *Computer Algorithms in C++,* 2nd Edition University Press

REFERENCES

1. Robert Kruse, *Data Structures and program design in C*, Pearson Education Asia
2. Trembley & Sorenson, *An introduction to Data Structures with applications*, McGraw Hill
3. Donald E Knuth, *The Art of Computer Programming, Vol.1: Fundamental Algorithms*, Addison-Wesley, 1997.
4. Langsam, Augenstein &Tanenbaum, *Data Structures using C & C++,* Pearson, 1995
5. N.Wirth, *Algorithms + Data Structures & Programs,* PHI
6. Horowitz Sahni & Mehta, *Fundamentals of Data Structures in C++,* Galgottia Pub.
7. Thomas Standish, *Data structures in Java,*Pearson Education Asia

ONLINE LEARNING RESOURCES

1. *https://www.tutorialspoint.com/advanced_data_structures/index.asp*
2. *http://peterindia.net/Algorithms.html*
3. *https://www.youtube.com/playlist?list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O*

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

II B.Tech – I Sem.

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(23CS0508) OBJECT ORIENTED PROGRAMMING THROUGH JAVA
(Common to CSE, CSIT & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Identify Java language components and how they work together in applications*
2. *Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.*
3. *Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications*
4. *Understand how to design applications with threads in Java*
5. *Understand how to use Java APIs for program development*

COURSE OUTCOMES (COs)

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

1. *Understand the Java language components for implementing control statements.*
2. *Apply the concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications*
3. *Apply the concepts of arrays, inheritance develop efficient java applications.*
4. *Analyze the interfaces for implementing multiple inheritance.*
5. *Evaluate the concepts of packages, file I/O, by using access control, and exception handling mechanisms to solve real world scenarios*
6. *Create the GUI applications by using concepts like multi-threading, Java FX, JDBC*

UNIT - I

Object Oriented Programming: Basic concepts, Principles

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT - II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events

TEXTBOOKS

1. Anitha Seth, B.L.Juneja, *JAVA one step ahead,* Oxford.
2. DebasisSamanta, MonalisaSarma, *Joy with JAVA, Fundamentals of Object Oriented Programming*, Cambridge, 2023.
3. Paul Deitel, Harvey Deitel, *JAVA for Programmers*, 4th Edition, Pearson.

REFERENCES

1. The complete Reference Java, 11thedition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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II B.Tech – I Sem.

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(23CS0509) ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB
(Common to CSE, CSIT & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *acquire practical skills in constructing and managing Data structures*
2. *apply the popular algorithm design methods in problem-solving scenarios*

COURSE OUTCOMES (COs)

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

1. *Design and develop programs to solve real world problems with the popular algorithm design methods.*
2. *Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs.*
3. *Relate the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.*
4. *Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications.*
5. *Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems.*
6. *Compare the performance of different of algorithm design strategies*

EXPERIMENTS COVERING THE TOPICS:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Finding Biconnected components in a graph
- Shortest path algorithms using greedy Method
- 0/1 Knapsack Problem using Dynamic Programming and Backtracking
- Travelling Salesperson problem using Branch and Bound
- N-Queens Problem using Backtracking
- Job Sequencing using Branch and Bound

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.

4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the biconnected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job Sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

REFERENCES

1. Horowitz Ellis, SahniSartaj, Mehta, Dinesh, *Fundamentals of Data Structures in C++,* 2nd Edition, Universities Press
2. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, *Computer Algorithms/C++,* 2ndEdition, University Press
3. Robert Kruse, *Data Structures and program design in C*, Pearson Education Asia
4. Trembley& Sorenson, *An introduction to Data Structures with applications*, McGraw Hill

ONLINE LEARNING RESOURCES

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

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II B.Tech – I Sem.

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(23CS0510) OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB
(Common to CSE, CSIT & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Practice object-oriented programming in the Java programming language*
2. *Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism*
3. *Illustrate inheritance, Exception handling mechanism, JDBC connectivity*
4. *Construct Threads, Event Handling, implement packages, Java FX GUI*

COURSE OUTCOMES (COs)

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

1. *Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.*
2. *Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.*
3. *Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, JDBC, and other utility classes.*
4. *Identify and fix defects and common security issues in code.*
5. *Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.*
6. *Proficiently construct graphical user interface (GUI) applications using JavaFX*

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Programs:

Exercise – 1:

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program implement method overloading.

c) Write a JAVA program to implement constructor.

d) Write a JAVA program to implement constructor overloading.

Exercise - 4

a) Write a JAVA program to implement Single Inheritance

b) Write a JAVA program to implement multi level Inheritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

a) Write a JAVA program give example for "super" keyword.

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism

b) Write a JAVA program Illustrating Multiple catch clauses

c) Write a JAVA program for creation of Java Built-in Exceptions

d) Write a JAVA program for creation of User Defined Exception

Exercise - 7

a) Write a JAVA program that creates threads by extending Thread class.First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds,(Repeat the same by implementing Runnable)

b) Write a program illustrating is Alive and join ()

c) Write a Program illustrating Daemon Threads.

d) Write a JAVA program Producer Consumer Problem

Exercise – 8

a) Write a JAVA program that import and use the user defined packages

b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)

c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

REFERENCES

1. P. J. Deitel, H. M. Deitel, *Java for Programmers*, Pearson Education, PHI, 4th Edition, 2007.
2. P. Radha Krishna, *Object Oriented Programming through Java*, Universities Press, 2nd Edition, 2007
3. Bruce Eckel, *Thinking in Java*, Pearson Education, 4th Edition, 2006.
4. Sachin Malhotra, Saurabh Chaudhary, *Programming in Java*, Oxford University Press, 5th Edition, 2010.

ONLINE LEARNING RESOURCES

1. https://java-iitd.vlabs.ac.in/
2. http://peterindia.net/JavaFiles.html

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II B.Tech – I Sem.

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(23CS0549) PYTHON PROGRAMMING
(Skill Enhancement Course)
(Common to All Branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *Introduce core programming concepts of Python programming language.*
2. *Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries*
3. *Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these*

COURSE OUTCOMES (COs)

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

1. *Showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions.*
2. *Apply Python programming concepts to solve a variety of computational problems*
3. *Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs*
4. *Acquire the skills in different operators and statements in python*
5. *Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas*
6. *Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries*

UNIT - I

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.

4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operatorsviii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT - II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. addition ii. Insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT III

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT IV

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT V

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:

a) Apply head () function to the pandas data frame
b) Perform various data selection operations on Data Frame

30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

REFERENCES

1. Gowrishankar S, Veena A., *Introduction to Python Programming*, CRC Press.
2. S Sridhar, J Indumathi, V M Hariharan, *Python Programming*, 2ndEdition, Pearson, 2024
3. Y. Daniel Liang, *Introduction to Programming Using Python*, Pearson.

ONLINE LEARNING RESOURCES

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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II B.Tech – I Sem.

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(23HS0805) ENVIRONMENTAL SCIENCE
(Common to All Branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To make the students to get awareness on environment.*
2. *To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.*
3. *To save earth from the inventions by the engineers.*

COURSE OUTCOMES (COs)

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

1. *To make the students to get awareness about the environment.*
2. *To understand the importance of protecting natural ecosystems for future.*
3. *To understand the various types of pollutions and its causes.*
4. *To understand the various engineering techniques to protect the environment.*
5. *To make awareness about social issues and laws of environmental protection.*
6. *To understand the concept of sustainable development and role of engineering Technology in environment and human health.*

UNIT - I

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources.

UNIT - II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.

b. Grassland ecosystem

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports 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 conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies.

Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

TEXTBOOKS

1. Erach Bharucha for University Grants Commission, *Text book of Environmental Studies for Undergraduate Courses*, Universities Press.
2. Palaniswamy, *Environmental Studies*, Pearson education
3. S. Azeem Unnisa, *Environmental Studies* Academic Publishing Company
4. K. Raghavan Nambiar, *Text book of Environmental Studies* for Undergraduate Courses as per UGC model syllabus, Scitech Publications (India), Pvt. Ltd.

REFERENCES

1. Deeksha Dave and E.Sai Baba Reddy, *Textbook of Environmental Science*, Cengage Publications.
2. M.Anji Reddy, *Text book of Environmental Sciences and Technology*, BS Publication.
3. J.P.Sharma, *Comprehensive Environmental studies*, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, *Environmental Sciences and Engineering*, Prentice hall of India Private limited
5. G.R.Chatwal, *A Text Book of Environmental Studies*, Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, *Introduction to Environmental Engineering and Science*, Prentice hall of India Private limited

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II B.Tech – II Sem.

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(23HS0852) OPTIMIZATION TECHNIQUES
(Common to CSM & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *To provide the basic knowledge about Optimization, importance, application areas of in the industry, Linear Programming.*
2. *To impart different optimization models under typical situations in the business organization like transportation, assignment.*
3. *To understand the process of sequencing in a typical industry.*
4. *To describe different game strategies under cut-throat competitive business environment*
5. *To develop networks of activities of projects and to find out optimal modes of completing projects using network modelling evaluation techniques.*

COURSE OUTCOMES (COs)

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

1. *Understanding Optimization and Formulation of Linear Programing Models*
2. *Formulate and Solve Transportation & Assignment Models*
3. *Sequencing of operations and optimizing*
4. *Develop the knowledge on to decrease idle time and elapsed time*
5. *Discuss the game theory and strategies*
6. *Developing networks of activities and finding optimal mode of projects evaluation.*

UNIT - I

Introduction: Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical method, Simplex method: Maximization and Minimization model(exclude Duality problems), Big-M method and Two Phase method.

UNIT - II

Transportation Problem: Introduction, Transportation Model, Finding initial basic feasible solutions, Moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy.

Assignment Problem – Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

UNIT III

Sequencing: Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, Two jobs and m Machines Problems.

UNIT IV

Game Theory: Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.

UNIT V

Project Management: Network Analysis – Definition –objectives -Rules for constructing network diagram- Determining Critical Path – Earliest & Latest Times – Floats - Application of CPM and PERT techniques in Project Planning and Control – PERT Vs CPM. (exclude Project Crashing).

TEXTBOOKS

1. R.Pannerselvam, *Operations Research,* PHI Publications.
2. S.D.Sharma-Kedarnath, *Operations Research*,
3. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, *Operations Research*, Pearson Education.
4. *Engineering Optimization: Theory and practice*, S.S.Rao, New Age International (P) Limited

REFERENCES

1. ND Vohra, *Quantitative Techniques in Management*, Tata McGraw Hill, 4th Edition, 2011.
2. Hiller & Libermann, *Introduction to O.R,* (TMH).
3. Maurice Saseini, ArhurYaspan& Lawrence Friedman, *Operations Research: Methods & Problems*, Pearson
4. Barry Render, Ralph M. Stair, Jr and Michael E. Hanna, *Quantitative Analysis For Management*
5. Wagner, *Operations Research*, PHI Publications.

ONLINE LEARNING SOURCES

1. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

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II B.Tech – II Sem.

L	T	P	C
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(23HS0838) PROBABILITY & STATISTICS
(Common to All Branches of Engineering)

COURSE OBJECTIVES

The objectives of this course

1. *To familiarize the students with the foundations of probability and statistical methods.*
2. *To help the students in getting a thorough understanding of fundamentals of probability and usage of statistical techniques like testing of hypothesis.*

COURSE OUTCOMES (COs)

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

1. *Acquire knowledge in finding the analysis of categorically and various statistical elementary tools*
2. *Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.*
3. *Apply binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies*
4. *Interpret the properties of normal distributions and its applications.*
5. *Analyze to test various hypotheses included in theory and types of errors for large samples.*
6. *Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems*

UNIT - I

Descriptive statistics

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT - II

Probability

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT III

Probability distributions

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

UNIT IV

Estimation and Testing of hypothesis, large sample tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

UNIT V

Small sample tests

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

TEXTBOOKS

1. Miller and Freunds, *Probability and Statistics for Engineers*,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 11/e, Sultan Chand &; Sons Publications, 2012.

REFERENCES

1. S. Ross, *a First Course in Probability*, Pearson Education India, 2002.
2. W. Feller, *an Introduction to Probability Theory and its Applications*, 1/e, Wiley, 1968.
3. B. V. Ramana, *Higher Engineering Mathematics*, Mc Graw Hill Education.

ONLINE LEARNING RESOURCES

4. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
5. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

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(23CS0902) MACHINE LEARNING
(Common to CSM & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *Define machine learning and its different types (supervised and unsupervised) and understand their applications.*
2. *Apply supervised learning algorithms including decision trees and k-nearest neighbors (k-NN).*
3. *Implement unsupervised learning techniques, such as K-means clustering.*

COURSE OUTCOMES (COs)

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

1. *Identify machine learning techniques suitable for a given problem.*
2. *Solve real-world problems using various machine learning techniques.*
3. *Apply Dimensionality reduction techniques for data pre-processing.*
4. *Apply classification techniques for data processing*
5. *Explain what is learning and why it is essential in the design of intelligent machines.*
6. *Evaluate Advanced learning models for language, vision, speech, decision making etc.*

UNIT - I

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT - II

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT III

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT IV

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT V

Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

TEXTBOOK

1. M N Murthy, V S Ananthanarayana, *Machine Learning Theory and Practice* Universities Press (India), 2024

REFERENCES

1. Tom M. Mitchell, *Machine Learning*, McGraw-Hill Publication, 2017
2. Peter Harrington, *Machine Learning in Action,* DreamTech
3. Pang-Ning Tan, Michel Stenbach, Vipin Kumar, *Introduction to Data Mining*, 7th Edition, 2019.

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

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II B.Tech – II Sem.

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(23CS0512) DATABASE MANAGEMENT SYSTEMS
(Common to all CSE & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra*
2. *Introduce the concepts of basic SQL as a universal Database language*
3. *Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization*
4. *Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques*

COURSE OUTCOMES (COs)

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

1. *Understand the basic concepts of database management systems*
2. *Analyze a given database application scenario to use ER model for conceptual design of the database*
3. *Develop relational algebra expressions to query and optimize the database using SQL*
4. *Utilize SQL proficiently to address diverse query challenges*
5. *Employ normalization methods to enhance database structure*
6. *Assess and implement transaction processing, concurrency control and database recovery protocols in databases.*

UNIT - I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT - II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependencyLossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing.

TEXTBOOKS

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, TMH 3rd edition, (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

REFERENCES

1. Robert Kruse, *Data Structures and program design in C,* Pearson Education Asia
2. Trembley & Sorenson, *An introduction to Data Structures with applications,* McGraw Hill
3. Donald E Knuth, Addison-Wesley, *The Art of Computer Programming*, Vol.1: Fundamental Algorithms, 1997.
4. Langsam, Augenstein & Tanenbaum, *Data Structures using C & C++:* Pearson, 1995
5. N.Wirth, *Algorithms + Data Structures & Programs,* PHI
6. Horowitz Sahni & Mehta, *Fundamentals of Data Structures in C++,* Galgottia Pub.
7. Thomas Standish, *Data structures in Java*, Pearson Education Asia
8. C J Date, *Introduction to Database Systems,* 8th edition, Pearson.
9. RamezElmasri, Shamkant B. Navathe, *Database Management System* 6th edition Pearson

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

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II B.Tech – II Sem.

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(23CS0506) DIGITAL LOGIC AND COMPUTER ORGANIZATION
(Common to all CSE & CSE allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals*
2. *Describe memory hierarchy concepts*
3. *Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices*

COURSE OUTCOMES (COs)

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

1. *Differentiate between combinational and sequential circuits based on their characteristics and functionalities.*
2. *Demonstrate an understanding of computer functional units.*
3. *Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems.*
4. *Demonstrate Hardwired Control and Multi programmed Control Units*
5. *Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability.*
6. *Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques.*

UNIT - I

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT - II

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT III

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT IV

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT V

Input / Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

TEXTBOOKS

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, *Computer Organization,* 6th edition, McGraw Hill
2. M. Morris Mano, *Digital Design,* 6th Edition, Pearson Education.

REFERENCES

1. William Stallings, *Computer Organization and Architecture,* 11thEdition, Pearson.
2. M.Moris Mano, *Computer Systems Architecture,* 3rdEdition, Pearson
3. David A. Paterson, John L.Hennessy, *Computer Organization and Design*, Elsevier
4. Roth, *Fundamentals of Logic Design*, 5thEdition, Thomson

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/106/103/106103068/

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(23CS0903) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB
(Common to all CSE & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *The student should be made to study the concepts of Artificial Intelligence.*
2. *The student should be made to learn the methods of solving problems using AI*
3. *The student should be made to introduce the concepts of Expert Systems and Machine Learning.*
4. *To learn about computing central tendency measures and Data pre-processing techniques*
5. *To learn about classification and regression algorithms*
6. *To apply different clustering algorithms for a problem.*

COURSE OUTCOMES (COs)

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

1. *Understand the Mathematical and statistical prospective of machine learning algorithms through python programming*
2. *Appreciate the importance of visualization in the data analytics solution*
3. *Derive insights using Machine learning algorithms*
4. *Evaluate and demonstrate AI and ML algorithms*
5. *Evaluate different algorithms*

Software Required for ML: Python/R/Weka

List of Experiments

1. Pandas Library
   a. Write a python program to implement Pandas Series with labels.
   b. Create a Pandas Series from a dictionary.
   c. Creating a Pandas Data Frame.
   d. Write a program which makes use of the following Pandas methods
   i) describe () ii) head () iii) tail () iv) info ()
2. Pandas Library: Visualization
   a. Write a program which use pandas inbuilt visualization to plot following graphs:
   i) Bar plots ii) Histograms iii) Line plots iv) Scatter plots
3. Write a Program to Implement Breadth First Search using Python.
4. Write a program to implement Best First Searching Algorithm
5. Write a Program to Implement Depth First Search using Python.
6. Write a program to implement the Heuristic Search
7. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)
8. Apply the following Pre-processing techniques for a given dataset.

a. Attribute selection
b. Handling Missing Values
c. Discretization
d. Elimination of Outliers

9. Apply KNN algorithm for classification and regression
10. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
11. Apply Random Forest algorithm for classification and regression
12. Demonstrate Naïve Bayes Classification algorithm.
13. Apply Support Vector algorithm for classification
14. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

REFERENCES

1. Stuart J. Russell and Peter Norvig, *Artificial Intelligence A Modern Approach*, 4th Edition, Pearson, 2020
2. Martin C. Brown (Author), *Python: The Complete Reference*, McGraw Hill Education, Fourth edition, 2018
3. R. NageswaraRao , *Core Python Programming,* Dreamtech Press India Pvt Ltd 2018.
4. Tom M. Mitchell, *Machine Learning*, McGraw-Hill Publication, 2017
5. Peter Harrington, *Machine Learning in Action,* DreamTech
6. Pang-Ning Tan, Michel Stenbach, Vipin Kumar, *Introduction to Data Mining*,7th Edition, 2019.

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II B.Tech –II Sem.

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0	0	3	1.5

(23CS0515) DATABASE MANAGEMENT SYSTEMS LAB
(Common to All CSE & CSE Allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Populate and query a database using SQL DDL/DML Commands*
2. *Declare and enforce integrity constraints on a database*
3. *Writing Queries using advanced concepts of SQL*
4. *Programming PL/SQL including procedures, functions, cursors and triggers*

COURSE OUTCOMES (COs)

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

1. *Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment*
2. *Constructing and execute queries to manipulate and retrieve data from databases.*
3. *Develop application programs using PL/SQL.*
4. *Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system.*
5. *Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality*
6. *Establish database connectivity through JDBC (Java Database Connectivity)*

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

5. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
6. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
7. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
8. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
9. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
10. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
13. Create a table and perform the search operation on table using indexing and non-indexing techniques.
14. Write a Java program that connects to a database using JDBC
15. Write a Java program to connect to a database using JDBC and insert values into it
16. Write a Java program to connect to a database using JDBC and delete values from it

REFERENCES

1. *Oracle: The Complete Reference* by Oracle Press
2. Nilesh Shah, *Database Systems Using Oracle*, PHI, 2007
3. Rick F Vander Lans, *Introduction to SQL*, Fourth Edition, Pearson Education, 2007
4. RamezElmasri, Shamkant, B. Navathe, *Database Systems*, Pearson Education, 6th Edition, 2013.
5. Corlos Coronel, Steven Morris, Peter Robb, *Database Principles Fundamentals of Design Implementation and Management*, 10th edition, Cengage Learning, 2022

ONLINE LEARNING RESOURCES

1. http://www.scoopworld.in
   http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

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(23CS0550) FULL STACK DEVELOPMENT – 1
(Common to All CSE & CSE Allied branches)

COURSE OBJECTIVES

The objectives of this course

1. *Make use of HTML elements and their attributes for designing static web pages*
2. *Build a web page by applying appropriate CSS styles to HTML elements*
3. *Experiment with JavaScript to develop dynamic web pages and validate forms*

COURSE OUTCOMES (COs)

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

1. *Design Websites.*
2. *Understand basic concepts of HTML and creation of static webpages*
3. *Apply Styling to web pages.*
4. *Make Web pages interactive.*
5. *Design Forms for applications.*
6. *Choose Control Structure based on the logic to be implemented.*

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

Sample Experiments:

1. Lists, Links and Images
   a. Write a HTML program, to explain the working of lists.
   b. Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
   c. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
   d. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
   e. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames
   a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
   b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
   c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
   d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS
   a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, , tags.
   b. Write a HTML program, to embed audio and video into HTML web page.
   c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms
   a. Write a program to apply different types of selector forms
      i. Simple selector (element, id, class, group, universal)
      ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
      iii. Pseudo-class selector
      iv. Pseudo-element selector
      v. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model
   a. Write a program to demonstrate the various ways you can reference a color in CSS.
   b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
   c. Write a program using the following terms related to CSS font and text:
      i. font-size ii. font-weight iii. font-style
      iv. text-decoration v. text-transformation vi. text-alignment
   d. Write a program, to explain the importance of CSS Box model using
      i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion
   a. Write a program to embed internal and external JavaScript in a web page.
   b. Write a program to explain the different ways for displaying output.

c. Write a program to explain the different ways for taking input.
d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects
   a. Write a program using document object properties and methods.
   b. Write a program using window object properties and methods.
   c. Write a program using array object properties and methods.
   d. Write a program using math object properties and methods.
   e. Write a program using string object properties and methods.
   f. Write a program using regex object properties and methods.
   g. Write a program using date object properties and methods.
   h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.
8. JavaScript Conditional Statements and Loops
   a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
   b. Write a program to display week days using switch case.
   c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
   d. Write a program to print data in object using for-in, for-each and for-of loops
   e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]
   f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)
9. JavaScript Functions and Events
   a. Design a appropriate function should be called to display
      i. Factorial of that number
      ii. Fibonacci series up to that number
      iii. Prime numbers up to that number
      iv. Is it palindrome or not
   b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
      i. Factorial of that number
      ii. Fibonacci series up to that number
      iii. Prime numbers up to that number
      iv. Is it palindrome or not
   c. Write a program to validate the following fields in a registration page
      i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
      ii. Mobile (only numbers and length 10 digits)
      iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

TEXTBOOKS

1. John Dean, *Web Programming with HTML5, CSS and JavaScript*, Jones & Bartlett Learning, 2019.

REFERENCES

1. Robet W Sebesta, *Programming the World Wide Web*, 7thEdition, Pearson, 2013.
2. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, 2nd edition, APress, O'Reilly.

ONLINE LEARNING RESOURCES

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

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II B.Tech – II Sem.

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(23HS0815) DESIGN THINKING & INNOVATION
(Common to All Engineering Branches)

COURSE OBJECTIVES
The objectives of this course

1. *Is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.*

COURSE OUTCOMES (COs)
At the end of the course, Student will be able to

1. *Define the concepts related to design thinking.*
2. *Explain the fundamentals of Design Thinking and innovation*
3. *Apply the design thinking techniques for solving problems in various sectors.*
4. *Analyze to work in a multidisciplinary environment*
5. *Evaluate the value of creativity*
6. *Formulate specific problem statements of real time issues*

UNIT - I
Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II
Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III
Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV

Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V

Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

TEXTBOOKS

1. Tim Brown,*Change by design,* Harper Bollins (2009)
2. Idris Mootee, *Design Thinking for Strategic Innovation*, 2013, John Wiley & Sons.

REFERENCES

1. David Lee, *Design Thinking in the Classroom*, Ulysses press
2. Shrutin N Shetty, *Design the Future*, Norton Press
3. William Lidwell,*Universal Principles of Design*- Kritinaholden, Jill Butter.
4. Chesbrough.H, *The Era of Open Innovation* – 2013

ONLINE LEARNING RESOURCES

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/previe

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SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT
(Common to All Engineering Branches)

The following the recommended list of projects for engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. *Water facilities and drinking water availability*
2. *Health and hygiene*
3. *Stress levels and coping mechanisms*
4. *Health intervention programmes*
5. *Horticulture*
6. *Herbal plants*
7. *Botanical survey*
8. *Zoological survey*
9. *Marine products*
10. *Aqua culture*
11. *Inland fisheries*
12. *Animals and species*
13. *Nutrition*
14. *Traditional health care methods*
15. *Food habits*
16. *Air pollution*
17. *Water pollution*
18. *Plantation*
19. *Soil protection*
20. *Renewable energy*
21. *Plant diseases*
22. *Yoga awareness and practice*
23. *Health care awareness programmes and their impact*
24. *Use of chemicals on fruits and vegetables*
25. *Organic farming*
26. *Crop rotation*
27. *Floury culture*
28. *Access to safe drinking water*

29. *Geographical survey*
30. *Geological survey*
31. *Sericulture*
32. *Study of species*
33. *Food adulteration*
34. *Incidence of Diabetes and other chronic diseases*
35. *Human genetics*
36. *Blood groups and blood levels*
37. *Internet Usage in Villages*
38. *Android Phone usage by different people*
39. *Utilization of free electricity to farmers and related issues*
40. *Gender ration in schooling level- observation.*

Complementing the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. *Reading Skill Program (Reading Competition)*
2. *Preparation of Study Materials for the next class.*
3. *Personality / Leadership Development*
4. *Career Guidance for X class students*
5. *Screening Documentary and other educational films*
6. *Awareness Program on Good Touch and Bad Touch (Sexual abuse)*
7. *Awareness Program on Socially relevant themes.*

Programs for Women Empowerment

1. *Government Guidelines and Policy Guidelines*
2. *Women's Rights*
3. *Domestic Violence*
4. *Prevention and Control of Cancer*
5. *Promotion of Social Entrepreneurship*

General Camps

1. *General Medical camps*
2. *Eye Camps*
3. *Dental Camps*
4. *Importance of protected drinking water*
5. *ODF awareness camp*
6. *Swatch Bharath*
7. *AIDS awareness camp*
8. *Anti-Plastic Awareness*
9. *Programs on Environment*
10. *Health and Hygiene*
11. *Hand wash programmes*
12. *Commemoration and Celebration of important days*

Programs for Youth Empowerment

1. *Leadership*
2. *Anti-alcoholism and Drug addiction*
3. *Anti-tobacco*
4. *Awareness on Competitive Examinations*
5. *Personality Development*

Common Programs

1. *Awareness on RTI*
2. *Health intervention programmes*
3. *Yoga*
4. *Tree plantation*
5. *Programs in consonance with the Govt. Departments like –*
    - *i. Agriculture*
    - *ii. Health*
    - *iii. Marketing and Cooperation*
    - *iv. Animal Husbandry*
    - *v. Horticulture*
    - *vi. Fisheries*
    - *vii. Sericulture*
    - *viii. Revenue and Survey*
    - *ix. Natural Disaster Management*
    - *x. Irrigation*
    - *xi. Law & Order*
    - *xii. Excise and Prohibition*
    - *xiii. Mines and Geology*
    - *xiv. Energy*

Role of Students:

- *Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.*
- *For conducting special camps like Health related, they will be coordinating with the Governmental agencies.*
- *As and when required the College faculty themselves act as Resource Persons.*
- *Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.*
- *And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.*
- *An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.*

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week):**

- *A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.*
- *A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.*
- *The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.*

2. **Community Awareness Campaigns (One Week):**

- *Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.*

3. **Community Immersion Programme (Three Weeks):**

- *Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.*

4. **Community Exit Report (One Week):**

- *During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them*

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(23CS1401) NATURAL LANGUAGE PROCESSING FOR AI

COURSE OBJECTIVES

The objectives of this course

1. *Basics of NLP, Morphology, Tokenization, N-gram Models*
2. *POS Tagging, Parsing, Treebanks, Ambiguity Handling*
3. *Word Sense Disambiguation, Semantic Parsing, Sentiment Analysis*
4. *Machine Translation, Transformers, BERT/GPT, Ethical NLP*
5. *Speech Recognition, Feature Extraction, Discourse Analysis*

COURSE OUTCOMES (COs)

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

1. *Understand morphological processing and the structure of words and documents.*
2. *Analyze syntactic structures using various parsing algorithms.*
3. *Apply semantic parsing techniques to interpret natural language text.*
4. *Use NLP tools and libraries to analyze and interpret natural language data in real-world scenarios*
5. *Understand predicate-argument structures and meaning representation systems.*
6. *Apply cross-lingual language models and speech recognition techniques in NLP applications*

UNIT I: Introduction to NLP

Introduction to NLP: Origins and Challenges, Language and Grammar in NLP, Regular Expressions and Finite-State Automata, Tokenization: Text Segmentation and Sentence Splitting, Morphological Parsing: Stemming and Lemmatization, Spelling Error Detection and Correction, Minimum Edit Distance and Applications, Statistical Language Models: Unigram, Bigram, and Trigram Models, Processing Indian Languages in NLP.

