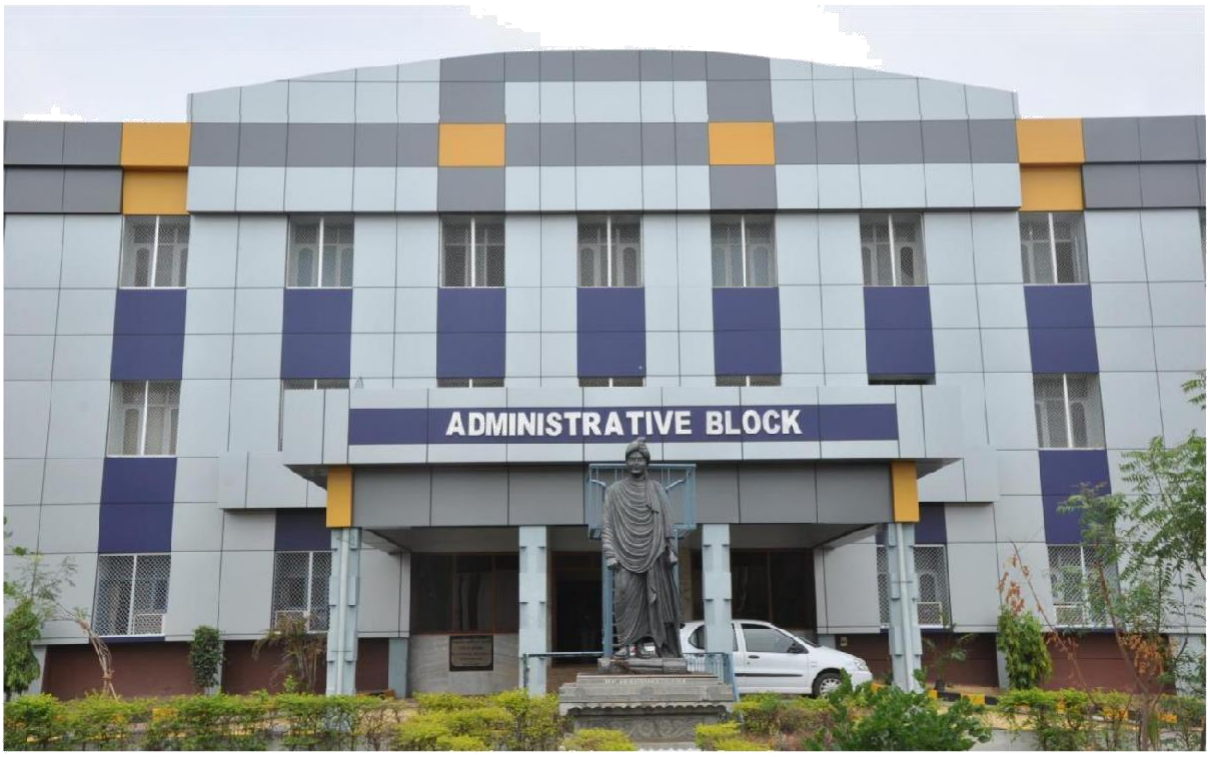

Scheme–2023

Department of Emerging Technologies in Computer Science

G.Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for III & IV Year of FOUR YEAR B.Tech. Degree Course in

Computer Science and Engineering (AI&ML)

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

G. PULLA REDDY ENGINEERING COLLEGE (Autonomous) : KURNOOL

SCHEME -23

B. TECH – CSE(AI&ML)

Applicable from the Academic Year 2023-24 onwards

B.Tech – V Semester: CSE (AI&ML)

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	PC	Natural Language Processing	3	0	0	3	30	70	100
2	PC	Operating Systems & System Programming	3	0	0	3	30	70	100
3	PC	Computer Vision & Image Processing	3	0	0	3	30	70	100
4	ES	Introduction to Quantum Technologies and Applications	3	0	0	3	30	70	100
5	PE	**Professional Elective-I**	3	0	0	3	30	70	100
6	OE	**Open Elective-I**	3	0	0	3	30	70	100
7	PC	Computer Vision & Machine Learning Lab	0	0	3	1.5	30	70	100
8	PC	AI & System Programming 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	INT	Evaluation of Community Service Internship	-	-	-	2	0	100	100
		Total	**20**	**1**	**8**	**25**			

B.Tech - VI Semester: CSE (AI&ML)

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	PC	Cloud Computing for AI	3	0	0	3	30	70	100
2	PC	Big Data Analytics & AI Applications	3	0	0	3	30	70	100
3	PC	Full Stack AI Development	3	0	0	3	30	70	100
4	PE	**Professional Elective-II**	3	0	0	3	30	70	100
5	PE	**Professional Elective-III**	3	0	0	3	30	70	100
6	OE	**Open Elective-II**	3	0	0	3	30	70	100
7	PC	Big Data & Cloud Computing Lab	0	0	3	1.5	30	70	100
8	PC	Full Stack AI 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									

NATURAL LANGUAGE PROCESSING (NLP)

V Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM301	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand the fundamentals and challenges of natural language understanding.
CO2:	Apply linguistic preprocessing techniques such as tokenization, stemming, POS tagging, and parsing.
CO3:	Implement NLP algorithms for tasks like classification, translation, and information retrieval.
CO4:	Develop deep learning models using RNNs, LSTMs, and Transformer-based architectures for NLP.
CO5:	Use NLP tools and libraries to analyze and interpret natural language data in real-world scenarios.

UNIT– I

Fundamentals of Natural Language Processing: Introduction to NLP: Definitions, Applications, Challenges, Linguistic Essentials: Syntax, Semantics, Pragmatics, Text Processing: Tokenization, Lemmatization, Stemming, Stopword Removal, Normalization, and N-gram Generation, POS Tagging and Named Entity Recognition, NLP Libraries:, NLTK, SpaCy Overview.

UNIT– II

Text Representation and Statistical NLP: Bag of Words and TF-IDF, Language Modeling: Unigrams, Bigrams, N-gram Models, Word Embeddings: Word2Vec, GloVe, FastText, Cosine Similarity and Distance Measures, Text Classification using Naive Bayes and SVM, Evaluation Metrics: Accuracy, Precision, Recall, F1.

UNIT– III

Deep Learning for NLP: Neural Network Basics for NLP, Recurrent Neural Networks (RNNs) and Limitations, LSTM and GRU Networks, Sequence Labeling: POS Tagging, NER using Bi-LSTM, Text Classification using CNNs and RNNs, Model Evaluation and Hyperparameter Tuning.

UNIT– IV

Transformers and Advanced NLP: Attention Mechanism and Self-Attention, Transformer Architecture: Encoder-Decoder Models, Pretrained Language Models: BERT, RoBERTa, GPT, Fine-tuning Transformers for Text Classification, Question Answering and Text Summarization using Transformers, Sentiment Analysis and Zero-shot Classification.

UNIT– V

Applications, Ethics, and Multilingual NLP: Machine Translation: Rule-based vs Neural MT, Chatbots and Conversational AI, Information Retrieval and Question Answering, Speech-to-Text and Text-to-Speech Overview, Multilingual NLP and Low-Resource Languages, Bias, Fairness, and Ethics in NLP.

Text Books:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Pearson Education.
2. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, O'Reilly

Media.

3. Yoav Goldberg, Neural Network Methods in NLP, Morgan & Claypool.

Reference Books:

1. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press.
2. Delip Rao and Brian McMahan, Natural Language Processing with PyTorch, O'Reilly.
3. Thushan Ganegedara, Transformers for Natural Language Processing, Packt Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. https://www.coursera.org/specializations/natural-language-processing

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

OPERATING SYSTEM & SYSTEM PROGRAMMING (OS&SP)

V Semester: CSM | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM302	PC	3	0	0	3	30	70	100

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

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

CO1:	Understand and analyze the basic structure and functions of operating systems and different OS types.
CO2:	Illustrate process management concepts, including states, scheduling algorithms, synchronization methods, and deadlock handling.
CO3:	Explain and evaluate memory management techniques and file system functionalities including paging, segmentation, allocation, and disk scheduling.
CO4:	Understand I/O hardware/software mechanisms, security principles, and Unix/Linux system features.
CO5:	Describe the components and functioning of system software including language processors, macro processors, linkers, and loaders.

UNIT– I

Fundamentals of Operating Systems: Introduction to Operating Systems, Definition and Basics, Generations and Types of Operating Systems, System Calls.
Process Management: Process Concepts, Process States, Process Control Block, Context Switching, Threads and Multithreading, Process Scheduling: Scheduling Criteria and Scheduling Algorithms, **Process Synchronization and Deadlocks:** Race Conditions, Critical Section, Mutual Exclusion, Peterson's Solution, Semaphores, Dining Philosophers, Deadlocks: Definition, Characteristics, Prevention, Avoidance, Detection and Recovery.

UNIT– II

Memory Management: Logical vs. Physical Address Mapping, Paging and Page Tables, Segmentation, Virtual Memory: Demand Paging, Page Faults, Page Replacement Algorithms.
File System Management: File Concepts, Access Methods, File Types and Operations, Directory Structure, File System Structure, Allocation Methods, Free-Space Management,
Storage Management: Mass Storage, Disk Structure, Disk Scheduling Algorithms.

UNIT– III

I/O System Management: I/O Hardware, Devices, Device Controllers, Direct Memory Access, I/O Software: Interrupt Handlers, Device Drivers.
Security: Security Environment, Security Design Principles, User Authentication, Protection Mechanisms, Protection Domain, Access Control List.

UNIT– IV

System Software: Overview of System Software, Software and Software Hierarchy, Systems Programming and Machine Structure, Interfaces, Address Space, and Computer Languages, System Software Development and Recent Trends.
Language Processors: Programming Languages and Language Processing, Symbol Tables and Data Structures for Language Processing, Search and Allocation Data Structures, Assemblers.

UNIT– V

System Programming: Scanning and Parsing**,** Programming Language Grammars and Classification, Ambiguity in Grammatic Specification, Scanning, Parsing, Compilers and Interpreters: Compilation Process, Overview of Interpreters and Debuggers, Operating System Commands, File I/O, Process Creation & Control (fork, exec), Pipes, Signals, and Basic Threading.

Text Books:

1. Operating System Concepts (9th or 10th Edition) by Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne in publisher: Wiley
2. Operating Systems: A Concept-Based Approach (3rd Edition) by D. M. Dhamdhere, publisher:
   McGraw-Hill.

Reference Books:

1. Real-Time Systems: Theory and Practice by Rajib Mall, Publisher: Pearson
2. System Software: An Introduction to Systems Programming (3rd Edition) by Leland L. Beck & D. Manjula, Publisher: Pearson

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

COMPUTER VISION AND IMAGE PROCESSING (CV&IP)

V Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM303	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand image formation, representation, and apply basic image processing and frequency domain techniques for image enhancement and restoration.
CO2:	Apply edge detection, segmentation, morphological, and texture analysis techniques for extracting features from images.
CO3:	Analyze 3D vision and motion using techniques like stereo vision, optical flow, and camera calibration for scene understanding and depth estimation.
CO4:	Evaluate object recognition approaches and machine learning models including traditional and deep learning techniques used in computer vision.
CO5:	Implement advanced computer vision applications such as image compression, face recognition, and medical image analysis using case studies.

UNIT– I

Introduction to Computer Vision and Image Processing: Overview of Computer Vision and Image Processing, Definitions and scope, Historical development and applications, Image Formation and Representation: Image acquisition methods.
Fundamentals of Image Processing: Point operations (brightness and contrast adjustments),Spatial filtering techniques
Fourier Transform and Frequency Domain Processing: Discrete Fourier Transform (DFT).

UNIT– II

Image Analysis Techniques: Gradient operators (Sobel, Prewitt), Canny edge detector, Corner and interest point detection,
Image Segmentation: Thresholding methods, Region-based segmentation, Clustering techniques (K-means, Mean-Shift)
Morphological Image Processing: Erosion and dilation, Opening and closing operations, Applications in shape analysis, Applications in pattern recognition.

UNIT– III

3D Vision and Motion Analysis: Stereo Vision**,** Epipolar geometry, Disparity mapping.
Structure from Motion (SfM): Feature tracking across frames, 3D reconstruction from motion, Applications in scene understanding.
Camera Calibration and 3D Reconstruction: Intrinsic and extrinsic parameters, Calibration techniques, 3D point cloud generation.

UNIT– IV

Object Recognition and Machine Learning in Vision: Feature Descriptors and Matching, Speeded-Up Robust Features (SURF).
Object Detection and Recognition: Template matching, Deformable part models, Convolutional Neural Networks (CNNs).
Introduction to Machine Learning for Vision: Supervised and unsupervised learning, Support Vector Machines (SVMs), Decision trees and random forests.

UNIT– V

Applications and Advanced Topics: Image Compression**,** Lossy and lossless compression techniques, Standards (e.g., JPEG, PNG).
Case Studies: Face recognition systems., Automated visual inspection, Medical image analysis.

Text Books:

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

Reference Books:

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

Web References:

1. Coursera: Introduction to Computer Vision and Image Processing. https://www.coursera.org/learn/introduction-computer-vision-watson-opencv?utm_source=chatgpt.com
2. Stanford University: CS231n: Deep Learning for Computer Vision. https://cs231n.stanford.edu/?utm_source=chatgpt.com
3. MIT OpenCourseWare: Introduction to Computer Vision. https://ocw.mit.edu/courses/6-869-advances-in-computer-vision-fall-2014/

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (IQTA)								
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 Hours						**End Exam Duration: 3 Hours**		

Course Out comes: 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 (ManyStates 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, Psi Quantum, 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, One world 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. GiulianoBenenti, 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.

Web References:

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

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. QuestionNo.2to4shallbe EITHER/OR Type for Ten marks each. Students hall 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. QuestionNo.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 VISION & MACHINE LEARNING LAB (CV&ML(P))

V Semester: CSM | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM304	PC	0	0	3	1.5	30	70	100

End Exam Duration: 3 Hours

Course Outcomes: After successful completion of this lab, students will be able to

CO1:	Apply computer vision techniques to solve real-time image processing problems.
CO2:	Train and evaluate machine learning models for classification and regression tasks.
CO3:	Design and test feature extraction techniques from images.
CO4:	Use OpenCV, Scikit-learn, TensorFlow/PyTorch for practical implementations.
CO5:	Integrate vision-based features with ML algorithms for end-to-end solutions.

List of Experiments

1. Image preprocessing techniques: resizing, filtering, thresholding using OpenCV
2. Edge detection using Sobel, Canny, and Laplacian operators
3. Object detection using contour detection and bounding boxes
4. Feature extraction using HOG, SIFT, and ORB
5. Implement face detection using Haar cascades or DNN models
6. Train a machine learning model (SVM / KNN) for image classification
7. Build and evaluate a decision tree classifier using scikit-learn
8. Implement a logistic regression model for binary classification on numerical dataset
9. Apply PCA for feature reduction and visualization
10. Design a simple neural network using TensorFlow/Keras for image classification
11. Train and evaluate a CNN model for digit recognition using MNIST dataset

List of Additional Experiments

1. To convert image from BGR to grayscale using cvtColor() color conversion function in for converting the image from one color code to other.
2. Apply reading an image in one format − showing it in a window and writing the same image in other format using OpenCV package.
3. Design clear identification of the edges with OpenCV provides very simple and useful function called Canny()for detecting the edges..
4. Building a OpenCV has a built-in facility to perform face detection using the Haar cascade classifier for face detection.

Textbooks:

1. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press..

2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly.

3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer.

References:

1. Adrian Rosebrock, Practical Python and OpenCV (PyImageSearch).

2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.

3. Bishop C. M., Pattern Recognition and Machine Learning, Springer.

Web References:
1. https://opencv.org
2. https://www.tensorflow.org/tutorials
3. https://www.kaggle.com/learn/intro-to-machine-learning
4. https://www.pyimagesearch.com
5. NPTEL Course on Deep Learning

AI & SYSTEM PROGRAMMING LAB (AI&SP(P))

V Semester: CSM | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM305	PC	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 search algorithms and logic programming using AI tools.
CO2:	Construct assemblers, macro processors, and shell scripts.
CO3:	Develop system utilities using C and integrate them with AI tools.
CO4:	Demonstrate real-time intelligent system automation using scripting and AI logic.

List of Experiments

1. Write simple programs in Prolog for facts, rules, and queries.
2. Develop a Prolog-based expert system for medical diagnosis or animal identification.
3. Implement Depth-First Search (DFS) and Breadth-First Search (BFS) in Python.
4. Implement A* Search Algorithm using heuristics in Python.
5. Implement the Minimax algorithm for a simple game (e.g., Tic Tac Toe).
6. Implement CPU Scheduling Algorithms.
7. Implement Page Replacement Algorithms.
8. Demonstrate inter-process communication using pipes and signals in Linux.
9. Integrate AI logic (search/expert system) into a shell script or system utility for task automation.
10. Develop an AI-powered system utility (e.g., Intelligent File Manager, AI Bot for CLI commands).

Additional Experiments

1. Design and implement a two-pass assembler in C.
2. Implement a Macro Processor using C for assembly language programs.
3. Develop a simple Linux Shell (command interpreter) using C.
4. Write shell scripts for file operations, process creation and monitoring.

Lab Software Requirements:

1. Languages: Python, Prolog, C
2. Tools: GCC, SWI-Prolog, Linux (Ubuntu/WSL), Shell, Lex/Yacc (optional)
3. IDEs: Code::Blocks / VS Code / Geany / Terminal-based compilation.

FULL STACK DEVELOPMENT-I
(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 Hours

Course Outcomes: At the end of the course students 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.

