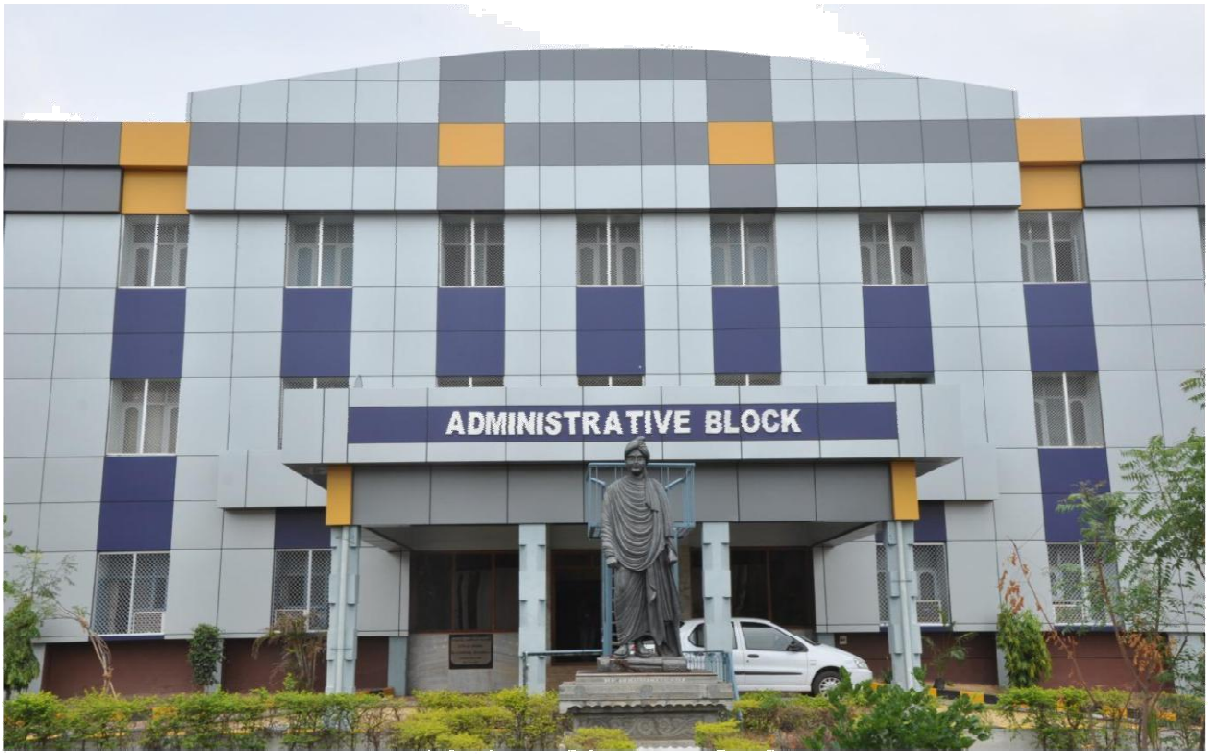

Scheme – 2023

Department of Computer Science & Engineering

G. Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for V semester of FOUR YEAR B.Tech. Degree Course in

Computer Science and Engineering

(With Effect from the Batch Admitted in 2023-24)

G. PULLA REDDY ENGINEERING COLLEGE (Autonomous) : KURNOOL

SCHEME -23

B. TECH – CSE

Applicable from the Academic Year 2023-24 onwards

B.Tech – V Semester: CSE

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	PC	Introduction to Artificial Intelligence	3	0	0	3	30	70	100
2	PC	Computer Networks	3	0	0	3	30	70	100
3	PC	Automata Theory and Compiler Design	3	0	0	3	30	70	100
4	ES	Introduction to Quantum Technologies and Applications	3	0	0	3	30	70	100
5	PE-I	Professional Elective-I	3	0	0	3	30	70	100
6	OE-I	Open Elective-I	3	0	0	3	30	70	100
7	PC	Introduction to Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC	Computer Networks Lab	0	0	3	1.5	30	70	100
9	SEC	Full Stack Development – I	0	1	2	2	30	70	100
10	AC	Technical Paper Writing & IPR	2	0	0	-	0	0	0
11	Internship	Evaluation of Community Service Internship	-	-	-	2	100	0	100
		Total	**20**	**1**	**8**	**25**			

B.Tech - VI Semester: CSE

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	PC	Introduction to Machine Learning	3	0	0	3	30	70	100
2	PC	Cloud Computing	3	0	0	3	30	70	100
3	PC	Cryptography & Network Security	3	0	0	3	30	70	100
4	PE-II	Professional Elective-II	3	0	0	3	30	70	100
5	PE-III	Professional Elective-III	3	0	0	3	30	70	100
6	OE-II	Open Elective-II	3	0	0	3	30	70	100
7	PC	Introduction to Machine Learning Lab	0	0	3	1.5	30	70	100
8	PC	Cryptography & Network Security Lab	0	0	3	1.5	30	70	100
9	SEC	Full Stack Development – II	0	1	2	2	30	70	100
10	ES	Tinkering Lab	0	0	2	1	30	70	100
		Total	**18**	**1**	**10**	**24**			
Mandatory Industry Internship of 08 weeks duration during summer vacation									

INTRODUCTION TO ARTIFICIAL INTELLIGENCE(IAI)								
V Semester: Common to CSE & CSBS						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS301	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand the fundamental concepts of Artificial Intelligence
CO2:	Solve problems by applying heuristic search method.
CO3:	Understand the different knowledge representation techniques, applications of AI, namely game playing, theorem proving, and machine learning.
CO4:	Apply logical reasoning and learning techniques
CO5:	Understand the fundamental concepts 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 dempster shafer 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.