UNIT II: Word-Level and Syntactic Analysis

Introduction, Part-of-Speech (POS) Tagging: Rule-Based, Stochastic and Transformation-Based Approaches, Hidden Markov Models (HMM) and Maximum Entropy Models for POS Tagging, Context-Free Grammar (CFG) and Constituency Parsing, Treebanks and Normal Forms for Grammar, Top-Down and Bottom-Up Parsing Strategies, CYK Parsing Algorithm, Probabilistic Context-Free Grammars (PCFGs), Feature Structures and Unification.

UNIT III: Text Classification and Information Retrieval

Naïve Bayes Classifier for Text Classification, Training and Optimization for Sentiment Analysis, Information Retrieval: Basic Concepts and Design Features, Information Retrieval Models: Classical, Non-Classical, and Alternative Models, Cluster Model, Fuzzy Model, and LSTM-Based Information, Retrieval, Word Sense Disambiguation (WSD) Methods: Supervised and Dictionary-Based Approaches.

UNIT IV: Machine Translation and Semantic Processing

Introduction to Machine Translation (MT), Language Divergence and Typology in MT Encoder Decoder Model for Machine Translation, Translating in Low-Resource Scenarios, MT Evaluation Metrics and Techniques, Bias and Ethical Issues in NLP and Machine Translation, Semantic Analysis and First-Order Logic in NLP, Thematic Roles and Selectional Restrictions in Semantics, Word Senses and Relations Between Senses

UNIT V: Speech Processing and Advanced NLP Models

Speech Fundamentals: Phonetics and Acoustic Phonetics, Digital Signal Processing in Speech Analysis, Feature Extraction in Speech: Short-Time Fourier Transform (STFT), Mel-Frequency Cepstral Coefficients (MFCC) and Perceptual Linear Prediction (PLP), Hidden Markov Models (HMMs) in Speech Recognition.

TEXTBOOKS:

1. Daniel Jurafsky & James H. Martin – *Speech and Language Processing*: *An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*, Pearson Education, 2023.
2. Tanveer Siddiqui & U.S. Tiwary – *Natural Language Processing and Information* Retrieval, Oxford University Press.

REFERENCE BOOKS :

1. T.V. Geetha – *Understanding Natural Language Processing* – Machine Learning and Deep Learning Perspectives, Pearson, 2024.
2. Akshay Kulkarni & Adarsha Shivananda – *Natural Language Processing Recipes* - Unlocking Text Data with Machine Learning and Deep Learning using Python, Apress, 2019.

WEB LINKS AND VIDEO LECTURES:

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
3. https://archive.nptel.ac.in/courses/106/106/106106211/

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(23CS0905) SYSTEM SOFTWARE PROGRAMMING
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand the architecture and design of system software including compilers, assemblers, linkers, loaders, and macro processors.*
2. *To gain in-depth knowledge of programming tools, shell environments, and low-level system utilities.*
3. *To apply principles of system programming in Unix/Linux environments.*
4. *To explore process creation, inter-process communication, signal handling, and multithreading using C/C++.*
5. *To enable development of foundational tools like simple compilers, parsers, and loaders.*

COURSE OUTCOMES:

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

1. *Explain the architecture and functions of system software like assemblers, loaders, linkers, and macro processors.*
2. *Apply scanning and parsing techniques for programming language processing.*
3. *Develop and analyze assembly-level programs and understand compilation techniques.*
4. *Implement Unix/Linux system programming tasks such as process creation, pipes, signals, and thread management.*
5. *Demonstrate hands-on experience in shell scripting, debugging, and low-level system tools*
6. *Analyze the compilation process and implement basic system-level programming concepts like process creation, file I/O, and concurrency mechanisms*

UNIT - I: Language Processors and Assemblers

Language processing system overview, Phases of compilation and data structures, Assemblers – features, single pass and two-pass assembler, Intermediate code generation, Literal and symbol tables, Relocation and linking concepts

UNIT - II: Macro Processors and Loaders

Macro instruction and features, Nested macros and macro expansion, Macro processing in two-pass assemblers, Design of macro processors, Loaders: absolute, relocating, and linking, Dynamic loading and linking, bootstrap loader.

UNIT - III: Scanning, Parsing, and Compilers

Language grammars and ambiguity, Lexical analysis – regular expressions, token generation, Syntax analysis – parsing techniques (top-down, bottom-up), Semantic analysis and intermediate code generation, Code optimization techniques – constant folding, dead code elimination.

UNIT IV: Linkers, Debuggers, and Shell Programming

Symbol resolution and relocation, Linking (static vs dynamic), relocation records, Debugging techniques and breakpoints, Unix/Linux shell environment, Shell commands, variables, redirection, pipes, control statements, Shell script functions and script-based automation.

UNIT V: Unix/Linux System Programming

Introduction to system-level programming in C, File I/O system calls (open, read, write, close), Process creation using fork(), exec(), wait(), Inter-process communication (pipes, FIFO), Signal handling and POSIX threads (pthread_create, pthread_join), Case studies: background processes, daemon creation, mini shell.

TEXTBOOKS:

1. Leland L. Beck, D. Manjula, System Software: *An Introduction to Systems Programming*, 3rd Edition, Pearson.

2. Silberschatz, Galvin, Gagne, *Operating System Concepts*, 10th Edition, Wiley (selectively for system calls & programming).

REFERENCE BOOKS:

1. D.M. Dhamdhere, *System Programming and Operating Systems*, McGraw Hill.

2. Neil Matthew, Richard Stones, *Beginning Linux Programming*, Wrox.

3. Andrew S. Tanenbaum, *Modern Operating Systems*, Pearson Education.

4. Yashwant Kanetkar, *Unix Shell Programming*, BPB Publications.

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(23CS0906) COMPUTER VISION & IMAGE PROCESSING
(Common to CSM & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *Introduce fundamental concepts of image processing and computer vision.*
2. *Develop proficiency in applying algorithms for image analysis and interpretation.*
3. *Explore techniques for feature extraction, object recognition, and scene understanding.*
4. *Understand the integration of machine learning methods in computer vision applications*.

COURSE OUTCOMES:

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

1. *Understand image formation, representation, and apply basic image processing and frequency domain techniques for image enhancement and restoration.*
2. *Apply edge detection, segmentation, morphological, and texture analysis techniques for*
   extracting features from images.
3. *Apply stereo vision and camera calibration techniques for 3D scene understanding and depth estimation*
4. *Analyze 3D vision and motion using techniques like stereo vision, optical flow, and camera*
   calibration for scene understanding and depth estimation.
5. *Evaluate object recognition approaches and machine learning models including traditional*
   and deep learning techniques used in computer vision.
6. *Implement advanced computer vision applications such as image compression, face recognition, and medical image analysis using case studies.*

UNIT I: Introduction to Computer Vision and Image Processing

Overview of Computer Vision and Image Processing:Definitions and scope, Historical development and applications, Image Formation and Representation: Image acquisition methods, Sampling and quantization, Color spaces and models, Fundamentals of Image Processing:Point operations (brightness and contrast adjustments), Histogram processing, Spatial filtering techniques Fourier Transform and Frequency Domain Processing:Discrete Fourier Transform (DFT), Filtering in the frequency domain, Image restoration concept.

UNIT II: Image Analysis Techniques

Edge Detection and Feature Extraction:Gradient operators (Sobel, Prewitt), Canny edge detector, Corner and interest point detection, Image Segmentation:Thresholding methods, Region-based segmentation, Clustering techniques (K-means, Mean-Shift), Morphological

Image Processing: Erosion and dilation, Opening and closing operations, Applications in shape analysis, Texture Analysis, Statistical methods (co-occurrence matrices), Transform-based methods (Gabor filters), Applications in pattern recognition

UNIT III: 3D Vision and Motion Analysis

Stereo Vision:Epipolar geometry,Disparity mapping, Depth estimation techniques, Structure from Motion (SfM):Feature tracking across frames, 3D reconstruction from motion, Applications in scene understanding, Optical Flow and Motion Analysis:Lucas-Kanade method, Horn-Schunck method, Motion segmentation, Camera Calibration and 3D Reconstruction:Intrinsic and extrinsic parameters, Calibration techniques, 3D point cloud generation

UNIT IV: Object Recognition and Machine Learning in Vision

Feature Descriptors and Matching:Scale-Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF), Feature matching algorithms, Object Detection and Recognition:Template matching, Deformable part models, Convolutional Neural Networks (CNNs), Introduction to Machine Learning for Vision:Supervised and unsupervised learning, Support Vector Machines (SVMs), Decision trees and random forests, Deep Learning Architectures:Autoencoders, Recurrent Neural Networks (RNNs), Generative Adversarial Networks (GANs)

UNIT V: Applications and Advanced Topics

Image Compression:Lossy and lossless compression techniques, Standards (e.g., JPEG, PNG), Morphological Image Processing:Dilation, erosion, opening, and closing operations.,Applications in shape analysis, Case Studies:Face recognition systems., Automated visual inspection, Medical image analysis.

TEXTBOOKS:

1. Gonzalez, R. C., & Woods, R. E. (2008). *Digital Image Processing* (3rd ed.). Pearson Prentice
Hall.Stony Brook University
2. Szeliski, R. (2010). Computer Vision: *Algorithms and Applications*. Springer.

REFERENCE BOOKS

1. Forsyth, D. A., & Ponce, J. (2002). Computer Vision: *A Modern Approach*. Prentice Hall.
2. Shapiro, L. G., & Stockman, G. C. (2001). Computer Vision. Prentice Hall.

ONLINE LEARNING RESOURCES:

1. Coursera: Introduction to Computer Vision and Image Processing. LinkCoursera
2. Stanford University: CS231n: Deep Learning for Computer Vision. Linkcs231n.stanford.edu
3. MIT OpenCourseWare: Introduction to Computer Vision. Link

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(23CS0519) INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *Introduce fundamental quantum concepts like superposition and entanglement.*
2. *Understand theoretical structure of qubits and quantum information.*
3. *Explore conceptual challenges in building quantum computers.*
4. *Explain principles of quantum communication and computing.*
5. *Examine real-world applications and the future of quantum technologies.*

COURSE OUTCOMES :

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

1. *Explain core quantum principles in a non-mathematical manner.*
2. *Compare classical and quantum information systems.*
3. *Identify theoretical issues in building quantum computers.*
4. *Discuss quantum communication and computing concepts.*
5. *Recognize applications, industry trends, and career paths in quantum technology.*
6. *Societal & ethical implications of quantum technologies*

Unit 1: Introduction to Quantum Theory and Technologies

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India‘s Quantum Mission, EU, USA, China

Unit 2: Theoretical Structure of Quantum Information Systems

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

Unit 3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what‘s working and what remains elusive,The role of quantum software in managing theoretical complexities.

Unit 4: Quantum Communication and Computing – Theoretical Perspective

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real World Importance and Future Potential

Unit 5: Applications, Use Cases, and the Quantum Future

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

TEXTBOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing*: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. Alastair I.M. Rae, *Quantum Physics: A Beginner's Guide, Oneworld* Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.

7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: *Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. GiulianoBenenti, GiulioCasati, GiulianoStrini, *Principles of Quantum Computation and Information,* Volume I: Basic Concepts, World Scientific Publishing, 2004.
9. K.B. Whaley et al., *Quantum Technologies and Industrial Applications*: European Roadmap and Strategy Document, Quantum Flagship, European Commission, 2020.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, MeitY/DST Publications, 2020 onward.

ONLINE LEARNING RESOURCES:

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

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(23CS0921) DATA VISUALIZATION
(Professional Elective Course-I)
(Common to CSM & CAI)

COURSE OBJECTIVES

The objectives of this course

1. *To understand the principles, techniques, and tools of data visualization*
2. *To develop the ability to transform data into visual insights using different types of charts and plots.*
3. *To introduce the cognitive and perceptual foundations of effective data visualization.*
4. *To apply tools and programming environments (like Python, Tableau, or Power BI) for creating interactive and dynamic visualizations.*
5. *To analyze real-world datasets and effectively communicate data-driven findings visually.*

COURSE OUTCOMES:

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

1. *Interpret different types of data and recognize the appropriate visualization methods. Understand, Analyze)*
2. *Design effective and interactive data visualizations using various tools. (Apply, Create)*
3. *Apply visual encoding techniques to represent complex data effectively*
4. *Apply visual encoding and perceptual principles in presenting complex data. (Apply, Evaluate)*
5. *Analyze and visualize real-world data sets using Python libraries and dashboards. (Analyze, Evaluate)*
6. *Create visual stories and dashboards for effective communication of insights. (Create,Apply)*

UNIT I: Introduction to Data Visualization & Perception

Introduction to Data Visualization, Importance and Scope of Data Visualization, Data Types and Sources, Visual Perception: Pre-attentive Processing, Gestalt Principles, Data-Ink Ratio, Data Density, Lie Factor, Visualization Process and Design Principles, Tools Overview: Tableau, Power BI, Python Libraries

UNIT II: Visualization Techniques for Categorical & Quantitative Data

Charts for Categorical Data: Bar Charts, Pie Charts, Column Charts, Charts for Quantitative Data: Histograms, Line Charts, Boxplots, Scatter Plots, Bubble Charts, Heatmaps, Choosing the Right Chart Type, Best Practices in Labeling, Coloring, and Scaling.

UNIT III: Multidimensional, Temporal and Hierarchical Data Visualization

Visualizing Multivariate Data: Parallel Coordinates, Radar Charts, Time-Series Visualization: Time Plots, Animation over Time, Geographic Data Visualization: Maps, Choropleths, Hierarchical Data: Treemaps, Sunburst Charts, Network and Graph Visualization.

UNIT IV: Data Visualization Using Python and Dashboards

Introduction to Matplotlib, Seaborn, and Plotly, Creating Static and Interactive Charts, Pandas Visualization Capabilities, Dashboards with Dash, Streamlit, Power BI, Case Studies: Real-world Dataset Visualization.

UNIT V: Storytelling with Data and Ethical Visualization

Storytelling and Narrative Techniques in Visualization, Dashboards and Reporting, Misleading Visualizations and Bias, Ethical Principles in Data Visualization, Final Project: Create a Storytelling Dashboard with Real Data.

TEXTBOOKS:

1. Tamara Munzner, Visualization *Analysis and Design*, CRC Press, 2014.
2. Nathan Yau, Data Points: *Visualization That Means Something*, Wiley, 2013.

REFERENCE BOOKS:

1. Alberto Cairo, The Truthful Art: *Data, Charts, and Maps for Communication*, New Riders, 2016.
2. Cole Nussbaumer Knaflic, Storytelling with Data: *A Data Visualization Guide for BusinessProfessionals*, Wiley, 2015.
3. Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly, 2019.
4. Rohan Chopra, Hands-On Data Visualization with Bokeh, Packt Publishing, 2019.

ONLINE LEARNING RESOURCES:

1. NPTEL: Data Visualization - IIT Madras
2. Coursera: Data Visualization with Python by IBM

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(23CS0922) SOFT COMPUTING
(Professional Elective Course-I)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *Understand the concepts of soft computing techniques and how they differ from traditional AI techniques.*
2. *Introduce the fundamentals of fuzzy logic and fuzzy systems.*
3. *Familiarize with artificial neural networks and their architectures.*
4. *Learn genetic algorithms and their role in optimization.*
5. *Explore hybrid systems integrating fuzzy logic, neural networks, and genetic algorithms.*

COURSE OUTCOMES:

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

1. *Understand the components and applications of soft computing.*
2. *Apply fuzzy logic concepts to real-world problems.*
3. *Build and train various neural network models.*
4. *Implement genetic algorithms for problem-solving and optimization.*
5. *Design hybrid systems using soft computing techniques.*

UNIT I: Introduction to Soft Computing and Fuzzy Logic

Introduction to Soft Computing: Definition, Components, Differences with Hard Computing, Applications of Soft Computing, Fuzzy Logic: Crisp Sets vs Fuzzy Sets, Membership Functions, Fuzzy Set Operations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems: Mamdani and Sugeno Models, Defuzzification Techniques.

UNIT II: Artificial Neural Networks – I

Introduction to Neural Networks: Biological Neurons vs Artificial Neurons, Architecture of Neural Networks: Feedforward, Feedback, Learning Rules: Hebbian, Delta, Perceptron Learning Rule, Single Layer Perceptron and its Limitations, Multi-Layer Perceptron: Backpropagation Algorithm, Applications of Neural Networks

UNIT III: Artificial Neural Networks – II

Hopfield Networks and Associative Memories, Radial Basis Function Networks, Self-Organizing Maps (SOM), Recurrent Neural Networks (RNNs) – Basic Concepts, Convolutional Neural Networks (CNNs) – Overview and Applications, Practical Use Cases in Image and Pattern Recognition.

UNIT IV: Genetic Algorithms and Optimization

Introduction to Genetic Algorithms, GA Operators: Selection, Crossover, Mutation, Fitness Function and Evaluation, Schema Theorem, Elitism, Applications in Function Optimization, Scheduling, and Robotics, Introduction to Particle Swarm Optimization (PSO).

UNIT V: Hybrid Systems and Advanced Topics

Hybrid Systems: Neuro-Fuzzy Systems, Fuzzy-GA, GA-ANN, ANFIS: Architecture and Learning, Case Studies on Hybrid Systems, Introduction to Deep Learning in Soft Computing, Real-World Applications: Forecasting, Control Systems, Medical Diagnosis, Image Processing.

TEXTBOOKS:

1. S. N. Sivanandam, S. N. Deepa, ―*Principles of Soft Computing*‖, Wiley India, 3rd Edition
2. Timothy J. Ross, ―*Fuzzy Logic with Engineering Applications*‖, Wiley, 4th Edition
3. S. Rajasekaran and G. A. Vijayalakshmi Pai, ―*Neural Networks, Fuzzy Logic and GeneticAlgorithm: Synthesis and Applications*‖, PHI

REFERENCE BOOKS:

1. Laurene Fausett, ―Fundamentals of Neural Networks: Architectures, Algorithms and Applications‖, Pearson
2. David E. Goldberg, ―Genetic Algorithms in Search, Optimization and Machine Learning‖,Pearson
3. Simon Haykin, ―Neural Networks and Learning Machines‖, Pearson, 3rd Edition
4. Bart Kosko, ―Neural Networks and Fuzzy Systems‖, Prentice Hall

ONLINE LEARNING RESOURCES:

1. NPTEL – Soft Computing by Prof. S. Sengupta (IIT Kharagpur)
2. Coursera – Neural Networks and Deep Learning (Andrew Ng)

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(23CS0923) EXPLORATORY DATA ANALYSIS WITH PYTHON
(Professional Elective Course-I)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the principles and practices of Exploratory Data Analysis (EDA) using Python.*
2. *To teach techniques for data cleaning, preprocessing, transformation, and visualization.*
3. *To apply statistical techniques and visual methods to discover patterns and relationships.*
4. *To gain experience using popular Python libraries such as NumPy, Pandas, Matplotlib, and seaborn.*
5. *To prepare datasets for further machine learning and predictive modeling.*

COURSE OUTCOMES:

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

1. *Understand and apply key concepts of EDA and data preprocessing. (Cognitive Level:Understand, Apply)*
2. *Perform exploratory analysis using Python libraries and interpret results. (Cognitive Level:Apply, Analyze)*
3. *Handle missing data, outliers, and categorical features effectively. (Cognitive Level: Apply)*
4. *Illustrate charts and graphs*
5. *Create meaningful visualizations to support data-driven insights. (Cognitive Level: Analyze,Evaluate)*
6. *Use EDA as a foundation for data science workflows. (Cognitive Level: Apply, Create)*

UNIT I – Introduction to EDA and Python Environment

Introduction to Data Science and EDA, Importance of EDA in Data Science Life Cycle, Setting up Python Environment: Jupyter, Anaconda, VS Code, Introduction to NumPy and Pandas: Arrays, Series, DataFrames, Data loading, viewing, basic operations (info, describe, shape)

UNIT II – Data Wrangling and Preprocessing

Handling Missing Data (mean, median, drop, interpolation), Dealing with Duplicates, Outliers, and Anomalies, Encoding Categorical Variables (Label, One-hot), Data Transformation: Scaling, Normalization, Binning, Data Types Conversion and Data Type Casting.

UNIT III – Univariate and Bivariate Analysis

Measures of Central Tendency and Dispersion, Distribution Plots: Histograms, Boxplots, KDE, Bar Charts, Count Plots, Pie Charts, Bivariate Analysis: Scatter Plots, Pair Plots, Heatmaps, Correlation and Covariance Analysis

UNIT IV – Data Visualization Techniques

Visualization with Matplotlib and Seaborn, Customizing Plots: Titles, Legends, Labels, Themes, Advanced Visuals: Violin Plots, Strip Plots, Swarm Plots, Multivariate Visualization and Subplots, Plotly and Interactive Visualizations (basic overview)

UNIT V – EDA Case Studies and Real-Time Datasets

Step-by-step EDA on Sample Datasets (Titanic, Iris, Sales, etc.), Outlier Detection Techniques, Feature Engineering Techniques in EDA, EDA Report Generation using Python Notebooks, Preparing Data for Machine Learning Models

TEXTBOOKS:

1. Jake VanderPlas, *Python Data Science* Handbook: Essential Tools for Working with Data, O'Reilly, 2016.
2. Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly, 2018.

REFERENCE BOOKS:

1. Joel Grus, *Data Science from Scratch*, O'Reilly, 2019.
2. Aurelien Geron, Hands-On *Machine Learning with Scikit*-Learn, Keras & TensorFlow, 2nd
Edition, O'Reilly, 2019.
3. Allen B. Downey, Think Stats: *Probability and Statistics for Programmers*, O'Reilly, 2014.

ONLINE LEARNING RESOURCES:

1. NPTEL Course – Data Science for Engineers
2. Coursera – Applied Data Science with Python Specialization (University of Michigan)

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(23CS0924) COMPUTATIONAL INTELLIGENCE
(Professional Elective Course-I)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *Understand the concepts and foundations of computational intelligence.*
2. *Study neural networks, fuzzy logic systems, and evolutionary algorithms.*
3. *Explore hybrid systems and their applications.*
4. *Apply computational intelligence techniques to real-world problem-solving.*
5. *Analyze the effectiveness of various computational intelligence approaches.*

COURSE OUTCOMES:

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

1. *Describe and differentiate neural networks, fuzzy logic, and evolutionary computation*
2. *Apply neural and fuzzy systems for real-time decision-making. (Apply)*
3. *Analyze real-world optimization problems and apply fuzzy logic techniques to evaluate and interpret uncertain data*
4. *Analyze complex problems using soft computing tools. (Analyze)*
5. *Develop hybrid intelligent systems. (Create)*
6. *Evaluate and compare the performance of CI-based systems. (Evaluate)*

UNIT I: Introduction to Computational Intelligence and Artificial Neural Networks

Definition and Scope of Computational Intelligence (CI), Components of CI: Neural Networks, Fuzzy Logic, Evolutionary Computation, Biological Neuron vs. Artificial Neuron, McCulloch-Pitts Model, Perceptron, Adaline and Madaline, Multilayer Feedforward Networks, Backpropagation Algorithm, Applications of ANN in Pattern Recognition and Classification.

UNIT II: Fuzzy Logic and Fuzzy Systems

Introduction to Fuzzy Logic and Fuzzy Sets, Membership Functions, Fuzzy Set Operations, Fuzzy Rules and Inference Systems, Fuzzification and Defuzzification, Fuzzy Control Systems, Fuzzy Reasoning and Approximate Reasoning

UNIT III: Evolutionary Computation Techniques

Basics of Evolutionary Algorithms (EA), Genetic Algorithms (GA): Operators, Encoding, Fitness Function, Selection, Crossover and Mutation, Convergence Criteria, Genetic Programming (GP), Differential Evolution (DE), Applications of GA and GP

UNIT IV: Swarm Intelligence and Hybrid Systems

Swarm Intelligence: Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Behavior of Swarms and Collective Intelligence, Comparison of Evolutionary Algorithms and Swarm Techniques, Hybrid Systems: Neuro-Fuzzy, Fuzzy-GA, ANN-GA Systems, Case Studies in Hybrid Systems

UNIT V: Applications of Computational Intelligence

CI in Image and Signal Processing, CI for Optimization Problems and Robotics, CI in Biomedical Engineering and Finance, Intelligent Agents and Decision-Making Systems, Real-time Applications and Emerging Trends in CI.

TEXTBOOKS:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic* Algorithms: Synthesis and Applications, PHI Learning.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India.

REFERENCE BOOKS:

1. S.N. Sivanandam, S. N. Deepa, *Principles of Soft Computing*, Wiley India.
2. Simon Haykin, *Neural Networks and Learning Machines*, Pearson.
3. James Kennedy and Russell C. Eberhart, Swarm Intelligence, Morgan Kaufmann.
4. Andries P. Engelbrecht, *Computational Intelligence*: An Introduction, Wiley.