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 divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>,<header>, <main>, <nav>, <section>, , tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

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 aprogram 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.

Web References:

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**	**-**	**-**	**-**

Course Outcomes: At the end of the course, students 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 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

CLOUD COMPUTING FOR AI(CCAI)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM306	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Explain cloud computing architecture, services, and deployment models.
CO2:	Utilize cloud platforms (AWS, GCP, Azure) for training and deploying AI models.
CO3:	Handle large-scale data storage and processing in the cloud environment.
CO4:	Integrate AI workflows using server less and container-based architectures.
CO5:	Analyze challenges in security, cost, scalability, and performance of cloud-based AI systems.

UNIT– I

Introduction to Cloud Computing and AI Integration: Basics of Cloud Computing: Characteristics, Models, and Services, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, Community, AI and Cloud Convergence: Benefits and Challenges, Use Cases of AI in Cloud: NLP, Vision, Analytics.

UNIT– II

Storage, Computing and Data Processing in the Cloud: Cloud Storage Services: S3, Blob, BigQuery, Virtualization and Elastic Computing, Distributed Computing with Hadoop and Spark, Data Ingestion and Processing Pipelines.

UNIT– III

Cloud-based Machine Learning and Deep Learning: ML Services on AWS (SageMaker), Azure ML, GCP Vertex AI, Training and Deploying Models on Cloud, AutoML and Custom ML Model Workflows, GPUs/TPUs for Model Training, Experiment Tracking and Model Evaluation.

UNIT– IV

Advanced Cloud Concepts for AI Applications: Containers and Docker for AI Applications, Kubernetes and Cloud-native AI Workflows, Serverless Computing: AWS Lambda, Azure Functions, CI/CD Pipelines for AI Models in Cloud.

UNIT– V

Security, Ethics and Case Studies in Cloud AI: Security and Privacy in Cloud-based AI, Identity and Access Management (IAM) in Cloud, Ethical Issues and Fairness in Cloud AI, Case Study: AI in Healthcare Cloud Solutions, Case Study: Real-Time Analytics in Financial Cloud Services.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw- Hill.
2. Judith Hurwitz et al., Cloud Computing for Dummies, Wiley.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly.

Reference Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Distributed and Cloud Computing, Morgan Kaufmann.

2. Tomasz Kajdanowicz et al., Practical Cloud AI, Springer.

3. Mark Wilkins, AI and Machine Learning for Coders in Cloud, Packt Publishing.

Web References:

1. https://www.aws.training/

2. https://www.coursera.org/specializations/gcp-machine-learning-ai

3. https://learn.microsoft.com/en-us/training/paths/build-ai-solutions-with-azure/

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

BIG DATA ANALYTICS & AI APPLICATIONS(BDAI)

VI Semester: CSM | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM307	PC	3	0	0	3	30	70	100

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

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

CO1:	Understand the architecture and ecosystem of big data processing.
CO2:	Analyze and manage large-scale datasets using Hadoop and Spark.
CO3:	Apply AI/ML techniques to extract insights from big data.
CO4:	Design and implement scalable data pipelines using distributed frameworks.
CO5:	Solve real-world domain problems with AI-powered big data solutions.

UNIT– I

Introduction to Big Data and Analytics Ecosystem: Definition and Characteristics of Big Data – Volume, Velocity, Variety, Veracity, Value, Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Big Data Challenges and Opportunities, Hadoop Ecosystem Overview: HDFS, MapReduce, YARN, NoSQL Databases: Key-Value, Columnar, Document, Graph Models, Data Lake vs. Data Warehouse.

UNIT– II

Big Data Tools and Frameworks: Apache Spark Architecture and RDDs, Spark SQL, Data Frames, and Datasets, Spark Streaming for Real-Time Analytics, Kafka for Data Ingestion and Message Queues, Hive, Pig, and Impala for Big Data Querying, Comparative Analysis of Hadoop vs. Spark.

UNIT– III

Machine Learning on Big Data: Introduction to MLlib and Scikit-learn, Data Preprocessing for Big Data ML Pipelines, Supervised Learning: Classification and Regression on Large Datasets, Unsupervised Learning: Clustering and Dimensionality Reduction, Model Evaluation and Validation Techniques, Distributed Training and Optimization Techniques.

UNIT– IV

AI Applications on Big Data: Predictive Maintenance using Big Data & AI, Fraud Detection in Banking with Machine Learning, AI in Healthcare: Diagnosis, Genomics, Patient Monitoring, Retail and E-commerce Analytics, AI for Smart Cities and IoT Sensor Data Analysis, Evaluation of Real-Time AI Applications on Streaming Data.

UNIT– V

Advanced Topics and Case Studies: Deep Learning on Big Data using Tensor Flow on Spark, Explainable AI (XAI) in Big Data Environments, Ethical Issues and Data Governance in Big Data AI, Edge Computing and AI for Low Latency Applications, Case Study 2: Big Data AI Solution in Smart Manufacturing.

Text Books:

1. Big Data: Principles and Paradigms by Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi – Wiley
2. Learning Spark: Lightning-Fast Big Data Analysis by Jules S. Damji et al. – O'Reilly
3. Data Science and Big Data Analytics by EMC Education Services – Wiley

Reference Books:

1. 1. Designing Data-Intensive Applications by Martin Kleppmann – O'Reilly
2. Machine Learning with Spark by Rajdeep Dua, Tathagata Das – Packt Publishing

3. Streaming Systems by Tyler Akidau – O'Reilly Media
4. Artificial Intelligence for Big Data by Anand Deshpande – Packt

Web References:

1. https://www.coursera.org/specializations/big-data – Coursera Big Data Specialization
2. https://spark.apache.org/docs/latest/ – Apache Spark Documentation
3. https://www.edx.org/course/big-data-analysis-with-python – edX
4. https://www.udacity.com/course/ai-for-business-leaders--nd088 – Udacity AI for Business
5. https://www.kaggle.com/learn/intro-to-machine-learning – Kaggle ML Tutorials
6. https://data-flair.training/blogs/apache-spark-tutorial/ – Spark Tutorials

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

FULL STACK AI DEVELOPMENT(FSAI)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM308	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand and apply full stack development principles in the context of AI solutions.
CO2:	Build and serve machine learning models via RESTful APIs.
CO3:	Design frontend interfaces for interaction with AI models.
CO4:	Deploy AI applications using modern DevOps tools and cloud platforms.
CO5:	Manage datasets, model versioning, and workflows in production-grade systems.

UNIT– I

Introduction to Full Stack AI Development: Overview of Full Stack Development in AI Context, Layers: Frontend, Backend, ML Layer, and Deployment Layer, Tools and Technology Stack (React, Node.js, Flask, Django, FastAPI, TensorFlow, PyTorch, MongoDB, PostgreSQL), Understanding Model Lifecycle and ML Ops. Version Control: Git essentials, branching, merging, pull requests,Project Hosting: GitHub Pages, repository management.

UNIT– II

Backend Development and API Integration:
Introduction to Flask / FastAPI for model serving, RESTful API design and documentation (Swagger/OpenAPI), Connecting AI/ML models to APIs, Authentication, request handling, and session management, Error handling and response structuring.

UNIT– III

Frontend Development for AI Interfaces: Overview of frontend frameworks (React/Angular/Vue), Creating dynamic forms and dashboards for AI input/output, Data visualization using Chart.js, D3.js, Connecting frontend to API endpoints, Responsive design for AI application UX, LangChain & OpenAI API: Prompt Engineering, RAG Pipelines.

UNIT– IV

Model Deployment and MLOps: Basics of CI/CD pipelines for AI models, Using Docker for containerization, Deployment on cloud platforms (Heroku, AWS, GCP), Introduction to MLflow, DVC, and model versioning, Logging, monitoring, and performance metrics, Deployment using Netlify / Render.

UNIT– V

Capstone Project and Case Studies: Full Stack AI Project Planning & Implementation, Use cases: Chatbot, Recommendation System, Image Classification App, NLP Web App, Industry-oriented workflows and best practices, Ethical considerations and data governance in AI applications.

Text Books:

1. "Full Stack Deep Learning" by Hamel Husain et al. (online version available at fullstackdeeplearning.com).
2. "Building Machine Learning Powered Applications" by Emmanuel Ameisen, O'Reilly.
3. "Flask Web Development" by Miguel Grinberg.

Reference Books:

1. "Machine Learning Engineering" by Andriy Burkov.
2. "Designing Data-Intensive Applications" by Martin Kleppmann.

3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurelien Geron.
Web References:
1. https://fullstackdeeplearning.com/
2. FastAPI Documentation
3. Flask Mega-Tutorial
Question Paper Pattern:
Sessional Examination: 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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

BIG DATA & CLOUD COMPUTING LAB(BDCC(P))

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM309	PC	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:	Students will be able to implement big data pipelines and cloud-based solutions using tools like Hadoop, Spark, and cloud platforms such as AWS, Azure, or GCP.
CO2:	Students gain proficiency in managing distributed data processing, scalable storage, cloud service provisioning, and deploying applications using containers and orchestration platforms.
CO3:	Students will understand the synergy between big data technologies and cloud Computing to solve real-world problems efficiently.

List of Experiments

1. Installation and Configuration of Hadoop Cluster (Single Node & Multi-node) Hadoop HDFS setup, Name Node & Data Node configuration.
2. Working with HDFS: File Operations Upload, read, delete, and replicate files in HDFS.
3. Map Reduce Programming Basics Word count.
4. Apache Hive & Pig for Querying Large Datasets Creation of tables, data loading, and running queries.
5. Apache Spark Basics: RDDs and Data Frames Implement Spark transformations and actions.
6. Introduction to Cloud Computing and AWS/Azure/GCP Console Creating virtual machines, basic compute and storage services.
7. Cloud Storage and Database Services Using S3 (AWS), Blob (Azure), or GCP buckets and Cloud SQL/NoSQL.
8. Deploying Big Data Workloads on Cloud (EMR, HDInsight, Dataproc)
9. Cloud Function/Serverless Deployment.

List of Additional Experiments

1. Map Reduce Programming Basics sorting, and filtering examples in Java/Python.
2. Data Preprocessing and Machine Learning using PySpark MLlib Classification or regression using MLlib pipelines (Cognitive Level: Apply & Evaluate).
3. Running Hadoop/Spark jobs in cloud-managed services.
4. Building and deploying a serverless function (e.g., AWS Lambda) Containerization with Docker.
5. Building, running, and managing Docker containers Orchestration with Kubernetes in the Cloud Deploy and manage a containerized application using GKE/EKS/AKS.

References:

1. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing.
2. Benjamin Bengfort, Data Analytics with Hadoop, O'Reilly.
3. Srinivasan & J.Shrinivasan, Cloud Computing – A Hands-on Approach, Wiley India.

Web References

1. https://www.coursera.org/specializations/big-data
2. https://www.edx.org/learn/cloud-computing
3. https://www.coursera.org/specializations/gcp-data-machine-learning

FULL STACK DEVELOPMENT-II (Skill Enhancement Course)								
VI 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**
SCCS02	**SEC**	**0**	**1**	**2**	**2**	**30**	**70**	**100**
End Exam Duration: 3 Hours								

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

CO1:	Demonstrate proficiency in writing JavaScript programs using modern syntax and DOM manipulation techniques to create dynamic web content.
CO2:	Build interactive and responsive user interfaces using React.js.
CO3:	Develop and deploy server-side applications using Node.js and Express.js.
CO4:	Integrate MySQL with Express applications to perform structured data storage, retrieval, and manipulation through SQL queries and API connectivity.

1.Introduction to Modern JavaScript and DOM

a. Write a JavaScript program to link JavaScript file with the HTML page.
b. Write a JavaScript program to select the elements in HTML page using selectors.
c. Write a JavaScript program to implement the event listeners.
d. Write a JavaScript program to handle the click events for HTML button elements.
e. Write a JavaScript program to demonstrate the following.
   i. Function declaration
   ii. Function definition
   iii. Arrow functions

2. Basics of React. Js

a. Write a React program to implement a counter button using react class components.
b. Write a React program to implement a counter button using react functional components.
c. Write a React program to handle the button click events in functional component.
d. Write a React program to conditionally render a component in the browser.
e. Write a React program to display text using String literals.

3. Important concepts of React. js

a. Write a React program to implement a counter button using React use State hook.
b. Write a React program to fetch the data from an API using React use Effect hook.
c. Write a React program with two react components sharing data using Props.
d. Write a React program to implement forms.
e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Node. js and Express. js

a. Write a program to implement the hello world message in the route through the browser using Express.js.
b. Write a program to develop a small website with multiple routes using Express. js.
c. Write a program to print hello world in the browser console using Express.js.
d. Write a program to implement the CRUD operations using Express.js.
e. Write a program to establish the connection between API and Database using Expres-My SQL driver.

5. **Introduction to MySQL**

a. Write a program to create a Database and table inside that database using My SQL Command line client.
b. Write MySQL queries to create table, and insert the data, update the data in the table.

c. Write MySQL queries to implement the subqueries in the My SQL command line client.

d. Write a MySQL program to create the script files in the My SQL workbench.

e. Write a MySQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API

Text Books:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett.
2. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
4. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic websites by Robin Nixon.
5. AZAT MARDAN, Full Stack Java Script: Learn Back bone. js, Node.js and MongoDB.2015

Reference Books:

1. Full-Stack JavaScript Development by Eric Bush
2. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.

Web References:

1. https://ict.iitk.ac.in/product/full-stack-developer-html5-css3-js-bootstrap-php-4/
2. https://www.w3schools.com/html
3. https://www.w3schools.com/css
4. https://www.w3schools.com/js/
5. https://www.w3schools.com/nodejs
6. https://www.w3schools.com/typescript

FULL STACK AI LAB

VI Semester: CSE (AI & ML)						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM310	PC	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 basic NLP tasks such as tokenization, stemming, lemmatization, and POS tagging.
CO2:	Preprocess and vectorize text data using classical and modern techniques including TF-IDF and word embeddings.
CO3:	Build deep learning-based NLP models using RNNs, LSTMs, GRUs, and attention mechanisms.
CO4:	Fine-tune transformer models like BERT, RoBERTa, and GPT for text classification, QA, and NER.
CO5:	Develop and deploy end-to-end NLP applications with deep learning models using Python frameworks.

List of Experiments

1. Text Preprocessing: Implement tokenization, stopword removal, stemming, and lemmatization using NLTK and spaCy.
2. Part-of-Speech Tagging & Named Entity Recognition: Use NLTK or spaCy to perform POS tagging and NER on news articles.
3. Text Vectorization: Implement Bag-of-Words, TF-IDF, and Word2Vec/GloVe embeddings for given datasets.
4. Sentiment Analysis: Train a basic feed forward neural network using Tensor Flow/Keras or PyTorch for binary sentiment classification.
5. Sequence Modeling with RNNs: Build an RNN model for next word prediction or text generation using movie scripts or news data.
6. LSTM-Based Text Classification: Develop an LSTM model for multi-class classification (e.g., Amazon reviews).
7. Named Entity Recognition using Bi-LSTM + CRF: Implement a sequence tagging model for NER using deep learning.
8. Text Summarization using Seq2Seq: Implement an encoder-decoder architecture for extractive or abstractive summarization.
9. Machine Translation: Use an attention-based encoder-decoder model to perform translation (e.g., English to French).
10. Fine-Tuning Transformer Models: Use Hugging Face Transformers to fine-tune BERT or DistilBERT for text classification.
11. Question Answering System: Implement a QA model using pre-trained transformer models like BERT or T5.
12. NLP Model Deployment: Deploy a trained NLP model as a REST API using Flask or FastAPI.

List of Additional Experiments

1. Real-Time Machine Translation for Low-Resource Indian Languages using Neural MT.
2. Design a responsive Registration Form using HTML, CSS, and JavaScript.
3. Create and host your webpage on GitHub Pages using Git.
4. Create a Feedback Form that fetches and displays stored data dynamically.

5. Train & test a Linear Regression Model on form-submitted data stored in MongoDB.
6. Create a Data Analytics Dashboard using Streamlit or Flask.
References:
1. Tom Young, Devamanyu Hazarika, Recent Trends in Deep Learning Based NLP, Springer.
2. Delip Rao, Brian McMahan, Natural Language Processing with PyTorch, O'Reilly.
3. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly.
4. Research articles from ACL Anthology, arXiv NLP preprints, and IEEE Transactions on Affective Computing.
Web References
1. https://www.coursera.org/specializations/natural-language-processing
2. https://www.udemy.com/course/natural-language-processing-with-deep-learning-in-python/

TINKERING LAB (TLP(P))								
V/VI Semester: Common to all branches						**Scheme:2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L/D	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
ESCM02	**ES**	**-**	**-**	**2**	**1**	**30**	**70**	**100**
					End Exam Duration:3 Hrs			

Course Outcomes:

After the completion of the course students will be able to

CO1:	Experiment, innovate, and solve real-world challenges.

LIST OF EXPERIMENTS

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Demonstrate a traffic light circuit-using breadboard.
3. Build and demonstrate automatic Street Light using LDR.
4. Simulate the Arduino LED blinking activity in Tinkercad.
5. Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6. Interfacing IR Sensor and Servo Motor with Arduino.
7. Blink LED using ESP32.
8. LDR Interfacing with ESP32.
9. Control an LED using Mobile App.
10. Design and 3D print a Walking Robot
11. Design and 3D Print a Rocket.
12. Build a live soil moisture-monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13. Demonstrate all the steps in design thinking to redesign a motor bike.

References:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2. https://atl.aim.gov.in/ATL-Equipment-Manual/
3. https://aim.gov.in/pdf/Level-1.pdf
4. https://aim.gov.in/pdf/Level-2.pdf
5. https://aim.gov.in/pdf/Level-3.pdf

G. PULLA REDDY ENGINEERING COLLEGE (Autonomous) : KURNOOL
SCHEME -23
CSE(AI&ML)
Applicable from the Academic Year 2023-24 onwards

B.Tech – VII Semester: CSE (AI&ML)

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	PC	Generative AI	3	0	0	3	30	70	100
2	BS&H	**Management Course-II**	2	0	0	2	30	70	100
3	PE	**Professional Elective-IV**	3	0	0	3	30	70	100
4	PE	**Professional Elective-V**	3	0	0	3	30	70	100
5	OE	**Open Elective-III**	3	0	0	3	30	70	100
6	OE	**Open Elective-IV**	3	0	0	3	30	70	100
7	SEC	Prompt Engineering	0	1	2	2	30	70	100
8	AC	Gender Sensitization / Constitution of India	2	0	0	-	0	0	0
9	INT	Evaluation of Industry Internship	-	-	-	2	0	100	100
		Total	**19**	**1**	**2**	**21**			

B.Tech – VIII Semester: CSE (AI&ML)

S.No	Category	Title	L	T	P	Credits	CIA	End Exam	Total Marks
1	INT & PROJ	Internship	0	0	08	**4**	100	0	100
		Project Work	0	0	16	**8**	30	70	100
		Total	**0**	**0**	**24**	**12**			

GENERATIVE AI(GAI)								
VII Semester: CSM						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CM401	PC	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						**End Exam Duration:** 3 Hours		

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

CO1:	Demonstrate a strong understanding of the architecture and functioning of Generative AI models, including transformers and LLMs.
CO2:	Be capable of applying prompt engineering techniques to steer model behavior for desired outputs across various tasks.
CO3:	Design and fine-tune generative models for applications such as text generation, image creation, music synthesis, and conversational AI.
CO4:	Analyze and evaluate the effectiveness of prompts and generated content, using relevant metrics and methodologies.
CO5:	Apply ethical principles to ensure responsible development and deployment of generative AI systems.

UNIT– I

Introduction to Generative AI (Cognitive Level: Understand, Remember) Overview of AI and types of AI, What is Generative AI? Definitions and Concepts, Historical evolution of generative models, Types of generative models – GANs, VAEs, Autoregressive Models, Introduction to Transformers and LLMs, Applications and use cases of Generative AI, Challenges in Generative AI development, Introduction to text-to-image and image-to-text models.

UNIT– II

Fundamentals of Prompt Engineering Definition and significance of Prompt Engineering, Types of prompts: Zero-shot, One-shot, Few-shot, Techniques for effective prompt design, Prompt templates and chaining, Prompt tuning and parameter-efficient tuning, Evaluating prompt performance, Use of APIs for testing prompts (OpenAI, Cohere, Anthropic), Best practices and prompt libraries.

UNIT– III

Working with Large Language Models (LLMs) Overview of pre-trained LLMs: GPT, BERT, LLaMA, Claude, PaLM, Architectures and tokenization strategies, Fine-tuning vs. in-context learning, LLM-powered tools (ChatGPT, GitHub Copilot, Bard, Claude), Role of attention mechanism and transformer layers, Tools for model experimentation (Hugging Face, LangChain), Performance metrics for LLMs, Case studies of model adaptation and deployment.

UNIT– IV

Applications of Generative AI Text generation and summarization, Image and art generation (DALL·E, Midjourney, Stable Diffusion), Code generation and completion tools (Codex, Copilot), Music and video generation, Generative chatbots and customer service, Story generation and dialogue systems, Domain-specific applications (Legal, Healthcare, Education), Comparative study of generative models by task.

UNIT– V

Ethics, Security & Responsible AI Bias and fairness in LLMs and generative systems, Explainability and transparency in generative AI, Copyright and originality issues, Adversarial use of generative models – deepfakes, misinformation, AI safety protocols and red-teaming, Regulatory and policy frameworks for generative AI, Responsible prompt crafting and moderation.

Text Books:

1. Deep Learning with Python by François Chollet, Manning Publications.

2. Transformers for Natural Language Processing by Denis Rothman, Packt.

3. Practical Generative AI by Amit Shukla, BPB Publications.

Reference Books:

1. Paul Crickard , Data Engineering with Python, Packt Publishing, October 2020.

2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013

3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

Web References:

1. https://technicalsummaries.com/docs/books/fundamentals

2. https://medium.com/@dom.n/the

3. https://www.qlik.com/us/data

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

PROMPT ENGINEERING (PE)								
VII Semester: Common to CSE,CSM & CSBS						**Scheme:** 2023		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
SCCS03	SEC	0	1	2	2	30	70	100
End Exam Duration: 3 Hours								

Course Outcomes: At the end of the course students will be able to	
CO1:	Understand the fundamentals and evolution of prompt engineering
CO2:	Understand the craft effective closed-ended, open-ended, and role-based prompts
CO3:	Understand to probe and stress-test AI models for bias and robustness.
CO4:	Apply prompt to optimization techniques and performance evaluation methods.
CO5:	Evaluate the bias and promoting ethical prompting practices in NLP/ML systems.

UNIT– I

Introduction to Prompt Engineering

- Lesson1:Foundations of Prompt Engineering
  - Overview of prompt engineering and its significance in NLP and ML.
  - Historical context and evolution of prompt-based approaches.

Types of Prompts and Their Applications

- Lesson2: Closed-Ended Prompts
  - Understanding and creating prompts for specific answers.
  - Applications in question-answering systems.
- Lesson3:Open-Ended Prompts
  - Crafting prompts for creative responses.
  - Applications in language generation models

UNIT– II

Strategies for Effective Prompting

- Lesson4:Probing Prompts
  - Designing prompts to reveal model biases.
  - Ethical considerations in using probing prompts.
- Lesson5: Adversarial Prompts
  - Creating prompts to stress-test models.
  - Enhancing robustness through adversarial prompting.

UNIT– III

Fine-Tuning and Optimizing with Prompts

- Lesson6: Fine-Tuning Models with Prompts
  - Techniques for incorporating prompts during model training.

Balancing prompt influence and generalization

- Lesson7: Optimizing Prompt Selection
  - Methods for selecting optimal prompts for specific tasks.
  - Customizing prompts based on model behavior.

UNIT– IV

Evaluation and Bias Mitigation

- Lesson8: Evaluating Prompt Performance
  - Metrics and methodologies for assessing model performance with prompts.

- Interpreting and analyzing results.
- Lesson9:Bias Mitigation in Prompt Engineering
  - Strategies to identify and address biases introduced by prompts.
  - Ensuring fairness and inclusivity in prompt-based models.

UNIT– V

Real-World Applications and Case Studies

- Lesson10: Case Studies in Prompt Engineering
- Exploration of successful implementations and challenges in real-world scenarios
- Guest lectures from industry experts sharing their experiences

Text Books:

1. "PromptEngineeringinAction" –DannyD. Sullivan.
2. "TheArtofPromptEngineeringwithChatGPT:AHands-OnGuide"–NathanHunter.

Reference Books:

1. "PromptEngineeringinPractice"–MichaelF. Lewis
2. "MasteringAIPromptEngineering:TheUltimateGuideforChatGPTUsers"–Adriano Damiao
3. "Writing AI Prompts for Dummies" – Stephanie Diamond and Jeffrey Allan
4. "Prompt Engineering Guide" (Online Resource) – promptingguide.ai

Web References:

1. https://www.udemy.com/course/understanding-prompt-engineering/?couponCode=NVDINCTA35TRT

GENDER SENSITIZATION (GS)								
VII 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**
AC401		**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 concepts of gender and its related terminology
CO2:	Identify the biological, sociological, psychological and legal aspects of gender.
CO3:	Analyze the gendered division of labour and its relation to politics and economics.
CO4:	Use the knowledge in understanding how gender discrimination operates in our society and how to counter it.
CO5:	Appraise how the various mass/ electronic / print media perpetuate gender stereotypes of men and women to the detriment of the well-being of society.

UNIT – I

UNDERSTANDING GENDER: Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II

GENDER ROLES AND RELATIONS: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum.

UNIT – III

GENDER AND LABOUR: Division and Valuation of Labour-Housework: The Invisible Labor- ―My Mother doesn‘t Work ―Share the Load-Work: Its Politics and Economics -Fact and Fiction-Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

UNIT – IV

GENDER-BASED VIOLENCE: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence.

UNIT – V

GENDER AND CULTURE: Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues - Gender Sensitive Language- Just Relationships.

Text Books:

1. A. Suneetha, Uma Bhrugubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn. March 1990

Reference Books:

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The dowry Problems in India,London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), Women in Developing Countries, Assessing Strategies for

Empowerment, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, Women and Politics World Wide, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, Gender Sensitization: Issues and Challenges (English, Hardcover), Raj Publications, 2019
6. A.Revathy & Murali, Nandini, A Life in Trans Activism (Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Web References:

1. Understanding Gender chrome-extension:
https://kdpelmjpfafjppnhbloffcjpeomlnpah/
https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf
https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2. Gender Roles and Relations
https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and stereotypes
https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
3. Gender and Labour
https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be redressed
https://onlinecourses.nptel.ac.in/noc23_mg67/preview
4. Gender-Based Violence
https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en
https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls
https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

CONSTITUTION OF INDIA (CI)								
VII 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**
AC402	**AC**	**2**	**-**	**-**	**-**	**0**	**-**	**0**

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

CO1:	Understand the formation and principles of Indian Constitution.
CO2:	Understand structure and functions of Union government and State executive. Duties of President, Vice president, Prime Minister, Governor, Chief Minister cabinet and State Legislature.
CO3:	Understand constitutional amendments of 42, 44,74,76,86 and 91. Central-State relations, President rule.
CO4:	Understand Indian social structure and languages in India. Rights of women, SC, ST and then weaker section.
CO5:	Understand the structure of Judiciary, Role and functions of Supreme Court, High court and Subordinate courts, Judicial review.

UNIT– I

Historical back ground, Significance of Constitution, Making of the constitution, Role of the constituent Assembly, Salient features, the Preamble, Citizenship, procedure for amendment of Constitution Fundamental rights-Derivative principles of state policy-Elections in India.

UNIT– II

Union Executive: Structures of Union Government & Functions, President, Vice President, Prime Minister, Cabinet, Parliament- State Executive: Structures and Functions, Governor, Chief Minister, Cabinet, State Legislature.

UNIT– III

Central, State Relations, President's Rule, Constitutional Amendments [42, 44, 74, 76, 86 & 91]-Constitutional functionaries, Working of Parliamentary system in India.

UNIT– IV

Indian Social Structure, Languages in India-Political Parties & Pressure groups, Rights of Women-S.C"s, S.T"s & other weaker sections.

UNIT– V

Judiciary: Structure, Organization of Judiciary, independence of the Judiciary, role and functions of Supreme Court, High Courts & Sub ordinate courts, Judicial Review.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India", Wedwe& Company

2. Macivel, Page, "An Introduction Analysis", Society

3. M.V. Pylee, "Indian Constitution", S. Chand Publications

4. Subhash C Kashyao :"Our Constitution", NationalBank,Trust, India.

5. Constitutional Law of India by Dr.S.M.Rajan

Reference Books:

1. The Constitution of India.By the Ministry of Law and Justice, The Govt. of India.

2. Constitutional Law of India by kashyapsubhasah

3. Indian constitution Law by M.P.Jain

4. Constitutional Law of India by H.M Seervai

Web References:

1. https://www.india.gov.in/my-government/constitution-india

List of Professional Electives

Professional Elective – I

1. Data Visualization Techniques
2. Soft Computing
3. Exploratory Data Analysis
4. Computational Intelligence
5. Theory of Computation & Compiler Design

Professional Elective – II

1. Graph Neural Networks
2. Recommender Systems
3. Predictive Analytics for AI
4. Blockchain for AI
5. Computer Networks & Internet Protocols

Professional Elective – III

1. Introduction to Quantum Computing
2. AI for Finance
3. Social Network Analysis
4. Cybersecurity & AI-Driven Threat Detection
5. Fundamentals of Software Engineering

Professional Elective – IV

1. Explainable AI & Model Interpretability
2. AI in Cyber Security
3. AI- Driven Software Engineering & DevOps
4. AI for Robotics

Professional Elective – V

1. MLOps & AI Model Deployment
2. Data Wrangling
3. Healthcare AI
4. AI for Smart Cities & IoT Systems

Management Course-II

1. Business Ethics And Corporate Governance
2. E-Business
3. Management Science

DATA VISUALIZATION TECHNIQUES(DVT)

V Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM311	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Interpret different types of data and recognize the appropriate visualization methods.
CO2:	Design effective and interactive data visualizations using various tools.
CO3:	Apply visual encoding and perceptual principles in presenting complex data.
CO4:	Analyze and visualize real-world data sets using Python libraries and dashboards.
CO5:	Create visual stories and dashboards for effective communication of insights.

UNIT– I

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

UNIT– II

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

UNIT– III

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

UNIT– IV

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

UNIT– V

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

Text Books:

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

Reference Books:

1. Alberto Cairo, The Truthful Art: Data, Charts, and Maps for Communication, New Riders, 2016.
2. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley, 2015.

3. Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly, 2019.

4. Rohan Chopra, Hands-On Data Visualization with Bokeh, Packt Publishing, 2019.

Web References:

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

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

SOFT COMPUTING (SC)

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

Course Outcomes: At the end of the course students 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, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

Text Books:

1.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.

6. Timothy J. Ross, ―Fuzzy Logic with Engineering Applications‖, McGraw- Hill International editions, 1995

Web References:

1. https://www.tutorialspoint.com/fuzzy_logic/index.htm

2. https://archive.nptel.ac.in/courses/106/105/106105173/

Question Paper Pattern:

Sessional Examination:

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 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

EXPLORATORY DATA ANALYSIS(EDA)

V Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM312	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand and apply key concepts of EDA and data preprocessing.
CO2:	Perform exploratory analysis using Python libraries and interpret results.
CO3:	Handle missing data, outliers, and categorical features effectively.
CO4:	Create meaningful visualizations to support data-driven insights.
CO5:	Use EDA as a foundation for data science workflows.

UNIT– I

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

UNIT– II

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

UNIT– III

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

UNIT– IV

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

UNIT– V

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

Text Books:

1. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly, 2016.

2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly, 2018.

Reference Books:

1. Joel Grus, Data Science from Scratch, O'Reilly, 2019.

2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 2nd Edition, O'Reilly, 2019.

3. Allen B. Downey, Think Stats: Probability and Statistics for Programmers, O'Reilly, 2014.

Web References:

1. NPTEL Course – Data Science for Engineers
2. https://www.coursera.org/specializations/data-science-python

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

COMPUTATIONAL INTELLIGENCE (CI)

V Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM313	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand the description and differentiation of neural networks, fuzzy logic, and evolutionary computation.
CO2:	Apply neural and fuzzy systems for real-time decision-making.
CO3:	Analyze complex problems using soft computing tools.
CO4:	Develop hybrid intelligent systems.
CO5:	Evaluate and compare the performance of CI-based systems.

UNIT– I

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

UNIT– II

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

UNIT– III

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

UNIT– IV

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

UNIT– V

Applications of Computational Intelligence: CI in Image and Signal Processing, CI for Optimization Problems and Robotics, CI in Biomedical Engineering and Finance, and Decision-Making Systems, Real-time Applications and in CI.

Text Books:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, PHI Learning.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India.
3. "Computational Intelligence: Concepts to Implementations" Author: Russell C. Eberhart and Yuhui Shi Publisher: Morgan Kaufmann / Elsevier ISBN: 9781558607590

Reference Books:

1. S.N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley India.
2. Simon Haykin, Neural Networks and Learning Machines, Pearson.

3. James Kennedy and Russell C. Eberhart, Swarm Intelligence, Morgan Kaufmann.

4. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley.

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

THEORY OF COMPUTATION & COMPILER DESIGN (TCCD)								
V Semester: CSM & CSD						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
CM314	**PE**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hours						**End Exam Duration: 3 Hours**		

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, AI Applications.

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, AI Applications.

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.

Web References:

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.

GRAPH NEURAL NETWORKS(GNN)

VI Semester: CSM | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM315	PE	3	0	0	3	30	70	100

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

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

CO1:	Understand the basics of graph structures and their significance in machine learning
CO2:	Understand and Compare graph learning methods using spectral and spatial approaches.
CO3:	Learn and implement different types of GNN architectures.
CO4:	Apply GNNs to real-world structured data problems.
CO5:	Use modern libraries and tools to train and evaluate GNNs.

UNIT– I

Fundamentals of Graph Theory and Machine Learning on Graphs : Introduction to Graphs: Nodes, Edges, Adjacency Matrix, Types of Graphs: Directed, Undirected, Weighted, Bipartite, Graph Traversal Algorithms (BFS, DFS), Graph Representations for ML (Adjacency List, Matrix, Laplacian), Node, Edge, and Graph-level Prediction Problems, Motivation and Challenges for Learning on Graphs.

UNIT– II

Spectral and Spatial Methods for Graph Learning: Spectral Graph Theory Basics, Graph Convolution via Spectral Methods, Chebyshev and First-order Approximations, Spatial Graph Convolutions, Comparison of Spectral vs Spatial GNNs, Graph Laplacian and Eigenvalue Properties.

UNIT– III

Graph Neural Network Architectures: Graph Convolutional Networks (GCNs), Graph Attention Networks (GATs), GraphSAGE: Sampling and Aggregation, Graph Isomorphism Networks (GIN), Message Passing Neural Networks (MPNNs), Inductive vs Transductive GNN Learning.