Text Books:

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

Reference Books:

1. David Poole, Alan Mack worth, Randy Goebel,‖ Computational Intelligence: a logical

approach‖, Oxford University Press.
2. G. Luger, —Artificial Intelligence: Structures and Strategies for complex problemsolving‖, Fourth Edition, Pearson Education.
3. J. Nilsson, —Artificial Intelligence: A new Synthesis‖, Elsevier Publishers.
4. Artificial Intelligence, SarojKaushik, CENGAGE Learning.
Online Learning Resources:
1. https://nptel.ac.in/courses/106106226
2. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
3. https://onlinecourses.nptel.ac.in/noc25_cs159/preview
4. https://ai.google
5. https://swayam.gov.in/nd1_noc19_me71/preview
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

COMPUTER NETWORKS (CN)

V Semester: Common to CSE & CSBS | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS302	PC	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand the basic components of networks,network models.
CO2:	Understand the concepts of data link layer and its techniques.
CO3:	Understand various routing algorithms at network layer.
CO4:	Familiarize with the concepts of protocols and congestion control techniques at transport layer.
CO5:	Understand the principles of application layer.

UNIT – I

Computer Networks and the Internet: What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput, Reference Models-OSI, TCP/IP, Guided Transmission Media-Twisted Pairs, Coaxial Cable, Fiber Optics, Wireless Transmission**.**

UNIT – II

The Data Link Layer, Access Networks, and LANs: Data Link Layer Design Issues, Error Detection-Parity Checks, Checksum, Cyclic Redundancy Check (CRC) and Correction, Elementary Data Link Protocols-Initial Simplifying Assumptions, Basic Transmission and Receipt, Sliding Window Protocols.

Introduction to the Link-Multiple Access Protocols, Switched Local Area Networks,Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page

UNIT – III

The Network Layer: Routing Algorithms-The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing ,Broadcast Routing, Multicast Routing, Internetworking, The Network Layer in The Internet.

UNIT – IV

The Transport Layer: Connectionless Transport: UDP, The Internet Transport Protocols: Introduction to TCP, TCP Service Model, TCP Protocol, TCP Segment Header, Connection Establishment and Release, Congestion Control.

UNIT – V

Principles of Network Applications: Principles of Network Applications-Transport Services available to applications, Transport Services Provided by the internet, The Web and HTTP-Overview of HTTP,HTTP Message Format, Electronic Mail in the Internet-SMTP, Comparision with HTTP, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 6th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, Networks for Computer Scientists and Engineers, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

AUTOMATA THEORY AND COMPILER DESIGN (ATCD)

V Semester: Common to CSE & CSBS						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS303	PC	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Design the finite automata for any regular language.
CO2:	Design the Context Free Grammar and push down automata.
CO3:	Understand the Turing machine and Lexical analyser.
CO4:	Understand the concepts of parser, Intermediate Code Generation
CO5:	Understand the Code Optimization and Code Generation techniques

UNIT – I

Introduction to Automata and Regular Expressions

Introduction, Alphabets, Strings and Languages, Chomsky Hierarchy, Automata and Grammars, Regular Grammar and Language, Finite Automata, Deterministic finite Automata (DFA), Nondeterministic finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Regular Expressions, Converting Regular Expression into Finite Automata, Adrens Theorem.

UNIT – II

Context Free Grammars and Pushdown Automata

Context Free Language, Context Free Grammar, Derivation and Parse tree, Ambiguity, Simplification of CFG‘s, Chomsky Normal Form, Greibach Normal Form, Push Down Automat (PDA), Design of PDA, Equivalence of PDA and CFL/CFG

UNIT – III

Turing Machines and Introduction to Compilers

Turing Machine, TM Model, Language acceptance, Design of Turing Machine, Compilers, Phases of Compiler, The role of Lexical Analyzer, Input Buffering.

UNIT – IV

Parsers and Intermediate Code Generation

Parser, Top-Down parsers: Recursive Descent Parsers, Predictive Parsers Bottom–up Parsers: Shift-Reduce Parsing, Simple LR parser, Intermediate Code Generation: Three address codes.

UNIT – V

Code Optimization and Code Generation

Code Optimization: Peephole optimization, Basic blocks and flow graphs, DAG, Principles of Source Code Optimization, Code Generation: Issues in Design of Code Generation, Simple Code Generator.