ONLINE LEARNING RESOURCES:

1. NPTEL - Computational Intelligence
2. Coursera – Computational Intelligence
3. YouTube: IIT Lectures on Soft Computing and CI

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(23CE0150) GREEN BUILDINGS
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES :

The objectives of this course

1. *To understand the fundamental concepts of green buildings, their necessity, and sustainable features.*
2. *To analyze green building concepts, rating systems, and their benefits in India.*
3. *To apply green building design principles, energy efficiency measures, and renewable energy sources.*
4. *To evaluate air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.*
5. *To assess material conservation strategies, waste management, and indoor environmental quality in green buildings.*

COURSE OUTCOMES:

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

1. *Choose appropriate materials and techniques for achieving the goal of green buildings during their design.*
2. *Analyze market opportunities, resources, different practices of green buildings and its effects on environment*
3. *Evaluate energy efficiency in design of green buildings*
4. *Design effective and eco-friendly green buildings*
5. *Apply natural air conditioning and lighting techniques in design of green buildings*
6. *Conserve materials, water and maintain quality of environment in construction of green buildings.*

UNIT – I Introduction to Green Building

Necessity of Green Buildings, Benefits of Green Buildings,Green Building Materials and Equipment in India, Key Requisites for Constructing A GreenBuilding, Important Sustainable Features for Green Buildings.

UNIT – II Green Building Concepts and Practices

Indian Green Building Council,Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT – III Green Building Design

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – IV Air Conditioning

Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – V Material Conservation

Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome,tobacco Smoke.

TEXT BOOKS:

1. Indian Society of Heating Refrigerating and Air conditioning Engineers, Handbook on Green Practice, 2025

2.Tom Woolley and Sam Kimings*, Green Building Hand Book*, 2009.

REFRENCE BOOKS:

1.Trish riley, *Complete Guide to Green Buildings*

2.Kent Peterson, *Standard for the design for High Performance Green Buildings,* 2009

3.Energy Conservation Building Code –ECBC, BEE published, 2020

4.Dr.G.Prabhakaran, *Green Buildings and Eco-Engineering,* Vinsa Publishing, 1st edition, 2025

ONLINE LEARNING RESOURCES:

https://archive.nptel.ac.in/courses/105/102/105102195/

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(23CE0151) CONSTRUCTION TECHNOLOGY AND MANAGEMENT
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course are to make the student:

1. *To understand project management fundamentals, organizational structures, and leadership principles in construction.*
2. *To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.*
3. *To apply planning, scheduling, and project management techniques such as CPM and PERT.*
4. *To evaluate various contract types, contract formation, and legal aspects inconstruction management.*
5. *To assess safety management practices, accident prevention strategies, and quality management systems in construction.*

COURSE OUTCOMES :

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

1. *Realize objectives, functions, public relations and management structure in projects.*
2. *Plan and care the human resource needed for the project and can fix the rent of the construction equipment and can perform benefit cost analysis.*
3. *Apply different techniques in scheduling of projects.*
4. *Formulate CPM/PERT networks to evaluate the project completion time and also monitor the project during its life cycle.*
5. *Draft a contract document by incorporating various clauses as per Indian Contract act*
6. *Implement safety measures to reduce construction related accidents*

UNIT – I

Introduction: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability

UNIT – II

Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation

UNIT – III

Planning, Scheduling and Project Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network formulation and Time Computation.

UNIT – IV

Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract forLabour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control

UNIT – V

Safety Management :– Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics

TEXT BOOKS:

1. SK. Sears, GA. Sears and RH. Cloug, *Construction Project Management*, John Wiley and Sons, 6th Edition, 2016.
2. Saleh Mubarak, *Construction Project Scheduling and Control*, 4th Edition, 2019

REFRENCE BOOKS:

1.Brien, J.O. and Plotnick, F.L., CPMin *Construction Management*, Mcgraw Hill, 2010.
2. Punmia, B.C., and Khandelwal, K.K., *Project Planning and control with PERT and CPM*, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, *Construction Management and Organisational Behaviour*, Wiley-Blackwell, 2016.

ONLINE LEARNING RESOURCES:

https://archive.nptel.ac.in/courses/105/104/105104161/

https://archive.nptel.ac.in/courses/105/103/105103093/

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(23EE0261) ELECTRICAL SAFETY PRACTICES AND STANDARDS
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the basic principles of electrical safety, effects of electric shock, and hazards like arc and blast.*
2. *To learn about safety equipment, overvoltage protection, and fire prevention methods in electrical systems.*
3. *To gain knowledge of grounding practices, bonding methods, and maintaining safe distances in electrical environments.*
4. *To become familiar with electrical safety standards, regulations, and practical safety practices in various installations*

COURSE OUTCOMES:

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

1. *Understanding the Fundamentals of Electrical Safety*
2. *Identifying and Applying Safety Components*
3. *Analyzing Grounding Practices and Electrical Bonding*
4. *Applying Safety Practices in Electrical Installations and Environments*
5. *Identify various national and international standards and statutory requirements related to electrical safety*
6. *Compare and interpret the applications of different electrical safety codes and regulations*

UNIT I Introduction To Electrical Safety:

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II Safety Components:

Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment‘s - Fire extinguishers for electrical safety.

UNIT III Grounding:

General requirements for grounding and bonding- Definitions- System grounding Equipment grounding - The Earth - Earthing practices- Determining safe approach distance- Determining arc hazard category.

UNIT IV Safety Practices:

General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.

UNIT V Standards For Electrical Safety:

Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate

TEXT BOOKS:

1. Massimo A.G.Mitolo, ―*Electrical Safety of Low-Voltage Systems*‖, McGraw Hill, USA, 2009.

2. Mohamed El-Sharkawi, ―*Electric Safety - Practice and Standards*‖, CRC Press, USA, 2014

REFERENCES:

1. Kenneth G.Mastrullo, Ray A. Jones, ―The Electrical Safety Program Book‖, Jones and Bartlett Publishers, London, 2nd Edition, 2011.

2. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers,London, 2009.

3. Fordham Cooper, W., ―Electrical Safety Engineering‖, Butterworth and Company, London,1986.

4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, ―Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

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(23ME0356) SUSTAINBLE ENERGY TECHNOLOGIES
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of the course are to

1. *Demonstrate the importance the impact of solar radiation, solar PVmodules*
2. *Understand the principles of storage in PV systems*
3. *Discuss solar energy storage systems and their applications*
4. *Get knowledge in wind energy and bio-mass*
5. *Gain insights in geothermal energy, ocean energy and fuel cells.*

COURSE OUTCOMES

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

1. *llustrate the importance of solar radiation and solar PV modules.*
2. *Discuss the storage methods in PV systems*
3. *Explain the solar energy storage for different applications*
4. *Understand the principles of wind energy, and bio-mass energy*
5. *Attain knowledge in geothermal energy, ocean energy and fuel cells*
6. *Explain the principles of sustainability and the environmental, social, economic aspects of energy use*

UNIT – 1 Solar Radiation:

Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

Solar PV Modules And PV Systems: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT – 2 Storage In PV Systems:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT – 3 Solar Energy Collection:
Flat plate and concentrating collectors, classification of concentrating collectors, orientation.
Solar Energy Storage And Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – 4 Wind Energy:
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.
BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – 5 Geothermal Energy:
Origin, Applications, Types of Geothermal Resources, Relative Merits
Ocean Energy: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges
FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

TEXT BOOKS:
1. Solar Energy – *Principles of Thermal Collection and Storage*/Sukhatme S.P. and J.K.Nayak/TMH
2. *Non-Conventional Energy Resources*- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

REFERENCES:
1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa 4. Non-conventional Energy Source- G.D Roy/Standard Publishers

ONLINE LEARNING RESOURCES:
https://nptel.ac.in/courses/112106318
https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13
https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3
https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

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(23EC0406) ELECTRONIC CIRCUITS
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand semiconductor diodes, their characteristics and applications.*
2. *To explore the operation, configurations, and biasing of BJTs.*
3. *To study the operation, analysis, and coupling techniques of BJT amplifiers.*
4. *To learn the operation, applications and uses of feedback amplifiers and oscillators.*
5. *To analyze the characteristics, configurations, and applications of operational amplifiers*.

COURSE OUTCOMES:

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

1. *Explain the operation and characteristics of PN junction diodes and special-purpose diodes such as Zener, Tunnel, LED, Varactor, and Photodiode.*
2. *Analyze the behavior of rectifier circuits (half-wave, full-wave, and bridge) with and without filters, and describe clipping and clamping circuits.*
3. *Demonstrate the operation of Bipolar Junction Transistors in different configurations and evaluate suitable biasing techniques for amplifier stability.*
4. *Compare the performance of single and multistage amplifiers using different coupling methods and analyze the simplified hybrid model in CE, CB, and CC configurations.*
5. *Classify feedback amplifiers and oscillators, and construct basic RC and LC oscillator circuits to meet required oscillation conditions*.
6. *Apply operational amplifier concepts to design and implement analog signal processing applications such as summing amplifiers, integrators, differentiators, and comparators*

UNIT-I Semiconductor Diode and Applications:

Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only). **Special Diodes:** Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II Bipolar Junction Transistor (BJT):

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III Single stage amplifiers:

Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V Op-amp:

Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 opamp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. *Electronics Devices and Circuits*, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGrawHill, 2006.

2. *Electronics Devices and Circuits* Theory, David A. Bell, 5th Edition, Oxford University press.
2008.

REFERENCE BOOKS:

1. *Electronics Devices and Circuits Theory*, R.L.Boylestad, LousisNashelsky and K.Lal Kishore,12th edition, 2006, Pearson, 2006.

2. *Electronic Devices and Circuits*, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012

3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

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(23HS0855) MATHEMATICS FOR MACHINE LEARNING AND AI
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.*
2. *To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.*
3. *To equip students with optimization techniques and graph-based methods used in AI applications.*
4. *To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.*

COURSE OUTCOMES:

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

1. *Apply linear algebra concepts to ML techniques like PCA and regression*
2. *Analyze probabilistic models and statistical methods for AI applications*
3. *Implement optimization techniques for machine learning algorithms.*
4. *Apply the fundamental concepts of Gradient Descent in machine learning to choose the right optimization algorithm*
5. *Utilize vector calculus and transformations in AI-based models*
6. *Develop graph-based AI models using mathematical representations*

UNIT I: Linear Algebra for Machine Learning

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: Probability and Statistics for AI

Probability distributions: Gaussian, Binomial, Poisson. Bayes‘ Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: Optimization Techniques for ML

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions.Gradient Descent and its variants (Momentum, Adam) Newton‘s method, BFGS method.

UNIT IV: Vector Calculus & Transformations

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

TEXTBOOKS:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, *Mathematics for Machine Learning,* Cambridge University Press, 2020.

2. Christopher Bishop, Springer, *Pattern Recognition and Machine Learning*.

REFERENCE BOOKS:

1. Gilbert Strang, *Linear Algebra and Its Applications*, Cengage Learning, 2016.

2. Jonathan Gross, Jay Yellen, *Graph Theory and Its Applications*, CRC Press, 2018.

WEB REFERENCES:

1.MIT– Mathematics for Machine Learning https://ocw.mit.edu

2.Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/

3.DeepAI – Mathematical Foundations for AI https://deepai.org

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(23HS0842) MATERIALS CHARACTERIZATION TECHNIQUES
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES
The objectives of this course

1. *To provide exposure to different characterization techniques*
2. *To explain the basic principles and analysis of different spectroscopic techniques*
3. *To elucidate the working of Scanning electron microscope - Principle, limitations and applications.*
4. *To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications*
5. *To educate the uses of advanced electric and magnetic instruments for characterization*

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

1. *Analyze the crystal structure and crystallite size by various methods*
2. *Analyze the morphology of the sample by using a Scanning Electron Microscope*
3. *Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope*
4. *Explain the differences between SEM and TEM*
5. *Explain the principle and experimental arrangement of various spectroscopic techniques*
6. *Identify the construction and working principle of various Electrical & Magnetic Characterization technique*

UNIT I Structure analysis by Powder X-Ray Diffraction

Introduction, Bragg‘s law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle Xray scattering (SAXS) (in brief).

UNIT II Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III Microscopy Technique -2 - Transmission Electron Microscopy (TEM)

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT IV Spectroscopy techniques

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V Electrical & Magnetic Characterization techniques

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

TEXTBOOKS:

1. Material Characterization: *Introduction to Microscopic and Spectroscopic Methods* – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. *Microstructural Characterization of Materials* - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

REFERENCE BOOKS:

1. *Fundamentals of Molecular Spectroscopy* – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall , 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. *Materials Characterization Techniques* -Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

NPTEL COURSES LINK :

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

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(23HS0806) CHEMISTRY OF ENERGY SYSTEMS
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course

1. *To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries*
2. *To understand the basic concepts of processing and limitations of Fuel cells & their applications*
3. *To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications*
4. *Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.*
5. *To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method*

COURSE OUTCOMES

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

1. *Solve the problems based on electrode potential, Describe the Galvanic Cell*
2. *Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer*
3. *Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell*
4. *Discuss about the Basic design of fuel cells, Classify the fuel cell*
5. *Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion*
6. *Apply the photo voltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power*
7. *Differentiate Chemical and Physical methods of hydrogen storage,Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures Describe the liquification methods*

UNIT-1: Electrochemical Systems:

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications**.**

UNIT-2: Fuel Cells:

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-3: Photo and Photo electrochemical Conversions:

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-4: Solar Energy:

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT-5: Hydrogen Storage:

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

TEXT BOOKS

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

REFERENCE BOOKS:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al. 4.Hydrogen storage by Levine Klebonoff

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(23HS0821) ENGLISH FOR COMPETITIVE EXAMINATIONS
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To enable the students to learn about the structure of competitive English*
2. *To understand the grammatical aspects and identify the errors*
3. *To enhance verbal ability and identify the errors*
4. *To improve word power to answer competitive challenges*
5. *To make them ready to crack competitive exams*

COURSE OUTCOMES:

By the end of the program students will be able to

1. *Identify the basics of English grammar and its importance*
2. *Explain the use of grammatical structures in sentences*
3. *Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams*
4. *Analyze an unknown passage and reach conclusions about it.*
5. *Choose the appropriate form of verbs in framing sentences*
6. *Develop speed reading and comprehending ability thereby perform better in competitive exams*

UNIT – I Grammar-1

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefiniteDegrees of Comparison-Adverbs-types- errors-Conjunctions-usage Prepositions-usage-Tag Questions, types-identifying errors- Practice

UNIT – II Grammar-2

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If ClauseVoice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT-III Verbal Ability

Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph

UNIT-IV Reading Comprehension And Vocubulary

Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT-V Writing For Competitive Examinations

Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs Essay writing-types

TEXTBOOKS:

1. Wren & Martin, *English for Competitive Examinations,* S.Chand & Co, 2021
2. *Objective English for Competitive Examination***,** Tata McGraw Hill, New Delhi, 2014.

REFERENCE BOOKS:

1. Hari Mohan Prasad, *Objective English for Competitive Examination,* Tata McGraw Hill, NewDelhi, 2014.
2. Philip Sunil Solomon, *English for Success in Competitive Exams*, Oxford 2016
3. Shalini Verma , *Word Power Made Handy*, S Chand Publications
4. Neira, Anjana Dev & Co. *Creative Writing: A Beginner's Manual.* Pearson Education India,2008.
5. Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6. Michel Swan, *Practical English Usage*,Oxford,2006

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(23HS0822) ENTREPRENEURSHIP AND NEW VENTURE CREATION
(Open Elective -1)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course are

1. *To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership*
2. *To encourage creativity and innovation*
3. *To enable them to learn pitching and presentation skills*
4. *To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept*
5. *To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona*

COURSE OUTCOMES

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

1. *Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship*
2. *Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution*
3. *Analyze and refine business models to ensure sustainability and profitability*
4. *Build Prototype for Proof of Concept and validate MVP of their practice venture idea*
5. *Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture*
6. *Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders*

UNIT-I: Entrepreneurship Fundamentals and context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16industries to choose from), Venture Activity

Unit II: Problem & Customer Identification

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas. Core Teaching Tool: Several types of activities including Class, game, Gen AI, _Get out of the Building‘ and Venture Activity

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity. Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options. Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT-V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha *Entrepreneurship*, McGrawHill, 11th Edition.(2020)

2. Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business,(2011).

3. Osterwalder, A., & Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek,*Start with Why,* Penguin Books limited. (2011)

2. Brown Tim,*Change by Design Revised & Updated: How Design Thinking*

3. *Transforms Organizations and Inspires Innovation,* Harper Business.(2019)

4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited

5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

E-RESOURCES

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

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(23CS1402) COMPUTER VISION AND NLP LAB

COURSE OBJECTIVES:

The objectives of this course

1. *To provide hands-on experience in implementing image processing and computer vision algorithms.*
2. *To familiarize students with natural language processing techniques using Python libraries.*
3. *To enable the integration of CV and NLP for building intelligent applications.*

COURSE OUTCOMES:

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

1. *Apply image processing techniques for feature extraction and classification.*
2. *Apply computer vision techniques to solve real-time image processing problems*
3. *Implement NLP techniques such as tokenization, POS tagging, and sentiment analysis.*
4. *Analyze visual and textual data using open-source tools.*
5. *Evaluate and test the performance of various image feature extraction methods for different computer vision tasks*
6. *Develop applications that combine Computer Vision and NLP for real-world tasks.*

List of Experiments:

1. Load and display an image using OpenCV and perform basic operations like resizing, cropping, and rotation.
2. Apply edge detection (Sobel, Canny) and thresholding techniques on grayscale and color images.
3. Implement image filtering operations: Gaussian, Median, and Bilateral filters.
4. Perform object detection using contour detection and bounding boxes.
5. Detect faces using Haar Cascade or DNN-based pre-trained models in OpenCV.
6. Implement color-based object tracking using HSV space and CamShift algorithm.
7. Preprocess text data (tokenization, stopword removal, stemming, lemmatization) using NLTK/spaCy.
8. Implement Part-of-Speech (POS) tagging and Named Entity Recognition (NER) using spaCy.
9. Build a simple sentiment analysis classifier using bag-of-words or TF-IDF and Naïve Bayes.
10. Perform topic modeling using Latent Dirichlet Allocation (LDA).
11. Extract text from an image using Optical Character Recognition (OCR) with Tesseract and perform text summarization.
12. Final Mini Project: Integrate CV and NLP (e.g., Read text from signboards or documents and translate/summarize it).

Lab Software Requirements:

- **Languages/Tools:** Python, OpenCV, NLTK, spaCy, Tesseract OCR, scikit-learn, NumPy, Pandas, Matplotlib
- **Platforms:** Jupyter Notebook / Google Colab / PyCharm / VS Code

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(23CS0908) AI & SYSTEM PROGRAMMING LAB
(Common to CSM&CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide practical exposure to foundational AI algorithms and system programming.*
2. *To develop skills to write intelligent systems and low-level programs.*
3. *To integrate concepts of AI and system programming for automation and optimization.*

COURSE OUTCOMES:

After successful completion of the lab, students will be able to:

1. *Implement various search algorithms and logic programming paradigms using AI development tools.*
2. *Design and construct system-level programs such as assemblers and macro processors.*
3. *Develop and execute shell scripts for automating system-level tasks.*
4. *Build system utilities in C language and demonstrate their integration with AI tools.*
5. *Apply scripting and logic programming techniques to automate real-time intelligent systems.*
6. *Analyze and evaluate the performance of integrated AI and system-level automation solutions.*

List of Experiments*:*

1. Write simple programs in Prolog for facts, rules, and queries.
2. Develop a Prolog-based expert system for medical diagnosis or animal identification.
3. Implement Depth-First Search (DFS) and Breadth-First Search (BFS) in Python.
4. Implement A* Search Algorithm using heuristics in Python.
5. Implement the Minimax algorithm for a simple game (e.g., Tic Tac Toe).
6. Design and implement a two-pass assembler in C.
7. Implement a Macro Processor using C for assembly language programs.
8. Develop a simple Linux Shell (command interpreter) using C.
9. Write shell scripts for file operations, process creation, and monitoring.
10. Demonstrate inter-process communication using pipes and signals in Linux.
11. Integrate AI logic (search/expert system) into a shell script or system utility for task automation. **12.Final Mini Project**: Develop an AI-powered system utility (e.g., Intelligent File Manager, AI Bot for CLI commands).

Lab Software Requirements:

- **Languages:** Python, Prolog, C
- **Tools:** GCC, SWI-Prolog, Linux (Ubuntu/WSL), Shell, Lex/Yacc (optional)
- **IDEs:** Code::Blocks / VS Code / Geany / Terminal-based compilation

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(23CS0909) FULL STACK DEVELOPMENT-II
(Skill Enhancement course)
(Common to CSM &CAI)

COURSE OUTCOMES:

The objectives of this course

1. *Make use of Modern- day JavaScript with ES6 standards for designing Dynamic web page*
2. *Building robust & responsive User Interfaces using popular JavaScript library _React.js'. Building robust backend APIs using _Express. js'*
3. *Establishing the connection between frontend (React) User interfaces and backend APIs (Express) with Data Bases(My SQL)*
4. *Familiarize students with GitHub for remote repository hosting and collaborative development.*

COURSE OBJECTIVES:

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

1. *Building fast and interactive UIs*
2. *Applying Declarative approach for developing web apps*
3. *Understanding ES6 features to embrace modern JavaScript*
4. *Building reliable APIs with Express. Js*
5. *Create and manage Git repositories, track changes, and push code to GitHub.*
6. *Deploy full-stack applications with database integration and version control tools*

Experiments covering the Topics:

- Introduction to DOM (Document Object Model), Ecma Script (ES6) standards and features like Arrow functions, Spread operator, Rest operator, Type coercion, Type hoisting, String literals, Array and Object Destructuring.
- Basics of React. js like React Components, JSX, Conditional rendering Differences between Real DOM and Virtual DOM.
- Important React.js concepts like React hooks, Props, React forms, Fetch API, Iterative rendering using JavaScript map() function.
- JavaScript runtime environment node. js and its uses, Express. js and Routing, Micro-Services architecture and MVC architecture, database connectivity using (My SQL)
- Introduction to My SQL, setting up MySQL and configuring, Databases, My SQL queries, subqueries, creating My SQL driver for database connectivity to Express. js server.
- Introduction to Git and GitHub and upload project& team collaboration

Sample Experiments:

1. Introduction to Modern JavaScript and DOM

a. Write a JavaScript program to link JavaScript file with the HTML page
b. Write a JavaScript program to select the elements in HTML page using selectors
c. Write a JavaScript program to implement the event listeners
d. Write a JavaScript program to handle the click events for the HTML button elements
e. Write a JavaScript program to With three types of functions
i) Function declaration
ii) Function definition
iii) Arrow functions

2. Basics of React. js

a. Write a React program to implement a counter button using react class components
b. Write a React program to implement a counter button using react functional components
c. Write a React program to handle the button click events in functional component
d. Write a React program to conditionally render a component in the browser
e. Write a React program to display text using String literals

3. Important concepts of React. js

a. Write a React program to implement a counter button using React use State hook
b. Write a React program to fetch the data from an API using React use Effect hook
c. Write a React program with two react components sharing data using Props.
d. Write a React program to implement the forms in react
e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Git and GitHub

a. Setup

- Install Git on local machine.
- Configure Git (user name, email).
- Create GitHub account and generate a personal access token.

b. Basic Git Workflow

- Create a local repository using git init
- Create and add files → git add .
- Commit files → git commit -m "Initial commit"
- Connect to GitHub remote → git remote add origin
- Push to GitHub → git push -u origin main

c. Branching and Collaboration

- Create a branch → git checkout -b feature1
- Merge branch to main → git merge feature1
- Resolve merge conflicts (guided)

5. Upload React Project to GitHub

- Create a new React app using npx create-react-app myapp
- Initialize a git repo and push to GitHub
- Use .gitignore to exclude node_modules
- Create multiple branches: feature/navbar, feature/form

- Practice merge and pull requests (can use GitHub GUI)

6. Introduction to Node. js and Express. Js

a. Write a program to implement the _hello world‘ message in the route through the browser using Express
b. Write a program to develop a small website with multiple routes using Express. js
c. Write a program to print the _hello world‘ in the browser console using Express. js
d. Write a program to implement the CRUD operations using Express. js
e. Write a program to establish the connection between API and Database using Express – My SQL driver

7. Introduction to My SQL

a. Write a program to create a Database and table inside that database using My SQL Command line client
b. Write a My SQL queries to create table, and insert the data, update the data in the table
c. Write a My SQL queries to implement the subqueries in the My SQL command line client
d. Write a My SQL program to create the script files in the My SQL workbench
e. Write a My SQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API

8. Team Collaboration Using GitHub

- Form groups of 2–3 students
- Create a shared GitHub repo
- Assign tasks and work in branches
- Use Issues, Pull Requests, and Code Reviews
- Document code with README.md

TEXTBOOKS:

1. Web Design with HTML, CSS, *JavaScript and JQuery Set Book* by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. John Dean, *Web Programming with HTML5, CSS and JavaScript*, Jones & Bartlett Learning, 2019.
3. Pro MERN Stack: *Full Stack Web App Development with Mongo*, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O‘Reilly.
4. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon
5. AZAT MARDAN, *Full Stack Java Script*: Learn Back bone. js, Node.jsand Mongo DB.2015

REFERENCE BOOKS:

1. Full-Stack JavaScript Development by Eric Bush.
2. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
3. Tomasz Dyl ,KamilPrzeorski , MaciejCzarnecki, Mastering Full Stack React Web Development 2017

ONLINE LEARNING RESOURCES:

1. https://ict.iitk.ac.in/product/full-stack-developer-html5-css3-js-bootstrap-php-4/
2. https://www.w3schools.com/html
3. https://www.w3schools.com/css
4. https://www.w3schools.com/js/
5. https://www.w3schools.com/nodejs
6. https://www.w3schools.com/typescript
7. https://docs.github.com/
8. https://education.github.com/git-cheat-sheet-education.pdf

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(23EC0417) TINKERING LAB
(Common to All Branches)

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

COURSE OBJECTIVES

The objectives of this course is to

1. *Encourage Innovation and Creativity*
2. *Provide Hands-on Learning and Impart Skill Development*
3. *Foster Collaboration and Teamwork*
4. *Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship*
5. *Impart Problem-Solving mind-set*

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

COURSE OUTCOMES

The students will be able to experiment, innovate, and solve real-world challenges

LIST OF EXPERIMENTS:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Design and 3D print a Walking Robot
3) Design and 3D Print a Rocket.
4) Temperature & Humidity Monitoring System (DHT11 + LCD)
5) Water Level Detection and Alert System
6) Automatic Plant Watering System
7) Bluetooth-Based Door Lock System
8) Smart Dustbin Using Ultrasonic Sensor
9) Fire Detection and Alarm System
10) RFID-Based Attendance System
11) Voice-Controlled Devices via Google Assistant
12) Heart Rate Monitoring Using Pulse Sensor
13) Soil Moisture-Based Irrigation
14) Smart Helmet for Accident Detection
15) Milk Adulteration Detection System
16) Water Purification via Activated Carbon

17) Solar Dehydrator for Food Drying
18) Temperature-Controlled Chemical Reactor
19) Ethanol Mini-Plant Using Biomass
20) Smart Fluid Flow Control (Solenoid + pH Sensor)
21) Portable Water Quality Tester
22) AI Crop Disease Detection
23) AI-based Smart Irrigation
24) ECG Signal Acquisition and Plotting
25) AI-Powered Traffic Flow Prediction
26) Smart Grid Simulation with Load Monitoring
27) Smart Campus Indoor Navigator
28) Weather Station Prototype
29) Firefighting Robot with Sensor Guidance
30) Facial Recognition Dustbin
31) Barcode-Based Lab Inventory System
32) Growth Chamber for Plants
33) Biomedical Waste Alert System
34) Soil Classification with AI
35) Smart Railway Gate
36) Smart Bin Locator via GPS and Load Sensors
37) Algae-Based Water Purifier
38) Contactless Attendance via Face Recognition

Note: The students can also design and implement their own ideas, apart from the list of experiments mentioned above.