UNIT– IV

Applications of GNNs: Node Classification (e.g., Cora, Citeseer), Link Prediction (e.g., Recommender Systems), Graph Classification (e.g., Molecule Property Prediction), Traffic Forecasting and Social Network Modeling, GNNs in Healthcare and Bioinformatics.

UNIT– V

Implementation, Optimization, and Recent Advances: Overview of PyTorch Geometric and DGL, Data Loading and Preprocessing for Graph Datasets, Model Training, Loss Functions, and Evaluation Metrics, Hyperparameter Tuning in GNNs.

Text Books:

1. Zonghan Wu, Shirui Pan, Fengwen Chen, Guodong Long, Chengqi Zhang, Philip S. Yu, A Comprehensive Survey on Graph Neural Networks, IEEE Transactions on Neural Networks and Learning Systems, 2021.
2. Yao Ma, Jiliang Tang, Deep Learning on Graphs, Cambridge University Press, 2021.
3. William L. Hamilton, Graph Representation Learning, Morgan & Claypool Publishers, 2020.

Reference Books:

1. Barrett, Jure Leskovec, Mining of Massive Datasets, Cambridge University Press.
2. Thomas Kipf, GCN and related papers and tutorials (arXiv).
3. Petar Veličković, Graph Attention Networks (original paper and slides).

4. Michael Bronstein et al., Geometric Deep Learning: Grids, Groups, Graphs, Geodesics, and Gauges (arXiv preprint).

Web References:

1. https://pytorch-geometric.readthedocs.io/ – PyTorch Geometric Docs
2. https://cs.stanford.edu/people/jure/ – Stanford GNN Projects
3. https://www.coursera.org/learn/graph-neural-networks – Coursera GNN Course by Stanford

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

RECOMMENDER SYSTEMS (RS)

VI Semester: CSM & CSD						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM316	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Aware of various issues related to Personalization and Recommendations.
CO2:	Design and implement a set of well-known Recommender System approaches used in E commerce and Tourism industry.
CO3:	Develop new Recommender Systems for a number of domains especially, Education, Health-care.

UNIT– I

An Introduction to Recommender Systems, Neighborhood-Based Collaborative Filtering

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain Specific Challenges in Recommender Systems. Advanced Topics and Applications. Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood- Neighborhood-Based Collaborative Filtering: Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods, A Regression Modelling View of Neighborhood Methods.

UNIT– II

Model-Based Collaborative Filtering, Content-Based Recommender Systems

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models. Content-Based Recommender Systems: Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering, Summary

UNIT– III

Knowledge-Based Recommender Systems, Ensemble Based and Hybrid Recommender Systems

Introduction, Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems, Summary. Introduction, Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids, Summary.

UNIT– IV

Evaluating Recommender Systems, Context-Sensitive Recommender Systems

Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures, Limitations of Evaluation Measures. Introduction, The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Modelling.

UNIT– V

Time- and Location-Sensitive Recommender Systems

Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Location-Aware Recommender Systems Location-Aware Recommender Systems, Summary.

Text Books:
1. Charu C. Aggarwal, ―Recommender Systems‖, Springer,2016.
Reference Books:
1. Francesco Ricci, LiorRokach, ―Recommender Systems Handbook‖, 2nd ed., Springer, 2015 Edition
Web References:
1. Recommendation System -Understanding The Basic Concepts (analyticsvidhya.com)
2. Recommender Systems | Coursera
Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

PREDICTIVE ANALYTICS FOR AI(PAAI)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM317	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand the principles and importance of predictive analytics.
CO2:	Apply regression and classification models for predictive tasks.
CO3:	Perform data pre-processing, feature selection, and transformation.
CO4:	Evaluate and validate models using standard metrics.
CO5:	Design predictive solutions to solve domain-specific challenges.

UNIT– I

Introduction to Predictive Analytics: Introduction to Predictive Analytics and Business Intelligence, Types of Predictive Models: Classification, Regression, Time Series, Supervised vs Unsupervised Learning, Predictive Modeling Workflow, Applications in Marketing, Finance, Healthcare, Challenges in Predictive Analytics, AI Applications.

UNIT– II

Data Preparation and Feature Engineering: Data Cleaning: Handling Missing, Noisy, and Inconsistent Data, Feature Scaling: Normalization, Standardization, Encoding Categorical Variables, Feature Extraction and Construction, Dealing with Imbalanced Datasets.

UNIT– III

Predictive Modeling with Regression and Classification: Linear Regression and Polynomial Regression, Logistic Regression for Binary Classification, Decision Trees and Random Forest, k-Nearest Neighbors (k-NN) and Naïve Bayes, Support Vector Machines (SVM), Model Selection and Comparison.

UNIT– IV

Model Evaluation and Validation: Training, Testing, and Validation Sets, Cross-Validation Techniques (k-Fold, Stratified, LOOCV), Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, ROC-AUC, Confusion Matrix and Classification Report, Bias-Variance Trade-off and Overfitting.

UNIT– V

Advanced Topics and Applications: Ensemble Learning: Bagging, Boosting (AdaBoost, XGBoost), Predictive Analytics with Time Series (ARIMA, Prophet), Use of Predictive Analytics in IoT, Retail, and Healthcare, Ethics and Privacy in Predictive Analytics, Building and Deploying End-to-End Predictive Systems, AI Applications

Text Books:

1. Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Wiley, 2014.
2. John D. Kelleher, Brendan Tierney, Data Science: Predictive Analytics and Data Mining, MIT Press, 2018.

Reference Books:

1. Galit Shmueli et al., Data Mining for Business Analytics: Concepts, Techniques, and

Applications in R, Wiley, 2017.

2. Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer, 2009.

Web References:

1.https://www.coursera.org/specializations/predictive-analytics - Coursera Specialization

2.https://www.edx.org/course/data-science-and-machine-learning-capstone - edX Predictive Analytics Courses

3.https://www.kaggle.com/learn/intro-to-machine-learning - Kaggle Tutorials

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

BLOCKCHAIN FOR AI (BCAI)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM318	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Explain the fundamentals of blockchain and its components.
CO2:	Analyze the role of consensus mechanisms in maintaining trust and decentralization.
CO3:	Apply blockchain for secure data sharing in AI systems.
CO4:	Develop and deploy smart contracts using Ethereum/Solidity.
CO5:	Evaluate blockchain-based AI applications in healthcare, finance, and supply chains.

UNIT– I

Blockchain Fundamentals and Architecture: Introduction to Blockchain Technology, Components: Blocks, Hashing, Merkle Trees, Types of Blockchains: Public, Private, Consortium, Distributed Ledger Technology (DLT) and P2P Networks, Blockchain Structure and Mining, Use Cases and Evolution of Blockchain.

UNIT– II

Smart Contracts and Consensus Mechanisms: Smart Contracts: Definition, Features, Use Cases, Ethereum and Solidity Basics, Consensus Algorithms: PoW, PoS, DPoS, PBFT, Gas, Transactions, and Events in Ethereum, Hyperledger Fabric: Architecture and Chaincode, Deployment and Testing of Smart Contracts.

UNIT– III

Integration of Blockchain and AI: Motivation for Integrating Blockchain with AI, Decentralized AI Models and Federated Learning, Secure Model Sharing and Provenance, Blockchain for DataIntegrity in AI Systems, AI for Blockchain (e.g., optimizing consensus), Case Study: Decentralized AI Marketplace.

UNIT– IV

Applications of Blockchain in AI Systems: Blockchain for Explainable and Trusted AI, Applications in Healthcare and Genomics, Blockchain for Autonomous Vehicles and IoT, Financial AI Systems with Smart Contracts, Supply Chain and Logistics Intelligence, NFT-based AI Applications (Digital Identity, IP).

UNIT– V

Security, Privacy and Challenges in Blockchain-AI: Security Challenges: Sybil Attacks, 51% Attacks, Privacy Preservation and Zero Knowledge Proofs, Scalability and Energy Concerns in Blockchain-AI, Ethical and Legal Concerns in AI with Blockchain, Interoperability of Blockchain Platforms, Future Trends: Quantum-Resistant Blockchain AI.

Text Books:

1. Imran Bashir, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Packt, 2020.
2. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015.
3. Joseph Holbrook, Architecting AI Solutions on Blockchain, Packt Publishing, 2020.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach, VPT,

2017.

2. Karamjit Singh, Blockchain for AI: Use Cases and Implementation, Springer, 2023.

3. Roger Wattenhofer, The Science of the Blockchain, 2016.

Web References:

1. https://www.coursera.org/specializations/blockchain
2. https://www.edx.org/certificates/professional-certificate/uc-berkeleyx-blockchain-fundamentals
3. https://www.coursera.org/learn/ai-blockchain-ibm

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

COMPUTER NETWORKS & INTERNET PROTOCOLS (CNIP)

VI Semester: CSM & CSD | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM319	PE	3	0	0	3	30	70	100

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

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

CO1:	Identify the basic components of a computer networks and analyze its performance.
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 network applications.

UNIT– I

Computer Networks and the Internet – What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks. Reference Models, Guided Transmission Media, Wireless Transmission.

UNIT– II

The Data Link Layer, Access Networks, and LANs – Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols. Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer.

UNIT– III

The Network Layer – Routing Algorithms, Internetworking, The Network Layer in The Internet.

UNIT– IV

The Transport Layer – Connectionless Transport: UDP, The Internet Transport Protocols: TCP, Congestion Control.

UNIT– V

Principles of Network Applications – Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, 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, 5th 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.

Web References:

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 Examination:

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 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

INTRODUCTION TO QUANTUM COMPUTING (IQC)

VI Semester: CSM & CSD						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM320	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Explain the fundamental concepts of quantum mechanics used in computing.
CO2:	Construct and analyze quantum circuits using standard gates.
CO3:	Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
CO4:	Develop simple quantum programs using Qiskit or similar platforms.
CO5:	Analyze applications and challenges of quantum computing in real-world domains.

UNIT– I

Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT– II

Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT– III

Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT– IV

Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT– V

Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.

2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.

3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.

2.Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.

3.Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Web References:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera–Quantum Mechanics and Quantum Computation by UC Berkeley
3. *edX–The Quantum Internet and Quantum Computers*
4. YouTube–Quantum Computing for the Determined by Michael Nielsen
5. *Qiskit Textbook–IBM Quantum*

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

AI FOR FINANCE(AIF)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM321	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Describe the fundamentals of AI techniques applicable to finance.
CO2:	Analyze financial time series data using AI-based models.
CO3:	Apply machine learning for fraud detection and credit risk analysis.
CO4:	Build predictive models for stock prices, trading, and customer segmentation.
CO5:	Evaluate the limitations and ethical implications of AI in financial systems.

UNIT– I

Introduction to Finance and AI Applications: Introduction to Financial Markets and Instruments, Overview of AI Techniques in Finance, Types of Financial Data: Market, Transactional, Customer, Financial Statements and Key Indicators, AI Use Cases in Investment.

UNIT– II

Machine Learning in Finance: Supervised Learning for Credit Scoring, Unsupervised Learning for Customer Segmentation, Feature Engineering for Financial Data, Handling Imbalanced Datasets in Fraud Detection.

UNIT– III

Deep Learning and NLP in Finance: Introduction to Deep Learning for Finance, Stock Price Prediction using LSTM and RNNs, Sentiment Analysis from Financial News and Tweets, NLP for Document Classification: Earnings Reports, Chatbots.

UNIT– IV

AI-Driven Financial Applications: Fraud Detection Systems using ML and DL, Credit Risk and Loan Default Prediction, AI in Algorithmic and High-Frequency Trading, Robo-Advisors: Architecture and Optimization.

UNIT– V

Ethics, Regulation, and Future of AI in Finance: Regulatory Frameworks in AI-based Finance, Explainability and Interpretability of Financial Models, Ethical Issues: Bias, Fairness, Transparency.

Text Books:

1. Yves Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, O'Reilly, 2020.
2. Yves Hilpisch, Python for Finance: Mastering Data-Driven Finance, O'Reilly, 2018.
3. Markus Loecher, Machine Learning for Finance, Packt Publishing, 2021.

Reference Books:

1. A. W. Lo, The Evolution of Technical Analysis, Wiley Finance, 2010
2. Tony Guida, Big Data and Machine Learning in Quantitative Investment, Wiley, 2019.
3. Tucker Balch, AI for Trading – Georgia Tech Specialization, Coursera

Web References:

1. https://www.youtube.com/watch?v=2BrpKpWwT2A&list=PLQVvvaa0QuDcOdF96TBtRtuQks

ErCEBYZ

2. https://www.youtube.com/watch?v=zUJ8u9k0FzA&list=PL4i4aZbplv9KZzkgz2U3RYObCcmXSHwOc

3. https://www.udemy.com/course/ai-for-finance/?couponCode=IND21PM

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

SOCIAL NETWORK ANALYSIS (SNA)

VI Semester: CSM & CSD | **Scheme:** 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM322	PE	3	0	0	3	30	70	100

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

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

CO1:	Understand basic network models and social network structures.
CO2:	Analyze key properties like centrality, clustering, and small-world effect.
CO3:	Apply community detection algorithms and influence maximization.
CO4:	Interpret diffusion models for viral marketing and information spread.
CO5:	Use tools such as Gephi, NetworkX, or SNAP for real-world SNA.

UNIT– I

Introduction to Social Networks and Graph Theory: Basic Concepts: Graphs, Nodes, Edges, Directed/Undirected Graphs, Real-world Examples: Facebook, Twitter, LinkedIn, Adjacency Matrix and Graph Representation, Types of Social Networks: Ego, Bipartite, Multilayer, Degree Distribution, Path Length, and Connectivity, Random Graph Models: Erdős–Rényi and Watts-Strogatz.

UNIT– II

Structural Properties of Networks: Network Centrality Measures: Degree, Closeness, Betweenness, Eigenvector Centrality and PageRank, Network Clustering and Community Detection Basics, Triadic Closure and Clustering Coefficient, Small-world Phenomenon and Milgram's Experiment, Homophily, Influence, and Structural Balance.

UNIT– III

Community Detection and Subgroup Analysis: Girvan–Newman Algorithm and Modularity, Label Propagation and Louvain Method, Clique Detection and k-Core Decomposition, Overlapping Communities and Fuzzy Clustering, Cohesive Subgroups and Structural Equivalence, Evaluation Metrics: NMI, Modularity Score.

UNIT– IV

Information Diffusion and Influence in Networks: Models of Diffusion: Linear Threshold and Independent Cascade, Influence Maximization and Viral Marketing, Contagion Models and Epidemic Spreading, Rumor Propagation and Cascade Models, Information Bottlenecks and Bridges, Measuring Influence and Reach.

UNIT– V

Tools, Applications, and Ethics in SNA: SNA Tools: Gephi, Pajek, NetworkX, SNAP, Case Study: Twitter and Hashtag Analysis, LinkedIn Network Mining and Graph Features, Applications in Marketing, Security, and Epidemiology, Ethical Issues in Social Network Data Mining, Building and Visualizing Your Own Social Graph.

Text Books:

1. Wasserman, S., & Faust, K., Social Network Analysis: Methods and Applications, Cambridge University Press, 1994.
2. Easley, D., & Kleinberg, J., Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
3. Newman, M., Networks: An Introduction, Oxford University Press, 2010.

Reference Books:

1. Borgatti, S. P., Everett, M. G., & Johnson, J. C., Analyzing Social Networks, SAGE Publications, 2018.

2. Barabási, A.-L., Linked: How Everything Is Connected to Everything Else, Basic Books, 2014

3. Hansen, D., Shneiderman, B., & Smith, M. A., Analyzing Social Media Networks with NodeXL, Elsevier, 2020.

Web References:

1. Coursera – Social Network Analysis (University of Michigan)
2. YouTube – NetworkX and Gephi Tutorials (freeCodeCamp, TheNetNinja)
3. edX – Networks: Friends, Money, and Bytes (University of California, Berkeley)
4. Khan Academy – Graph Theory

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

CYBERSECURITY & AI-DRIVEN THREAT DETECTION (CAITD)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM323	PE	3	0	0	3	30	70	100

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

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

CO1:	Understand cyber security frameworks, threat types, and vulnerabilities.
CO2:	Apply AI/ML techniques for cyber threat identification and classification.
CO3:	Analyze patterns in malware, network traffic, and security logs.
CO4:	Design and evaluate intelligent intrusion detection and prevention systems
CO5:	Explore ethical hacking practices and policy aspects in AI-based security.

UNIT– I

Fundamentals of Cyber security: Introduction to Cybersecurity: CIA Triad, Threats & Vulnerabilities, Types of Attacks: Malware, Phishing, DDoS, Insider Threats, Security Policies and Access Controls, Risk Assessment and Vulnerability Management, Cryptography Basics: Symmetric, Asymmetric, Hash Functions, Cybersecurity Frameworks: NIST, ISO 27001, OWASP.

UNIT– II

Machine Learning for Cyber Threat Detection: Supervised and Unsupervised Learning in Security Contexts, Feature Engineering for Security Data, Classification Models for Intrusion Detection (SVM, RF, KNN), Clustering Techniques for Anomaly Detection, Evaluation Metrics: Accuracy, Precision, ROC, F1 Score, Case Study: AI for Email Phishing Detection.

UNIT– III

Deep Learning in Threat Intelligence: Deep Neural Networks for Cybersecurity, RNNs and LSTMs for Log and Sequence Data, Autoencoders for Anomaly Detection, CNNs for Malware Classification using Binary Analysis, Adversarial Attacks on AI-based Security Systems.