Text Books:

1. Introduction to Automata theory languages and Computation, Hopcroft H.E. and Ullman Jeffrey.D, 3/e, 2006, Pearson Education, New Delhi, India.
2. Mishra K L P and Chandrasekaran N, ―Theory of Computer Science - Automata, Languages and Computation‖, 2/e, 2007, PHI, New Delhi, India.
3. Compilers: Principles, Techniques, and Tools, Updated 2e July 2023 Alfred V. Aho , Monica S. Lam, Ravi Sethi , Jeffrey D. Ullman , Sorav Bansal

Reference Books:

1. Introduction to Languages and Theory of Computation, John C Martin, 1/e, 2009, Tata McGraw Hill Education, Hyderabad, India.
2. Introduction to Theory of Computation, Sipser, 2/e, 2005, Thomson, Australia
3. Compiler Construction: Principles And Practice, Kenneth C. Louden, Thomson/ Delmar Cengage Learning, 2006
4. Lex &yacc, Doug Brown, John Levine and Tony Mason, 2 nd Edition, O'reilly Media
5. Engineering a compiler, Keith Cooper and Linda Torczon, 2 nd Edition, Morgan Kaufmann, 2011.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/104/106104028//
2. https://nptel.ac.in/courses/106/104/106104123/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (IQTA)
(Qualitative Treatment)

V Semester: Common for all Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ESCM03	ES	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Explain core quantum principles in a non-mathematical manner
CO2:	Compare classical and quantum information systems.
CO3:	Identify theoretical issues in building quantum computers.
CO4:	Discuss quantum communication and computing concepts.
CO5:	Recognize applications, industry trends, and career paths in quantum technology

UNIT – I

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 – II

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 – III

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, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

UNIT – IV

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 – V

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

Text Books:

1. Michael A Nielsen and Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, Cambridge.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, Cambridge.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley.
2. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press.
4. Alastair I M Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications.
5. Eleanor G Rieffel and Wolfgang H Polak, Quantum Computing: A Gentle Introduction, MIT Press.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books.
7. Bruce Rosenblum and Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press.
8. Giuliano Benenti, Giulio Casati and Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing
9. K.B. Whaley et al., Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document, Quantum Flagship, European Commission.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, MeitY/DST Publications.

Online Learning Resources:

1. https://www.coursera.org/learn/quantum-mechanics
2. https://nptel.ac.in/courses/106106232

Question Paper Pattern:

Qualitative Treatment

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB (IAI(P))								
V Sem: Common to CSE & CSBS						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23A31301P	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**

End Exam Duration: 3 Hours

Course Outcomes: At the end of the course students will be able to

CO1: Implement uninformed and informed searching strategies

CO2: Implement the adversarial search techniques.

CO3: Demonstrate search techniques and gaming theory

CO4: Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.

List of Experiments

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a program to implement Best First Searching Algorithm
4. Write a program to implement the Heuristic Search
5. Write a Program to implement 8-Queens Problem using Python.
6. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)
7. Write a program to implement 8 puzzle programs using different heuristics. Using it play the game Tic-Tac-Toe at the end the game the program should display the no. of nodes generated, cutoff values at each stage in the form of a table.
8. Write a Program to Implement Alpha-Beta Pruning using Python.
9. Write a Program to Implement Water-Jug problem using Python.
10. Write a program to schedule a meeting among a 5 busy people using Default Reasoning the output Should give the time, place and day of the meeting.
11. Write a program to implement the Unification algorithm
12. Develop a knowledge base system consisting of facts and rules about some specialized knowledge Domain

Text Books:

1. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.
2. Xiao, Perry. Artificial intelligence programming with Python: from zero to hero. John Wiley & Sons, 2022.

Reference Books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Fourth 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.

Web References:

1.https://onlinecourses.nptel.ac.in/noc19_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

COMPUTER NETWORKS LAB (CN (P))								
V Semester: Common to CSE & CSBS						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS305	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
End Exam Duration: 3 Hrs								
Course Outcomes : At the end of the course the student will be able to								
CO1:	Implement data link layer protocols and framing techniques							
CO2:	Implement Dijkstra's ,Distance Vector routing algorithms.							
CO3:	Implement congestion control mechanisms and basic network security techniques.							
CO4:	Implement frame sorting technique and Nmap							

LIST OF EXPERIMENTS

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijkastra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting technique used in buffers.
10. Operating System Detection using Nmap

Additional Experiments

1. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslook up.
2. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network
3. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.
4. Programs using Wireshark
   - i)Packet Capture Using Wire shark
   - ii) Starting Wire shark
   - iii) Viewing Captured Traffic
   - iv) Analysis and Statistics & Filters
5. Do the following using NS2 Simulator
   - i) NS2 Simulator-Introduction
   - ii) Simulate to Find the Number of Packets Dropped
   - iii) Simulate to Find the Number of Packets Dropped by TCP/UDP
   - iv) Simulate to Find the Number of Packets Dropped due to Congestion
   - v) Simulate to Compare Data Rate& Throughput.
   - vi) Simulate to Plot Congestion for Different Source/Destination
   - vii) Simulate to Determine the Performance with respect to transmission of Packets.