Note: A minimum of 8 to 10 experiments must be completed by the students

Students need to refer to the following links:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2. https://atl.aim.gov.in/ATL-Equipment-Manual/
3. https://aim.gov.in/pdf/Level-1.pdf
4. https://aim.gov.in/pdf/Level-2.pdf

https://aim.gov.in/pdf/Level-3.pdf

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(23CS1403) EVALUATION OF COMMUNITY SERVICE INTERNSHIP

Mandatory Community Service Project / Internship of 08 weeks duration during summer vacation

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(23CS0911) CLOUD COMPUTING FOR AI
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the concepts, models, and services of cloud computing and its role in AI.*
2. *To explore the architecture and deployment of AI applications on cloud platforms.*
3. *To equip students with skills in using cloud-based tools and services for AI/ML workloads.*
4. *To understand data storage, processing, and security in cloud for AI tasks.*
5. *To apply cloud computing principles to real-world AI-based solutions.*

COURSE OUTCOMES:

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

1. *Explain cloud computing architecture, services, and deployment models.*
2. *Utilize cloud platforms (AWS, GCP, Azure) for training and deploying AI models.*
3. *Handle large-scale data storage and processing in the cloud environment.*
4. *Process and manage large-scale data efficiently using cloud computing tools and services*
5. *Integrate AI workflows using serverless and container-based architectures.*
6. *Analyze challenges in security, cost, scalability, and performance of cloud-based AI systems.*

UNIT I: Introduction to Cloud Computing and AI Integration

Basics of Cloud Computing: Characteristics, Models, and Services, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, Community, AI and Cloud Convergence: Benefits and Challenges, Use Cases of AI in Cloud: NLP, Vision, Analytics, Overview of Cloud Providers for AI: AWS, Azure, GCP.

UNIT II: Storage, Computing, and Data Processing in the Cloud

Cloud Storage Services: S3, Blob, BigQuery, Virtualization and Elastic Computing, Distributed Computing with Hadoop and Spark, Data Ingestion and Processing Pipelines, Data Lakes and Warehousing in the Cloud, Cost Optimization for Storage and Compute Resources.

UNIT III: Cloud-based Machine Learning and Deep Learning

ML Services on AWS (SageMaker), Azure ML, GCP Vertex AI, Training and Deploying Models on Cloud, AutoML and Custom ML Model Workflows, GPUs/TPUs for Model Training, Experiment Tracking and Model Evaluation, Integration of Notebooks (Jupyter, Colab) with Cloud Storage.

UNIT IV: Advanced Cloud Concepts for AI Applications

Containers and Docker for AI Applications, Kubernetes and Cloud-native AI Workflows, Serverless Computing: AWS Lambda, Azure Functions, CI/CD Pipelines for AI Models in Cloud, Scaling AI Applications using Load Balancers and Auto-Scaling. Monitoring and Logging in Cloud for AI Workflows.

UNIT V: Security, Ethics, and Case Studies in Cloud AI

Security and Privacy in Cloud-based AI, Identity and Access Management (IAM) in Cloud, Cost Management and Billing for AI Services, Ethical Issues and Fairness in Cloud AI, Case Study: AI in Healthcare Cloud Solutions, Case Study: Real-Time Analytics in Financial Cloud Services.

TEXTBOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, *Mastering Cloud Computing*, McGraw-Hill.
2. Judith Hurwitz et al., Cloud Computing for Dummies, Wiley.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly.

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(23CS0912) BIG DATA ANALYTICS & AI APPLICATIONS
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamentals of big data and its role in AI-driven applications.*
2. *To explore big data tools and technologies such as Hadoop, Spark, and NoSQL databases.*
3. *To enable students to build scalable AI pipelines for data analytics.*
4. *To apply AI/ML algorithms for real-time and batch processing environments.*
5. *To demonstrate use cases of big data in domains like healthcare, finance, and IoT using AI.*

COURSE OUTCOMES:

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

1. *Understand the architecture and ecosystem of big data processing.*
2. *Analyze and manage large-scale datasets using Hadoop and Spark.*
3. *Apply AI/ML techniques to extract insights from big data.*
4. *Utilize artificial intelligence techniques to derive meaningful insights and patterns from big data*
5. *Design and implement scalable data pipelines using distributed frameworks.*
6. *Solve real-world domain problems with AI-powered big data solutions.*

UNIT I: Introduction to Big Data and Analytics Ecosystem

Definition and Characteristics of Big Data – Volume, Velocity, Variety, Veracity, Value, Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Big Data Challenges and Opportunities, Hadoop Ecosystem Overview: HDFS, MapReduce, YARN, NoSQL Databases: Key-Value, Columnar, Document, Graph Models, Data Lake vs. Data Warehouse.

UNIT II: Big Data Tools and Frameworks

Apache Spark Architecture and RDDs, Spark SQL, DataFrames, and Datasets, Spark Streaming for Real-Time Analytics, Kafka for Data Ingestion and Message Queues, Hive, Pig, and Impala for Big Data Querying, Comparative Analysis of Hadoop vs. Spark.

UNIT III: Machine Learning on Big Data

Introduction to MLlib and Scikit-learn, Data Preprocessing for Big Data ML Pipelines, Supervised Learning: Classification and Regression on Large Datasets, Unsupervised Learning: Clustering and Dimensionality Reduction, Model Evaluation and Validation Techniques, Distributed Training and Optimization Techniques.

UNIT IV: AI Applications on Big Data
Predictive Maintenance using Big Data & AI, Fraud Detection in Banking with Machine Learning, AI in Healthcare: Diagnosis, Genomics, Patient Monitoring, Retail and E-commerce Analytics, AI for Smart Cities and IoT Sensor Data Analysis, Evaluation of Real-Time AI Applications on Streaming Data.

UNIT V: Advanced Topics and Case Studies Deep Learning on Big Data using TensorFlow on Spark, Explainable AI (XAI) in Big Data Environments, Ethical Issues and Data Governance in Big Data AI, Edge Computing and AI for Low Latency Applications, Case Study 1: AI-Powered Big Data in Healthcare, Case Study 2: Big Data AI Solution in Smart Manufacturing.

TEXTBOOKS:
1. Rodrigo N. Calheiros, Amir Big Data: *Principles and Paradigms* by Rajkumar Buyya, VahidDastjerdi – Wiley
2. Learning Spark: Lightning-Fast Big Data Analysis by Jules S. Damji et al. – O'Reilly
3. Data Science and Big Data Analytics by EMC Education Services – Wiley

REFERENCE BOOKS:
1. Designing Data-Intensive Applications by Martin Kleppmann – O'Reilly
2. Machine Learning with Spark by Rajdeep Dua, Tathagata Das – Packt Publishing
3. Streaming Systems by Tyler Akidau – O‘Reilly Media
4. Artificial Intelligence for Big Data by Anand Deshpande – Packt

ONLINE LEARNING RESOURCES:
- https://www.coursera.org/specializations/big-data – Coursera Big Data Specialization
- https://spark.apache.org/docs/latest/ – Apache Spark Documentation

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(23CS1404) FULL STACK AI DEVELOPMENT

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the concepts of full stack development with integration of AI capabilities.*
2. *To provide practical exposure to frontend and backend frameworks suitable for AI applications.*
3. *To build intelligent web applications using ML/DL models.*
4. *To explore RESTful APIs, microservices, and deployment strategies for AI solutions.*
5. *To develop skills for scalable, end-to-end AI-powered application development.*

COURSE OUTCOMES:

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

1. *Understand the architecture and components of full stack AI systems.*
2. *Develop web interfaces and backend logic integrated with AI models.*
3. *Use Python, JavaScript, and frameworks like Flask, Node.js, React for AI web solutions.*
4. *Deploy machine learning models using RESTful APIs and containers.*
5. *Build, test, and scale full-stack intelligent applications.*
6. *Manage datasets, model versioning, and workflows in production-grade systems*

UNIT I: Introduction to Full Stack AI Development

Overview of Full Stack Development in AI Context, Components: Frontend, Backend, Database, AI Models, MVC, MVVM Architectures for AI Applications, Introduction to Web Technologies (HTML, CSS, JS, Bootstrap), Role of JavaScript Frameworks in AI Dashboards, Full Stack AI Development Life Cycle.

UNIT II: Frontend Technologies for AI Applications

React.js for Dynamic AI Interfaces, State Management in React (Hooks, Redux), Data Binding and Visualization with Chart.js, D3.js, Integration with AI Results (JSON APIs to UI), UI/UX Design for Intelligent Apps, Responsive Design and Accessibility.

UNIT III: Backend and AI Model Integration

Node.js and Express.js for Backend Services, Flask API Development for ML Models, REST API Creation and Consumption, Handling File Uploads, JSON Input, Streaming Output, Integration of Pre-trained Models (Sklearn, TensorFlow, PyTorch), Middleware, Error Handling, and Model Response Evaluation.

UNIT IV: Databases, Authentication, and AI Workflows

MongoDB and PostgreSQL for Storing AI Inputs/Outputs, User Authentication and Session Management (JWT, OAuth), CRUD Operations with AI Insights, Building AI Feedback Loops with Data Storage, Secure AI Application Workflows, Creating Intelligent Dashboards with Real-Time Data.

UNIT V: Deployment, Scaling & Case Studies

Containerization using Docker for AI Microservices, Deployment to Cloud (AWS, GCP, Azure), CI/CD Pipelines for AI Model Updates, Monitoring and Logging in AI Apps, Performance and Load Testing of AI APIs, Case Study: End-to-End Full Stack AI Project (Deployment + Demo).

TEXTBOOKS:

1. Full Stack Development with Flask and React by O. Olatunde – Packt Publishing
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron –O'Reilly
3. Flask Web Development by Miguel Grinberg – O'Reilly Media

REFERENCE BOOKS:

1. Node.js Design Patterns by Mario Casciaro – Packt
2. Building Machine Learning Powered Applications by Emmanuel Ameisen – O'Reilly
3. Mastering React by Adam Horton – Packt
4. MongoDB: The Definitive Guide by Kristina Chodorow – O'Reilly

ONLINE LEARNING RESOURCES:

- https://fullstackopen.com/en/ – Full Stack Open
- https://www.coursera.org/specializations/full-stack – Coursera Full Stack Development

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(23CS0925) GRAPH NEURAL NETWORKS
(Professional Elective-II)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamentals of graph theory and graph-structured data.*
2. *To explore the concepts of neural networks extended to non-Euclidean domains.*
3. *To understand architectures and algorithms behind various types of GNNs.*
4. *To apply GNN models in real-world applications such as recommendation, social networks,and bioinformatics.*
5. *To enable students to build and evaluate GNN models using frameworks like PyTorch Geometric and DGL.*

COURSE OUTCOMES:

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

1. *Understand the basics of graph structures and their significance in machine learning.*
2. *Learn and implement different types of GNN architectures.*
3. *Apply GNNs to real-world structured data problems.*
4. *Implement GNN architectures using deep learning frameworks to address classification, regression, and link prediction tasks on real-world graph datasets*
5. *Use modern libraries and tools to train and evaluate GNNs.*
6. *Analyze the effectiveness and limitations of GNNs in different domains.*

UNIT I: Fundamentals of Graph Theory and Machine Learning on Graphs Introduction to Graphs: Nodes, Edges, Adjacency Matrix, Types of Graphs: Directed, Undirected, Weighted, Bipartite, Graph Traversal Algorithms (BFS, DFS), Graph Representations for ML (Adjacency List, Matrix, Laplacian), Node, Edge, and Graph-level Prediction Problems, Motivation and Challenges for Learning on Graphs.

UNIT II: Spectral and Spatial Methods for Graph Learning Spectral Graph Theory Basics, Graph Convolution via Spectral Methods, Chebyshev and First-order Approximations, Spatial Graph Convolutions, Comparison of Spectral vs Spatial GNNs, Graph Laplacian and Eigenvalue Properties.

UNIT III: Graph Neural Network Architectures

Graph Convolutional Networks (GCNs), Graph Attention Networks (GATs), GraphSAGE: Sampling and Aggregation, Graph Isomorphism Networks (GIN), Message Passing Neural Networks (MPNNs), Inductive vs Transductive GNN Learning.

UNIT IV: Applications of GNNs

Node Classification (e.g., Cora, Citeseer), Link Prediction (e.g., Recommender Systems), Graph Classification (e.g., Molecule Property Prediction), Traffic Forecasting and Social Network Modeling, GNNs in Healthcare and Bioinformatics, Explainability and Interpretability in GNNs.

UNIT V: Implementation, Optimization, and Recent Advances

Overview of PyTorch Geometric and DGL, Data Loading and Preprocessing for Graph Datasets, Model Training, Loss Functions, and Evaluation Metrics, Hyperparameter Tuning in GNNs, Recent Research Trends and Architectures (e.g., Heterogeneous GNNs, Graph Transformers), Challenges and Future Directions in GNNs.

TEXTBOOKS:

1. Zonghan Wu, Shirui Pan, Fengwen Chen, Guodong Long, Chengqi Zhang, Philip S. Yu, A *Comprehensive Survey on Graph Neural Networks*, IEEE Transactions on Neural Networks and Learning Systems, 2021.
2. Yao Ma, Jiliang Tang, *Deep Learning on Graphs*, Cambridge University Press, 2021.
3. William L. Hamilton, *Graph Representation Learning, Morgan* & Claypool Publishers, 2020.

REFERENCE BOOKS:

1. Barrett, Jure Leskovec, *Mining of Massive Datasets*, Cambridge University Press.
2. Thomas Kipf, GCN and related papers and tutorials (arXiv).
3. Petar Veličković, Graph Attention Networks (original paper and slides).
4. Michael Bronstein et al.,Geometric Deep Learning: Grids, Groups, Graphs, Geodesics, and Gauges (arXiv preprint).

ONLINE LEARNING RESOURCES:

1. https://pytorch-geometric.readthedocs.io/ – PyTorch Geometric Docs
2. https://cs.stanford.edu/people/jure/ – Stanford GNN Projects
3. https://www.coursera.org/learn/graph-neural-networks – Coursera GNN Course by Stanford

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(23CS0926) RECOMMENDER SYSTEMS
(Professional Elective-II)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand the theoretical foundations and practical techniques behind recommender systems.*
2. *To explore collaborative, content-based, and hybrid recommendation methods.*
3. *To apply matrix factorization and deep learning for building intelligent recommenders.*
4. *To analyze system performance using standard evaluation metrics.*
5. *To design and implement recommender systems for real-world applications.*

COURSE OUTCOMES:

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

1. *Aware of various issues related to Personalization and Recommendations.*
2. *Design and implement a set of well-known Recommender System approaches used in E commerce and Tourism industry.*
3. *Apply matrix factorization and deep learning models to recommendation problems.*
4. *Implement deep learning-based models for solving recommendation problems effectively*
5. *Evaluate and optimize recommender systems using appropriate metrics.*
6. *Develop new Recommender Systems for a number of domains especially, Education, Health-care.*

UNIT I: An Introduction to Recommender Systems, Neighborhood-Based Collaborative Filtering

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain Specific Challenges in Recommender Systems. Advanced Topics and Applications. Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Neighborhood-Based Collaborative Filtering: Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods, A Regression Modelling View of Neighborhood Methods.

UNIT II: Model-Based Collaborative Filtering, Content-Based Recommender Systems

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models. Content-Based Recommender Systems: Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering, Summary.

UNIT III: Knowledge based Recommender System, Ensemble based and Hybrid Recommender Systems

Introduction, Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems, Summary. Introduction, Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids, Summary.

UNIT IV: Evaluating Recommender Systems, Context-Sensitive Recommender Systems

Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures, Limitations of Evaluation Measures. Introduction, The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Modelling.

UNIT V: Time- and Location-Sensitive Recommender Systems

Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Location-Aware Recommender Systems Location-Aware Recommender Systems, Summary.

TEXTBOOKS:

1. Charu C. Aggarwal, *Recommender Systems*: The Textbook, Springer, 2016.

REFERENCE BOOKS:

1. Francesco Ricci, LiorRokach, ―Recommender Systems Handbook‖, 2nd ed., Springer, 2015 Edition.

ONLINE LEARNING RESOURCES:

1. Recommendation System -Understanding The Basic Concepts (analyticsvidhya.com)
2. Recommender Systems | Coursera

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(23CS0927) PREDICTIVE ANALYTICS
(Professional Elective-II)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamental concepts and techniques of predictive analytics.*
2. *To apply statistical models and machine learning algorithms for prediction.*
3. *To interpret model performance using evaluation metrics.*
4. *To explore feature engineering, model tuning, and cross-validation.*
5. *To implement predictive solutions for real-world business and research problems.*

COURSE OUTCOMES:

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

1. *Understand the principles and importance of predictive analytics.*
2. *Apply regression and classification models for predictive tasks.*
3. *Perform data preprocessing, feature selection, and transformation.*
4. *Compare different machine learning models and select the best one based on performance*
5. *Evaluate and validate models using standard metrics.*
6. *Design predictive solutions to solve domain-specific challenges.*

UNIT I: Introduction to Predictive Analytics

Introduction to Predictive Analytics and Business Intelligence, Types of Predictive Models: Classification, Regression, Time Series, Supervised vs Unsupervised Learning, Predictive Modeling Workflow, Applications in Marketing, Finance, Healthcare, Challenges in Predictive Analytics.

UNIT II: Data Preparation and Feature Engineering

Data Cleaning: Handling Missing, Noisy, and Inconsistent Data, Feature Selection and Dimensionality Reduction (PCA, LDA), Feature Scaling: Normalization, Standardization, Encoding Categorical Variables, Feature Extraction and Construction, Dealing with Imbalanced Datasets.

UNIT III: Predictive Modeling with Regression and Classification

Linear Regression and Polynomial Regression, Logistic Regression for Binary Classification, Decision Trees and Random Forest, k-Nearest Neighbors (k-NN) and Naïve Bayes, Support Vector Machines (SVM), Model Selection and Comparison.

UNIT IV: Model Evaluation and Validation

Training, Testing, and Validation Sets, Cross-Validation Techniques (k-Fold, Stratified, LOOCV), Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, ROC-AUC, Confusion Matrix and Classification Report, Bias-Variance Trade-off and Overfitting, Hyperparameter Tuning: Grid Search, Random Search.

UNIT V: Advanced Topics and Applications

Ensemble Learning: Bagging, Boosting (AdaBoost, XGBoost), Predictive Analytics with Time Series (ARIMA, Prophet), Deep Learning for Predictive Modeling (ANNs, LSTM), Use of Predictive Analytics in IoT, Retail, and Healthcare, Ethics and Privacy in Predictive Analytics, Building and Deploying End-to-End Predictive Systems.

TEXTBOOKS:

1. Dean Abbott, Applied Predictive Analytics: *Principles and Techniques for the Professional Data Analyst,* Wiley, 2014.
2. John D. Kelleher, Brendan Tierney, Data Science: *Predictive Analytics and Data Mining*, MIT Press, 2018.

REFERENCE BOOKS:

1. Galit Shmueli et al., Data Mining for Business Analytics: Concepts, Techniques, and Applications in R, Wiley, 2017.
2. Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer, 2009.

ONLINE LEARNING RESOURCES:

- https://www.coursera.org/specializations/predictive-analytics – Coursera Specialization
- https://www.edx.org/course/data-science-and-machine-learning-capstone – edX Predictive Analytics Courses
- https://www.kaggle.com/learn/intro-to-machine-learning – Kaggle Tutorials

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(23CS0928) BLOCKCHAIN FOR AI
(Professional Elective-II)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand the foundational concepts of blockchain technology and its architecture.*
2. *To explore smart contracts, consensus algorithms, and distributed ledger technology.*
3. *To investigate the integration of AI with blockchain for secure, decentralized applications.*
4. *To develop blockchain-enabled AI solutions for real-world use cases.*
5. *To understand the ethical, security, and scalability challenges in Blockchain-AI ecosystems.*

COURSE OUTCOMES:

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

1. *Explain the fundamentals of blockchain and its components.*
2. *Analyze the role of consensus mechanisms in maintaining trust and decentralization.*
3. *Understand the role of blockchain in ensuring data security and integrity*
4. *Apply blockchain for secure data sharing in AI systems.*
5. *Develop and deploy smart contracts using Ethereum/Solidity.*
6. *Evaluate blockchain-based AI applications in healthcare, finance, and supply chains.*

UNIT I: Blockchain Fundamentals and Architecture

Introduction to Blockchain Technology, Components: Blocks, Hashing, Merkle Trees, Types of Blockchains: Public, Private, Consortium, Distributed Ledger Technology (DLT) and P2P Networks, Blockchain Structure and Mining, Use Cases and Evolution of Blockchain.

UNIT II: Smart Contracts and Consensus Mechanisms

Smart Contracts: Definition, Features, Use Cases, Ethereum and Solidity Basics, Consensus Algorithms: PoW, PoS, DPoS, PBFT, Gas, Transactions, and Events in Ethereum, Hyperledger Fabric: Architecture and Chaincode, Deployment and Testing of Smart Contracts.

UNIT III: Integration of Blockchain and AI

Motivation for Integrating Blockchain with AI, Decentralized AI Models and Federated Learning, Secure Model Sharing and Provenance, Blockchain for Data Integrity in AI Systems, AI for Blockchain (e.g., optimizing consensus), Case Study: Decentralized AI Marketplace.

UNIT IV: Applications of Blockchain in AI Systems

Blockchain for Explainable and Trusted AI, Applications in Healthcare and Genomics, Blockchain for Autonomous Vehicles and IoT, Financial AI Systems with Smart Contracts, Supply Chain and Logistics Intelligence, NFT-based AI Applications (Digital Identity, IP).

UNIT V: Security, Privacy and Challenges in Blockchain-AI

Security Challenges: Sybil Attacks, 51% Attacks, Privacy Preservation and Zero Knowledge Proofs, Scalability and Energy Concerns in Blockchain-AI, Ethical and Legal Concerns in AI with Blockchain, Interoperability of Blockchain Platforms, Future Trends: Quantum-Resistant BlockchainAI.

TEXTBOOKS:

1. Imran Bashir, Mastering Blockchain: *Unlocking the Power of Cryptocurrencies*, Smart Contracts, and Decentralized Applications, Packt, 2020.
2. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015.
3. Joseph Holbrook, Architecting AI Solutions on Blockchain, Packt Publishing, 2020.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach, VPT, 2017.
2. Karamjit Singh, Blockchain for AI: Use Cases and Implementation, Springer, 2023.
3. Roger Wattenhofer, The Science of the Blockchain, 2016.

ONLINE LEARNING RESOURCES:

- Coursera: Blockchain Specialization – University at Buffalo
- edX: Blockchain Fundamentals – UC Berkeley
- Coursera: AI and Blockchain – IBM

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(23CS0929) INTRODUCTION TO QUANTUM COMPUTING
(Professional Elective-III)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the principles and mathematical foundations of quantum computation.*
2. *To understand quantum gates, circuits, and computation models.*
3. *To explore quantum algorithms and their advantages over classical ones.*
4. *To develop the ability to simulate and write basic quantum programs.*
5. *To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.*

COURSE OUTCOMES:

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

1. *Explain the fundamental concepts of quantum mechanics used in computing.*
2. *Construct and analyze quantum circuits using standard gates.*
3. *Design and simulate quantum circuits for basic computational tasks*
4. *Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.*
5. *Develop simple quantum programs using Qiskit or similar platforms*
6. *Analyze the advantages and limitations of quantum algorithms compared to classical approaches.*

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

TEXTBOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing,Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

ONLINE LEARNING RESOURCES:

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

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(23CS0930) AI FOR FINANCE
(Professional Elective-III)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the role of Artificial Intelligence (AI) in financial applications and decision making.*
2. *To understand financial data types, sources, and processing methods.*
3. *To apply machine learning and deep learning models in various finance sectors.*
4. *To analyze risk, fraud detection, credit scoring, and portfolio management using AI.*
5. *To evaluate ethical and regulatory challenges in AI-enabled finance.*

COURSE OUTCOMES:

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

1. *Describe the fundamentals of AI techniques applicable to finance.*
2. *Analyze financial time series data using AI-based models.*
3. *Apply machine learning for fraud detection*
4. *Apply machine learning for fraud detection and credit risk analysis.*
5. *Build predictive models for stock prices, trading, and customer segmentation.*
6. *Evaluate the limitations and ethical implications of AI in financial systems.*

UNIT I: Introduction to Finance and AI Applications

Introduction to Financial Markets and Instruments, Overview of AI Techniques in Finance, Types of Financial Data: Market, Transactional, Customer, Financial Statements and Key Indicators, AI Use Cases in Banking, Insurance, and Investment, FinTech and the Rise of Robo-Advisors.

UNIT II: Machine Learning in Finance

Supervised Learning for Credit Scoring, Unsupervised Learning for Customer Segmentation, Feature Engineering for Financial Data, Handling Imbalanced Datasets in Fraud Detection, Time Series Forecasting with Regression and ARIMA, Model Validation and Backtesting in Finance.

UNIT III: Deep Learning and NLP in Finance

Introduction to Deep Learning for Finance, Stock Price Prediction using LSTM and RNNs, Sentiment Analysis from Financial News and Tweets, NLP for Document Classification: Earnings Reports, Chatbots and Virtual Assistants in Banking, Reinforcement Learning for Portfolio Optimization.

UNIT IV: AI-Driven Financial Applications

Fraud Detection Systems using ML and DL, Credit Risk and Loan Default Prediction, AI in Algorithmic and High-Frequency Trading, Robo-Advisors: Architecture and Optimization, Blockchain and AI Integration for Financial Security, Case Studies: AI in Wealth Management & Insurance.

UNIT V: Ethics, Regulation, and Future of AI in Finance

Regulatory Frameworks in AI-based Finance, Explainability and Interpretability of Financial Models, Ethical Issues: Bias, Fairness, Transparency, Data Privacy and GDPR in Financial AI, Responsible AI Practices in Finance, Emerging Trends: Quantum AI, Decentralized Finance (DeFi).

TEXTBOOKS:

1. Yves Hilpisch, *Artificial Intelligence in Finance*: A Python-Based Guide, O'Reilly, 2020.
2. Yves Hilpisch, *Python for Finance*: Mastering Data-Driven Finance, O'Reilly, 2018.
3. Markus Loecher, *Machine Learning for Finance*, Packt Publishing, 2021.

REFERENCE BOOKS:

1. A. W. Lo, The Evolution of Technical Analysis, Wiley Finance, 2010.
2. Tony Guida, Big Data and Machine Learning in Quantitative Investment, Wiley, 2019.
3. Tucker Balch, AI for Trading – Georgia Tech Specialization, Coursera.