UNIT– IV

Real-Time Threat Detection and SIEM Systems: Security Information and Event Management (SIEM), Log Analysis and Real-Time Alerting, Threat Intelligence Platforms (TIPs), Integration of AI in SIEM Tools (Splunk, ELK Stack), Network Traffic and Packet Inspection using ML, SOC Operations and Automation using AI.

UNIT– V

Ethical Hacking, Privacy, and Legal Aspects: Penetration Testing & Ethical Hacking with AI Tools, Red Team vs. Blue Team Simulation, Data Privacy Regulations: GDPR, HIPAA, Cyber Laws, and AI Bias Fairness in Security Decision Making, Case Study: Ethical Dilemmas in AI Security Systems.

Text Books:

1. Stallings, W., Network Security Essentials: Applications and Standards, Pearson Education.
2. Shon Harris & Fernando Maymi, CISSP All-in-One Exam Guide, McGraw Hill.
3. Emmanuel Tsukerman, Machine Learning for Cybersecurity Cookbook, Packt Publishing.
4. Clarence Chio & David Freeman, Machine Learning and Security, O'Reilly Media.

Reference Books:

1. John Paul Mueller, Luca Massaron, Machine Learning for Dummies, Wiley..
2. Mark Stamp, Information Security: Principles and Practice, Wiley.
3. Bruce Schneier, Secrets and Lies: Digital Security in a Networked World, Wiley.
4. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning, Cambridge

University Press.

Web References:

1. https://www.coursera.org/learn/ai-for-cybersecurity
2. https://www.edx.org/search?q=Cybersecurity%20Fundamentals%20by%20Rochester%20Institute%20of%20Technology
3. https://ocw.mit.edu/
4. https://www.youtube.com/results?search_query=Cybersecurity+%26+AI+Tutorials+by+Simplilearn%2C+Great+Learning%5D
5. https://www.udemy.com/courses/search/?src=ukw&q=Machine+Learning+for+Cybersecurity
6. Splunk Documentation – AI & Threat Detection

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

FUNDAMENTALS OF SOFTWARE ENGINEERING (FSE)

VI Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM324	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Obtain basic software life cycle activity skills
CO2:	Design software requirements specifications for given problems
CO3:	Implement structure, object oriented analysis and design for given problems
CO4:	Design test cases for given problems
CO5:	Apply quality management concepts at the application level

UNIT– I

Basic concepts in software engineering and software project management Concepts: Evolution of software engineering techniques, Software Myths, Software development life cycle (SDLC) models: waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models.

Software project management: Project planning, Project estimation, COCOMO, Project scheduling, Staffing, Organization and team structure

UNIT– II

Requirements analysis and specification: The nature of software, Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management.

UNIT– III

Software Design: Good Software Design, Cohesion and coupling, Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Patterns, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design

Component level Design: Designing Class based components, traditional Components. Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams.

UNIT– IV

Coding and Testing: Coding standards and guidelines, code review, software documentation, Testing,Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs, AI Applications.

UNIT– V

Software quality and reliability : Software quality, reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, AI Applications.

Text Books:

1. Rajib Mall, ―Fundamentals of Software Engineering‖, 5th Edition, PHI, 2018.
2. Pressman R, ―Software Engineering- Practioner Approach‖, McGraw Hill.

Reference Books:

1. Somerville, ―Software Engineering‖, Pearson

2. Richard Fairley, ―Software Engineering Concepts‖, Tata McGraw Hill.

3. Jalote Pankaj, ―An integrated approach to Software Engineering‖, Narosa

Web References:

1.https://nptel.ac.in/courses/106/105/106105182/

2.http://peterindia.net/SoftwareDevelopment.html

3.https://www.geeksforgeeks.org/software-engineering/

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

EXPLAINABLE AI & MODEL INRERPRETABILITY (EAMI)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM402	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand the need for explainability in modern AI systems.
CO2:	Differentiate between black-box and white-box models.
CO3:	Apply interpretability techniques such as SHAP, LIME, and PDPs.
CO4:	Evaluate the fairness and transparency of AI systems.
CO5:	Use explainability tools for model auditing and deployment in high-stakes domains.

UNIT– I

Foundations of Explainable AI: Introduction to Explainability and Interpretability, Importance of XAI in Healthcare, Finance, and Law , White-box vs Black-box Models, Desiderata: Fairness, Accountability, Transparency, Human Centered AI and Trust.

UNIT– II

Model-Specific Explainability Techniques: Decision Trees and Rule-based Models, Linear Models and Feature Importance, Generalized Additive Models (GAMs), Visualization of Weights and Coefficients, Logistic Regression Coefficient Interpretation.

UNIT– III

Model-Agnostic Explainability Techniques: Local Interpretable Model-agnostic Explanations (LIME), SHAP Values (SHapley Additive exPlanations), Partial Dependence Plots (PDPs), Individual Conditional Expectation (ICE) Plots, Feature Interaction and Permutation Importance, Comparative Analysis of SHAP, LIME, PDP, Model Debugging with XAI.

UNIT– IV

Deep Learning Explainability: Visualizing CNNs: Filters, Feature Maps, Saliency Maps and Grad-CAM, Integrated Gradients, Explaining RNNs and LSTM Outputs, Concept Activation Vectors (TCAV), Explaining Language Models (BERT, GPT) Evaluation of Deep Model Explanations.

UNIT– V

Fairness, Bias & Tools for XAI: Fairness Metrics: Demographic Parity, Equal Opportunity, Sources of Bias in Data and Models, Introduction to AIF360, What-If Tool, Fairlearn, Case Study: Bias in Hiring Algorithms, Explainability in ML Pipelines (MLFlow, Skater), XAI in Federated and Privacy-Preserving AI, Designing Interpretable AI Systems from Scratch.

Text Books:

1. Christoph Molnar, ―Interpretable Machine Learning‖, Leanpub.
2. Sameer Singh et al., ―Explainable AI: Interpreting, Explaining and Visualizing Deep Learning‖, Springer.
3. Dan Roth, Zachary Lipton, and Been Kim, ―Explainable AI: Foundations, Developments, Prospects‖, MIT Press (Online forthcoming).

Reference Books:

1. Marco Tulio Ribeiro et al., ―Why Should I Trust You?‖ (LIME) – Research Paper
2. Scott Lundberg et al., ―A Unified Approach to Interpreting Model Predictions‖ (SHAP) – NIPS
3. A. Barredo Arrieta et al., ―Explainable Artificial Intelligence (XAI): Concepts, Taxonomies,

Opportunities and Challenges‖, Information Fusion Journal.
4. Zachary C. Lipton, —The Mythos of Model Interpretability‖ – Communications of the ACM

Web References:

1. https://www.coursera.org/specializations/explainable-artificial-intelligence-xai
2. HarvardX – Data Science: Machine Learning Interpretability

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

AI IN CYBER SECURITY (AICS)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM403	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand AI principles and their relevance in Cyber Security.
CO2:	Apply machine learning techniques to detect and respond to threats.
CO3:	Analyze security incidents using intelligent tools and models.
CO4:	Evaluate and implement AI models for malware detection and anomaly analysis.
CO5:	Design AI- based cyber Security frameworks for real-world scenarios.

UNIT– I

Introduction to AI in Cyber Security: Role of AI in Modern Cyber Security, Overview of Cyber Threats and Attack Vectors, Fundamentals of Machine Learning for Security, AI vs Traditional Security Techniques, AI-Based Cyber Defense Lifecycle, Threat Intelligence with AI, Cyber security Data Types and Challenges, Case Studies of AI-Driven Attacks and Defenses.

UNIT– II

Machine Learning for Cyber Threat Detection: Supervised Learning for Intrusion Detection, Unsupervised Learning for Anomaly Detection, Feature Engineering from Network Traffic, Classification Algorithms: SVM, Decision Trees, Random Forests, Clustering Techniques: K-Means, DBSCAN, Ensemble Models and Model Evaluation Metrics, Real-Time Threat Detection Pipelines, Data Imbalance and Adversarial Sampling.

UNIT– III

Deep Learning in Cyber Security: Neural Networks for Threat Classification, CNNs for Malware Detection from Binary Files, RNNs/LSTMs for Sequential Log Analysis, Auto encoders for Anomaly Detection, GANs in Malware Evasion and Defense, Transfer Learning for Threat Signature Extraction. **Deep Learning vs Traditional Models:** A Comparative Study, Real-World Use Cases and Limitations.

UNIT– IV

AI for Specific Security Domains: AI for Phishing and Spam Detection, AI in Cloud Security and Edge Devices, Botnet and DDoS Attack Detection**,** AI-Driven Endpoint Security, Natural Language Processing for Threat Intelligence, Behavioral Biometrics and Fraud Detection, AI in Social Engineering Attack Prevention, Security Information and Event Management (SIEM) with AI.

UNIT– V

Challenges, Ethics & Future of AI in Cyber Security: Explainable AI (XAI) in Cyber Security, Adversarial Attacks and Defenses in AI Systems, Data Privacy and Federated Learning, Legal and Ethical Issues in AI Security Solutions, AI Model Bias and Fairness in Security Decisions, Securing AI Models Against Manipulation, Building Scalable AI-Powered SOCs, Future Trends: Autonomous Security, AI-Augmented Threat Hunting.

Text Books:

1. Clarence Chio & David Freeman, Machine Learning and Security, O'Reilly Media.

2. Xiaofeng Chen et al., Artificial Intelligence and Big Data Analytics for Cyber Security , Springer.

3. Mark Stamp, Information Security: Principles and Practice‖, Wiley.

4. Brandon Dixon & Justin Bingham – AI in Cyber Security, Packt Publishing

Reference Books:
1. Sumeet Dua & Xian Du, Data Mining and Machine Learning in Cyber Security, CRC Press.
2. Shai Shalev-Shwartz & Shai Ben-David, ―Understanding Machine Learning‖, Cambridge University Press.
3. Zhiwei Lin & Yang Xiang, Cyber Security Intelligence and Analytics‖, Springer.
4. Bhavani Thuraisingham, Data Mining for Malware Detection‖, CRC Press.
Web References:
1. Coursera – AI for Cyber Security‖ by University of Colorado.
2. Udemy – Machine Learning for Cyber Security.
Question Paper Pattern:
Sessional Examination: 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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

AI-DRIVEN SOFTWARE ENGINEERING & DEVOPS(AISED)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM404	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand AI's role in modern software development and operations.
CO2:	Apply machine learning techniques to automate software engineering tasks.
CO3:	Design and manage intelligent CI/CD and DevOps workflows.
CO4:	Evaluate AI tools in software testing, refactoring, and monitoring.
CO5:	Implement AI-based solutions for predictive maintenance and decision support in DevOps.

UNIT– I

Foundations of AI in Software Engineering: Overview of Traditional vs AI-driven Software Development, AI Opportunities in Software Lifecycle Phases, Introduction to ML/DL Models in Engineering Tasks, Code Representation and Learning from Code, NLP for Source Code Understanding, Software Knowledge Graphs and Reasoning, Datasets and Benchmarks for Software Engineering AI, Case Studies of AI-Enhanced Development Tools.

UNIT– II

AI in Code Generation and Refactoring: Program Synthesis and Code Completion Models, Large Language Models (e.g., Codex, CodeBERT) in IDEs, Code Clone Detection and Automated Refactoring Learning-Based Bug Detection and Code Smell Identification, AI in Software Architecture Recommendations Embedding Techniques for Source Code.

UNIT– III

Intelligent Testing, QA, and Debugging: Test Case Generation Using AI, Automated Unit Testing, Regression Testing with ML, Learning Bug Patterns from Repositories, AI-Based Static and Dynamic Code Analysis, Fault Localization and Automated Debugging.

UNIT– IV

AI in DevOps Automation and CI/CD: DevOps Fundamentals and Integration with AI, Intelligent CI/CD Pipeline Design, Predictive Build Failure and Log Analysis, AI in Infrastructure-as-Code and Deployment Orchestration, Self-Healing, Systems and AIOps Concepts, Log Analytics and Anomaly, DevSecOps and AI for Security Automation.

UNIT– V

Advanced Topics and Ethical Considerations: Explainability and Transparency in AI-driven tools, Ethical and Legal Aspects in Automated Engineering**,** Human-AI Collaboration in Software Teams, Risk Management in Autonomous Code Deployment, AI for Technical Debt Prediction and Management, AI for Developer Productivity Analytics.

Text Books:

1. Tim Menzies, Diomidis Spinellis, and Thomas Zimmermann, ―Perspectives on Data Science for Software Engineering‖, Morgan Kaufmann.
2. André van der Hoek, Reid Holmes, Software Engineering for Machine Learning, Springer.
3. Len Bass, Ingo Weber, Liming Zhu, DevOps: A Software Architect's Perspective, Addison-Wesley.

Reference Books:

1. Carlos Eduardo Parnin et al., AI for Software Engineering: Foundations, Advances, and Trends, Springer.
2. Luciano Baresi et al., Machine Learning Techniques for Software Quality Evaluation, Springer.

3. Gene Kim, Jez Humble, and Nicole Forsgren, Accelerate: The Science of Lean Software and DevOps, IT Revolution.

Web References:

1. Coursera – ―AI for Software Engineering‖ by DeepLearning.AI
2. edX – ―DevOps for Developers‖ by Microsoft
3. GitHub Copilot and OpenAI Codex documentation
4. PapersWithCode – AI for Software Engineering benchmarks
5. MIT OCW – ―Software Systems‖ and ―DevOps and CI/CD
6. Udemy – ―AI-Powered DevOps Pipelines and Automation
7. Google Cloud – AIOps and MLOps tutorials

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

AI FOR ROBOTICS (AIR)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM405	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Provide foundational knowledge in Generative AI and its core architectures.
CO2:	Explore applications of generative models in text, image, and audio domains.
CO3:	Equip students with hands-on experience in training and fine-tuning generative models.
CO4:	Teach techniques for deploying AI models efficiently and securely in real-world settings.
CO5:	Analyze the ethical, interpretability, and security concerns surrounding generative models.

UNIT– I

Foundations of Generative AI: Introduction to Generative AI: Concepts, Use Cases, Types of Generative Models: GANs, VAEs, Diffusion, Autoregressive, Mathematical Foundations: Probabilistic Modeling & Latent Spaces, Generative Loss Functions: Adversarial Loss, KL Divergence, ELBO, Model Training Challenges: Mode Collapse, Posterior Collapse, Tools & Libraries: PyTorch, Tensor Flow, Hugging Face Transformers, Evaluation Metrics: FID, BLEU, Perplexity, Case Studies of Generative AI Systems.

UNIT– II

Generative Modeling for Text, Images, and Audio: Transformer Models: GPT, T5, BERT for Text Generation, Vision Models: StyleGAN, DALL·E, Stable Diffusion, Audio Generation: WaveNet Jukebox, Voice Cloning, Multi-modal Generation: CLIP, Flamingo, BLIP, Prompt Engineering & Controlled Generation, Fine-Tuning & LoRA Techniques, Evaluation Techniques for Generated Media,Comparison of Open vs Proprietary Foundation Models.

UNIT– III

Model Serving and Deployment Essentials: Overview of AI Deployment Pipelines, Model Packaging: ONNX, TorchScript, SavedModel, REST & gRPC API Serving using FastAPI, Flask, Triton Inference, Batch vs Real-time Inference, Asynchronous Processing, Containerization & Orchestration with Docker and Kubernetes, Cloud Deployment: AWS SageMaker, GCP Vertex AI, Azure ML, Cost Optimization and Resource Management, Edge AI: TinyML, Mobile Deployment using TensorFlow Lite, CoreML.

UNIT– IV

MLOps and Model Lifecycle Management: MLOps Lifecycle: Versioning, Experiment Tracking, **CI/CD for ML:** GitHub Actions, Jenkins, MLflow, Model Monitoring & Drift Detection, Logging and Metrics using Prometheus, Grafana, Auto-scaling and Load Balancing of Inference Services, Continuous Training and Feedback Loops, Model Governance and Audit Trails, Role of Explainability in Deployment.

UNIT– V

Challenges and Responsible Deployment: Interpretability of Generative Models, Security and Adversarial Attacks on Generative Models, Bias, Fairness, and Harmful Content Generation, Privacy-Preserving Techniques: Differential Privacy, Federated Learning, Ethical and Legal Frameworks for Generative AI, Open Source vs Proprietary Models: Deployment Implications, Responsible AI Guidelines & Compliance (GDPR, EU AI Act), Capstone: End-to-End Generative Model Deployment Project.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, ―Deep Learning‖, MIT Press.
2. Aurélien Géron, ―Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow‖,

O'Reilly Media.

3. O‘Reilly, —Generative Deep Learning‖ by David Foster.

Reference Books:

1. Packt Publishing, —Practical Deep Learning‖ by Ronald T. Kneusel.
2. “Transformers for Natural Language Processing” by Denis Rothman.
3. “Machine Learning Engineering” by Andriy Burkov.

Web References:

1. Coursera – —Generative AI with Large Language Models‖ by DeepLearning.AI
2. Hugging Face Course – https://huggingface.co/learn
3. Fast.ai – —Practical Deep Learning for Coders‖
4. YouTube – Full Stack Deep Learning by Berkeley AI
5. AWS Machine Learning University – Model Deployment
6. TowardsDataScience and PapersWithCode – Latest research & code repositories

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

MLOPS & AI MODEL DEPLOYMENT (MLOPS)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM406	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Illustrate the lifecycle and pipeline components of MLOps and implement basic version control and orchestration for ML workflows.
CO2:	Package ML models using appropriate tools and deploy them using Docker and Kubernetes environments with effective resource management.
CO3:	Develop and deploy machine learning models as APIs using FastAPI/Flask and configure for real-time or batch inference scenarios.
CO4:	Monitor and log ML systems using modern tools and detect data/model drift with strategies for continuous evaluation and feedback.
CO5:	Implement end-to-end MLOps solutions using cloud platforms and CI/CD tools, and analyze deployment challenges in real-world use cases.