Text Books:
1. Cisco Networking Academy, ―CCNA1 and CCNA2 Companion Guide‖, Cisco Networking Academy Program, 3rd edition, 2003.
2. Elloitte Rusty Harold, ―Java Network Programming‖, 3rd edition, O'REILLY, 2011.
3. Shivendra S.Panwar, Shiwen Mao, Jeong- dong Ryoo, and Yihan Li, ―TCP/IP Essentials A Lab-Based Approach‖, Cambridge University Press, 2004.
Online Learning Resources:
1. https://www.netacad.com/courses/packet-tracer- Cisco Packet Tracer.
2. https://www.isi.edu/nsnam/ns/ns-documentation.html-NS Manual
3. https://www.wireshark.org/docs/wsug_html_chunked/-Wireshark.
4. http://www.nptelvideos.in/2012/11/computer-networks.html
5. https://nptel.ac.in/courses/106105183

FULL STACK DEVELOPMENT-I(FSD-1(P))
(Skill Enhancement Course)

V Semester: Common to CSE,CSM,CSD & CSBS						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
SCCS01	**SEC**	**0**	**1**	**2**	**2**	**30**	**70**	**100**

End Exam Duration: 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Design and structure modern web pages using FORM, FRAME, TABLE, and IMAGE elements.
CO2:	Apply Cascading Style Sheets (CSS) effectively to control layout, visual presentation, and responsiveness.
CO3:	Develop dynamic and interactive web functionalities using Java Script.
CO4:	Utilize built-in and user-defined JavaScript objects to manipulate data, validate forms, and create Structured client-side logic.

LIST OF EXPERIMENTS

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

B.Write a HTML program to explain the working of hyperlinks using <a> tag and href, target attributes.

c. 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.

d. 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

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

Write a program to apply different types of selector forms

a. Simple selector (element, id, class, group, universal)

b. Combinator selector (descendant, child, adjacent sibling, general sibling)

c. Pseudo-class selector

d. Pseudo-element selector

e. 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. Write a program using string object properties and methods.
e. Write a program using regex object properties and methods.
f. Write a program using date object properties and methods.
g. 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, obtain the numbers from the user and output 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.Java script 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)

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).

3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 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

TECHNICAL PAPER WRITING & IPR(TPW&IPR)								
V/VI Semester: Common to all branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
AC301	**AC**	**2**	**0**	**0**	**0**	**-**	**-**	**-**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course the student will be able to

CO1:	Develop precise and ethical technical writing with logical structure and critical analysis.
CO2:	Formulate and present structured research content and synopsis.
CO3:	Understand and apply the principles of publishing, journal types, indexing with proper citation and plagiarism standards
CO4:	Understand fundamental knowledge of intellectual property rights, international frameworks and registration of trademarks.
CO5:	Understand the fundamentals of laws of copyrights and patents, intellectual property audits.

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, Problems and 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 and citation rules.

UNIT – IV

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights Trade Marks: 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.

Text Books:

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. Adrian Wallwork. English for Writing Research Papers, Second Edition. Springer

Cham Heidelberg New York ,2016

Online Learning Resources:

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://lawbhoomi.com/intellectual-property-rights-notes/
3. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

List of Professional Electives

Professional Elective – I

1) Object Oriented Analysis and Design
2) Soft Computing
3) Introduction to Microprocessors & Microcontrollers
4) Data Warehousing & Data Mining

OBJECT ORIENTED ANALYSIS AND DESIGN (OOAD)

V Semester: Common to CSE,CSD & CSM | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS311	PE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand modeling principles, UML concepts, and their role in software development.
CO2:	Compare and contrast the object-oriented model with the E-R and EER models.
CO3:	Create behavioral models using interaction, use case, and activity diagrams.
CO4:	Analyze system behavior using state machines and evaluate architectural design through component/deployment diagrams.
CO5:	Apply UML to real-world systems using patterns, frameworks, and case studies.

UNIT – I

Introduction to UML: Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle. Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT – II

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Classes: Terms, concepts, modeling techniques for Class diagrams.

UNIT – III

Basic Behavioural Modeling-I: Interactions, Interaction diagrams.

Basic Behavioural Modeling-II: Use cases, Use case Diagrams, Activity Diagrams.

UNIT – IV

Advanced Behavioral Modeling: Events and signals, state machines, Processes and Threads, Time and Space, state chart diagrams.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT – V

Patterns and Frameworks, Artifact Diagrams, Case Study: The Unified Library application.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modelling Language User Guide, Pearson Education 2nd Edition.
2. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modelling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Mark Priestley: Practical Object-Oriented Design with UML, TMH.
5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105153/
2. https://www.tutorialspoint.com/object_oriented_analysis_design/index.htm

3. https://archive.nptel.ac.in/courses/106/105/106105224/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SOFT COMPUTING (SC)								
V Semester: Common to CSE,CSD & CSM						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CS312	**PE-I**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course the student will be able to	
CO1:	Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
CO2:	Understand fuzzy logic and reasoning to handle and solve engineering problems.
CO3:	Apply the Classification techniques on various applications.
CO4:	Perform various operations of genetic algorithms and Rough Sets.
CO5:	Understand the Integration of Soft Computing Techniques.

UNIT – I

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT – II

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

UNIT – III

Fuzzy Decision Making, Particle Swarm Optimization.