ONLINE LEARNING RESOURCES:

- Coursera: AI for Trading – by NYIF and Google Cloud
- edX: Artificial Intelligence in Finance – NYIF
- Udemy: Machine Learning and AI in Finance
- DataCamp: Financial Trading with Python
- YouTube: AI for Finance by Sentdex, Two Minute Papers, and Data Professor

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(23CS0931) SOCIAL NETWORK ANALYSIS
(Professional Elective-III)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamentals and key concepts of social network theory and graph theory.*
2. *To analyze the structure and properties of large-scale social networks.*
3. *To apply centrality, influence, and community detection measures.*
4. *To model information diffusion and network dynamics.*
5. *To implement real-world social network analysis using tools and datasets.*

COURSE OUTCOMES:

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

1. *Understand basic network models and social network structures.*
2. *Analyze key properties like centrality, clustering, and small-world effect.*
3. *Apply community detection algorithms and influence maximization.*
4. *Implement influence maximization techniques to identify key nodes in social networks*
5. *Interpret diffusion models for viral marketing and information spread.*
6. *Use tools such as Gephi, NetworkX, or SNAP for real-world SNA.*

UNIT I: Introduction to Social Networks and Graph Theory

Basic Concepts: Graphs, Nodes, Edges, Directed/Undirected Graphs, Real-world Examples: Facebook, Twitter, LinkedIn, Adjacency Matrix and Graph Representation, Types of Social Networks: Ego, Bipartite, Multilayer, Degree Distribution, Path Length, and Connectivity, Random Graph Models: Erdős–Rényi and Watts-Strogatz.

UNIT II: Structural Properties of Networks

Network Centrality Measures: Degree, Closeness, Betweenness, Eigenvector Centrality and PageRank, Network Clustering and Community Detection Basics, Triadic Closure and Clustering Coefficient, Small-world Phenomenon and Milgram‘s Experiment, Homophily, Influence, and Structural Balance.

UNIT III: Community Detection and Subgroup Analysis

Girvan–Newman Algorithm and Modularity, Label Propagation and Louvain Method, Clique Detection and k-Core Decomposition, Overlapping Communities and Fuzzy Clustering, Cohesive Subgroups and Structural Equivalence, Evaluation Metrics: NMI, Modularity Score.

UNIT IV: Information Diffusion and Influence in Networks

Models of Diffusion: Linear Threshold and Independent Cascade, Influence Maximization and Viral Marketing, Contagion Models and Epidemic Spreading, Rumor Propagation and Cascade Models, Information Bottlenecks and Bridges, Measuring Influence and Reach.

UNIT V: Tools, Applications, and Ethics in SNA

SNA Tools: Gephi, Pajek, NetworkX, SNAP, Case Study: Twitter and Hashtag Analysis, LinkedIn Network Mining and Graph Features, Applications in Marketing, Security, and Epidemiology, Ethical Issues in Social Network Data Mining, Building and Visualizing Your Own Social Graph.

TEXTBOOKS:

1. Wasserman, S., & Faust, K., *Social Network Analysis*: Methods and Applications, Cambridge University Press, 1994.
2. Easley, D., & Kleinberg, J., *Networks, Crowds, and Markets*: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
3. Newman, M., Networks: *An Introduction, Oxford University* Press, 2010.

REFERENCE BOOKS:

1. Borgatti, S. P., Everett, M. G., & Johnson, J. C., Analyzing Social Networks, SAGE Publications, 2018.
2. Barabási, A.-L., Linked: How Everything Is Connected to Everything Else, Basic Books, 2014.
3. Hansen, D., Shneiderman, B., & Smith, M. A., Analyzing Social Media Networks with NodeXL, Elsevier, 2020.

ONLINE LEARNING RESOURCES:

- Coursera – Social Network Analysis (University of Michigan)
- [YouTube – NetworkX and Gephi Tutorials (freeCodeCamp, TheNetNinja)]
- edX – Networks: Friends, Money, and Bytes (University of California, Berkeley)
- Khan Academy – Graph Theory

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(23CS0932) CYBERSECURITY & AI-DRIVEN THREAT DETECTION
(Professional Elective-III)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide a foundational understanding of cybersecurity principles and threat landscapes.*
2. *To explore the application of AI and machine learning techniques in detecting cyber threats.*
3. *To analyze malware behavior, intrusion patterns, and anomaly detection using intelligent systems*
4. *To evaluate and build automated systems for real-time security analytics.*
5. *To understand the ethical, legal, and societal implications of AI-driven security systems.*

COURSE OUTCOMES:

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

1. *Understand cybersecurity frameworks, threat types, and vulnerabilities.*
2. *Apply AI/ML techniques for cyber threat identification and classification.*
3. *Analyze malware patterns to understand threats and vulnerabilities*
4. *Analyze patterns in malware, network traffic, and security logs.*
5. *Design and evaluate intelligent intrusion detection and prevention systems.*
6. *Explore ethical hacking practices and policy aspects in AI-based security.*

UNIT I: Fundamentals of Cybersecurity

Introduction to Cybersecurity: CIA Triad, Threats & Vulnerabilities, Types of Attacks: Malware, Phishing, DDoS, Insider Threats, Security Policies and Access Controls, Risk Assessment and Vulnerability Management, Cryptography Basics: Symmetric, Asymmetric, Hash Functions, Cybersecurity Frameworks: NIST, ISO 27001, OWASP.

UNIT II: Machine Learning for Cyber Threat Detection

Supervised and Unsupervised Learning in Security Contexts, Feature Engineering for Security Data, Classification Models for Intrusion Detection (SVM, RF, KNN), Clustering Techniques for Anomaly Detection, Evaluation Metrics: Accuracy, Precision, ROC, F1 Score, Case Study: AI for Email Phishing Detection.

UNIT III: Deep Learning in Threat Intelligence

Deep Neural Networks for Cybersecurity, RNNs and LSTMs for Log and Sequence Data, Autoencoders for Anomaly Detection, CNNs for Malware Classification using Binary Analysis, Adversarial Attacks on AI-based Security Systems, Case Study: Threat Detection using Deep Learning.

UNIT IV: Real-Time Threat Detection and SIEM Systems

Security Information and Event Management (SIEM), Log Analysis and Real-Time Alerting, Threat Intelligence Platforms (TIPs), Integration of AI in SIEM Tools (Splunk, ELK Stack), Network Traffic and Packet Inspection using ML, SOC Operations and Automation using AI

UNIT V: Ethical Hacking, Privacy, and Legal Aspects

Penetration Testing & Ethical Hacking with AI Tools, Red Team vs. Blue Team Simulation, Data Privacy Regulations: GDPR, HIPAA, Cyber Laws, AI Bias and Fairness in Security DecisionMaking, Case Study: Ethical Dilemmas in AI Security Systems, Future Trends: Zero Trust, AI SOC, Federated Threat Detection.

TEXTBOOKS:

1. Stallings, W., *Network Security Essentials*: Applications and Standards, Pearson Education.
2. Shon Harris & Fernando Maymi, CISSP All-in-One Exam Guide, McGraw Hill.
3. Emmanuel Tsukerman, Machine Learning for Cybersecurity Cookbook, Packt Publishing.
4. Clarence Chio & David Freeman, Machine Learning and Security, O'Reilly Media.

REFERENCE BOOKS:

1. John Paul Mueller, Luca Massaron, Machine Learning for Dummies, Wiley.
2. Mark Stamp, Information Security: Principles and Practice, Wiley.
3. Bruce Schneier, Secrets and Lies: Digital Security in a Networked World, Wiley.
4. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning, Cambridge University Press.

ONLINE LEARNING RESOURCES:

- Coursera – AI for Cybersecurity (IBM)
- edX – Cybersecurity Fundamentals by Rochester Institute of Technology
- MIT OpenCourseWare – Computer and Network Security
- [YouTube – Cybersecurity & AI Tutorials by Simplilearn, Great Learning]
- Udemy – Machine Learning for Cybersecurity
- Splunk Documentation – AI & Threat Detection

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(23CE0152) DISASTER MANAGEMENT
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course

1. *Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.*
2. *Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.*
3. *Apply wind engineering principles and computational techniques in designing wind-resistant structures.*
4. *Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.*
5. *Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.*

COURSE OUTCOMES:

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

1. *Examine types and patterns of natural disasters, interpret hazard maps, and evaluate disaster risk reduction and recovery measures.*
2. *Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.*
3. *Apply wind engineering principles in the design of wind–resistant structures.*
4. *Apply computational techniques for the analysis and design of wind–resistant structures.*
5. *Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.*
6. *Design disaster-resistant structures with innovative construction materials*

UNIT-I Introduction to Natural Disasters

Brief introduction to different types of natural disasters, occurrence of disasters in different climatic and geographical regions, hazard maps (earthquake and cyclone) of the world and India, regulations for disaster risk reduction, post-disaster recovery and rehabilitation (socioeconomic consequences).

UNIT-II Cyclones and Their Impact

Climate change and its impact on tropical cyclones, nature of cyclonic wind, velocities and pressure, cyclone effects, storm surges, floods, and landslides. Behavior of structures in past cyclones and windstorms, case studies. Cyclonic retrofitting, strengthening of structures, and adaptive sustainable reconstruction. Life-line structures such as temporary cyclone shelters

UNIT-III Wind Engineering and Structural Response

Basic wind engineering, aerodynamics of bluff bodies, vortex shedding, and associated unsteadiness along and across wind forces. *Lab:* Wind tunnel testing and its salient features. Introduction to Computational Fluid Dynamics (CFD). General planning and design considerations under windstorms and cyclones. Wind effects on buildings, towers, glass panels, etc., and wind-resistant features in design. Codal provisions, design wind speed, pressure coefficients. Coastal zoning regulations for construction and reconstruction in coastal areas. Innovative construction materials and techniques, traditional construction techniques in coastal areas

UNIT-IV Seismology and Earthquake Effects

Causes of earthquakes, plate tectonics, faults, seismic waves; magnitude, intensity, epicenter, energy release, and ground motions. Earthquake effects on ground, soil rupture, liquefaction, and landslides. Performance of ground and buildings in past earthquakes – behavior of various types of buildings and structures, collapse patterns; behavior of non-structural elements such as services, fixtures, and mountings – case studies. Seismic retrofitting – weakness in existing buildings, aging, concepts in repair, restoration, and seismic strengthening

UNIT-V Planning and Design Considerations for Seismic Safety

General planning and design considerations; building forms, horizontal and vertical eccentricities, mass and stiffness distribution, soft storey effects, etc.; seismic effects related to building configuration. Plan and vertical irregularities, redundancy, and setbacks. Construction details – various types of foundations, soil stabilization, retaining walls, plinth fill, flooring, walls, openings, roofs, terraces, parapets, boundary walls, underground and overhead tanks, staircases, and isolation of structures. Innovative construction materials and techniques. Local practices – traditional regional responses. Computational investigation techniques.

TEXT BOOKS:

1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.

REFRENCE BOOKS:

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.
3. Bimal Kanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020

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(23CE0153) SUSTAINABILITY IN ENGINEERING PRACTICES
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES

*The objectives of this course***:**

1. *To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.*
2. *To analyze sustainable construction materials, their durability, and life cycle assessment.*
3. *To apply energy calculations in construction materials and assess their embodied energy.*
4. *To evaluate green building standards, energy codes, and performance ratings.*
5. *To assess the environmental effects of energy use, climate change, and globa lwarming*

COURSE OUTCOMES:

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

1. *Recognize the rule of construction materials in contributing to CO_2 emissions from materials.*
2. *Choose construction materials that are more sustainable.*
3. *Calculate the embodied energy of various construction materials and assess their contribution to overall building energy consumption.*
4. *Differentiate between embodied and operational energy in buildings and evaluate total life cycle energy use for sustainable construction.*
5. *Implement energy efficiency standards, and rating systems such as LEED, GRIHA, and ECBC, including the role of materials, insulation, and thermal performance in sustainable building design.*
6. *Analyze the environmental impacts of non-renewable energy sources, including their role in global warming, greenhouse effects, acid rain, and regional climate changes*

UNIT – I Introduction

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO2Contribution From Cement and Other Construction Materials.

UNIT – II Materials Used In Sustainable Construction

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT – III Energy Calculations

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT – IV Green Buildings

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT – V Environmental Effects

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: *Green Building Design & Delivery*, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016

REFRENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

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(23EE0262) RENEWABLE ENERGY SOURCES
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course is to

1. *Know the importance of energy, resources of renewable energy, their usage and impact on environment.*
2. *Recognize the significance of solar energy, its harnessing technologies & its applications.*
3. *Identify the method of exploiting energy from wind and parameters to be considered for the selection of site for wind turbine installation.*
4. *Explain the concept of bio energy and its conversion devices.*
5. *Differentiate various renewable energies such as tidal energy, fuel cells*

COURSE OUTCOMES:

At the end of the course the student will be able to:

1. *State various sources of energies, its availability and explain the importance of them by observing the global energy scenario.*
2. *Distinguish the types of solar energy tapping devices and describe the method of harnessing the solar energy.*
3. *Summarize the wind energy systems and elucidate the impact of it in environmental aspects.*
4. *Describe the biomass conversion process and list out various bioenergy applications.*
5. *Interpret the knowledge of renewable energies such as tidal energy, OTEC.*
6. *Identify numerous applications renewable energy resources and illustrate its harnessing technologies*

UNIT I Solar Energy:

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II PV Energy Systems:

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT III Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT IV Geothermal Energy:

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT – V Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

TEXT BOOKS:

1.G. D. Rai, —*Non-Conventional Energy Sources*‖, 4th Edition, Khanna Publishers, 2000.
2.Chetan Singh Solanki —Solar Photovoltaics fundamentals, technologies and applications‖ 2nd Edition PHI Learning Private Limited. 2012.

REFERENCE BOOKS:

1.Stephen Peake, —Renewable Energy Power for a Sustainable Future‖, Oxford International Edition, 2018.

2.S. P. Sukhatme, —Solar Energy‖,3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
3.B H Khan , — Non-Conventional Energy Resources‖, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

4.S. Hasan Saeed and D.K.Sharma,—Non-Conventional Energy Resources‖,3rd Edition, S.K.Kataria& Sons, 2012.

5.G. N. Tiwari and M.K.Ghosal, —Renewable Energy Resource: Basic Principles and Applications‖, Narosa Publishing House, 2004.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

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(23ME0349) AUTOMATION AND ROBOTICS
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of the course are to

1. *Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes*
2. *Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.*
3. *Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments*
4. *Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications*
5. *Familiarity of industrial automation and robotics, and practical applications in manufacturing processes*

COURSE OUTCOMES:

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

1. *Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production*
2. *Analyse and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques.*
3. *Classify the robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility*
4. *Explain the various components of robots and its feed back systems and its corrective measures.*
5. *Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems*
6. *Design program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks*

UNIT-I Introduction to Automation:

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT –II Automated flow lines:
Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT- III Introduction to Industrial Robotics:
Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT- IV Manipulator Kinematics:
Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics. Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT- V Robot Programming:
Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:
1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.

REFERENCES:
1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam
Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

ONLINE LEARNING RESOURCES:
https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl-gt76o
https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3 ZJgwEjyE

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(23EC0441) DIGITAL ELECTRONICS
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.*
2. *To analyze combinational circuits like adders, subtractors, and code converters.*
3. *3To explore combinational logic circuits and their applications in digital design.*
4. *To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.*
5. *To gain knowledge about programmable logic devices and digital IC's.*

COURSE OUTCOMES:

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

1. *Apply Boolean algebra and Karnaugh Maps to simplify and analyze logic expressions.*
2. *Design basic logic gates like AND, OR, NAND, NOR, XOR.*
3. *Analyze and design combinational circuits like adders, subtractors, and perform code conversions.*
4. *Design and implement logic functions using multiplexers, decoders, encoders, and comparators..*
5. *Understand sequentiall logic circuits, including latches, flipflops, counters, and shift registers.*
6. *Implement logic circuits using ROM, PLA, PAL, and standard digital ICs like 74-series*

UNIT-I Logic Simplification and Combinational Logic Design:

Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, ExNOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II Introduction to Combinational Design 1:

Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III Combinational Logic Design 2:

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV Sequential Logic Design:
Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT-V Programmable Logic Devices:
ROM, Programmable Logic Devices (PLA and PAL).
Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:
1. *Digital Design*, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. *Switching theory and Finite Automata Theory*, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:
1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

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III B.Tech. – II Sem.

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(23HS0853) OPTIMIZATION TECHNIQUES FOR ENGINEERS

(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course:

1. *To provide the basic knowledge about Optimization, importance, application areas of in the industry, Linear Programming.*
2. *To impart different optimization models under typical situations in the business organization like transportation, assignment.*
3. *To understand the process of sequencing in a typical industry.*
4. *To describe different game strategies under cut-throat competitive business environment*

COURSE OUTCOMES:

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

1. *Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.*
2. *Interpret the transportation models' solutions and infer solutions to the real-world problems*
3. *Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications*
4. *Understand theoretical concepts, formulating problems, applying various methods, and analyzing their performance*
5. *Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives*
6. *Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives*

UNIT – I: Linear programming I

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II Linear programming II:Duality in Linear Programming

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III Non-linear programming: Unconstrained optimization techniques

Introduction: Classification of Unconstrained minimization methods

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV Non-linear programming: Constrained optimization techniques

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V Geometric Programming

Unconstrained Minimization Problems:

solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOK:

1. Singiresu S Rao., *Engineering Optimization*: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, *Introduction to Optimization Techniques*, (7-e) Jain Brothers, New Delhi.

REFERENCES:

1. Harvey M. Wagner, *Principles of Operation Research*, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. *Mathematics of Non-linear Programming*, Springer Verlag.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

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(23HS0858) MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.*
2. *To develop understanding of the transition from finite-dimensional systems to infinite dimensional function spaces and Hilbert space concepts.*
3. *To establish quantum mechanical formalism including measurement theory, uncertainty relations,and time evolution principles.*
4. *To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.*
5. *To introduce advanced concepts in composite systems, measurement processes, and modern perspectives* in quantum mechanics.

COURSE OUTCOMES:

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

1. *Understand vector spaces, inner products, and linear operators with applications to quantum systems*
2. *Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems*
3. *Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution*
4. *Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations*
5. *Understand statistical applications and interpretation with measurement processes*
6. *Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum* theory

UNIT I: Linear Algebra Foundation for Quantum Mechanics

Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finitedimensional examples (2×2 matrices, spin-1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\varphi|$, $\langle\varphi|\psi\rangle$), Change of basis (transformations, unitary matrices).

UNIT II: From Finite to Infinite Dimensions

Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int\psi^*\varphi\, dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT III: Quantum Mechanical Formalism

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT IV: Applications and Statistical Interpretation

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: Advanced Topics

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

TEXTBOOKS:

1. David J. Griffiths, Darrell F. Schroeter, ―*Introduction to Quantum Mechanics*‖, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, *Principles of Quantum Mechanics*, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

REFERENCE BOOKS:

1. George. F. Simmons, ―*Introduction to Topology and Modern Analysis*‖,MedTech Science Press.
2. Gilbert Strang, *Linear Algebra and Its Applications*, 4th Edition, Cengage Learning (2006).
3. John von Neumann and Robert T Beyer, *Mathematical Foundations of Quantum Mechanics*,Princeton Univ. Press (1996).

WEB RESOURCES

1. https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf
2. https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf

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(23HS0843) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES

The objectives of this course

1. *To make the students to understand the concept of crystal growth, defects in crystals and thin films.*
2. *To provide insight into various semiconducting materials and their properties.*
3. *To develop a strong foundation in semiconductor physics and device engineering*
4. *To elucidate excitonic and luminescent processes in solid-state materials*
5. *To understand the principles, technologies, and applications of modern display systems*

COURSE OUTCOMES

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

1. *Understand crystal growth and thin film preparation*
2. *Summarize the basic concepts of semiconductors*
3. *Illustrate the working of various semiconductor devices*
4. *Explain the different types of Transistors*
5. *Analyze various luminescent phenomena and the devices based on these concepts*
6. *Explain the working of different display devices*

UNIT-I Fundamentals of Materials Science

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II Semiconductors

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor Devices:

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence:

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Interband luminescence, Direct and indirect gap materials. **Photoluminescence :** General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot. Electro-**luminescence :** General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V Display devices :

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

TEXTBOOKS:

1. *Principles of Electronic Materials and Devices*-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4thedition, 2021.

2. *Semiconductor physics & devices*: basic principles, 4th Edition, McGraw-Hill, 2012.

REFERENCE BOOKS:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition

2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005

3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.

4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011 NPTEL

COURSE LINKS:

https://nptel.ac.in/courses/113/106/113106062/

https://onlinecourses.nptel.ac.in/noc20_ph24/preview

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(23HS0807) CHEMISTRY OF POLYMERS AND APPLICATIONS

(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand the basic principles of polymers*
2. *To understand natural polymers and their applications*
3. *To impart knowledge to the students about synthetic polymers, their preparation and importance*
4. *To enumerate the applications of hydogel polymers*
5. *To enumerate applications of conducting and degradable polymers in engineering*.

COURSE OUTCOMES

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

1. *Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer*
2. *Describe the physical and chemical properties of natural polymers and Modified cellulosics*
3. *Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers*
4. *Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,*
5. *Explain classification and mechanism of conducting and degradable polymers*.
6. *Apply knowledge of polymers in various fields such as biomedical, packaging, electronics, and environmental applications*

Unit – I: Polymers-Basics and Characterization:-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit – III: Synthetic Polymers

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit-IV: Hydrogels of Polymer networks

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels**,** Applications of hydrogels in drug delivery.

Unit – V: Conducting and Degradable Polymers: Conducting polymers:

Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping,Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

TEXT BOOKS:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

REFERENCES BOOKS:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2.Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

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(23HS0823) ACADEMIC WRITING AND PUBLIC SPEAKING
(Open Elective course –II)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To encourage all round development of the students by focusing on writing skills*
2. *To make the students aware of non-verbal skills*
3. *To develop analytical skills*
4. *To deliver effective public speeches*

COURSE OUTCOMES (CO):

By the end of the program students will be able to

1. *Understand various elements of Academic Writing*
2. *Identify sources and avoid plagiarism*
3. *Demonstrate the knowledge in writing a Research paper*
4. *Analyse different types of essays*
5. *Assess the speeches of others and know the positive strengths of speakers*
6. *Build confidence in giving an impactful presentation to the audience*

UNIT – I Introduction to Academic Writing

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT – II Academic Journal Article

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT – III Essay & Writing Reviews

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT – IV Public Speaking

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

UNIT – V Public Speaking and Non-Verbal Delivery

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage – Signs

TEXTBOOKS:

1.Critical Thinking, *Academic Writing and Presentation Skills*: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)

2.Pease, Allan & Barbara. The Definitive Book of Body LanguageRHUS Publishers, 2016

REFERENCE BOOKS

1.Alice Savage, Masoud Shafiei **Effective Academic Writing,**2Ed.,2014 .sserPytisrevinUdrofxO

2. Shalini Verma, **Body Language**, S Chand Publications 2011.

3. Sanjay Kumar and Pushpalata,**Communication Skills** 2E 2015, Oxford

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(23CS0914) BIG DATA & CLOUD COMPUTING LAB
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide hands-on experience in working with big data tools and cloud computing environments.*
2. *To equip students with practical skills in data ingestion, transformation, analysis, and visualization using Hadoop and Spark ecosystems.*
3. *To enable deployment and management of cloud services using AWS, Azure, or GCP.*
4. *To expose students to cloud-native storage, computing, and container orchestration techniques.*
5. *To integrate big data workflows with cloud infrastructure for scalable, distributed data processing.*

COURSE OUTCOMES:

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

1. *Implement big data processing pipelines using tools such as Hadoop and Apache Spark.*
2. *Design and deploy scalable cloud-based solutions using platforms like AWS, Azure, or GCP.*
3. *Manage distributed data processing and scalable storage systems efficiently in cloud environments.*
4. *Provision and configure cloud services for data analytics and application deployment.*
5. *Develop and deploy containerized applications using orchestration platforms like Docker and Kubernetes.*
6. *Analyze real-world problems and apply integrated big data and cloud computing solutions to address them effectively*

List of Lab Experiments:

1.Installation and Configuration of Hadoop Cluster (Single Node & Multi-node)
Hadoop HDFS setup, NameNode & DataNode configuration
2. Working with HDFS: File Operations
Upload, read, delete, and replicate files in HDFS
3. MapReduce Programming Basics
Word count, sorting, and filtering examples in Java/Python
4. Apache Hive & Pig for Querying Large Datasets
Creation of tables, data loading, and running queries
5. Apache Spark Basics: RDDs and DataFrames
Implement Spark transformations and actions
6. Data Preprocessing and Machine Learning using PySpark MLlib

Classification or regression using MLlib pipelines
7. Introduction to Cloud Computing and AWS/Azure/GCP Console
Creating virtual machines, basic compute and storage services
8.Cloud Storage and Database Services
Using S3 (AWS), Blob (Azure), or GCP buckets and Cloud SQL/NoSQL
9.Deploying Big Data Workloads on Cloud (EMR, HDInsight, Dataproc)
Running Hadoop/Spark jobs in cloud-managed services
10. Cloud Function/Serverless Deployment
11.Building and deploying a serverless function (e.g., AWS Lambda)
Containerization with Docker
12.Building, running, and managing Docker containers
Orchestration with Kubernetes in the Cloud
Deploy and manage a containerized application using GKE/EKS/AKS

TEXT BOOKS:

1. Tom White, Hadoop: The Definitive Guide, O'Reilly Media.
2. Rajkumar Buyya et al., *Mastering Cloud Computing*, McGraw-Hill Education.
3. Holden Karau et al., Learning Spark: Lightning-Fast Big Data Analysis, O'Reilly Media.

REFERENCE BOOKS:

1. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing.
2. Benjamin Bengfort, Data Analytics with Hadoop, O'Reilly.
3. Srinivasan & J.Shrinivasan, Cloud Computing – A Hands-on Approach, Wiley India.

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(23CS1405) FULL STACK AI LAB

COURSE OBJECTIVES:

The objectives of this course

1. *Enable students to build end-to-end AI-powered web applications.*
2. *Integrate frontend, backend, database, and AI models in real-time.*
3. *Provide hands-on experience with Flask, Express, MongoDB, React, and ML models.*
4. *Develop and deploy AI applications using industry-standard practices.*

COURSE OUTCOMES:

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

1. *Design and develop end-to-end AI-powered applications incorporating data Design frontend interfaces using React/HTML/CSS.*
2. *Build backend logic using Flask or Node.js APIs.*
3. *Integrate and deploy ML models with web services.*
4. *Store and retrieve data using MongoDB/MySQL.*
5. *Test, debug, and deploy AI-based web applications.*
6. *Monitor, scale, and maintain deployed AI models effectively in real-world production environments.*

List of Lab Experiments:

1. Setup Flask or Node.js server with React/HTML frontend.
2. Create login/signup system with Express/Flask and MongoDB.
3. Train and save ML model (e.g., Naive Bayes, Logistic Regression).
4. Build API to serve ML model predictions via Flask.
5. Integrate ML predictions in frontend using fetch/AJAX.
6. Create dynamic dashboard using Chart.js/Plotly.
7. Implement JWT tokens or sessions for authentication.
8. Add file upload functionality (image/text for prediction).
9. Store interactions/predictions in database and visualize history.
10. Create CI/CD pipeline using GitHub Actions/Heroku.
11. Build mini-project: News Classifier / Spam Detector / Fake News Detector.
12. Final Demo & Deployment on Render/Heroku/Vercel/localhost

TEXT BOOKS:

1.“*Full Stack Deep Learnin***g”** by Emmanuel Ameisen, O‘Reilly, 2020

2. **“***Flask Web Development***”** by Miguel Grinberg, O‘Reilly, 2018

3. **“***Python Machine Learning***”** by Sebastian Raschka, Packt Publishing.