UNIT– I

Introduction to MLOps and Deployment Pipelines: Definition and need of MLOps, ML system lifecycle and pipeline components, DevOps vs. MLOps: key differences, CI/CD for ML projects, Data versioning and model lineage, Introduction to DVC, Git, and MLFlow, Workflow orchestration using Apache Airflow, Automated testing in ML pipelines

UNIT– II

Model Packaging and Environment Management: Packaging ML models using Pickle, Joblib, ONNX, Python virtual environments, Conda, Pipenv, Introduction to Docker for ML workloads, Building Dockerfiles for ML apps, Using Kubernetes for orchestration, Security, logging, and resource management, Docker Compose and Helm charts for deployment, Hands-on: Containerize and deploy a scikit-learn model.

UNIT– III

Model Serving and APIs: RESTful API design for ML models, Model deployment using FastAPI and Flask, TensorFlow Serving, TorchServe basics, Introduction to gRPC for ML deployment, Asynchronous inference and batch vs real-time serving, Load testing and benchmarking, Authentication and authorization in model APIs, Deploying models on edge devices

UNIT– IV

Monitoring, Logging, and Continuous Evaluation: Importance of monitoring and alerting in MLOps, Data drift and model drift detection, Logging prediction results and metadata, Prometheus, Grafana, and ELK Stack, A/B testing and canary deployments, Shadow deployments and rollback strategies, Feedback loops for continuous learning, Integration with external monitoring tools.

UNIT– V

Cloud-native MLOps and Case Studies: ML deployment on AWS SageMaker, Azure ML, Google AI Platform, CI/CD using GitHub Actions, Jenkins, and GitLab CI, AutoML and model registry, Real-world case study: End-to-end MLOps pipeline, Challenges and limitations in enterprise ML deployment, Responsible AI in production systems, Future trends in MLOps, Capstone Project Planning

Text Books:

1. Introducing MLOps: How to Scale Machine Learning Projects with DevOps Tools – Mark

Treveil, Alok Shukla, O'Reilly Media.

2. Machine Learning Engineering – Andriy Burkov, TrueShelf Publishing.

3. Designing Machine Learning Systems – Chip Huyen, O'Reilly Media.

Reference Books:

1. Practical MLOps – Noah Gift, O'Reilly Media

2. Kubeflow for Machine Learning – Trevor Grant et al., O'Reilly

3. Hands-On MLOps: Implement Machine Learning in Production – Munn, Meza, Vohra, Packt Publishing

4. Research papers from arXiv, MLSys Conference, and ICML Industry Track

Web References:

3. Coursera MLOps Specialization (DeepLearning.AI)
4. MLOps: Continuous delivery and automation pipelines in ML (Google Cloud)
5. Ultimate DevOps to MLOps Bootcamp (Udemy)
6. MLOps Engineering on AWS (AWS Training)
7. Build your first MLOps workflow with Azure ML (Microsoft Learn)

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

DATA WRANGLING(DWRG)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
CM407	PE	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours					End Exam Duration: 3 Hours			

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

CO1:	Understand and apply core data wrangling techniques.
CO2:	Clean, transform, and reshape data using Python and SQL.
CO3:	Handle missing values, data inconsistencies, and outliers.
CO4:	Merge and join multiple datasets from different sources.
CO5:	Automate data pipelines and preprocessing workflows for analytics and ML.

UNIT– I

Introduction to Data Wrangling and Data Acquisition: Introduction to Data Wrangling: Importance and Use Cases , Types of Data: Structured, Semi Structured, Unstructured, Data Acquisition Techniques: APIs, Web Scraping, Reading Data from CSV, Excel, JSON, XML, Using Python libraries: pandas, requests, Beautiful Soup.

UNIT– II

Handling Missing, Noisy, and Inconsistent Data: Identifying and Understanding Missing Data, Techniques for Imputing Missing Values, Handling Inconsistent Data: Dates, Texts, Units, Removing Duplicates and Irrelevant Data.

UNIT– III

Data Transformation and Feature Engineering: Data Type Conversion and Parsing, Feature Extraction from Text, Dates, and Strings, One-Hot Encoding, Label Encoding, Binning and Discretization, Data Aggregation and Grouping, Pivoting.

UNIT– IV

Data Integration, Joining, and Workflows: Merging and Joining Datasets (Inner, Outer, Left, Right), Concatenation and Appending DataFrames, Data Consistency and Referential Integrity, Resolving Schema Mismatches, Designing Reusable Data Wrangling Functions.

UNIT– V

Tools, Libraries, and Case Studies in Data Wrangling: Pandas and NumPy Advanced Techniques, Pyjanitor, Dask, and Polars for Efficient Wrangling, Using OpenRefine for Data Cleaning, SQL vs NoSQL in Data Wrangling, Real-world Wrangling.

Text Books:

1.M. Heydt – Data Wrangling with pandas, O'Reilly Media

2.Hadley Wickham – R for Data Science (Data Wrangling Chapters), O'Reilly

3. J. VanderPlas – Python Data Science Handbook, O'Reilly Media.

Reference Books:

1.Wes McKinney – Python for Data Analysis, O'Reilly

2. Cathy O'Neil and Rachel Schutt – Doing Data Science, O'Reilly

3. David Mertz – Cleaning Data for Effective Data Science, Packt

Web References:
1.Data Wrangling with pandas (Datacamp): https://www.datacamp.com/courses/datamanipulation-with-pandas
2.Coursera: Data Wrangling, Analysis and AB Testing with SQL – https://www.coursera.org/learn/data-wrangling-analysis-abtesting
Question Paper Pattern:
Sessional Examination: 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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

HEALTHCARE AI (HAI)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM408	PE	3	0	0	3	30	70	100

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

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

CO1:	Understand and explain the challenges involved in mining large-scale datasets.
CO2:	Apply efficient algorithms for clustering, classification, and association rule mining in big data environments.
CO3:	Analyze and implement scalable solutions using frameworks such as MapReduce, Hadoop, and Spark.
CO4:	Solve real-world problems involving link analysis, recommendation systems, and mining of Web/social data.
CO5:	Critically evaluate algorithms based on scalability, efficiency, and effectiveness in large Datasets.

UNIT– I

Introduction to Massive Data and MapReduce Model: Types of Massive Data – Structured, Unstructured, and Semi-Structured, Challenges of Mining Massive Data Sets, Storage Systems – Distributed File Systems, HDFS, Introduction to MapReduce Programming Model, Designing MapReduce Algorithms.

UNIT– II

Frequent Itemset and Association Rule Mining: Market Basket Model, A-Priori Algorithm – Scalable Variants, Handling Large Datasets in Frequent Pattern Mining, Park-Chen-Yu Algorithm, SON Algorithm, Multistage and Multihash Algorithms.

UNIT– III

Clustering and Classification Techniques: Hierarchical and Partitional Clustering, K-Means Clustering and its Scalability, Decision Trees and Rule-Based Classification, Naïve Bayes Classifier for Large Datasets, Logistic Regression and Parallel Clustering Techniques.

UNIT– IV

Link Analysis and Mining of Web/Social Networks: Web Graph Structure and Crawling, PageRank and its Variants, Link Spam Detection, Community Detection in Large Graphs, Mining Social Network Graphs, Recommendation Systems – User-Based and Item-Based Collaborative Filtering.

UNIT– V

Frameworks and Real-World Applications: Introduction to Apache Spark and RDDs, Spark MLlib for Data Mining, Streaming and Real-Time Data Analysis, Mining on Cloud Platforms (AWS, GCP, Azure), Case Study: E-commerce, Finance, and Healthcare.

Text Books:

1. "Mining of Massive Datasets" by Jure Leskovec, Anand Rajaraman, and Jeffrey Ullman
2. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei
3. "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems" by Nathan Marz and James Warren

Reference Books:

1. "Big Data Analytics with Spark" by Mohammed Guller
2. "Hadoop: The Definitive Guide" by Tom White

3. "Practical Machine Learning with Spark" by Ajay Ohri

4. IEEE/ACM Journals and Conference Proceedings on Data Mining and Big Data

Web References(Online Courses):

1. Mining Massive Datasets – Stanford University (Coursera)

2. Big Data Analysis with Apache Spark – edX (BerkeleyX)

3. Data Mining Specialization – University of Illinois (Coursera)

Question Paper Pattern:

Sessional Examination:

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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

AI FOR SMART CITIES & IOT SYSTEMS(AISC)

VII Semester: CSM						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CM409	PE	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hours						End Exam Duration: 3 Hours		

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

CO1:	Understand the architecture and components of smart cities powered by AI and IoT.
CO2:	Analyze and design AI-driven solutions for transportation, energy, healthcare, waste management, and smart governance.
CO3:	Deploy IoT systems that integrate sensors, edge devices, and AI models.
CO4:	Evaluate and implement data-driven smart systems ensuring privacy, efficiency, and sustainability.
CO5:	Leverage cloud platforms and edge computing for scalable AIoT applications in urban environments.

UNIT– I

Introduction to AI in Smart Cities and IoT Systems: Smart City Concepts: Components, Infrastructure, and Urban Needs, Overview of IoT and AI Integration, Smart City Frameworks (India, Singapore, EU, etc.), IoT Architecture: Sensing, Network, Processing, and Application Layers, Role of AI in Urban Planning and Resource Optimization, Case Studies on AI in Smart Cities, Edge, Fog, and Cloud Computing Concepts for Smart Systems.

UNIT– II

AI Applications in Smart Transportation and Mobility: Traffic Monitoring and Congestion Prediction using AI, Intelligent Traffic Signal Control using Reinforcement Learning, Autonomous Vehicles and AI Algorithms, Vehicle Detection and License Plate Recognition using CV, Public Transport Optimization using Predictive Analytics, Smart Parking and Navigation Systems, Use of Drones and AI for Traffic Surveillance.

UNIT– III

AI and IoT for Smart Energy, Waste, and Water Management: AI for Smart Grids and Energy Consumption Prediction, Load Balancing and Demand Forecasting using ML, Waste Segregation and Collection Automation using CV, Water Quality Monitoring Systems using IoT Sensors, Leak Detection and Anomaly Detection Models, Smart Metering and Energy Theft Detection, Sustainability and Carbon Monitoring AI Models.

UNIT– IV

Smart Healthcare, Surveillance, and Public Safety: IoT-based Health Monitoring and Alert Systems, Predictive Healthcare and Disease Outbreak Detection, AI for CCTV Surveillance, Crowd Monitoring, and Violence Detection, NLP for Emergency Response and Chatbot Assistance Smart Ambulance Routing and Response Optimization, COVID-19 Contact Tracing and Monitoring via AI & IoT, Data Privacy, Security & Ethical Issues in Surveillance Systems.

UNIT-V

AIoT System Design, Deployment, and Governance: AI Model Deployment on Edge Devices Raspberry Pi, Jetson Nano), Smart City Dashboards and Data Visualization, Real-time Streaming and Analytics Platforms (Apache Kafka, Spark),Cloud Integration, AWS IoT, Google Cloud AI, Azure IoT Suite, Governance Frameworks, Data Privacy, and Policy Standards, Evaluation Metrics for Smart City Projects, Future Trends in AIoT and Smart Urban Living.

Text Books:
1. Pethuru Raj & Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
2. Janaka Ekanayake, Smart Grid: Technology and Applications, Wiley.
3. Rajkumar Buyya, Fog and Edge Computing: Principles and Paradigms, Wiley.
4. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley.
Reference Books:
1. Mahalik N. P., Sensor Networks and Applications, McGraw Hill.
2. Kim F. Taylor, Urban Artificial Intelligence and Governance, Springer
3. Dastbaz, J. & Pattinson, C., Smart Cities: Innovation and Sustainability, Springer.
4. Research papers from IEEE Smart Cities, AIoT Journal, and Springer Urban Tech.
Web References:
1 .https://www.microsoft.com/en-us/ai/ai-iot-smart-city
2. https://www.ibm.com/blogs/internet-of-things/iot-smart-cities/
1. https://developer.nvidia.com/embedded/jetson-ai-projects
2. https://link.springer.com/search?query=AI+smart+city
Question Paper Pattern:
Sessional Examination: 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 contains five short answer questions (2 marks each) for a total of ten marks. Remaining three questions shall be EITHER/OR type descriptive questions for ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of twenty marks, with two short answer questions from each unit. Remaining five questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR type descriptive questions and may contain sub-questions.

BUSINESS ETHICS AND CORPORATE GOVERNANCE(BECG)								
VII 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**
HSM401	**BS&H**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hours						**End Exam Duration: 3 Hours**		

Course Outcomes: At the end of the course, students will be able to	
CO1:	Understand loyalty and ethics identify different ethical frameworks, and analyze ethical challenges in management crises.
CO2:	Understand ethics in management, compare professional vs. technical ethics, and cultivate ethical values personally and organizationally.
CO3:	Understand corporate culture, its core elements, and how leadership influences it.
CO4:	Apply law and ethics to analyze fair trade and environmental protection practices.
CO5:	Apply corporate governance codes, analyze stakeholder roles, and implement CSR in India.

UNIT– I

ETHICS: Introduction – Meaning– Nature, Scope, significance, Loyalty, and ethical behavior. Value Systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management –Corporate Social Responsibility– Issues of Management – Crisis Management.

UNIT– II

ETHICS IN MANAGEMENT: Introduction: Ethics in production, finance, Human resource management and Marketing Management – The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

UNIT– III

CORPORATE CULTURE: Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

UNIT– IV

LEGAL FRAMEWORK: Law and Ethics - Agencies enforcing Ethical Business Behaviour -Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and Wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

UNIT– V

CORPORATE GOVERNANCE: Introduction - Meaning– Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory framework – Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee – Various committees - Reports- Benefits and Limitations.

Text Books:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference Books:

1. Dr.K. Nirmala, Karunakara Readdy. Business Ethics and Corporate Governance, HPH
2. R. Machiraju: Corporate Governance, HPH,2013
3. K. Venkataramana, Corporate Governance, SHBP.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/

Question Paper Pattern:

Sessional Examination:

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 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and may contain sub-questions.

E-BUSINESS

VII 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
HSM402	BS&H	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 concept of e-business, compare it with e-commerce, and evaluate its industry opportunities.
CO2:	Understand business models, compare portal types, and analyze B2B, B2C, and B2G models.
CO3:	Analyze electronic payment systems by understanding EFT, smart cards, debit, and credit cards.
CO4:	Evaluate e-security measures by understanding security protocols, public networks, and digital signatures.
CO5:	Apply online marketing concepts and compare e-CRM and e-SCM.

UNIT – I

Electronic Business Introduction: Nature, meaning, significance, functions, and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)- Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

UNIT – II

Electronic Markets and Business Models: Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models-Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

UNIT – III

Electronic Payment Systems: Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

UNIT – IV

E-Security: Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

UNIT – V

E-Marketing: Introduction: Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research–E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (E-CRM) E-supply chain management (E-SCM)

Text Books:

1. Arati Oturkar & Sunil Khilari. E-Business. Everest Publishing House, 2022

2. P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011
Reference Books:
1. Debjani, Kamalesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey. E-Commerce E-Management, Second Edition, Pearson, 2012.
3. Henry Chan. E-Commerce Fundamentals and Application, Raymond Leatham Wiley India 2007
4. S. Jaiswal. E-Commerce Galgotia Publication Pvt Ltd., 2003.
Online Learning Resources
1. https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
2. https://www.slideshare.net/VikramNani/e-commerce-business-models
3. https://www.slideshare.net/RiteshGoyal/electronic-payment-system
4. https://www.slideshare.net/WelingkarDLP/electronic-security
5. https://www.slideshare.net/Ankitha2404/emarketing-ppt
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.

MANAGEMENT SCIENCE(MS)								
VII Semester: Common to all branches						**Scheme:2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L/D	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
HSM403	**BS&H**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hours						**End Exam Duration:3 Hours**		

Course Outcomes: After the completion of the course students will be able to	
CO1:	Understand core management concepts, theories, organizational structures, and the role of social responsibility for effective management.
CO2:	Understand the essential operations management principles and apply marketing mix strategies in the industry.
CO3:	Understand key HRM concepts and functions and apply these practices to effectively manage the complete employee lifecycle within an organization.
CO4:	Apply SWOT analysis, PERT, and CPM techniques to strengthen project strategy formulation
CO5:	Apply the advanced management systems to enhance organizational quality, efficiency, innovation, and social responsibility.

UNIT – I

INTRODUCTION TO MANAGEMENT: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor‘s Scientific Theory-Henry Fayols’ principles - Elton Mayo‘s Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT – II

OPERATIONS MANAGEMENT: Principles and Types of Plant Layout -Methods of Production (Job, batch, and Mass Production), Work Study - Statistical Quality Control- **Material Management**: Objectives - Inventory- Functions - Types, Inventory Techniques - EOQ-ABC Analysis.

Marketing Management: Concept-Meaning-Nature-FunctionsofMarketing-MarketingMix-Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

UNIT – III

HUMAN RESOURCES MANAGEMENT (HRM):HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection -Process -Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

UNIT – IV

STRATEGIC& PROJECT MANAGEMENT: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process – Environmental Scanning-Steps in Strategy Formulation and Implementation –SWOT Analysis- Project Management - Network Analysis - Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM)Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT – V

CONTEMPORARY ISSUES IN MANAGEMENT: Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement

and retention - Business Process Re- engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.