UNIT – IV

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT – V

Rough Sets, Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

Text Books:

Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha –Cengage Learning

Reference Books:

1. S. N. Sivanandam & S. N. Deepa, ―Principles of Soft Computing‖, 2nd edition, Wiley India,2008.
2. David E. Goldberg, ―Genetic Algorithms-In Search, optimization and Machine learning,
Pearson Education.
3. J. S. R. Jang, C.T. Sun and E.Mizutani, ―Neuro-Fuzzy and Soft Computing, Pearson Education, 2004.
4. G.J. Klir & B. Yuan, ―Fuzzy Sets & Fuzzy Logic‖, PHI, 1995
5. Melanie Mitchell, ―An Introduction to Genetic Algorithm‖, PHI, 1998.
1. Timothy J. Ross, ―Fuzzy Logic with Engineering Applications‖, McGraw- Hill International editions, 1995

Online Learning Resources:

1. https://www.tutorialspoint.com/fuzzy_logic/index.htm
2. https://archive.nptel.ac.in/courses/106/105/106105173/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The

question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS (IMMC)								
V Semester: CSE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CS313	**PE-I**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course the student will be able to	
CO1:	Analyze the architectural features of 8 bit and 16 bit processors
CO2:	Apply the programming model of 8086 in assembly language programming.
CO3:	Analyze the active Interfacing operations of 8086
CO4:	Analyze the architectural concepts the 8051 microcontroller.
CO5:	Implement the programming model of 8051 in interfacing with peripherals

UNIT – I

Introduction to 8 bit and 16 bit processors: 8 bit and 16 bit processors, differences between 8 bit and 16 bit architectures, features, pin diagram, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, minimum mode and maximum mode configuration.

UNIT – II

8086 Memory & Programming: Memory segmentation, Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT – III

Peripheral Interfacing: Intel 8255 Programmable peripheral interface, Interfacing switches and LEDS, Intel 8251 USART architecture and DMA.

UNIT – IV

Introduction to Microcontroller Architecture of 8051– Special Function Registers I/O Pins Ports and Circuits-Timers-Serial Port. –Assembly language programming.

UNIT – V

Microcontroller Programming: Programming model of 8051, Instruction set-Addressing modes, Programming Switches, LEDs, Displays – Seven Segment, LCD, Sensors, Stepper Motor and Wave form generation

Text Books:

1. K M Bhurchandi, AKRay,Advanced MicroprocessorsandPeripherals,3rd edition,McGraw Hill Education, 2017.
2. Mazidi Muhammad Ali, Mazidi Janice Gillespie & Mc Kinlay Rolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.
3. RajKamal, Microcontrollers: Architecture, Programming, InterfacingandSystemDesign, 2ndedition, Pearson, 2012.

Reference Books:

1. John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, 3rd Edition, Pearson Ed, 2006.
2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publication Ltd, 2006.

Online Learning Resources:

1. www.nptel.onlinecourseac.in/.microprocessorsandmicrocontrollers.
2. https://onlinecourses.nptel.ac.in/noc18_ec03/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

DATA WAREHOUSING & DATA MINING (DWDM)								
V Semester: CSE						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS314	**PE-I**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand data warehouse concepts and OLAP system
CO2:	Apply suitable pre-processing and visualization techniques for data analysis
CO3:	Interpret frequent pattern and association rule mining techniques for data analysis
CO4:	Apply appropriate classification and clustering techniques for data analysis
CO5:	Implement data mining algorithms using WEKA tool

UNIT – I

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT – II

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT – III

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT – IV

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT – V

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

Text Books:

Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

Reference Books:

1.Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016

2.K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006

3.Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

Online Learning Resources:

1. https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining
2. https://nptel.ac.in/courses/106105174
3. https://www.youtube.com/playlist?list=PLmAmHQ-_5ySxFoIGmY1MJao-XYvYGxxgj

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

Open Elective – I

S. No.	Course Name	Offering Department	Eligible Branches
1	Green Buildings	CE	All Branches
2	Construction Technology and Management	CE	All Branches Except CE
3	Electrical Safety Practices and Standards	EEE	All Branches Except EEE
4	Sustainable Energy Technologies	ME	All Branches Except ME
5	Electronic Circuits	ECE	All Branches Except ECE
6	Java Programming	CSE	CE, EEE, ME and ECE
7	Foundations of Artificial Intelligence	CSE	CE, EEE and ECE
8	Ethical Hacking	CSE	All Branches
9	Quantum Technologies and Applications	CSE	All Branches
10	Mathematics for Machine Learning and AI	HBS	All Branches
11	Materials Characterization Techniques		
12	Chemistry of Energy Systems		
13	English for Competitive Examinations		
14	Entrepreneurship and New Venture Creation		

GREEN BUILDINGS (GB)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE501	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Understand the importance of green buildings, their necessity, and sustainable features
CO2:	Analyze various green building practices, rating systems, and their impact on environmental sustainability.
CO3:	Apply principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
CO4:	Evaluate HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
CO5:	Assess material conservation techniques, waste reduction strategies, and indoor air quality management in 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 Green Building, 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, 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. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference Books:

1. Complete Guide to Green Buildings by Trish riley

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

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

4. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S NanjundaRao – New Age International Publishers

5. Non-conventional Energy Resources – By D S Chauhan and S K Sreevasthava – New Age International Publishers

Online Learning Resources:

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

2. https://igbc.in/resources

3. https://www.grihaindia.org/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CONSTRUCTION TECHNOLOGY AND MANAGEMENT (CTM)

V Semester: All Branches Except CE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE502	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Understand project management fundamentals, organizational structures, and leadership principles in construction.
CO2:	Solve and formulate network analysis in CPM and PERT networks.
CO3:	Understand the structure of organization and resource allocation
CO4:	Evaluate various contract types, contract formation, and legal aspects in construction management
CO5:	Assess safety management practices, accident prevention strategies, and quality management systems in construction

UNIT – I

Introduction: Management Objectives and Functions; Stages of Project Management - Types of Organization, Organizational Chart of a Construction Company – Team of Construction Unit - Manager's Duties and Responsibilities.