REFERENCE BOOKS:

1.“*Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow***”** by Aurélien Géron

2. **“***MongoDB: The Definitive Guide***”** by Kristina Chodorow

3. **“***Node.js Design Patterns***”** by Mario Casciaro

ONLINE COURSES:

1. Full Stack Web Development with Flask and Python- Udemy

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(23HS0818) SOFT SKILLS
(Skill Enhancement Course)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To encourage all round development of the students by focusing on soft skills*
2. *To make the students aware of critical thinking and problem-solving skills*
3. *To enhance healthy relationship and understanding within and outside an organization*
4. *To function effectively with heterogeneous teams*

COURSE OUTCOMES :

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

1. *List out various elements of soft skills*
2. *Describe methods for building professional image*
3. *Apply critical thinking skills in problem solving*
4. *Analyse the needs of an individual and team for well-being*
5. *Assess the situation and take necessary decisions*
6. *Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being*

UNIT – I Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques **Activities: Intrapersonal Skills**- Narration about self- strengths and weaknesses- clarity of thought – selfexpression – articulating with felicity (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources) **Interpersonal Skills**- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. **Verbal Communication**- Oral Presentations- Extempore- brief addresses and speeches- convincingnegotiating- agreeing and disagreeing with professional grace. **Non-verbal communication** – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection **Activities**: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles **Activities:** Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT IV Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – SelfRegulation – Stress factors – Controlling Stress – Tips **Activities**: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges Activities Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:

1.The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.

2. Case studies may be given wherever feasible for example for Decision Making- The decision of KingLear.

TEXT BOOK:

1. Mitra Barun K, **Personality Development and Soft Skills**, Oxford University Press, Pap/Cdredition 20122.
2. Dr Shikha Kapoor, **Personality Development and Soft Skills: Preparing for Tomorrow,** KI2018,esuo Hgnihsilbu P lanoitanretnI

REFERENCE BOOK:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K,Soft SkillsS.Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan& Sangeetha Sharma,Soft Skills: An Integrated Approach to MaximisePersonalityPublished by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge UniversityPress, 2018

ONLINE LEARNING RESOURCES:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7Kl
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7.https://www.businesstrainingworks.com/training-resource/five-free-businessetiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

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III B.Tech. – II Sem.

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(23HS0816) TECHNICAL REPORT WRITING & IPR
(Audit Course)
(Common to All Branches)

COURSE OBJECTIVES:

The objectives of this course

1. *To enable the students to practice the basic skills of research paper writing*
2. *To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.*
3. *To practice the basic skills of performing quality literature review*
4. *To help them in knowing the significance of real life practice and procedure of Patents.*
5. *To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks*

COURSE OUTCOMES:

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

1. *Identify key secondary literature related to their proposed technical paper writing*
2. *Explain various principles and styles in technical writing*
3. *Use the acquired knowledge in writing a research/technical paper*
4. *Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc*
5. *Evaluate different forms of IPR available at national & international level*
6. *Develop skill of making search of various forms of IPR by using modern tools and techniques*

UNIT – I: Principles of Technical Writing:

Styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings discussing your limitations -hedging and criticizing -plagiarism and paraphrasing

UNIT – II: Technical Research Paper Writing:

Abstract- Objectives-Limitations-Review of Literature- Problemsand Framing Research Questions- Synopsis

UNIT – III:Process of research: publication mechanism:

Types of journals- indexing-seminars conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

UNIT – IV: Introduction to Intellectual property:

Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes

UNIT – V:Law of copy rights:

Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.Patent law, intellectual property audits.

TEXTBOOKS:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013

2.Meenakshi Raman, Sangeeta Sharma. *Technical Communication:Principles and practices.*Oxford

REFERENCE BOOKS:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.

2. Prabuddha Ganguli,*Intellectual Property Rights* Tata Mcgraw Hill, 2001

3. P.Naryan,*Intellectual Property Law*, 3rd Ed ,Eastern Law House, 2007.

4. Adrian Wallwork. *English for Writing Research Papers*Second Edition. Springer Cham Heidelberg New York ,2016

5. Dan Jones, Sam Dragga, *Technical Writing Style*

ONLINE RESOURCES

1.https://theconceptwriters.com.pk/principles-of-technical-writing/

2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html

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IV B.Tech. – I Sem.

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(23CS1406) GENERATIVE AI & PROMPT ENGINEERING

COURSE OBJECTIVES:

The objectives of this course

1. *Understand the foundations and working of Generative AI models.*
2. *Explore various generative models like GANs, VAEs, and LLMs.*
3. *Learn prompt engineering techniques to effectively interact with language models.*
4. *Design applications using LLMs with precise control through prompting.*
5. *Understand ethical and societal implications of using Generative AI.*

COURSE OUTCOMES:

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

1. *Explain the fundamentals of Generative AI, compare model architectures (GANs, VAEsTransformers), and evaluate their use in generating text, images, and other media.*
2. *Apply prompt engineering techniques including few-shot learning, output formatting, and debugging to control and guide generative model outputs.*
3. *Analyze the architecture and capabilities of large language models (LLMs), and build NLP applications using prompt engineering and fine-tuning techniques.*
4. *Design complex multi-step prompting workflows using tools like LangChain and Llama Index, and generate structured or multimodal outputs safely and effectively.*
5. *Assess the ethical, legal, and societal implications of generative AI, and evaluate its responsible use across fields like healthcare, education, and law.*
6. *Develop and present a real-world mini-project involving a generative AI solution (e.g., chatbot, content generator, creative assistant), showcasing integration, prompt design, and evaluation.*

Unit I: Introduction to Generative AI

Overview of Generative AI and Applications, Generative vs Discriminative Models, Latent Space and Data Generation Concepts, Architectures: GANs, VAEs, Autoregressive Models, Generative AI in Text, Image, Audio, and Video, LLMs: Pretrained Transformers as, Generators, Training Challenges and Evaluation of Generative Models, Case Studies: Image Synthesis, Text Generation.

Unit II: Prompt Engineering Fundamentals

Introduction to Prompt Engineering, Prompt Formats: Zero-shot, One-shot, Few-shot, Prompt Tuning vs Prompt Programming, In-Context Learning & Chain-of-Thought Prompting, Role of Instructions and Examples in Prompts, Controlling Output Style, Tone, and Format, Prompt Failure Cases and Debugging, Prompt Engineering for Coding, Text Completion, Q&A

Unit III: Generative Models in NLP

Transformer Architecture Recap (BERT, GPT), GPT-3/4, PaLM, Claude, and LLaMA Architectures, Text Generation Pipelines and APIs (OpenAI, HuggingFace), Prompt Engineering with GPT Models, Fine-tuning vs Instruct Tuning, Retrieval-Augmented Generation (RAG), Evaluation Metrics: BLEU, ROUGE, Perplexity, Building LLM-based Apps with LangChain.

Unit IV: Advanced Prompt Engineering & Tools

Role of Temperature, Top-k, Top-p Sampling, Structured Outputs: Tables, JSON, Function Calls, Agentic Prompting and Multi-step Reasoning, Prompt Chaining and Memory Handling, Prompt Templates for Automation (LangChain, LlamaIndex), Prompt Engineering for Multimodal Models (DALL·E, Gemini, Sora), Safety Layers & Guardrails in Prompting,AutoGPT, BabyAGI, and Agentic Workflow Building.

Unit V: Ethics, Risks, and Applications of Generative AI

Risks: Hallucination, Toxicity, Bias, Deepfakes and Misinformation Challenges, Copyright, IP, and Data Privacy in Generated Content, Evaluation of Responsible AI Outputs, Red Teaming and Safety Testing, Applications in Education, Medicine, Art, and Law, Regulatory Landscape for Generative AI, Future Trends and Research Directions

TEXTBOOKS

1. "*Deep Learning with Python*", François Chollet, Manning, 2nd Edition
2. "*Generative Deep Learning*", David Foster, O'Reilly, 2nd Edition
3. "*Building Systems with ChatGPT*", Emmanuel Ameisen (O'Reilly Short Reads)
4. "*The Art of Prompt Engineering*", Nathan Hunter (Free online eBook)

REFERENCE BOOKS & PAPERS

1. Vaswani et al., Attention is All You Need
2. OpenAI Technical Reports on GPT Models
3. Papers from NeurIPS, ACL, ICML related to XAI and LLMs
4. LangChain Documentation

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IV B.Tech. – I Sem.

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(23HS0861) BUSINESS ETHICS AND CORPORATE GOVERNANCE
(Management Course- II)

COURSE OBJECTIVES
The objectives of this course are

1. *To make the student understand the principles of business ethics*
2. *To enable them in knowing about the ethics in management*
3. *To facilitate the student' role in corporate culture*
4. *To impart knowledge about the fair-trade practices*
5. *To encourage the student in knowing about the corporate governance*

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

1. *Apply various ethical principles in business and corporate social responsibility practices*
2. *Recognize how personal ethics can influence behavior and apply in decision making*
3. *Explain the ethical challenges facing the various functional departments*
4. *Identify the organizational and cultural variables that impact ethical judgment*
5. *Analyze various ethical codes in corporate governance*
6. *Identify organizational policies and systems that employ ethical conduct*

UNIT-I: Ethics

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management -Corporate Social Responsibility – Issues of Management – Crisis Management.

UNIT-II: Ethics In Management

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

UNIT-III : Corporate Culture

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

UNIT- IV: Legal Frame Work

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

UNIT -V: Corporate Governance

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitation

TEXT BOOKS.

1. Murthy CSV: *Business Ethics and Corporate Governance*, HPH July 2017

2. Bholananth Dutta, S.K. Podder – *Corporation Governance*, VBH. June 2010

REFERENCE BOOKS

1. Dr. K. Nirmala, KarunakaraReaddy. *Business Ethics and Corporate Governance*, HPH

2. H.R.Machiraju: *Corporate Governance*, HPH, 2013

3. K. Venkataramana, *Corporate Governance*, SHBP.

4. N.M.Khandelwal. *Indian Ethos and Values for Managers*

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

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IV B.Tech. – I Sem.

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(23HS0862) E-BUSINESS
(Management Course- II)

COURSE OBJECTIVES

The Objectives of this course are

1. *To provide knowledge on emerging concept on E-Business related aspect.*
2. *To understand various electronic markets & business models*
3. *To impart the information about electronic payment systems & banking.*
4. *To create awareness on security risks and challenges in E-commerce*
5. *To the students aware* on different e-marketing channels & strategies.

COURSE OUTCOMES

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

1. *Remember E-Business & its nature, scope and functions*
2. *Understand E-market-Models which are practicing by the organizations*
3. *Apply the concepts of E-Commerce in the present globalized world*
4. *Analyze the various E-payment systems & importance of net banking*
5. *Evaluate market research strategies & E-advertisements*
6. *Understand the importance of E-security and control mechanisms*

Unit-I: Electronic Business

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce – E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries

Unit-II: Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Unit-III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions - Infrastructure requirements and regulatory aspects of e-payments

Unit-IV:E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms

Unit-V:E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

TEXT BOOKS:

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

REFERENCES:

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill‘s, 2005
2. Dave Chaffey.*E-Commerce E-Management,* Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application,* RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003

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(23HS0863) MANAGEMENT SCIENCE
(Management Course- II)

COURSE OBJECTIVES

The objectives of this course

1. *To provide fundamental knowledge on Management, Administration, Organization &its concepts*
2. *To make the students understand the role of management in Production*
3. *To impart the concept of HRM in order to have an idea on Recruitment, Selection,Training & Development, job evaluation and Merit rating concepts*
4. *To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management*
5. *To make the* students aware of the contemporary issues in modern management

COURSE OUTCOMES:

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

1. *Remember the concepts & principles of management and designs of organization in a practical world*
2. *Understand the knowledge of Work-study principles & Quality Control techniques in industry*
3. *Apply the process of Recruitment & Selection in organization*
4. *Analyze the concepts of HRM & different training methods*
5. *Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.*
6. *Create awareness* on contemporary issues in modern management & technology

UNIT- I Introduction To Management

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor‘s Scientific Theory-Henry Fayol‘s principles - Elton Mayo‘s Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management

UNIT - II Operations Management

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle

UNIT - III Human Resources Management (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT - IV Strategic & Project Management

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems)

UNIT - V Contemporary Issues In Management

Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility

TEXT BOOKS:

1. Frederick S. Hillier, Mark S. Hillier. *Introduction to Management Science*, October 26, 2023
2. A.R Aryasri, *Management Science*, TMH, 2019

REFERENCES:

1. Stoner, Freeman, Gilbert.*Management*, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, *Essentials of Management*, 6/e, TMH, 2005.
3. Thomas N.Duening& John M.Ivancevich, *Management Principles and Guidelines*, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, *Modern Management*, 9/e, PHI, 2005

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IV B.Tech. – I Sem.

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(23CS0933) EXPLAINABLE AI & MODEL INTERPRETABILITY

(Professional Elective course (PEC) – IV)

(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the principles of interpretability and explainability in AI/ML models.*
2. *To analyze the trade-offs between model accuracy and interpretability.*
3. *To explore popular post-hoc and intrinsic explainability techniques.*
4. *To examine fairness, accountability, and transparency in AI systems.*
5. *To develop hands-on skills with interpretability tools and libraries.*

COURSE OUTCOMES:

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

1. *Understand the need for explainability in modern AI systems.*
2. *Differentiate between black-box and white-box models.*
3. *Apply interpretability techniques such as SHAP, LIME, and PDPs.*
4. *Use PDPs to analyze feature impact*
5. *Evaluate the fairness and transparency of AI systems.*
6. *Use explainability tools for model auditing and deployment in high-stakes domains*.

UNIT I: Foundations of Explainable AI

Introduction to Explainability and Interpretability, Importance of XAI in Healthcare, Finance, and Law , White-box vs Black-box Models, Desiderata: Fairness, Accountability, Transparency, Human- Centered AI and Trust ,Taxonomy of XAI Techniques (Global vs Local, Post-hoc vs Intrinsic), Regulatory and Ethical Implications (GDPR, AI Bill of Rights), Model Simplicity vs Predictive Power.

UNIT II: Model-Specific Explainability Techniques

Decision Trees and Rule-based Models, Linear Models and Feature Importance, Generalized Additive Models (GAMs), Visualization of Weights and Coefficients, Logistic Regression Coefficient Interpretation, Case Study: Credit Scoring using Transparent Models,Comparison of Interpretable ML Models, Use Cases and Trade-offs.

UNIT III: Model-Agnostic Explainability Techniques

Local Interpretable Model-agnostic Explanations (LIME), SHAP Values (SHapley Additive exPlanations), Partial Dependence Plots (PDPs), Individual Conditional Expectation (ICE) Plots,Anchors and Counterfactual Explanations, Feature Interaction and Permutation Importance, Comparative Analysis of SHAP, LIME, PDP, Model Debugging with XAI.

UNIT IV: Deep Learning Explainability

Visualizing CNNs: Filters, Feature Maps, Saliency Maps and Grad-CAM, Integrated Gradients, Explaining RNNs and LSTM Outputs, Concept Activation Vectors (TCAV), Attention-based Interpretability in Transformers, Explaining Language Models (BERT, GPT) Evaluation of Deep Model Explanations.

UNIT V: Fairness, Bias & Tools for XAI

Fairness Metrics: Demographic Parity, Equal Opportunity, Sources of Bias in Data and Models, Discrimination Detection and Mitigation Strategies, Introduction to AIF360, What-If Tool, Fairlearn, Case Study: Bias in Hiring Algorithms, Explainability in ML Pipelines (MLFlow, Skater), XAI in Federated and Privacy-Preserving AI, Designing Interpretable AI Systems from Scratch.

TEXTBOOKS:

1. Christoph Molnar, ―*Interpretable Machine Learning*‖, Leanpub.
2. Sameer Singh et al., ―Explainable AI: Interpreting, *Explaining and Visualizing Deep Learning*‖, Springer.
3. Dan Roth, Zachary Lipton, and Been Kim, ―Explainable AI: Foundations, Developments, Prospects‖, MIT Press (Online forthcoming).

REFERENCE BOOKS:

1. Marco Tulio Ribeiro et al., ―Why Should I Trust You?‖ (LIME) – Research Paper Scott Lundberg et al., ―A Unified Approach to Interpreting Model Predictions‖ (SHAP) – NIPSBarredo Arrieta et al., ―Explainable Artificial Intelligence (XAI): Concepts, Taxonomies, Opportunities and Challenges‖, Information Fusion Journal.
2. Zachary C. Lipton, ―The Mythos of Model Interpretability‖ – Communications of the ACM

ONLINE LEARNING RESOURCES:

- Coursera – Explainable AI with Google Cloud
- Udacity – AI for Everyone by Andrew Ng
- HarvardX – Data Science: Machine Learning Interpretability

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(23CS0934) AI IN CYBERSECURITY
(Professional Elective course (PEC) – IV)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamental concepts of AI and their applications in cybersecurity.*
2. *To understand AI-driven techniques for threat detection, classification, and mitigation.*
3. *To explore machine learning and deep learning methods used for malware and intrusion detection.*
4. *To equip students with skills in building intelligent security systems.*
5. *To examine* ethical, legal, and privacy aspects in AI-driven cybersecurity

COURSE OUTCOMES:

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

1. *Understand AI principles and their relevance in cybersecurity.*
2. *Apply machine learning techniques to detect and respond to threats.*
3. *Analyze security incidents using intelligent tools and models.*
4. *Evaluate and implement AI models for malware detection and anomaly analysis.*
5. *Design AI-based cybersecurity* frameworks for real-world scenarios
6. *Demonstrate ethical awareness and critical thinking in the deployment of AI for cybersecurity applications, ensuring compliance with legal and privacy standards*

UNIT I: Introduction to AI in Cybersecurity

Role of AI in Modern Cybersecurity, Overview of Cyber Threats and Attack Vectors, Fundamentals of Machine Learning for Security, AI vs Traditional Security Techniques, AI-Based Cyber Defense Lifecycle, Threat Intelligence with AI, Cybersecurity Data Types and Challenges, Case Studies of AI- Driven Attacks and Defenses

UNIT II: Machine Learning for Cyber Threat Detection

Supervised Learning for Intrusion Detection, Unsupervised Learning for Anomaly Detection, Feature Engineering from Network Traffic, Classification Algorithms: SVM, Decision Trees, Random Forests, Clustering Techniques: K-Means, DBSCAN, Ensemble Models and Model Evaluation Metrics, Real-Time Threat Detection Pipelines, Data Imbalance and Adversarial Sampling

UNIT III: Deep Learning in Cybersecurity

Neural Networks for Threat Classification, CNNs for Malware Detection from Binary Files, RNNs/LSTMs for Sequential Log Analysis, Autoencoders for Anomaly Detection,GANs in Malware Evasion and Defense,Transfer Learning for Threat Signature Extraction, Deep Learning vs Traditional Models: A Comparative Study,Real-World Use Cases and Limitations

UNIT IV: AI for Specific Security Domains

AI for Phishing and Spam Detection, AI in Cloud Security and Edge Devices, Botnet and DDoS Attack Detection**,** AI-Driven Endpoint Security, Natural Language Processing for Threat Intelligence, Behavioral Biometrics and Fraud Detection, AI in Social Engineering Attack Prevention, Security Information and Event Management (SIEM) with AI

UNIT V: Challenges, Ethics & Future of AI in Cybersecurity

Explainable AI (XAI) in Cybersecurity, Adversarial Attacks and Defenses in AI Systems, Data Privacy and Federated Learning, Legal and Ethical Issues in AI Security Solutions, AI Model Bias and Fairness in Security Decisions, Securing AI Models Against Manipulation, Building Scalable AI- Powered SOCs, Future Trends: Autonomous Security, AI-Augmented Threat Hunting

TEXTBOOKS:

1. Clarence Chio & David Freeman, ―*Machine Learning and Security*‖, O'Reilly Media.
2. Xiaofeng Chen et al., ―*Artificial Intelligence and Big Data Analytics for Cybersecurity*‖, Springer.
3. Mark Stamp, ―*Information Security*: Principles and Practice‖, Wiley.

REFERENCE BOOKS:

1. Sumeet Dua & Xian Du, ―Data Mining and Machine Learning in Cybersecurity‖, CRC Press.
2. Shai Shalev-Shwartz & Shai Ben-David, ―Understanding Machine Learning‖, Cambridge University Press.
3. Zhiwei Lin & Yang Xiang, ―Cyber Security Intelligence and Analytics‖, Springer.
4. Bhavani Thuraisingham, ―Data Mining for Malware Detection‖, CRC Press.

ONLINE LEARNING RESOURCES:

1. Coursera – ―AI for Cybersecurity‖ by University of Colorado
2. Udemy – ―Machine Learning for Cybersecurity
3. edX – ―Cybersecurity MicroMasters‖ by RIT

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(23CS0935) AI-DRIVEN SOFTWARE ENGINEERING & DEVOPS
(Professional Elective course (PEC) – IV)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the principles and practices of AI-driven software engineering and DevOps.*
2. *To explore how AI techniques can automate and optimize software development workflows.*
3. *To study intelligent tools for code generation, testing, monitoring, and deployment.*
4. *To equip students with skills in AI-powered CI/CD pipelines and operations.*
5. *To foster an* understanding of ethical implications and reliability in intelligent software systems.

COURSE OUTCOMES:

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

1. *Understand AI's role in modern software development and operations.*
2. *Apply machine learning techniques to automate software engineering tasks.*
3. *Design and manage intelligent CI/CD and DevOps workflows.*
4. *Manage DevOps processes for automation and deployment*
5. *Evaluate AI tools in software testing, refactoring, and monitoring.*
6. *Implement AI-based solutions for predictive maintenance and decision support in DevOps.*

UNIT I: Foundations of AI in Software Engineering

Overview of Traditional vs AI-driven Software Development, AI Opportunities in Software Lifecycle Phases, Introduction to ML/DL Models in Engineering Tasks, Code Representation and Learning from Code, NLP for Source Code Understanding, Software Knowledge Graphs and Reasoning, Datasets and Benchmarks for Software Engineering AI, Case Studies of AI-Enhanced Development Tools

UNIT II: AI in Code Generation and Refactoring

Program Synthesis and Code Completion Models, Large Language Models (e.g., Codex, CodeBERT) in IDEs, Code Clone Detection and Automated Refactoring, Learning-Based Bug Detection and Code Smell Identification, AI in Software Architecture Recommendations, Embedding Techniques for Source Code, Prompt Engineering for Software Tasks, Reliability and Safety in Generated Code

UNIT III: Intelligent Testing, QA, and Debugging

Test Case Generation Using AI, Automated Unit Testing, Regression Testing with ML, Learning Bug Patterns from Repositories, AI-Based Static and Dynamic Code Analysis, Fault Localization and Automated Debugging, Quality Assurance Metrics Enhanced by AI, Reinforcement Learning for Test Prioritization, Ethics and Bias in AI-Driven Testing – (E)

UNIT IV: AI in DevOps Automation and CI/CD

DevOps Fundamentals and Integration with AI, Intelligent CI/CD Pipeline Design, Predictive Build Failure and Log Analysis, AI in Infrastructure-as-Code and Deployment Orchestration, Self-Healing Systems and AIOps Concepts, Log Analytics and Anomaly Detection in Production, AI in Monitoring, Tracing, and Feedback Loops, DevSecOps and AI for Security Automation

UNIT V: Advanced Topics and Ethical Considerations

Explainability and Transparency in AI-Driven Tools, Ethical and Legal Aspects in Automated Engineering**,** Human-AI Collaboration in Software Teams, Risk Management in Autonomous Code Deployment, AI for Technical Debt Prediction and Management, AI for Developer Productivity Analytics, Research Trends and Challenges in AI for SE, Capstone: Building a Smart DevOps Workflow

TEXTBOOKS:

1. Tim Menzies, Diomidis Spinellis, and Thomas Zimmermann, ―*Perspectives on Data Science for Software Engineering*‖, Morgan Kaufmann.
2. André van der Hoek, Reid Holmes, ―*Software Engineering for Machine Learning*‖, Springer.
3. Len Bass, Ingo Weber, Liming Zhu, ―DevOps: A Software Architect's Perspective‖, Addison- Wesley.

REFERENCE BOOKS:

1. Carlos Eduardo Parnin et al., ―AI for Software Engineering: Foundations, Advances, and Trends‖, Springer.
2. Luciano Baresi et al., ―Machine Learning Techniques for Software Quality Evaluation‖, Springer.
3. Gene Kim, Jez Humble, and Nicole Forsgren, ―Accelerate: The Science of Lean Software and DevOps‖, IT Revolution.

ONLINE LEARNING RESOURCES:

- Coursera – ―AI for Software Engineering‖ by DeepLearning.AI
- edX – ―DevOps for Developers‖ by Microsoft
- GitHub Copilot and OpenAI Codex documentation
- PapersWithCode – AI for Software Engineering benchmarks
- MIT OCW – ―Software Systems‖ and ―DevOps and CI/CD‖
- Udemy – ―AI-Powered DevOps Pipelines and Automation‖
- Google Cloud – AIOps and MLOps tutorials

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(23CS1411) AI FOR ROBOTICS
(Professional Elective course (PEC) – IV)

COURSE OBJECTIVES

The objectives of this course

1. *Introduce the fundamental principles of robotics and artificial intelligence integration.*
2. *Understand robot perception, localization, mapping, motion planning, and control using AI algorithms.*
3. *Apply machine learning and deep learning techniques in robotic environments.*
4. *Explore the use of reinforcement learning, behavior-based AI, and neural networks in autonomous robots.*
5. *Enable students to build intelligent robots that can perceive, learn, and adapt to dynamic environments.*

COURSE OUTCOMES

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

1. *Demonstrate an understanding of how AI techniques are applied in robot control and autonomy.*
2. *Apply vision, perception, and sensor fusion techniques for real-time robotic applications.*
3. *Implement path planning and navigation algorithms in dynamic environments.*
4. *Analyze and apply learning-based models such as reinforcement learning and deep neural networks in robotics.*
5. *Evaluate AI-enabled robotic systems based on their performance, efficiency, and adaptability.*
6. *Address ethical, interpretability, and regulatory aspects of model deployment*

UNIT I – Fundamentals of Robotics and AI

Introduction to Robotics: Types and Components, Overview of Artificial Intelligence and Machine Learning, Relationship between Robotics and AI, Sensors and Actuators in Robotics, Embedded Systems and Microcontrollers in Robotics, Architecture of Autonomous Robots, Programming Tools: ROS (Robot Operating System), Python, C++, Applications of AI in Robotics – Overview

UNIT II – Perception and Sensor Fusion

Computer Vision for Robotics: Basics and Techniques, Depth Sensing, RGB-D Cameras, LIDAR, and Ultrasonic Sensors, Feature Extraction and Object Recognition, Kalman Filter and Extended Kalman Filter, Particle Filter and Sensor Fusion Techniques, SLAM (Simultaneous Localization and Mapping) – Concepts, Visual SLAM and LiDAR-based SLAM, 3D Mapping and Scene Reconstruction.