Text books:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

References:

1. Stoner, Freeman, Gilbert. Management, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, Essentials ofManagement,6/e, TMH, 2005.
3. Thomas N.Duening & JohnM. Ivancevich, Management Principles and Guidelines, Biztantra
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.

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 contains Five short answer questions (2 marks each) for a total of Ten marks. Remaining Three questions shall be EIHER/OR Type descriptive questions for Ten marks each. Each of these descriptive 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 short answer questions (2 marks each) for a total of Twenty marks, with Two short answer questions from each unit. Remaining Five Questions (Each question covering one unit of syllabus) carrying 10 marks each shall be EITHER/OR Type descriptive questions and 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:

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Open Elective – II

S. No.	Course Name	Offering Department	Eligible Branches
1	Disaster Management	CE	All Branches
2	Sustainability In Engineering Practices	CE	All Branches
3	Renewable Energy Sources	EEE	All Branches Except EEE
4	Automation and Robotics	ME	All Branches Except ME
5	Product Lifecycle Management	ME	All Branches Except CE
6	Digital Electronics	ECE	All Branches Except ECE
7	Foundations of Operating Systems	CSE	CE, EEE, ME and ECE
8	Foundations of Machine Learning	CSE	CE, EEE and ECE
9	Web Technologies	CSE	CE, EEE, ME and ECE
10	Introduction to Information Systems	CSE	CE, EEE, ME and ECE
11	Optimization Techniques	HBS	All Branches Except ME
12	Physics of Electronic Materials and Devices	HBS	All Branches
13	Chemistry of Polymers and Applications		
14	Academic Writing and Public Speaking		
15	Mathematical Foundation of Quantum Technologies		

DISASTER MANAGEMENT (DM)

VI Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE601	OE-II	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 definitions and terminologies used in disaster management.
CO2:	Understand the types and categories of disasters.
CO3:	Understand the impact of disasters on socio-economic and environment.
CO4:	Plan for disaster risk reduction, mitigation and management strategies.
CO5:	Understand the relationship between development and disasters.

UNIT – I

Introduction: Concepts and definitions: disaster, hazard, vulnerability, risks, severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT – II

Disasters: Disasters classification

Natural Disasters: Floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.

Manmade Disasters: Industrial pollution – Artificial flooding in urban areas –Nuclear radiation – Chemical spills – Transportation accidents – Terrorist strikes, etc. – Mountain and coastal areas.

UNIT – III

Disaster Impacts: Disaster impacts –Environmental, physical, social, ecological, economic, political, etc., Health - psycho-social issues – Demographic aspects – Hazard locations – Global and national disaster trends – Climate change and urban disasters.

UNIT – IV

Disaster Risk Reduction:

Disaster Management Cycle - its phases: Prevention, mitigation, preparedness, relief and recovery – Risk analysis, vulnerability and capacity assessment – Early warning systems.

Post-Disaster Environmental Response (i.e. water, sanitation, food safety, waste management, disease control, security, and communications): Role and responsibilities of government, community, local institutions, NGOs and other stakeholders – Policies and legislation for disaster risk reduction – Activities of National Disaster Management Authority.

UNIT – V

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications – Sustainable and environmental friendly recovery – Reconstruction and development methods.

Text Books:

3. PradeepSahni, Disaster Risk Reduction in South Asia, PHI, New Delhi.
4. Ghosh G.K., Disaster Management, APH Publishing Corporation.
5. Singh B.K., Handbook of Disaster Management Techniques &Guidelines, Rajat Publication.

6. V. K. Sharma, Disaster Management, National Centre for Disaster Management, IIPE, Delhi

Reference Books:

6. A Status Report Publication of the Govt. of India, Ministry of Home Affairs, National Disaster Management Division, Disaster Management in India.

7. A. S. Arya, Anup Karanth, and Ankush Agarwal, Hazards, Disasters and Your Community; A Primer for Parliamentarians, GOI–UNDP Disaster Risk Management Programme.

8. Interagency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC.

Online Learning Resources:

4. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

5. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

6. www.odihpn.org, Disaster Preparedness Programme in India. A Cost Benefit Analysis, Commissioned and Published by the Humanitarian Practice Network 'at ODI HPN.

7. www.empowerpoor.org, Drought in India: Challenges and Initiatives; Poorest Areas in Civil Society (PACS) Programme. [2001–2008]

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.

SUSTAINABILITY IN ENGINEERING PRACTICES (SIE)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE602	OE-II	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 fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
CO2:	Analyze sustainable construction materials, their durability, and lifecycle assessment.
CO3:	Apply Energy Calculations in construction materials and assess the embodied energy.
CO4:	Evaluate green building standards, energy codes, and performance ratings.
CO5:	Assess the environmental effects of energy use, climate change, and global warming.

UNIT – I

Introduction: Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO2Contribution From Cement and Other Construction Materials.

UNIT – II

Materials Used in Sustainable Construction: Construction Materials and Indoor Air Quality-No/Low Cement Concrete-Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT – III

Energy Calculations: Components of Embodied Energy-Calculation of Embodied Energy for Construction Materials-Energy Concept and Primary Energy-Embodied Energy Via-A-Vis Operational Energy in Conditioned Building -Lifecycle Energy Use.

UNIT – IV

Green Buildings: Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building.

UNIT – V

Environmental Effects: Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

Text Books:

1. Charles J kibert Sustainable Construction: Green Building Design & Delivery,4th Edition, Wiley Publisher 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK,2016.

Reference Books:

1. Carig A.Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods& Techniques (3e),Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105157/

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.

RENEWABLE ENERGY SOURCES (RES)

VI 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
OE603	OE-II	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 principle operation of various renewable energy sources.
CO2:	Identify site selection of various renewable energy sources.
CO3:	Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomass, Tidal Wave and Fuel cell energies.
CO4:	Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems
CO5:	Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT – I

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT – II

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT – III

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT – IV

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT – V

Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Biomass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration.

Fuel Cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text Books:

1. G. D. Rai, “Non-Conventional Energy Sources”, 4th Edition, Khanna Publishers, 2000.

2. Chetan Singh Solanki "Solar Photo voltaics fundamentals, technologies and applications" 2nd Edition PHI Learning Private Limited. 2012.

Reference Books:

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.

2. S. P. Sukhatme, "Solar Energy", 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.

3. B H Khan,"Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

4. S. Hasan Saeed and D.K.Sharma, "Non-Conventional Energy Resources", 3rd Edition, S.K.Kataria& Sons, 2012.

5. G. N. Tiwari and M.K.Ghosal, —Renewable Energy Resource: Basic Principles and Applications, Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

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.

AUTOMATION AND ROBOTICS (ART)

VI 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
OE604	OE-II	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 fundamentals of automation, manufacturing systems and automation hardware.
CO2:	Analyze automated flow lines and apply assembly line balancing methods.
CO3:	Classify robots, joints, actuators, and sensors used in robotic systems.
CO4:	Solve basic manipulator kinematics using transformation matrices.
CO5:	Explain the robot programming method and its applications.

UNIT – I

Introduction to Automation: Notion of Automation, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT – II

Automated Flow Lines: Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – III

Introduction to Robotics: Definition of Robot, Classification of Robot configurations, Types of Joints, degrees of freedom, End effectors, types of end effectors, Grippers-Mechanical grippers, Vacuum cups, magnetic grippers, Tools.

Robot Actuators and Feedback Components: Electrical Actuators (Variable Reluctance stepper motor, Permanent magnet stepper motor), Hydraulic and Pneumatic actuators. Position sensors–Potentiometer, Resolvers, Encoders. Velocity sensors, Tactile sensors, Proximity sensors.

UNIT – IV

Manipulator Kinematics: Introduction to manipulator kinematics, position representation, forward transformation and reverse transformation of two degree freedom robot arm, three degree of freedom arm in two dimensions, four degree freedom manipulators in three dimension, 3×3 Rotation matrix, Homogeneous transformation matrix and D – H notation matrix.

UNIT – V

Robot Programming: Methods of robot programming- Lead through- WAIT, SIGNAL and delay commands; The textual robot programming languages, robot language structures, constants, variables and other data objects, motion commands, end effectors, sensors commands and monitor mode commands.

Robot Applications in Manufacturing: Material transfer and machine loading and unloading general considerations in material handling.

Processing Operations: Spot welding, continuous arc welding, spray coating, and other processing operations. Assembly and Inspection.

Text Books:

1. M P Groover, Automation , Production systems and Computer Integrated Manufacturing, Pearson Education, India

2. Mickel P Groover et. al, Industrial Robotics- Technology, Programming and Applications, McGraw Hill Publishers, New Delhi.

3. Deb S.R., Robotics Technology and Flexible Automation, TMH Publishers, New Delhi.

Reference Books:

1. Richard D. Klafter, Robotic Engineering: An Integrated Approach, Pearson Publications, New Jersy.

2. K. S. Fu, Ralph C. Gonzalez and C.S.G. Lee, Robotics, control, sensing, vision, Mc Graw Hill, New York.

3. Ashitava Ghosal, Robotics fundamental concepts and analysis, Oxford Higher Education, India

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.

PRODUCT LIFECYCLE MANAGEMENT (PLM)

VI 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
OE605	OE- II	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 Product life cycle management process.
CO2:	Understand different steps in Product development process.
CO3:	Get knowledge on Product data management
CO4:	Understand the implementation of PLM and its impact on the organization
CO5:	Understand core functions of PLM and supply chain and ERP systems

UNIT – I

Organization Business Models **(**MTS, MTO, CTO, ETO Etc), Basics of Enterprise Systems (PLM, ERP, MES), Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Components / Elements of PLM, Emergence of PLM, Significance of PLM, Differences between PLM and PDM

UNIT – II

Integrated Product development process-Conceive-Specification, Concept design, Design-Detailed design, Validation and analysis (Simulation), Tool design, Realize-Plan manufacturing, Manufacture, Build/Assemble, Test(quality check).

UNIT – III

Workflow Processes, Design Collaboration, Processes Management, Document Management, Visualization, Bill of Materials (BOM) Management – Lab exercises.

UNIT – IV

Engineering Change Control, Configuration Management, Manufacturing Process Management, Variant Management, Classification PLM Architecture, Various PLM tools, Data Modeling, Security management.

UNIT – V

CAD Integrations, Information authoring tools (e.g., MCAD, ECAD, Technical publishing), Core functions (e.g., data vaults), Data Flow to Other systems such as Supply chain and ERP systems. (4 hours for lab exercises)

Text Books:

1. Grieves, Michael, Product Lifecycle Management, McGraw-Hill publishers.
2. Antti Saaksvuori and Anselmi Immonen, Product Life Cycle Management, Springer publications

Reference Books:

1. Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill International
2. Burden, Rodger PDM: Product Data Management, Resource Publications.

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.

DIGITAL ELECTRONICS (DE)

VI 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
OE606	OE-II	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : After the completion of the course students will be able to

CO1:	Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
CO2:	Analyze combinational circuits like adders, sub tractors, and code converters.
CO3:	Explore combinational logic circuits and their applications in digital design.
CO4:	Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
CO5:	Gain knowledge about programmable logic devices and digital IC's.

UNIT – I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR AND and NAND/NOR realizations.

UNIT – II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Grayto Binary, BCD to excess3, BCD to Seven Segment display.

UNIT – III

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT – IV

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT – V

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL). Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

Text Books:

1. M Morris Mano and Michel D Ciletti, Digital Design, 5th Edition, Pearson Education, 1999
2. Zvi Kohavi and Nirah K Jha, Switching theory and Finite Automata Theory, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Charles H Roth, Jr., Fundamentals of Logic Design, 5th Edition, Brooks/cole Cengage Learning, 2004.

Online Learning Resources:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. www.odihpn.org, Disaster Preparedness Programme in India. A Cost Benefit Analysis, Commissioned and Published by the Humanitarian Practice Network 'at ODI HPN.

4. www.empowerpoor.org, Drought in India: Challenges and Initiatives; Poorest Areas in Civil Society (PACS) Programme. [2001–2008]

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 OPERATING SYSTEMS (FOS)

VI 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
OE607	OE-II	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:	Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
CO2:	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
CO3:	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
CO4:	Illustrate different conditions for deadlock and their possible solutions,memory management and its allocation policies.
CO5:	Design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms.

UNIT – I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging.

UNIT – II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT – IV

Memory- Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Allocation of frames, Thrashing. Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT – V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File System Mounting, Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:

1. Silber schatz A, Galvin P B, Gagne G, Operating System Concepts, 10th Edition, Wiley, 2018.

2. Tanenbaum A S, Modern Operating Systems, 4th Edition, Pearson , 2016

Reference Books:

1. Stallings W, Operating Systems -Internals and Design Principles, 9th edition, Pearson, 2018

2. D.M Dhamdhere, Operating Systems: A Concept Based Approach, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/

Question Paper Pattern:

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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 MACHINE LEARNING (FML)

VI 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
OE608	OE-II	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 machine learning techniques suitable for a given problem.
CO2:	Solve the problems using various machine learning techniques.
CO3:	Design application using machine learning techniques.
CO4:	Understand and explore Supervised Learning techniques.
CO5:	Understand and explore unsupervised learning techniques.

UNIT – I

Introduction to Machine Learning & Preparing to Model: Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.

UNIT – II

Modelling and Evaluation &Basics of Feature Engineering: Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.

UNIT – III

Bayesian Concept Learning & Supervised Learning: Classification: Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network. Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour(kNN), Decision tree, Random forest model, Support vector machines.

UNIT – IV

Supervised Learning: Regression: Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT – V

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K- Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules.

Text Books:

1. Saikat Dutt, Subramanian Chandra mouli, Amit Kumar Das, Machine Learning,

Pearson, 2019.

Reference Books:

1. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Online Learning Resources:

1. Andrew Ng, "Machine Learning B.Techning"
2. https://www.deeplearning.ai/machine-learning- B.Techning/
3. Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press.
4. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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.

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WEB TECHNOLOGIES (WT)

VI 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
OE609	OE-II	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:	Design a Web Page using Text Formatting Tags, Hyperlinks.
CO2:	Develop a webpage with Images, Tables Hyperlinks, Lists, and CSS.
CO3:	Design dynamic web pages using JavaScript.
CO4:	Design a Form using HTML Forms & Controls.
CO5:	Understand the basic concepts of PHP and database connection using XAMPP Server.

UNIT – I

HTML5: Overview of HTML5 and other web technologies, HTML5 and its essentials, Fundamentals of HTML5,Working with Text and organizing Text in HTML, Working with Links and URLs.

UNIT – II

Images: Working with Images, Image Maps, Creating Tables, Frames CSS: Overview of CSS, Backgrounds and Color Gradients in CSS, Fonts and Text Styles, List Styles, Table Layouts

UNIT – III

JavaScript: Overview of java script, Functions, Events, Java script Objects, Working with Browser Objects, Document Object, Document Object Model, Validation, Errors, and Exception Handling in JavaScript.

UNIT – IV

Forms: What's a Form? What Controls are available? Creating a Form and adding HTML Controls, Submitting Data from forms, Customizing Controls in CSS, Form validation using Java Script, Interactive Elements.

UNIT – V

Introduction to PHP: Installing and Configuring PHP: Building PHP with Apache on Windows, The Basics of PHP scripts. The Building blocks of PHP: Variables, Data Types, Operators and Expressions, Constants. Creating Forms, Accessing Form Input with User defined Arrays, Combining HTML and PHP code on a single Page, XAMPP Server configuration.

Text Books:

1. HTML5 Black Book, 2nd Edition, Dreamtech Press, 2016
2. Deitel and Deitel and Nieto, ―Internet and World Wide Web - How to Program‖, Prentice Hall, 5th Edition, 2011.
3. Julie C. Meloni, PHP MySQL and Apache, SAMS Teach yourself, Pearson Education (2007).

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford Higher Education., 1st edition, 10th impression, 2015.
2. Robert Pattinson, Beginners Guide for HTML and CSS Web Design and Web Development,2018.
3. Jeffrey C and Jackson, ―Web Technologies A Computer Science PerspectivePearsonEducation, 2011.

4. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.

Online Learning Resources:

1. https://www.tutorialspoint.com/Html/index.htm
2. https://www.w3.org/Style/CSS/
3. https://www.w3schools.com/php/

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 INFORMATION SYSTEMS (IIS)

VI 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
OE610	OE-II	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 concepts of Computer architecture and functionalities of System Software.
CO2:	Understand the page replacement and CPU Scheduling Algorithms
CO3:	Understand the phases of software development life cycle and process models.
CO4:	Design ER model for real life scenarios
CO5:	Apply SQL commands to create, update, modify, retrieve and normalization on the databases.

UNIT – I

Fundamentals of Computers & Computer Architecture: Introduction, Organization of a small computer, Central Processing Unit, Execution cycle, Instruction categories, measure of CPU performance, Memory, Input/output devices, BUS, addressing modes

System Software: Assemblers, Loaders and linkers, Compilers and interpreters.

UNIT – II

Operating System: Introduction, Memory management schemes, Page replacement algorithms, Process management, CPU scheduling algorithms.

Software engineering: Software engineering: Introduction to Software engineering, Life cycle of a software project, software Development models.

UNIT – III

Relational Database Management System: Introduction to DBMS, the database technology, data models, Database Users.

Entity Relationship (E-R) Modeling: Introduction, Notations, Modeling E-R Diagrams, Case Studies, Merits and Demerits of E-R modeling.