Construction Planning and Scheduling: Objectives and importance of planning and scheduling – Methods of Planning and Scheduling.

UNIT – II

Network Techniques in Construction management: Elements of network – Network techniques – Breakdown structures – Representation and specifying of activities and events – Rules for Network.

Critical Path Method (CPM): Introduction – Difference between CPM and PERT – Time estimates – Float – Critical path – Network analysis and computation problems.

UNIT – III

Program Evaluation and Review Technique (PERT): Introduction, time estimates, slack, critical path – Network analysis and computation problems.

Cost–Time Analysis in Net Work Planning: Importance of time – Project cost analysis innetwork planning – Updating – Resources allocation.

UNIT – IV

Tenders and Contracts: Type of tenders – Principles of tendering – Notice inviting tender – Contracts definition – Essentials – Types – Documents – Conditions of contracts.

Arbitration: Definition – Arbitrator – Arbitration agreement – Qualification of arbitrator – Advantages of arbitration.

UNIT – V

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

Text Books:

1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019
3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

Reference Books:

1. Brien, J.O. andPlotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010.
2. Punmia, B.C., andKhandelwal, 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 andOrganisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104161/
2. https://archive.nptel.ac.in/courses/105/103/105103093/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRICAL SAFETY PRACTICES AND STANDARDS (ESPS)

V Semester: All Branches Except EEE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE503	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Understanding the Fundamentals of Electrical Safety
CO2:	Identifying and Applying Safety Components
CO3:	Analyzing Grounding Practices and Electrical Bonding
CO4:	Applying Safety Practices in Electrical Installations and Environments
CO5:	Evaluating Electrical Safety Standards and Regulatory Compliance

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.

Reference Books:

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.

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/nou25_ec08/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SUSTAINABLE ENERGY TECHNOLOGIES (SET)

V Semester: All Branches Except ME | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE504	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Understand the importance of solar radiation and solar PV modules.
CO2:	Describe the storage methods in PV systems
CO3:	Explain the solar energy storage for different applications
CO4:	Illustrate the principles of wind energy, and bio-mass energy.
CO5:	Attain knowledge in geothermal energy, ocean energy and fuel cells.

UNIT – I

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 – II

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 – III

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 – IV

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 – V

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.	Sukhatme S.P. and J.K.Nayak , Solar Energy – Principles of Thermal Collection and Storage, TMH, 2009
2.	Khan B.H , Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi,2006
3.	Twidell & Weir, Renewable Energy Sources , Taylor and Francis / 2nd Special Indian Edition,2006
4.	G.N Tiwari and M.K.Ghosal , Fundamentals of Renewable Energy Sources, Alpha Science International Limited, 2007

Reference Books:

1.	D.Yogi Goswami, Frank Krieth& John F Kreider , Principles of Solar Engineering , Taylor & Francis,2015
2.	Ashok V Desai ,Non-Conventional Energy , New Age International (P) Ltd,1990
3.	R. Ramesh & K. Uday Kumar,Renewable Energy Technologies, Narosa Publishing,1997
4.	G.D Roy , Non-conventional Energy Source, Standard Publishers,2004
5.	Anjaneyulu & Francis , Energy Resources Utilization and Technologies , BS Publications/2012.
6.	Frank Krieth & John F Kreider, Principles of Solar Energy, Hemisphere Publications.2000

Online Learning Resources:

1.	https://nptel.ac.in/courses/112106318

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRONIC CIRCUITS (EC)

V Semester: All Branches Except ECE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE505	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Illustrate the VI Characteristics of Diode and special purpose diodes, Design rectifiers, wave shaping circuits and describe the behavior of special purpose diodes.
CO2:	Explore the operation, configurations, and biasing of BJTs.
CO3:	Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
CO4:	Understand the operation, applications and uses of feedback amplifiers and oscillators
CO5:	Analyze the characteristics, configurations, and applications of operational amplifiers.

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 op-amp 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 McGraw Hill, 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.
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

JAVA PROGRAMMING (JP)

V Semester: CE, EEE, ME and ECE						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE506	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2:	Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
CO3:	Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
CO4:	Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5:	Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX
CO6:	Choose appropriate data structure of Java to solve a problem

UNIT – I

Object Oriented Programming: Basic concepts, Features of Java , Principles

Program Structure in Java: Introduction, Writing Simple Java Programs, Java Statements

Data Types, **Variables, and Operators:** Introduction, Data Types in Java, Declaration of Variables, Type Casting, Scope of Variable Identifier, Variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting

Introduction to Operators: Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (--) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bit-wise Logical Operators.