UNIT III – Motion Planning and Navigation

Path Planning Algorithms – Dijkstra, A*, RRT, Obstacle Detection and Avoidance, Robot Kinematics and Dynamics, Trajectory Generation and Optimization, Localization Techniques – GPS, Wi-Fi, Odometry, Autonomous Navigation in Indoor and Outdoor Environments, Multi-Robot Coordination and Swarm Intelligence, Integration of Perception and Planning Systems

UNIT IV – AI Techniques in Robotics

Supervised and Unsupervised Learning for Robotics, Neural Networks and Deep Learning Models for Robot Vision, Reinforcement Learning – Q-Learning and Deep Q Networks, Policy Gradient and Actor-Critic Methods, Behavior-Based Robotics and Finite State Machines, Imitation Learning and Learning from Demonstration, Transfer Learning for Robotic Tasks, Safety and Generalization in AI Models for Robots

UNIT V – Advanced Applications and Ethical Considerations

Humanoid and Service Robots with AI, AI in Industrial, Healthcare, and Assistive Robotics, Edge AI and Real-Time Inference in Robots, Human-Robot Interaction and Social Intelligence, Autonomous Vehicles and Delivery Drones, AI in Robotics Competitions (RoboCup, DARPA), Ethical Issues in AI-Enabled Robotics, Future Trends: Neuromorphic and Quantum Robotics

TEXTBOOKS

1. "*Artificial Intelligence for Robotics*" by Robin R. Murphy
2. "*Probabilistic Robotics*" by Sebastian Thrun, Wolfram Burgard, Dieter Fox
3. "*Introduction to Autonomous Robots*" by Nikolaus Correll, Bradley Hayes, et al.

REFERENCE BOOKS

1. "Robot Operating System (ROS) for Absolute Beginners" by Lentin Joseph
2. "Modern Robotics: Mechanics, Planning, and Control" by Kevin M. Lynch and Frank C. Park
3. "Learning for Adaptive and Reactive Robot Control" by Aude Billard, Jean-Jacques Slotine
4. IEEE Transactions and Springer Journals on Robotics and Intelligent Systems

ONLINE COURSES

- AI for Robotics – Udacity (by Sebastian Thrun)
- Modern Robotics: Mechanics, Planning, and Control – Coursera (Northwestern University)
- Deep Learning for Robotics – edX

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(23CS0937) ML Ops & AI MODEL DEPLOYMENT
(Professional Elective course (PEC) – V)
(Common to CSM & CAI)

COURSE OBJECTIVE:

The objectives of this course

1. *To understand the principles and best practices of operationalizing machine learning models in production environments.*
2. *To explore the life cycle of AI model development, deployment, monitoring, and maintenance using modern MLOps frameworks.*
3. *To develop skills in CI/CD for ML, reproducibility, model versioning, and containerization using Docker and Kubernetes.*
4. *To deploy machine learning models using cloud-native services and track their performance using real-time metrics.*
5. *To address scalability, reliability, and ethical considerations in ML model deployment*.

COURSE OUTCOMES:

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

1. *Illustrate the lifecycle and pipeline components of MLOps and implement basic version control and orchestration for ML workflows.*
2. *Package ML models using appropriate tools and deploy them using Docker and Kubernetes environments with effective resource management.*
3. *Develop and deploy machine learning models as APIs using FastAPI/Flask*
4. *Deploy and configure APIs for real-time or batch inference*
5. *Monitor and log ML systems using modern tools and detect data/model drift with strategies for continuous evaluation and feedback.*
6. *Implement end-to-end MLOps solutions using cloud platforms and CI/CD tools, and analyze deployment challenges in real-world use cases.*

UNIT I: Introduction to MLOps and Deployment Pipelines

Definition and need of MLOps, ML system lifecycle and pipeline components, DevOps vs. MLOps: key differences, CI/CD for ML projects, Data versioning and model lineage, Introduction to DVC, Git, and MLFlow, Workflow orchestration using Apache Airflow, Automated testing in ML pipelines,

UNIT II: Model Packaging and Environment Management.

Packaging ML models using Pickle, Joblib, ONNX, Python virtual environments, Conda, Pipenv, Introduction to Docker for ML workloads, Building Dockerfiles for ML apps, Using Kubernetes for orchestration, Security, logging, and resource management, Docker Compose and Helm charts for deployment, Hands-on: Containerize and deploy a scikit-learn model

UNIT III: Model Serving and APIs

RESTful API design for ML models, Model deployment using FastAPI and Flask, TensorFlow Serving, TorchServe basics, Introduction to gRPC for ML deployment, Asynchronous inference and batch vs real-time serving, Load testing and benchmarking, Authentication and authorization in model APIs, Deploying models on edge devices

UNIT IV: Monitoring, Logging, and Continuous Evaluation

Importance of monitoring and alerting in MLOps, Data drift and model drift detection, Logging prediction results and metadata, Prometheus, Grafana, and ELK Stack, A/B testing and canary deployments, Shadow deployments and rollback strategies, Feedback loops for continuous learning, Integration with external monitoring tools

UNIT V: Cloud-native MLOps and Case Studies

ML deployment on AWS SageMaker, Azure ML, Google AI Platform, CI/CD using GitHub Actions, Jenkins, and GitLab CI, AutoML and model registry, Real-world case study: End-to-end MLOps pipeline, Challenges and limitations in enterprise ML deployment, Responsible AI in production systems, Future trends in MLOps, Capstone Project Planning

TEXT BOOKS:

1. Mark Treveil, Alok Shukla *Introducing MLOps*: How to Scale Machine Learning Projects with DevOps Tools –, O'Reilly Media.
2. Andriy Burkov *Machine Learning Engineering* –, TrueShelf Publishing.
3. *Designing Machine Learning Systems* – Chip Huyen, O‘Reilly Media.

REFERENCE BOOKS:

1. Practical MLOps – Noah Gift, O‘Reilly Media
2. Kubeflow for Machine Learning – Trevor Grant et al., O'Reilly
3. Hands-On MLOps: Implement Machine Learning in Production – Munn, Meza, Vohra, Packt Publishing
4. Research papers from arXiv, MLSys Conference, and ICML Industry Track

ONLINE COURSES:

- Coursera – MLOps Specialization by DeepLearning.AI
- Google Cloud – MLOps: Continuous Delivery and Automation Pipelines
- Udemy – MLOps: ML Pipelines, CI/CD, and Model Deployment

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(23CS0938) DATA WRANGLING
(Professional Elective course (PEC) – V)
(Common to CSM & CAI)

COURSE OBJECTIVES:

The objectives of this course

1. *To introduce the fundamental techniques for acquiring, cleaning, transforming, and manipulating data.*
2. *To enable students to handle real-world messy data for analysis and machine learning.*
3. *To teach efficient use of libraries like Pandas, NumPy, and SQL for data wrangling.*
4. *To promote understanding of handling missing values, outliers, and inconsistent formats.*
5. *To expose students to automation, reproducibility, and workflow design in data preprocessing.*

COURSE OUTCOMES:

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

1. *Understand and apply core data wrangling techniques.*
2. *Clean, transform, and reshape data using Python and SQL.*
3. *Handle missing values, data inconsistencies, and outliers.*
4. *Detect and treat outliers in datasets*
5. *Merge and join multiple datasets from different sources.*
6. *Automate data pipelines and preprocessing workflows for analytics and ML.*

UNIT I: Introduction to Data Wrangling and Data Acquisition

Introduction to Data Wrangling: Importance and Use Cases, Types of Data: Structured, Semi-Structured, Unstructured, Data Acquisition Techniques: APIs, Web Scraping, Reading Data from CSV, Excel, JSON, XML, Using Python libraries: pandas, requests, BeautifulSoup, Working with Databases using SQLAlchemy and pandas, Loading Large Datasets and Chunking, Exploratory Analysis Before Cleaning.

UNIT II: Handling Missing, Noisy, and Inconsistent Data

Identifying and Understanding Missing Data, Techniques for Imputing Missing Values, Handling Inconsistent Data: Dates, Texts, Units, Removing Duplicates and Irrelevant Data, Detecting and Treating Outliers, Normalization and Standardization Techniques, Regular Expressions for Text Cleaning, Visualizing Missing/Outlier Data.

UNIT III: Data Transformation and Feature Engineering

Data Type Conversion and Parsing , Feature Extraction from Text, Dates, and Strings, One-Hot Encoding, Label Encoding, Binning and Discretization, Data Aggregation and Grouping, Pivoting, Melting, and Reshaping Data, Handling Imbalanced Data, Creating Derived Features and Feature Selection.

UNIT IV: Data Integration, Joining, and Workflows

Merging and Joining Datasets (Inner, Outer, Left, Right), Concatenation and Appending DataFrames, Data Consistency and Referential Integrity, Resolving Schema Mismatches, Designing Reusable DataWrangling Functions, Automating Workflows with Functions and Pipelines, Data Lineage and Documentation, Case Study: End-to-End Data Wrangling Pipeline.

UNIT V: Tools, Libraries, and Case Studies in Data Wrangling

Pandas and NumPy Advanced Techniques, Pyjanitor, Dask, and Polars for Efficient Wrangling, Using OpenRefine for Data Cleaning, SQL vs NoSQL in Data Wrangling, Real-world Wrangling Case Studies (Finance, Healthcare, Retail), Best Practices and Common Pitfalls in Data Wrangling, Reproducibility and Versioning in Data Pipelines, Final Capstone: Build and Evaluate a Clean Dataset for ML/

TEXTBOOKS:

1. M. Heydt – *Data Wrangling with pandas*, O'Reilly Media.
2. Hadley Wickham – *R for Data Science (Data Wrangling Chapters*), O'Reilly.
3. J. VanderPlas – Python Data Science Handbook, O'Reilly Media.

REFERENCE BOOKS:

1. Wes McKinney – Python for Data Analysis, O'Reilly.
2. Cathy O'Neil and Rachel Schutt – Doing Data Science, O'Reilly.
3. David Mertz – Cleaning Data for Effective Data Science, Packt.

ONLINE LEARNING RESOURCES:

- Data Wrangling with pandas (Datacamp): https://www.datacamp.com/courses/data-manipulation-with-pandas
- Coursera: Data Wrangling, Analysis and AB Testing with SQL*https://www.coursera.org/learn/data-wrangling-analysis-abtesting*
- edX: Data Wrangling with R – https://online.rice.edu/courses/data-wrangling-r

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(23CS1412) HEALTHCARE AI
(Professional Elective course (PEC) – V)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide a foundational understanding of AI applications in healthcare.*
2. *To familiarize students with medical data types, preprocessing, and ethical considerations.*
3. *To explore ML and DL algorithms tailored for diagnosis, prognosis, and treatment recommendations.*
4. *To expose students to real-world healthcare systems and AI solutions like predictive modeling, EHRs, and medical imaging.*
5. *To enable students to design, evaluate, and deploy AI-driven healthcare applications*.

COURSE OUTCOMES:

After completing this course, students will be able to:

1. *Understand the scope, challenges, and benefits of AI in healthcare.*
2. *Apply data preprocessing and modeling techniques specific to biomedical data.*
3. *Analyze the performance of ML/DL models in clinical contexts.*
4. *Develop AI-driven applications for tasks like disease diagnosis, drug discovery, and patient monitoring.*
5. *Evaluate* ethical, legal, and societal implications of AI in healthcare.
6. *Critically evaluate algorithms based on scalability, efficiency, and effectiveness in large datasets*

UNIT I: Introduction to AI in Healthcare

Overview of Healthcare Systems and Data Ecosystem , AI in Clinical Decision Support Systems (CDSS), Types of Medical Data: EHRs, Imaging, Genomic, Sensor Data, Applications of AI in Diagnosis, Prognosis, and Monitoring, Use Cases: Radiology, Pathology, Oncology, Cardiology, Limitations and Challenges of AI in Healthcare, AI for Telemedicine and Remote Patient Monitoring.

UNIT II: Medical Data Preprocessing and Feature Engineering

Data Cleaning, Imputation, and Normalization for Clinical Data, Handling Missing Values, Outliers, and Bias, Feature Engineering from EHRs and Time-Series Data, Text Mining for Medical Notes using NLP, Encoding Diagnosis and Procedure Codes (ICD, CPT), Temporal Pattern Extraction from Clinical Sequences, Data Privacy, Anonymization, and HIPAA Compliance.

UNIT III: Machine Learning & Deep Learning in Healthcare

Supervised Learning for Risk Prediction and Classification, Unsupervised Learning for Patient Segmentation, Deep Learning for Medical Imaging: CNNs, Transfer Learning, Recurrent Neural Networks for Time-series Clinical Data, Survival Analysis and Time-to-Event Prediction, Model Evaluation Metrics: Sensitivity, Specificity, AUC, Handling Imbalanced Datasets in Healthcare, Interpretability in Medical ML Models (LIME, SHAP)

UNIT IV: Specialized Healthcare AI Applications

AI for Disease Diagnosis: Diabetes, Cancer, Heart Disease, AI in Medical Imaging: X-ray, MRI, CT Scan Analysis, Predictive Modeling for ICU Admission & Mortality Risk, AI in Genomics and Personalized Medicine, Drug Discovery and Repurposing with AI, Chatbots and Virtual Health Assistants, Remote Monitoring using IoT & Wearables + AI.

UNIT V: Ethics, Regulation, and Future Directions in Healthcare AI

Ethical AI in Healthcare: Bias, Fairness, and Accountability, Regulatory Landscape: FDA Approval, CE Marking, Explainable AI and Clinical Trust, Federated Learning for Privacy-Preserving AI, Clinical Trials and AI Decision-Support Tools, Case Studies: Google DeepMind, IBM Watson Health, PathAI, Responsible Deployment of AI in Healthcare Settings.

TEXTBOOKS:

1. Jiang, Fei et al. – *Artificial Intelligence in Healthcare*: Past, Present and Future.
2. Kevin Frick – *Introduction to Healthcare* AI.
3. Eric Topol – Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again.

REFERENCE BOOKS:

1. Mathias Goyen – AI in Medical Imaging.
2. Bertalan Meskó – The Guide to the Future of Medicine: Technology and The Human Touch.
3. Peter Szolovits – Artificial Intelligence in Medicine (Morgan Kaufmann).

ONLINE LEARNING RESOURCES:

Coursera: AI for Medicine Specialization (offered by DeepLearning.AI)
https://www.coursera.org/specializations/ai-for-medicine

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(23CS0940) AI FOR SMART CITIES & IOT SYSTEMS
(Professional Elective course (PEC) – V)
(Common to CSM & CAI)

COURSE OBJECTIVE:

The objectives of this course

1. *To understand the foundational concepts of smart cities and IoT architectures integrated with AI technologies.*
2. *To explore AI-driven solutions for urban mobility, transportation, and traffic management systems.*
3. *To apply AI and IoT techniques for efficient energy, waste, and water management in smart urban environments.*
4. *To examine AI applications in smart healthcare, surveillance, and public safety systems.*
5. *To design, deploy, and evaluate AIoT systems with an understanding of real-time processing, governance*, and future challenges.

COURSE OUTCOMES:

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

1. *Describe the architecture and components of smart cities and explain how AI and IoT integrate to optimize urban planning and services.*
2. *Apply AI models in transportation systems to improve traffic flow, public mobility, and autonomous vehicle operations.*
3. *Develop AI and IoT solutions for sustainable energy, waste, and water management in smart city ecosystems.*
4. *Analyze AI-based healthcare, surveillance, and emergency response applications, considering privacy and ethical aspects.*
5. *Design and deploy AIoT systems using edge/cloud platforms and evaluate them using appropriate governance and* performance metrics.
6. *Leverage cloud platforms and edge computing for scalable AIoT applications in urban environments*

Unit I: Introduction to AI in Smart Cities and IoT Systems

Smart City Concepts: Components, Infrastructure, and Urban Needs, Overview of IoT and AI Integration, Smart City Frameworks (India, Singapore, EU, etc.), IoT Architecture: Sensing, Network, Processing, and Application Layers, Role of AI in Urban Planning and Resource Optimization, Case Studies on AI in Smart Cities, Edge, Fog, and Cloud Computing Concepts for Smart Systems

Unit II: AI Applications in Smart Transportation and Mobility

Traffic Monitoring and Congestion Prediction using AI, Intelligent Traffic Signal Control using Reinforcement Learning, Autonomous Vehicles and AI Algorithms, Vehicle Detection and License Plate Recognition using CV, Public Transport Optimization using Predictive Analytics, Smart Parking and Navigation Systems, Use of Drones and AI for Traffic Surveillance

Unit III: AI and IoT for Smart Energy, Waste, and Water Management

AI for Smart Grids and Energy Consumption Prediction, Load Balancing and Demand Forecasting using ML, Waste Segregation and Collection Automation using CV, Water Quality Monitoring Systems using IoT Sensors, Leak Detection and Anomaly Detection Models, Smart Metering and Energy Theft Detection, Sustainability and Carbon Monitoring AI Models

Unit IV: Smart Healthcare, Surveillance, and Public Safety

IoT-based Health Monitoring and Alert Systems, Predictive Healthcare and Disease Outbreak Detection, AI for CCTV Surveillance, Crowd Monitoring, and Violence Detection, NLP for Emergency Response and Chatbot Assistance, Smart Ambulance Routing and Response Optimization, COVID-19 Contact Tracing and Monitoring via AI & IoT, Data Privacy, Security & Ethical Issues in Surveillance Systems

Unit V: AIoT System Design, Deployment, and Governance

AI Model Deployment on Edge Devices (Raspberry Pi, Jetson Nano), Smart City Dashboards and Data Visualization, Real-time Streaming and Analytics Platforms (Apache Kafka, Spark), Cloud Integration: AWS IoT, Google Cloud AI, Azure IoT Suite, Governance Frameworks, Data Privacy, and Policy Standards, Evaluation Metrics for Smart City Projects, Future Trends in AIoT and Smart Urban Living

TEXT BOOKS:

1. Pethuru Raj & Anupama C. Raman, *The Internet of Things:* Enabling Technologies, Platforms, and Use Cases, CRC Press.
2. Janaka Ekanayake, Smart Grid: *Technology and Applications*, Wiley.
3. Rajkumar Buyya, *Fog and Edge Computing:* Principles and Paradigms, Wiley.
4. Adrian McEwen, Hakim Cassimally, *Designing the Internet of Things*, Wiley.

REFERENCE BOOKS:

1. Mahalik N. P., Sensor Networks and Applications, McGraw Hill.
2. Kim F. Taylor, Urban Artificial Intelligence and Governance, Springer.
3. Dastbaz, J. & Pattinson, C., Smart Cities: Innovation and Sustainability, Springer.
4. Research papers from IEEE Smart Cities, AIoT Journal, and Springer Urban Tech.

ONLINE COURSES:

- Coursera – Smart Cities: Management of Smart Urban Infrastructures (EPFL)
- edX – Internet of Things (IoT) Program – Curtin University
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(23CE0154) BUILDING MATERIALS AND SERVICES
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of this course are to make the student :

1. *To understand the properties, classifications, and applications of building materialslike stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.*
2. *To analyze the composition, manufacturing process, and properties of cement and admixtures.*
3. *To apply knowledge of building components such as lintels, arches, walls, stairs,floors, roofs, foundations, and joinery.*
4. *To evaluate masonry, mortars, finishing techniques, and formwork systems.*
5. *To assess various building services including plumbing, ventilation, air conditioning,acoustics, and fire protection*.

COURSE OUTCOMES:

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

1. *Identify and classify construction materials and select materials appropriately for construction use.*
2. *Analyze physical and laboratory test of cement and select appropriate admixtures based on desired performances.*
3. *Identify and describe the functions, types, and structural aspects of essential building components such as lintels, arches, walls, vaults, staircases, floors, and roofs*
4. *Apply appropriate materials and construction techniques in the design of building components including joinery ,doors and windows and foundations, considering functional and structural requirements.*
5. *Design temporary supporting systems including formwork, scaffolding, shoring, and underpinning as per site conditions and structural needs.*
6. *Apply principles of acoustics to evaluate sound absorption and develop suitable acoustic design solutions for different building types*

UNIT – I

Stones and Bricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – Composition of Brick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, Paint sandPlastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

UNIT – II

Cement &Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness . Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types

UNIT – IV

Mortars, MasonryandFinishing's Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

UNIT – V

Building Services: Plumbing Services: Water Distribution, Sanitary – Lines &Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials andTypes; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire Resistant Materials and Constructions

TEXT BOOKS:

1. Arora & Bindra, *Building Materials and Construction*, Dhanpat Roy Publications, 4th Edition, 2010.
2. G C Sahu, Joygopal Jena, *Building Materials and Construction,* McGraw Hill Pvt Ltd, 2nd Edition, 2022

REFRENCE BOOKS:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain andArun Kumar Jain - Laxmi Publications (P) ltd., New Delh
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N.Subramanian ,‖Building Materials Testing and Sustainability‖, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

ONLINE LEARNING RESOURCES:

https://archive.nptel.ac.in/courses/105/102/105102088/

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(23CE0155) ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of this course are to make the student to:

1. *Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).*
2. *Analyze the impact of developmental activities on land use, soil, and water resources.*
3. *Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.*
4. *Develop environmental audit procedures and assess compliance with environmental regulations.*
5. *Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.*

COURSE OUTCOMES:

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

1. *Evaluate different EIA methods and use cost/benefit analysis to help in project decision-making*
2. *Identify the impacts of developmental activities on land, water, air, and biological environment, and suggest suitable mitigation measures.*
3. *Understand the impacts of developmental activities and deforestation on vegetation and wildlife.*
4. *Apply the principles of environmental risk assessment to identify potential risks and suggest appropriate mitigation strategies.*
5. *Apply environmental audit procedures and analyse audit data to prepare a report in accordance with environmental regulations*.
6. *Analyze environmental rules, EIA steps, and ISO 14000 to understand how they help in pollution control and reporting*

UNIT – I Concepts and methodologies of EIA

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters-Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II Impact of Developmental Activities and Land Use

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I Ain Surface Water, Air and Biological Environment: Methodology for The

Assessment of Impacts On Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III Assessment of Impact On Vegetation, Wildlife and Risk Assessment

Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT – IV Environmental Audit

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V Environmental Acts and Notifications

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

TEXT BOOKS:

1. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies*, B.S.Publications, Hyderabad, 3rd edition, 2021

2. N.S. Raman, A.R.Gajbhiye, S.R.Khandeshwar, *Environmental Impact Assessment*, TechSar Pvt. Ltd., 2nd edition, 2014

REFRENCE BOOKS:

1. K. Suresh Dhaneja, *Environmental Science and Engineering*, S.K., Katania & Sons Publication, New Delhi 2011.

2. V.S. Kulkarni, S.N. Kaul & R.K. Trivedy, *A Handbook of Environment Impact Assessment*, Scientific Publishers 2024

3. H. S. Peavy, Rowe, D. R, Tchobanoglous,G, *Environmental Engineering*, McGraw Hill International Editions, New York, 7th edition, 2017.

ONLINE LEARNING RESOURCES:

https://archive.nptel.ac.in/courses/124/107/124107160/

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(23EE0263) SMART GRID TECHNOLOGIES
(Open Elective (OE) – III)

COURSE OBJECTIVES

The objectives of this course:

1. *To understand concept of smart grid and its advantages over conventional grid*
2. *To know smart metering techniques*
3. *To learn wide area measurement techniques*
4. *To understand the problems associated with integration of distributed generation & its solution through smart grid.*

COURSE OUTCOMES:

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

1. *Understanding the Concept and Evolution of Smart Grids.*
2. *Analyzing Wide Area Monitoring System.*
3. *Analyzing Of Synchrophasor Technology.*
4. *Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts.*
5. *Evaluating Information and Communication Technology (ICT) Systems in Smart Grids.*
6. *Designing Smart Grid Applications and Cyber security Measures*

UNIT I Introduction to Smart Grid :

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT II Wide Area Monitoring System :

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT III Smart Meters:

Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT IV Information and Communication Technology:

Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT V Smart Grid Applications and Cyber Security:
Applications : Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

TEXT BOOKS:

1. James Momoh, "SMART GRID : *Fundamentals of Design and Analysis*", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "*Smart Grid*: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

REFERENCES:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.

2. Fereidoon.P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.

3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012

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(23ME0357) 3D PRINTING TECHNOLOGIES
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of the course are to

1. *Familiarize techniques for processing of CAD models for rapid prototyping.*
2. *Explain fundamentals of rapid prototyping techniques.*
3. *Demonstrate appropriate tooling for rapid prototyping process.*
4. *Focus Rapid prototyping techniques for reverse engineering.*
5. *Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.*
6. *Understand the software used STL file handling, post-processing steps, and real-world application challenges in 3D printing systems*

COURSE OUTCOMES:

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

1. *Use techniques for processing of CAD models for rapid prototyping.*
2. *Understand and apply fundamentals of rapid prototyping techniques.*
3. *Use appropriate tooling for rapid prototyping process.*
4. *Use rapid prototyping techniques for reverse engineering.*
5. *Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.*
6. *Demonstrate STL file issues and evaluate the importance of various 3D printing software tools*

UNIT I Introduction to 3D Printing

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for timecompression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II Solid and Liquid Based RP Systems

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III Powder Based & Other RP Systems

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered NetShaping (LENS) and Electron Beam Melting (EBM).
Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballastic Particle Manufacturing (BPM) and Shape Deposition Manufacturing(SDM).

UNIT IV Rapid Tooling & Reverse Engineering

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

UNIT V Errors in 3D Printing and Applications

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, ReverseEngineering,MedicalApplicationsofRP.

TEXTBOOKS:

1. Chee Kai Chua and Kah Fai Leong, ―3D Printing and Additive Manufacturing Principles and Applications‖ 5/e, World Scientific Publications, 2017.

2. Ian Gibson, David W Rosen, Brent Stucker, ―Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing‖, Springer, 2/e, 2010.

REFERENCE BOOKS:

1. Frank W.Liou, ―Rapid Prototyping & Engineering Applications‖, CRC Press, Taylor & Francis Group, 2011.

2. Rafiq Noorani, ―Rapid Prototyping: Principles and Applications in Manufacturing‖, John Wiley&Sons, 2006.

ONLINE LEARNING RESOURCES:

- NPTEL Course on Rapid Manufacturing.
- https://nptel.ac.in/courses/112/104/112104265/
- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RPilovepdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4.

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(23EC0414) MICROPROCESSORS AND MICROCONTROLLERS
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of this course

1. *To comprehend the architecture, operation, and configurations of the 8086 microprocessors.*
2. *To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.*
3. *To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.*
4. *To learn the architecture, instruction set, and programming of the 8051 microcontrollers.*
5. *To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons*.

COURSE OUTCOMES:

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

1. *Recall and identify fundamental concepts of microprocessor and microcontroller architectures*
2. *Explain the working principles and operational characteristics of microprocessor and microcontroller systems*
3. *Develop assembly language programs and implement basic interfacing circuits*
4. *Analyze system requirements and design appropriate interfacing solutions*
5. *Assess and compare different microprocessor and microcontroller architectures and their applications*
6. *Design and implement complete microprocessor/microcontroller-based systems*

UNIT I 8086 Architecture:

Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II 8086 Programming:

Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III 8086 Interfacing:

Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

TEXTBOOKS:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

REFERENCES:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004

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(23HS0856) WAVELET TRANSFORMS AND ITS APPLICATIONS
(Open Elective (OE) – III)

COURSE OBJECTIVES

The objectives of this course:

1. *To understand the wavelet transform as an alternative approach to Fourier Transform*
2. *To understand Multi Resolution Analysis and Wavelet concepts*
3. *To study the wavelet transform in both continuous and discrete domain*
4. *To understand the design of wavelets using Lifting scheme*
5. *To understand the applications of Wavelet transform*

COURSE OUTCOMES:

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

1. *Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms*
2. *Illustrate the multi resolution analysis ad scaling functions*
3. *Implement discrete wavelet transforms with multirate digital filters*
4. *Improve problem solving skills using discrete wavelet transform and filter banks*
5. *Understand multi resolution analysis and identify various wavelets and evaluate their time frequency resolution properties.*
6. *Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields*

UNIT – I: Wavelets

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms

UNIT – II: A Multiresolution Formulation of Wavelet Systems

Signal Spaces -The Scaling Function –Multi resolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III Filter Banks and the Discrete Wavelet Transform

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis-From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients-Lattices and Lifting - -Different Points of View.