Control Statements: Introduction, Control Statements- If Nested loops, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop

UNIT – II

Classes and Objects: Introduction to Classes: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Constructor Methods for Class, , Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this, finalize and Wrapper classes

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

UNIT – III

Arrays: Introduction, Declaration and Initialization of Arrays, Memory Storage & Access, Array Operations, Arrays as Vectors. Two dimensional Arrays, Arrays of Varying Lengths, Three dimensional Arrays.

Inheritance: Introduction, Access Control and Types of Inheritance, Multilevel and Hierarchical Inheritance, Final and Super keywords, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

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

UNIT – IV

Packages and Java Library :Packages:

Introduction, Defining Package, Importing Packages and Classes into Programs, Access Control, Packages in Java SE, Class Object, Enumeration, class Math, Wrapper Classes, Java util Classes and Interfaces, Formatter Class, Random Class, Formatting for Date/Time in Java

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

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams.

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, Java thread model, Creating a thread-Extending Thread class and Implementing Runnable interface, Thread life cycle, Thread class methods, Thread priorities, Deadlocks in Threads, Thread Synchronization and Inter Thread Communication

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

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_0128804645476 18816347 _shared/overview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (FAI)

V Semester: CE, EEE and ECE | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE507	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
CO2:	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO3:	Learn different knowledge representation techniques.
CO4:	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
CO5:	Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
CO6:	Analyze Supervised Learning Vs. Learning Decision Trees.

UNIT – I

Introduction to AI: Intelligent Agents, Problem-Solving Agents.

Searching for Solutions: Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT – II

Games: Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic- Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT – III

First-Order Logic: Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. **Knowledge Representation:** Ontological Engineering, Categories and Objects, Events.

UNIT – IV

Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT – V

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes‘ Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Text Books:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

Reference Books:

1. Artificial Intelligence, 3rd Edition, E. Rich and K. Knight (TMH).
2. Artificial Intelligence, 3rd Edition, Patrick Henny Winston, Pearson Education.

3. Artificial Intelligence, Shivani Goel, Pearson Education.

4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

Online Learning Resources:

1. https://swayam.gov.in/nd1_noc19_me71/preview

2. https://ai.google/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ETHICAL HACKING (EH)

V Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE508	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

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

CO1:	Understand the basics of security and ethical hacking.
CO2:	Understand about foot printing and types of attacks in social engineering.
CO3:	Understand about sniffers, hijacking and DoS attacks.
CO4:	Understand the importance of web server hacking, database hacking and SQL Injection.
CO5:	Understand about Wireless technologies, intrusion detection and firewalls.

UNIT – I

Introduction to Ethical Hacking: Introduction, Security fundamentals, Security testing, Hackers and crackers description, Ethical Hackers.

Technical Foundations of Hacking: The Hacking process, Information Security Systems and the Stack.

UNIT – II

Foot printing: Information Gathering Methodology , OS Fingerprinting, Fingerprinting Services, Enumeration, System Hacking.

Social Engineering: Social Engineering, Malware threats, Vulnerability analysis.

UNIT – III

Sniffers: Passive sniffing, Active sniffing, ARP,ARP poisoning and MAC flooding, tools for sniffing, wire shark, sniffing and spoofing countermeasures.

Session Hijacking: Transport layer Hijacking, Application layer Hijacking, Session Hijacking **Tools. Denial of Service:** DoS attack techniques, Distributed DoS, DDoS tools.

UNIT – IV

Web Server Hacking: HTTP protocol, scanning web servers, Banner grabbing and Enumeration, Web server, DoS/ DDoS and DNS attacks.

Database Hacking: Introduction to SQL and SQL injection and categories, Finger printing, UNION Exploitation technique, Boolean in SQL injection attacks, Out-of band exploitation, exploring the time-delay SQL injection technique, Stored procedure SQL injection and mitigations, SQL injection hacking tools.

UNIT – V

Wireless Technologies, Mobile Security: Mobile device operation and security, Wireless LAN's- Basics, Wireless LAN frequencies and signalling, Wireless LAN security.

IDS: Intrusion Detection and Prevention Systems. Firewalls and Honey pots.

Text Books:

1. Micheal Gregg, "Certified Ethical Hacker (CEH) Cert Guide", Pearson education, 2020.

Reference Books:

1. EC-Council, "Ethical Hacking and Counter measures (CEH)",CENGAGE Learning, 2020
2. Sai Satish, "Hacking Secrets Part-1", Indian Servers, 2018.
3. David Litchfield, Chris Anley "The Database Hackers Handbook: Defending Database Servers", Wiley.

Online Learning Resources:

1. https://www.coursera.org/courses?query=ethical%20hacking
2. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
3. https://www.geeksforgeeks.org/ethical-hacking-tutorial/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

QUANTUM TECHNOLOGIES AND APPLICATIONS (QTA)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE509	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Understand key quantum mechanical concepts and phenomena.
CO2:	Comprehend the structure and function of quantum algorithms and circuits.
CO3:	Explore applications in quantum communication and cryptography.
CO4:	Appreciate the role of quantum technologies in modern engineering systems.

UNIT – I

Fundamentals of Quantum Mechanics: Classical vs Quantum Paradigm, Postulates of Quantum Mechanics, Wavefunction and Schrödinger Equation (Time-independent), Quantum states, Superposition, Qubits, Measurement, Operators, and Observables, Entanglement and Non-locality

UNIT – II

Quantum Computing: Qubits and Bloch Sphere, Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates, Quantum Circuits, Basic Algorithms: Deutsch-Jozsa. Gover's, Shor's (conceptual), Error Correction and Decoherence

UNIT – III

Quantum Communication and Cryptography: Teleportation & No-Cloning, BB84 Protocol, Quantum Networks & Repeaters, Classical vs Quantum Cryptography, Challenges in Implementation

UNIT – IV

Quantum Sensors and Metrology: Quantum Sensing: Principles and Technologies, Quantum-enhanced Measurements, Atomic Clocks, Gravimeters, Magnetometers, NV Centers, Industrial Applications

UNIT – V

Quantum Materials and Emerging Technologies: Quantum Materials: Superconductors, Topological Insulators, Quantum Devices: Qubits, Josephson Junctions, National Quantum Missions (India, EU, USA, China), Quantum Careers and Industry Initiatives

Text Books:

1. Michael A Nielsen and Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge.
2. Leonard Susskind and Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, New York.

Reference Books:

1. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, Cambridge.
2. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide,
3. Phillip Kaye, Raymond Laflamme, and Michele Mosca, An Introduction to Quantum Computing
4. Sai Satish, "Hacking Secrets Part-1", Indian Servers, 2018.
5. David Litchfield, Chris Anley "The Database Hackers Handbook: Defending Database Servers", Wiley.

Online Learning Resources:

1. https://qiskit.org/
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MATHEMATICS FOR MACHINE LEARNING AND AI (MMLA)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE510	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Apply linear algebra concepts to ML techniques like PCA and regression
CO2:	Analyze probabilistic models and statistical methods for AI applications.
CO3:	Implement optimization techniques for machine learning algorithms.
CO4:	Utilize vector calculus and transformations in AI-based models.
CO5:	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, Eigen values, 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).

Text Books:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learningby Christopher Bishop, Springer.

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.

Online Learning Resources:

1. https://ocw.mit.eduhttps://
2. https://cs229.stanford.edu/
3. https://deepai.org

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The

question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MATERIALS CHARACTERIZATION TECHNIQUES (MCT)

V Semester: All Branches | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE511	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Analyze the crystal structure and crystallite size by various methods
CO2:	Analyze the morphology of the sample by using a Scanning Electron Microscope
CO3:	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope
CO4:	Explain the principle and experimental arrangement of various spectroscopic techniques
CO5:	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 X-ray 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.

Text Books:

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

Online Learning Resources:

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/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CHEMISTRY OF ENERGY SYSTEMS (CES)

V Semester: All Branches | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE512	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Solve the problems based on electrode potential, Describe the Galvanic Cell, Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2:	Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell, Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3:	Differentiate between Photo and Photo electro chemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photo electron catalytic conversion.
CO4:	Apply the photovoltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power
CO5:	Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic framework, Illustrate the carbon and metal oxide porous structures, Describe the liquification methods.

UNIT – I

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 – II

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 – III

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 – IV

Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications

UNIT – V

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

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ENGLISH FOR COMPETITIVE EXAMINATIONS (ECE)

V Semester: All Branches | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE513	OE-I	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration:** 3 Hrs

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

CO1:	Identify the basics of English grammar and its importance
CO2:	Explain the use of grammatical structures in sentences
CO3:	Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams
CO4:	Analyze an unknown passage and reach conclusions about it
CO5:	Choose the appropriate form of verbs in framing sentences
CO6:	Develop speed reading and comprehending ability thereby perform better in competitive exams

UNIT – I

Grammar - I: Nouns-classification-errors, Pronouns-types-errors, Adjectives-types-errors, Articles-definite indefinite, Degrees of Comparison, Adverbs-types- errors, Conjunctions-usage Prepositions-usage, Tag Questions, types-identifying errors- Practice

UNIT – II

Grammar - II: Verbs-tenses- structure-usages- negatives- positives- time adverbs, Sequence of tenses--If Clause, Voice-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 Vocabulary: 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

Text Books:

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, New Delhi, 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.

Online Learning Resources:

1. https://www.grammar.cl/english/parts-of-speech.htm
2. https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3. https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice
4. https://languagetool.org/insights/post/verb-tenses/
5. https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
6. https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ENTREPRENEURSHIP AND NEW VENTURE CREATION (ENVC)

V Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE514	OE-I	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Understand the concept of entrepreneurship, analyze its role in economic development, and develop a creative mindset for starting a business.
CO2:	Understand customer problems, validate them with potential customers, and evaluate customer segments and personas.
CO3:	Evaluate customer needs through jobs-to-be-done analysis and develop value propositions using prototypes and MVPs.
CO4:	Apply lean business models, financial and sales plans to design a venture with suitable funding and marketing channels.
CO5:	Analyze scaling aspirations and venture components to develop an investor-ready pitch

UNIT – I

Entrepreneurship Fundamentals and Context: Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial 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.

UNIT – II

Problem & Customer Identification: Understanding and analyzing 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 –Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

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.

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 analyzing 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.

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.

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).

Reference Books:

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

Online Learning Resources:

1. https://wadhwanifoundation.org/initiatives/entrepreneurship/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.