UNIT – IV Time-Frequency and Complexity

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V Bases and Matrix Examples

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example – Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

TEXT BOOK:

1. C. Sidney Burrus, Ramesh A. Gopinath, ―*Introduction to Wavelets and Wavelets Transforms*‖, Prentice Hall, (1997).
2. James S. Walker, ―*A Primer on Wavelets and their Scientific Applications*‖, CRC Press, (1999).

REFERENCES:

1. RaghuveerRao, ―*Wavelet Transforms*‖, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

WEB REFERENCE

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3.http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm
4.https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-ofwaveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

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(23HS0844) SMART MATERIALS AND DEVICES
(Open Elective (OE) – III)

COURSE OBJECTIVES

The objectives of this course

1. *To provide exposure to smart materials and their engineering applications.*
2. *To impart knowledge on the basics and phenomenon behind the working of smart materials*
3. *To explain the properties exhibited by smart materials*
4. *To educate various techniques used to synthesize and characterize smart materials*
5. *To identify the required smart material for distinct applications/devices*

COURSE OUTCOMES

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

1. *Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.*
2. *Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.*
3. *Summarize various types of synthesis of smart materials*
4. *Analyze the suitable method for synthesis of smart materials*
5. *Analyze various characterization techniques used for smart materials*
6. *Interpret* the importance of smart materials in various devices

UNIT I Introduction to Smart Materials

Historical account of the discovery and development of smart materials, Shape memory materials, chromo active materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II Properties of Smart Materials

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III Synthesis of Smart Materials

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV Characterization Techniques

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy,Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V Smart Materials based Devices

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

TEXTBOOKS:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

REFERENCE BOOKS:

1.Gauenzi,P.,SmartmStructures,Wiley,2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,Chaudhery
MustansarHussain, Paolo Di Sia, Springer,2022.
4.Fundamentals of Smart Materials,Mohsen Shahinpoor, Royal Society of Chemistry, 2020

COURSE LINK:

https://onlinecourses.nptel.ac.in/noc22_me17/preview

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(23HS0846) INTRODUCTION TO QUANTUM MECHANICS
(Open Elective (OE) – III)

COURSE OBJECTIVES

The objectives of this course

1. *To understand the fundamental differences between classical and quantum mechanics.*
2. *To study wave-particle duality, uncertainty principle, and their implications.*
3. *To learn and apply Schrödinger equations to basic quantum systems.*
4. *To use operator formalism and mathematical tools in quantum mechanics.*
5. *To explore angular momentum, spin and their quantum mechanical representations*.

COURSEOUTCOMES

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

1. *Explain the key principles of quantum mechanics and wave-particle duality*
2. *Apply Schrödinger equations to solve one-dimensional quantum problems*
3. *Analyze various types of operators*
4. *Solve quantum mechanical problems using operator and matrix methods.*
5. *Evaluate quantum states using Dirac notation and expectation values.*
6. *Analyze angular momentum and spin systems using Pauli matrices and operators*

UNIT- I: Principles Of Quantum Mechanics

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation.Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle.Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT- II: One Dimensional Problems And Solutions

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III: Operator Formalism

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT- IV: Mathematical Tools For Quantum Mechanics

The concept of row and column matrices, Matrix algebra,Hermitian operators – definition. Dirac‘s bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator,Ladder operators and their significance.

UNIT-V:Angular Momentum And Spin

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half(1/2), Spin angular momentum,Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

TEXT BOOKS:

1. *Quantum Mechanics*. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam,(1961).
2. P.M.Mathews and K.Venkatesam A *Text Book of Quantum Mechanics*., Tata McGraw Hill, New Delhi,(1976).
3. R.H.Dicke and J.P.Witke *Introduction to Quantum Mechanics*., Addison-Wisley Pub.Co.Inc.,London, (1960).
4.Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

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(23HS0808) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of this course

1. *To Understand Principle and Concepts of Green Chemistry.*
2. *To Understand the Types of Catalysis and Industrial Applications.*
3. *To Apply Green Solvents in Chemical Synthesis.*
4. *To Enumerate Different Sourced of Green Energy.*
5. *To Apply Alternative Greener Methods Foe Chemical Reactions*

COURSE OUTCOMES

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

1. *Apply the Green chemistry Principles for day-to-day life as well as synthesis, describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.*
2. *Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis*
3. *Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide,*
4. *Explain Supercritical water, recycling of green solvents.*
5. *Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.*
6. *Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications*.

UNIT 1: Principles And Concepts Of Green Chemistry

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom uneconomic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

UNIT 2: Catalysis And Green Chemistry

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT 3: Green Solvents In Chemical Synthesis

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT 4: Emerging Greener Technologies

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT 5: Alternative Greener Methods

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

TEXT BOOKS :

1. M. Lancaster, *Green Chemistry An Introductory* Text, Royal Society Of Chemistry, 2002.
2. Paul T. Anastas And John C. Warner, Green Chemistry Theory And Practice, 4th Edition, Oxford University Press, Usa

REFERENCES :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

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(23HS0824) EMPLOYABILITY SKILLS
(Open Elective (OE) – III)

COURSE OBJECTIVES:

The objectives of this course

1. *To encourage all round development of the students by focusing on productive skills*
2. *To make the students aware of Goal setting and writing skills*
3. *To enable them to know the importance of presentation skills in achieving desired goals.*
4. *To help them develop organizational skills through group activitiesTo function effectively with heterogeneous teams*

COURSE OUTCOMES:

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

1. *Understand the importance of goals and try to achieve them*
2. *Explain the significance of self-management*
3. *Apply the knowledge of writing skills in preparing eye-catchy resumes*
4. *Analyse various forms of Presentation skills*
5. *Judge the group behaviour appropriately*
6. *Develop skills required for employability*.

UNIT 1 Goal Setting and Self-Management

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT II Writing Skills

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT III Technical Presentation Skills

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT IV Group Presentation Skills

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality ManifestationGroup Discussion-Debate –Corporate Etiquette

UNIT V Job Cracking Skills

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

TEXTBOOKS:

1.Sabina Pillai, Agna Fernandez. *Soft Skills & Employability Skills*,2014.Cambridge Publisher.
2.AlkaWadkar. Life Skills for Success, Sage Publications, 2016

REFERENCE BOOKS:

1.Gangadhar Joshi. *Campus to Corporate Paperback* , Sage Publications. 2015
2. Sherfield Montogomery Moody,*Cornerstone Developing Soft Skills*, Pearson Publications. 4 Ed. 20083.
3.Shikha Kapoor. *Personality Development and Soft Skills - Preparing for Tomorrow* .
1 Edition, Wiley, 2017.
4. M. Sen Gupta, *Skills for Employability,* Innovative Publication, 2019.
5. Steve Duck and David T McMahan*, The Basics f Communication Skills A Relational Perspective,* Sage press, 2012

ONLINE LEARNING RESOURCES:

1.https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

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(23CE0156) GEO-SPATIAL TECHNOLOGIES
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of this course are to make the student :

1. *To understand raster-based spatial analysis techniques, including query, overlay, andcost-distance analysis.*
2. *To analyze vector-based spatial analysis techniques such as topology, overlay, andproximity analysis.*
3. *To apply network analysis techniques for geocoding, shortest path analysis, andlocation-allocation problems.*
4. *To evaluate surface and geostatistical analysis methods, including terrain modeling,watershed analysis, and spatial interpolation.*
5. *To assess GIS customization, Web GIS, and mobile mapping techniques for realworld applications.*

COURSE OUTCOMES:

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

1. *Apply raster-based spatial operations such as map algebra, reclassification, and cost-distance analysis to solve basic spatial problems.*
2. *Find and explain spatial relationships in vector data using overlay and buffer tools.*
3. *Construct and evaluate network models to determine optimal paths, service areas, and facility locations using time and distance constraints.*
4. *Work with network data to find shortest routes, service areas, and best locations for facilities.*
5. *Understand and explain terrain features and data patterns using elevation and interpolation methods.*
6. *Assess the role of customization, Web GIS, and location-based services in developing efficient and user-specific GIS applications using scripting and big data tools*

UNIT – I Raster Analysis

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path

.

UNIT – II Vector Analysis

Non-Topological Analysis: Attribute Database Query, Structured Query Language, CoOrdinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT – III Network Analysis

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

UNIT – IV Surface And Geostatistical Analysis

Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram

UNIT – V Customisation, Web Gis, Mobile Mapping

Customisation of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications Location Based Services: Emergency and Business Solutions - Big Data Analytics.

TEXT BOOKS:

1. Kang – Tsung Chang, *Introduction to Geographical Information System*, 4th Ed Tata McGraw Hill Edition, 2008
2. Lo, C.P. andYeung, Albert K.W., *Concepts and Techniques of Geographic Information* Systems Prentice Hall, 2002

REFRENCE BOOKS:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, ―An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105202
https://onlinecourses.nptel.ac.in/noc19_cs76/preview

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(23CE0157) SOLID WASTE MANAGEMENT
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of this course are to make the student **:**

1. *To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.*
2. *To analyze engineering systems for solid waste collection, storage, and transportation.*
3. *To apply resource and energy recovery techniques for sustainable solid waste management.*
4. *To evaluate landfill design, construction, and environmental impact mitigation strategies.*
5. *To assess hazardous waste management techniques, including biomedical and e-waste disposal.*

COURSE OUTCOMES:

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

1. *Categorize and can perform sampling of solid waste.*
2. *Plan for solid waste management for collection, storage and processing.*
3. *Device system for biological conversion of solid waste into useful end products*
4. *Device system for thermal conversion of solid waste into useful end products.*
5. *Design system for landfilling of solid waste*
6. *Effectively plan for various categories of solid waste such as biomedical waste, E-waste, nuclear waste, industrial waste management*

UNIT – I Solid Waste:

Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.

UNIT – II Engineering Systems for Solid Waste Management:

Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;

UNIT – III Engineering Systems for Resource and Energy Recovery:

Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products – Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems

UNIT – IV Landfills:

Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation

UNIT – V Hazardous Waste Management:.

Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA _*Integrated Solid Waste Management*, Engineering Principles and Management Issues‘ McGraw-Hill, 1993.

2. Vesilind PA, Worrell W and Reinhart D, _Solid Waste Engineering‘ Brooks/Cole Thomson Learning Inc., 2002

REFRENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, _Environmental Engineering‘, McGraw Hill Inc., New York, 1985.2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction‘ Prentice Hall, 2002

ONLINE LEARNING RESOURCES:

https://archive.nptel.ac.in/courses/105/103/105103205/

https://archive.nptel.ac.in/courses/120/108/120108005/

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(23EE0264) ELECTRIC VEHICLES
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of this course

1. *Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.*
2. *Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.*
3. *Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.*
4. *Design and analyze the various control structures for Electric vehicle*.

COURSE OUTCOMES :

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

1. *To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.*
2. *Understand Various dynamics of Electric Vehicles.*
3. *To remember and understand various configurations in parameters of EV system and dynamic aspects of EV.*
4. *To analyze fuel cell technologies in EV and HEV systems.*
5. *To analyze the battery charging and controls required of EVs.*
6. *Classify different energy management strategies*

UNIT I Introduction to EV Systems and Energy Sources:

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT II EV Propulsion and Dynamics:

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multimotor configurations- Fixed and variable geared transmission- In-wheel motor configurationClassification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT III Fuel Cells:

Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT IV Battery Charging and Control:

Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless chargingPower factor correction. Control: Introduction- Modeling of electro mechanical system-Feedback controller design approachPI controller‘s designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT V Energy Storage Technologies:

Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

TEXTBOOKS:

1.C.C Chan, K.T Chau: *Modern Electric Vehicle Technology*, Oxford University Press Inc., New York 2001,1st Edition 2.Ali Emadi, ―Advanced Electric Drive Vehicles‖, CRC Press, 2017,1st Edition

REFERENCE BOOKS:

1.Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2.Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,‖ Energy Storage in Power Systems‖ Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition
3.A.G.Ter-Gazarian, ―Energy Storage for Power Systems‖, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4.Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, ―Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2004,1st Edition
5.James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2003,2nd Edition.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

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(23ME0351) TOTAL QUALITY MANAGEMENT
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of the course are to

1. *To introduce the fundamental concepts, definitions, and dimensions of quality and Total Quality Management (TQM).*
2. *To explore the evolution of quality management through historical perspectives and contributions of quality gurus.*
3. *To explain the core principles of TQM including customer satisfaction, employee involvement, and continuous improvement.*
4. *To analyze the various TQM tools such as Benchmarking, QFD, FMEA, Six Sigma, and their role in quality enhancement.*
5. *To provide an understanding of quality systems like ISO 9000, ISO 14000, QS 9000, and the processes for their implementation.*

COURSE OUTCOMES:

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

1. *Define and explain the basic concepts of quality, quality costs, and the scope of Total Quality Management.*
2. *Summarize the philosophies and contributions of TQM pioneers and evaluate barriers and enablers for TQM implementation.*
3. *Apply TQM principles such as employee empowerment, customer satisfaction, and supplier partnerships to real-world business scenarios.*
4. *Analyze the application of tools like QFD, FMEA, Six Sigma, and Benchmarking in improving product and process quality.*
5. *Evaluate and formulate quality systems like ISO 9000 and ISO 14000, and design documentation and auditing processes.*
6. *Apply the tools and technics of the quality management to manufacturing and service process and to provide quality components at lowest cost*

UNIT – I Introduction:

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT - II Historical Review:

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT – III TQM Principles:

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT - IV TQM Tools:

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT – V Quality Systems:

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

TEXT BOOKS:

1.Dale H Besterfield, *Total Quality Management*, Fourth Edition, Pearson Education, 2015. 2.Subburaj Ramaswamy, *Total Quality Management*, Tata Mcgraw Hill Publishing Company Ltd., 2005. 3.Joel E.Ross , *Total Quality Management*, Third Eition, CRC Press, 2017.

REFERENCE BOOKS:

1.Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

2.Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.

3.Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015

4.Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Learning Resources:

https://www.youtube.com/watch?v=VD6tXadibk0

https://www.investopedia.com/terms/t/total-quality-management-tqm.asp

https://blog.capterra.com/what-is-total-quality-management/

https://nptel.ac.in/courses/110/104/110104080/

https://onlinecourses.nptel.ac.in/noc21_mg03/preview

https://nptel.ac.in/courses/110/104/110104085/

https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

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(23EC0442) TRANSDUCERS AND SENSORS
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of this course

1. *To understand characteristics of Instrumentation System and the operating principle of motion transducers.*
2. *To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.*
3. *To provide knowledge on flow transducers and their applications.*
4. *To study the working principles of pressure transducers.*
5. *To introduce working principle and applications of force and sound transducers.*

COURSE OUTCOMES:

After completing the course, the student will be able to,

1. *Understand characteristics of Instrumentation System and the operating principle of motion transducers.*
2. *Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.*
3. *Gain knowledge on flow transducers and their applications.*
4. *Learn the working principles of pressure transducers.*
5. *Understand the working principle and applications of force and sound transducers.*
6. *Analyze and select appropriate transducers based on application requirements, standards, calibration methods, and performance characteristics for industrial and biomedical instrumentation systems*

UNIT I Introduction:

General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification. **Motion Transducers:** Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT II Temperature Transducers:

Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics. Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezoelectric sensors.

UNIT III Flow Transducers:

Bernoulli‘s principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT V Force and Sound Transducers:

Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone**.**

TEXT BOOKS

1. A.K. Sawhney, ―A course in *Electrical and Electronics Measurements and Instrumentation*‖, Dhanpat Rai& Co. 3rd edition Delhi, 2010.

2. Rangan C.S, Sarma G.R and Mani V S V, ―Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS

1. Doebelin. E.O, ―Measurement Systems Application and Design‖,McGraw Hill International, New York, 2004.

2. Nakra B.C andChaudharyK.K , ―Instrumentation Measurement and Analysis‖, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

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(23HS0857) FINANCIAL MATHEMATICS
(Open Elective (OE) – IV)

COURSE OBJECTIVES:

The objectives of this course

1. *To provide mathematical foundations for financial modelling, risk assessment and asset pricing.*
2. *To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.*
3. *To develop analytical skills for fixed-income securities, credit risk, and investment strategies.*
4. *To equip students with computational techniques for pricing financial derivatives*.

COURSE OUTCOMES:

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

1. *Explain fundamental financial concepts, including arbitrage, valuation, and risk.*
2. *Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.*
3. *Analyze mathematical techniques for pricing options and financial derivatives.*
4. *Apply model credit risk concept in various contexts, such as loan portfolios*
5. *Evaluate interest rate models and bond pricing methodologies.*
6. *Utilize computational techniques such as Monte Carlo simulations for financial modeling*

UNIT-I: Asset Pricing and Risk Management

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II: Stochastic Models in Finance

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito‘s Lemma, Ito Integral, and Ito Isometry.

UNIT-III: Interest Rate and Credit Modelling

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV: Fixed-Income Securities and Bond Pricing

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT-V: Exotic Options and Computational Finance

Stochastic volatility models and the Feynman-Kac theorem.Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

TEXTBOOKS:

1. Ales Cerny, *Mathematical Techniques in Finance: Tools for Incomplete Markets*, Princeton University Press.
2. S.R. Pliska, *Introduction to Mathematical Finance: Discrete-Time Models*, Cambridge University Press.

REFERENCE BOOKS:

1. IoannisKaratzas& Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.
2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

WEB REFERENCES:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
  Coursera – Financial Engineering and Risk Management (Columbia University)https://www.coursera.org/
- National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

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(23HS0845) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS
(Open Elective (OE) – IV)

COURSE OBJECTIVES

The objectives of this course

1. *To provide exposure to various kinds of sensors and actuators and their engineering applications.*
2. *To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators*
3. *To explain the operating principles of various sensors and actuators*
4. *To educate the fabrication of sensors*
5. *To explain the required sensor and actuator for interdisciplinary application*

COURSE OUTCOMES

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

1. *Classify different types of Sensors and Actuators along with their characteristics*
2. *Summarize various types of Temperature and Mechanical sensors*
3. *Illustrates various types of optical and mechanical sensors*
4. *Analyze various types of Optical and Acoustic Sensors*
5. *Explain various types of Magnetic and Electromagnetic Sensors*
6. *Interpret the importance of smart materials in various devices*

UNIT I Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching. Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II Temperature and Mechanical Sensors

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermoresistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT IV Magnetic and Electromagnetic Sensors

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors. Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors,
Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

TEXTBOOKS:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

REFERENCE BOOKS:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley. 4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link:

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

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(23HS0809) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS
(Open Elective (OE) – IV)

COURSE OBJECTIVES

The objectives of this course

1. *To understand basics and characterization of nanomaterials.*
2. *To understand synthetic methods of nanomatrials.*
3. *To apply various techniques for charterization of nanomaterials.*
4. *To understand Studies of Nano-structured Materials*
5. *To enumerate the applications of advanced nanomaterials in engineering*

COURSE OUTCOMES

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

1. *Classify the nanostructure materials; describe scope of nanoscience and importance technology.*
2. *Describe the top-down approach, Explain aerosol synthesis and plasma arc technique,*
3. *Differentiate chemical vapor deposition method and electrode position method,*
4. *Discuss about high energy ball milling.*
5. *Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.*
6. *Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.*
7. *Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation*

Unit – I Basics and Characterization of Nanomaterials:

Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit – II Synthesis of nanomaterials :

Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, highenergy ball milling method.

Synthetic Methods**:** Bottom-Up approach**,** Sol-gel synthesis, microemulsions or reverse micelles, coprecipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III Techniques for characterization:

Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV Studies of Nano-structured Materials:

Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V Advanced Engineering Applications of Nanomaterials:

Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.

2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.

2. Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.

Nanomaterials

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(23HS0825) LITERARY VIBES
(Open Elective (OE) – IV)

COURSE OBJECTIVES

The objectives of this course

1. *To inculcate passion for aesthetic sense and reading skills*
2. *To encourage respecting others' experiences and creative writing*
3. *To explore emotions, communication skills and critical thinking*
4. *To educate how books serve as the reflection of history and society*
5. *To provide practical wisdom and duty of responding to events of the times*

COURSE OUTCOMES

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

1. *Identify genres, literary techniques and creative uses of language in literary texts.*
2. *Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces*
3. *Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments*
4. *Analyze the underlying meanings of the text by using the elements of literary texts*
5. *Evaluate their own work and that of others critically*
6. *Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance*

UNIT I: Poetry

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT II: Drama: *Twelfth Night*- William Shakespeare

1. Shakespeare -life and works
1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT III: Short Story

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT IV: Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT V: Novel: *Hard Times*- Charles Dickens

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

TEXT BOOKS:

1. Charles Dickens**.***Hard Times.*(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.*William Shakespeare. Twelfth Night***.** Oxford University Press,2016.

REFERENCES:

1. WJ Long.*History of English Literature***,** Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. *Essays, Short Stories and One Act Plays*, Oxford University Press .2018.
3. Dhanvel, SP. *English and Soft Skills*, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, *Explorations Volume*-II, Prasaranga Bangalore University,2014**.**
6. Dev Neira, Anjana & Co. *Creative Writing: A Beginner's Manual.*Pearson India, 2008.

ONLINE RESOURCES

https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeatscritical-analysis-summary-and-line-by-line-explanation/#google_vignette
https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
https://www.litcharts.com/lit/twelfth-night/themes
https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-andirony/

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(23CS1407) PROMPT ENGINEERING
(Skill Enhancement course)

COURSE OBJECTIVES

The objectives of this course

This course delves into prompt engineering principles, strategies, and best practices, a crucial aspect in shaping AI models' behaviour and performance. Understanding Prompt Engineering is a comprehensive course designed to equip learners with the knowledge and skills to effectively generate and utilize prompts in natural language processing (NLP) and machine learning (ML) applications. This course delves into prompt engineering principles, strategies, and best practices, a crucial aspect in shaping AI models' behaviour and performance.

COURSE OUTCOMES:

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

1. *Under standing the fundamentals and evolution of prompt engineering.*
2. *Gaining the ability to craft effective closed-ended, open-ended, and role-based prompts.*
3. *Learning to probe and stress-test AI models for bias and robustness.*
4. *Applying prompt optimization techniques and performance evaluation methods.*
5. *Mitigating bias and promoting ethical prompting practices in NLP/ML systems*
6. *Demonstrate ethical considerations, limitations, and responsible use of AI while engineering prompts.*

Module 1: Introduction to Prompt Engineering

- *Lesson 1: Foundations of Prompt Engineering*

o Overview of prompt engineering and its significance in NLP and ML.
o Historical context and evolution of prompt-based approaches.

Module 2: Types of Prompts and Their Applications

- *Lesson 2: Closed-Ended Prompts*

o Under standing and creating prompts for specific answers.
o Applications in question- answering systems.

- *Lesson 3: Open-Ended Prompts*

o Crafting prompts for creative responses.
o Applications in language generation models.

Module 3: Strategies for Effective Prompting

- *Lesson 4: Probing Prompts*

o Designing prompts to reveal model biases.
o Ethical considerations in using probing prompts.

- *Lesson 5: Adversarial Prompts*

o Creating prompts to stress-test models.
o Enhancing robustness through adversarial prompting.

Module 4: Fine-Tuning and Optimizing with Prompts

• *Lesson 6: Fine-Tuning Models with Prompts*

o Techniques for incorporating prompts during model training.

o Balancing prompt influence and generalization.

• *Lesson 7: Optimizing Prompt Selection*

o Methods for selecting optimal prompts for specific tasks

Customizing prompts based on model behavior.

Module 5: Evaluation and Bias Mitigation

• *Lesson 8: Evaluating Prompt Performance*

o Metrics and methodologies for assessing model performance with prompts.

o Interpreting and analyzing results.

• *Lesson 9: Bias Mitigation in Prompt Engineering*

o Strategies to identify and address biases introduced by prompts.

o Ensuring fairness and inclusivity in prompt-based models.

Module 6: Real-World Applications and Case Studies

• *Lesson 10: Case Studies in Prompt Engineering*

• *Exploration of successful implementations and challenges in real-world scenarios.*

• *Guest lectures from industry experts sharing their experiences.*

TEXT BOOKS:

1. "Prompt Engineering in Action" – *Danny D. Sullivan*
2. "The Art of Prompt Engineering with Chat GPT: A Hands-On Guide" – *Nathan Hunter.*

REFERENCE BOOKS:

1. "Prompt Engineering in Practice" – *Michael F. Lewis*
2. "Mastering AI Prompt Engineering: The Ultimate Guide for Chat GPT Users" – *Adriano Damiao*
3. "Writing AI Prompts For Dummies" – *Stephanie Diamond and Jeffrey Allan*
4. "Prompt Engineering Guide" (Online Resource) – *promptingguide.ai*

ONLINE RESOURCE LINK :

https://www.udemy.com/course/understanding-promptengineering/?couponCode=NVDINCTA35TRT

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(23HS0820) GENDER SENSITIZATION
(Audit course)

COURSE OBJECTIVES

The objectives of this course

1. *To enable students to understand the gender related issues, vulnerability of women and men*
2. *To familiarize them about constitutional safeguard for gender equality*
3. *To expose the students to debates on the politics and economics of work*
4. *To help students reflect critically on gender violence*
5. *To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.*

COURSE OUTCOMES:

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

1. *Understand the basic concepts of gender and its related terminology*
2. *Identify the biological, sociological, psychological and legal aspects of gender.*
3. *Use the knowledge in understanding how gender discrimination works in our society and how to counter it.*
4. *Analyzethe gendered division of labour and its relation to politics and economics.*
5. *Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups*
6. *Develop students' sensibility with regard to issues of gender in contemporary India*

Unit-1 Understanding Gender

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2 Gender Roles And Relations

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences-Declining Sex Ratio- Demographic Consequences-Gender Spectrum –

Unit-3 Gender And Labour

Division and Valuation of Labour-Housework: The Invisible Labor- ―My Mother doesn't Work.‖ ―Share the Load.‖-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4 Gender-Based Violence

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5 Gender And Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive LanguageJust Relationships

TEXT BOOKS

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity.* UK Paperback Edn. March 1990

REFERENCE BOOKS

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India,*London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment,* London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

ONLINE RESOURCES:

1. Understanding Gender

chromeextension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgup t a/kamla-gender1.pdf
https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

3.Gender Roles and Relations

https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-aregender-roles-and-stereotypes
https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-ourrelationships-7499408 https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour

https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-andhow-can-it-be-redressed https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. **GENDER-BASED VIOLENCE**

https://eige.europa.eu/gender-based-violence/what-is-gender-basedviolence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-andgirls
https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **GENDER AND CULTURE**

https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/
https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/
https://archive.nptel.ac.in/courses/109/106/109106136/
Abdulali Sohaila. ―I Fought For My Life…and Won.‖Available online (at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

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(23CS1408) EVALUATION OF INDUSTRY INTERNSHIP
(Audit course)

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(23CS1409) INTERNSHIP

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(23CS1410) PROJECT

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