UNIT – IV

Structured Query Language (SQL): Introduction to SQL, Data types, Data Definition language commands, Data Manipulation Language Commands and Data control Language Commands, Candidate Key, Primary key, Foreign key, Select Clause, Where Clause, Logical Connectives – AND, OR, Range Search, Pattern Matching, Order By, Group By, Set Operations – Union, Intersect and Minus, Aggregate Functions, Join Operations

UNIT – V

Normalization: Introduction, Need for Normalization, Process of Normalization, Types of Normal Forms (1NF, 2 NF,3 NF & BCNF), Merits and Demerits of Normalization.

Text Books:

1. Campus Connect Foundation Program – Computer Hardware and System Software Concepts, Programming Fundamentals- Vol. – 1, INFOSYS
2. Campus Connect Foundation Program – Relational Database Management System, Client Server Concepts, Introduction to Web Technologies - Vol. – 4, INFOSYS
3. Henry F. Korth& Abraham Silberschatz, - Data Base System Concepts, 5th Edition, 2005, Mc Graw hill

Reference Books:

1. M. Morris Mano [2011], [3 rd Edition], Computer system architecture, Pearson

Education, 2011

2. Sommerville [2008], [7th Edition], Software Engineering, Pearson education.

3. Raghu Ramakrishna and Johannes Gehrke [2003], [3rd Edition], Data Base Management Systems, TATA McGraw Hill

4. Tanenbaum [2000], Modern Operating System, Pearson Education

Online Learning Resources:

1. https://www.w3schools.com/sql/
2. https://www.geeksforgeeks.org/dbms/
3. https://www.tutorialride.com/software-engineering/software-engineering-tutorial.htm

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.

OPTIMIZATION TECHNIQUES (OT)

VI 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
OE611	OE-II	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 meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
CO2:	Interpret the transportation models' solutions and infer solutions to the real-world problems.
CO3:	Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
CO4:	Apply the concept of non-linear programming for solving the problems involving non linear constraints and objectives
CO5:	Apply the concept of unconstrained geometric programming for solving the problems L2, L3 involving non-linear constraints and objectives.

UNIT – I

Linear programming I: Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II

Linear programming II: Duality in Linear Programming

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III

Non-linear programming: Unconstrained Optimization Techniques

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV

Non-linear programming: **Constrained Optimization Techniques**

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT – V

Geometric Programming :

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Text Books:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd.

Publishers, New Delhi.

2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

Reference Books:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.

2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

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.

PHYSICS OF ELECTRONIC MATERIALS AND DEVICES (PEMD)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE612	OE-II	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 crystal growth and thin film preparation
CO2:	Summarize the basic concepts of semi conductors
CO3:	Illustrate the working of various semi conductor devices
CO4:	Analyze various luminescent phenomena and the devices based on the concepts
CO5:	Explain the working of different display devices

UNIT – I

Fundamentals of Materials Science: Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge.

UNIT – II

Semiconductors: Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT – III

Physics of Semiconductor Devices: Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Hetero junctions, Transistors, MOSFETs.

UNIT – IV

Excitons and Luminescence:

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photo luminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

UNIT – V

Display devices: LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Text Books:

1. S O Kasap, Principles of Electronic Materials and Devices, McGraw-Hill Education(India)Pvt.Ltd.,4th edition,2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. B G Streetman and S Banerjee, Solid State Electronic Devices, PHI Learning,6th edition
2. Eugene A Irene, Wiley, Electronic Materials Science,2005

3. Grover and Jamwal, DhanpatRai and Co., Electronic Components and Materials, New Delhi., 2012.

4. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineer, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

Online Learning Resources:

1. https://nptel.ac.in/courses/113/106/113106062/https://onlinecourses.nptel.ac.in/noc20_ph24/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.

CHEMISTRY OF POLYMERS AND APPLICATION (CPA)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE613	OE-II	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:	Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2:	Describe the physical and chemical properties of natural polymers and Modified cellulosics.
CO3:	Differentiate Bulk, solution, suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4:	Identify types of polymer networks, describe methods involve in hydrogel reparation, Explain applications of hydrogels in drug delivery
CO5:	Explain classification and mechanism of conducting and degradable polymers

UNIT – I

Polymers-Basics and Characterization: Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers,

Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT – II

Natural Polymers & Modified Cellulosics: Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified Cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT – III

Synthetic Polymers: Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT – IV

Hydrogels of Polymer Networks: Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

UNIT – V

Conducting and Degradable Polymers:

Conducting Polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable Polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. Billmayer, A Text book of Polymer science
2. G.S.Mishra, Polymer Chemistry
3. Gowarikar, Polymer Chemistry

Reference Books:

1. K J Saunders, Chapman and Hall, Organic polymer Chemistry
2. B Miller, Prentice Hall, Advanced Organic Chemistry
3. Premamoy Ghosh, Polymer Science and Technology, 3rd edition, McGraw-Hill, 2010.

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.

ACADEMIC WRITING AND PUBLIC SPEAKING (AWPS)

VI Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE614	OE-II	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 various elements of Academic Writing
CO2:	Identify sources and avoid plagiarism
CO3:	Demonstrate the knowledge in writing a Research paper
CO4:	Analyse different types of essays
CO5:	Assess the speeches of others and know the positive strengths of speakers
CO6:	Build confidence in giving an impactful presentation to the audience

UNIT – I

Introduction to Academic Writing:

Academic Writing: Introduction

Essential Features of Academic Writing: Courtesy, Clarity, Conciseness, Correctness, Coherence, Completeness

Types of Academic Writing: Descriptive, Analytical, Persuasive, Critical writing

UNIT – II

Academic Journal Article:

Art of condensation: summarizing and paraphrasing

Abstract Writing

Writing: Project Proposal, an application for internship, Technical/Research/Journal Paper Writing, Conference Paper Writing

Editing and Proofreading

Understanding and avoiding Plagiarism

UNIT – III

Essay Writing & Writing Reviews:

Types of Essays: Compare and Contrast Essay, Argumentative Essay, Exploratory Essay

Features and analysis of sample essays

Writing a Book Report

Summarizing

Writing a Book/Film Review

Writing a Statement of Purpose (SoP)

UNIT – IV

Public Speaking:

Public Speaking: Introduction, Nature, characteristics, and significance

Presentation skills: 4 P's of Presentation, Stage Dynamics, Answering Strategies during presentations

Analysis of impactful speeches

Types of speeches for academic events

UNIT – V

Public Speaking and Non-Verbal Delivery: Body Language, Facial Expressions, Kinesics, Oculesics, Proxemics, Haptics, Chronomics, Paralanguage, Signs

Text Books:

1. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. The Definitive Book of Body LanguageRHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei Effective Academic Writing,2Ed.,2014 Oxford University Press.
2. Shalini Verma, Body Language, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998

Online Learning Resources:

1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4
5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12 nonverbal-aspects-of delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

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.

MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES (MFQT)

VI Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE615	OE-II	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 Transformation theory and Hilbert space
CO2:	Analyze the properties and operators of Hilbert space and apply Eigen values to it.
CO3:	Apply statistics to measure theory, uncertainty relations and radiation theory.
CO4:	Evaluate problems on reversibility, equilibrium and macroscopic measurements.
CO5:	Formulate problems of composite system and measuring process

UNIT – I

Introductory Considerations: The origin of the Transformation Theory, The Original Formulation of Quantum Mechanics, The Equivalence of the two Theories: (i) The Transformation Theory, (ii) Hilbert Space.

UNIT – II

Abstract Hilbert Space: The definition of Hilbert space, The Geometry of Hilbert space, Degression on the Conditions A-E, Closed linear Manifolds, Operators in Hilbert space, The Eigen Value Problem, Continuation, Initial Consideration concerning the Eigenvalue Problem, Degression on the Existence and Uniqueness of solutions of the Eigenvalue Problems, Cumulative operators, The Trace.

UNIT – III

The Quantum Statistics: The statistical assertions of quantum mechanics, the statistical interpretation, Simultaneous Measurability and Measurability in General, Uncertainty Relations, Projections as Propositions, Radiation Theory.

UNIT – IV

Deductive Development of the Theory and General Considerations: The fundamental basis of the statistical theory, Conclusions from Experiments. Measurement and reversibility, Thermodynamics Considerations, Reversibility and equilibrium problems, The Macroscopic Measurement.

UNIT – V

The Measuring Process: Formulation of the problems, Composite systems, discussion of the Measuring process.

Text Books:

1. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).
2. M D Srinivas, Measurements and Quantum Probabilities, University Press, Hyderabad.

Reference Books:

1. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education) (2010)
2. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.
3. Gerad Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger. operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009

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.

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Open Elective – III

S.No.	Course Name	Offering Department	Eligible Branches
1	Building Materials and Services	CE	All Branches Except CE
2	Environmental Impact Assessment	CE	All Branches
3	Smart Grid Technologies	EEE	All Branches Except EEE
4	3D Printing Technologies	ME	All Branches Except ME
5	Composite Materials	ME	All Branches
6	Applications of Microprocessors and Microcontrollers	ECE	All Branches Except EEE and ECE
7	Introduction to Database Systems	CSE	CE, EEE, ME and ECE
8	Cyber Security	CSE	CE, EEE, ME and ECE
9	Modern C++	CSE	All Branches
10	Wavelet Transforms and its Applications	HBS	All Branches
11	Smart Materials and Devices		
12	Green Chemistry and Catalysis for Sustainable Environment		
13	Employability Skills		
14	Introduction to Quantum Mechanics		

BUILDING MATERIALS AND SERVICES (BMS)

VII 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
OE701	OE-III	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 properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, and plastics
CO2:	Analyze the composition, manufacturing process, and properties of cement and admixtures.
CO3:	Apply knowledge of building components such as lintels, arches, stairs, floors, roofs, foundations
CO4:	Evaluate masonry, mortars, finishing techniques ,and form work systems
CO5:	Assess various building services including plumbing, ventilation, acoustics, and fire protection.

UNIT – I

Building Materials:

Building Stones: Classifications– Properties – Structural Requirements.

Bricks: Composition of Brick Earth – Qualities of good brick – Types of brick.

Tiles: Characteristics of good tile– Types of tiles.

Wood: Structure – Types and Properties – Seasoning.

Other Materials: Properties and uses of Steel, Aluminum and Plastics.

UNIT – II

Cement & Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency– Initial &Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components:

Foundations: Types.

Floors: Types of Floors.

Roofs: Flat, Curved, Trussed.

Stair Cases – terminology: Types.

Lintels and Arches.

UNIT – IV

Mortars: Lime and Cement Mortars

Masonry: Bonds in Brick Masonry and Stone Masonry

Finishers: Plastering, Pointing, Painting.

Form Work: Types, Requirements – Scaffolding.

UNIT – V

Building Services:

Plumbing Services: Water Distribution, Sanitary – Lines &Fittings;

Ventilations: Functional Requirements – Natural and Mechanical ventilation

Acoustics: Characteristic – Absorption – Acoustic Design.

Fire Protection: Fire Hazards – Classification of Fire Resistant Materials and Constructions.

Text Books:
7. Building Materials and Construction–Arora & Bindra, Dhanpat Roy Publications
8. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt. Ltd., 2015
Reference Books:
1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delh
2. P.C.Varghese, Building Materials, Prentice Hall of India, 2015.
3. N.Subramanian, Building Materials Testing and Sustainability, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019
Online Learning Resources:
8. https://archive.nptel.ac.in/courses/105/102/105102088/
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.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE702	OE-III	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 various methodologies for conducting Environmental Impact Assessments
CO2:	Analyze the impact of land-use changes on soil, water, and air quality.
CO3:	Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
CO4:	Develop environmental audit reports and assess compliance with environmental policies.
CO5:	Interpret and apply environmental acts and regulations related to EIA.

UNIT – I

Concepts and methodologies of EIA: Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II

Impact of Developmental Activities and Land Use: Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment: Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

UNIT – IV

Environmental Audit: Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V

Environmental Acts and Notifications: The Environmental Protection Act, The Water Preservation Act, The Air(Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication,

Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)
Reference Books:
1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi
Online Learning Resources:
1. https://archive.nptel.ac.in/courses/124/107/124107160/
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.

SMART GRID TECHNOLOGIES (SGT)

VII 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
OE703	OE-III	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 Concept and Evolution of Smart Grids.
CO2:	Analyzing Wide Area Monitoring System and Synchrophasor Technology.
CO3:	Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts.
CO4:	Evaluating Information and Communication Technology (ICT) Systems in Smart Grids.
CO5:	Designing Smart Grid Applications and Cybersecurity Measures.

UNIT – I

Introduction to Smart Grid: Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT – II

Wide Area Monitoring System: Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT – III

Smart Meters: Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT – IV

Information and Communication Technology: Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT – V

Smart Grid Applications and Cyber Security: Applications: Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Text Books:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Books:

1.	Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2.	Fereidoon. P. Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3.	Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4.	Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

Online Learning Resources:

1.	https://nptel.ac.in/courses/108107113

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.

3D PRINTING TECHNOLOGIES (3DPT)

VII 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
OE704	OE–III	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 the fundamentals of AM, its process steps, classification, materials, and describe Vat Photo-polymerization methods with applications.
CO2:	Explain Material Jetting, Binder Jetting, and FDM processes in terms of materials, working principles, benefits, and illustrate their applications.
CO3:	Explain the working of Sheet Lamination, 3DP, and Powder Bed Fusion processes, and analyze their advantages and industrial use cases.
CO4:	Describe Directed Energy Deposition AM processes, benefits, and applications.
CO5:	Explain post-processing techniques in AM and understand the concepts of direct and indirect rapid tooling methods with examples.

UNIT – I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM.

Vat Photo-polymerization AM Processes: Stereolithography (SL), Materials, Process Modeling, SL resin curing process, SL scan patterns, Micro-Stereolithography, Mask Projection Processes, Process Benefits and Drawbacks, Applications of Vat Photo-polymerization, case studies.

UNIT – II

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes, case studies.

UNIT – III

Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies.

Three Dimensional Printing (3DP): Principle, Process, Applications, advantages and disadvantages of 3DP.

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, case studies.

UNIT – IV

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Benefits and drawbacks, Applications of Directed Energy Deposition Processes.

UNIT – V

Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Property Enhancements using Non-thermal and Thermal Techniques.

Rapid Tooling: Direct and Indirect methods AIM tooling, SLS rapid steel, Direct Laser Metal Sintering (DMLS), Laminate tooling. RTV silicon rubber moulds, Vacuum casting, Reaction injection Moulding (RIM),Wax Injection moulding, Spray metal tooling, 3D kelt tool

Text Books:

1. Chua C.K., Leong.K.F, and Lim C, C.S., Rapid Prototyping Principles and Applications, World Scientific Publishing Co. Pte. Ltd
2. D.T.Pham and S.S.Dimov, Rapid manufacturing The technologies and applications of rapid Prototyping and rapid tooling. Springer Publications

Reference Books:

1. Terry Wholers, Wholers report, Wholers Associates
2. Gibson D. W. Rosen and B. Stucker., Additive manufacturing technologies, Springer Publication

Online Resources:

1. https://www.nist.gov/additive-manufacturing
2. https://www.metal-am.com/
3. http://additivemanufacturing.com/basics/
4. https://www.3dprintingindustry.com/
5. https://www.thingiverse.com/
6. https://reprap.org/wiki/RepRap

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.

COMPOSITE MATERIALS (CM)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE705	OE-III	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 properties of fiber and matrix materials used in commercial composites.
CO2:	Describe the manufacture of polymer matrix composites.
CO3:	Compare and evaluate the metal manufacturing methods.
CO4:	Analyze the Hooke's law for different type of materials.
CO5:	Examine the elastic behaviour of the unidirectional composite.

UNIT – I

Basic Concepts and Characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites

UNIT – II

Manufacturing of Polymer Composites: Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, Resin Transfer Moulding, injection moulding, compression moulding Properties and applications.

UNIT – III

Manufacturing of Metal Matrix Composites: Stir Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

Manufacturing of Carbon – Carbon Composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT – IV

Coordinate Transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation.

UNIT – V

Elastic Behaviour of Unidirectional Composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Text Books:

1. R M Jones, Mechanics of Composite Materials Mc Graw Hill Company, New York.
2. Isaac and M.Daniel, Engineering Mechanics of Composite Materials, Oxford University Press, New York

Reference Books:

1. Madhujit Mukhopadadhyay, Mechanics of composite materials and structures, Universities Press, Hyderabad
2. L. R. Calcote, Analysis of Laminated Composite Structures ,Van Nostrand

Rainfold, US

3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley Interscience, New York

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.

APPLICATIONS OF MICROPROCESSORS AND MICROCONTROLLERS (AMMC)

VII Semester: All Branches Except EEE and ECE					Scheme: 2023			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE706	OE-III	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 architectural concepts of 8086 microprocessor.
CO2:	Apply the programming model of 8086 in assembly language programming.
CO3:	Analyze the multiple concepts of 8086 interfacing.
CO4:	Analyze the architectural concepts the 8051 microcontroller.
CO5:	Apply the programming model of 8051 in interfacing with peripherals.

UNIT – I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT – II

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

UNIT – III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT – IV

8051 Microcontroller: Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT – V

Interfacing Microcontroller: Programming 8051 Instruction set - Addressing modes Programming Switches, LEDs, Displays – Seven Segment, LCD, Sensors, Stepper Motor and Waveform generation- Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Text Books:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Mazidi Muhammad Ali, Mazidi Janice Gillespie & Mc KinlayRolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, 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.

INTRODUCTION TO DATABASE SYSTEMS (IDS)

VII 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
OE707	OE-III	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 basic concepts of database management systems
CO2:	Analyze a given database application scenario to use ER model for conceptual design of the database
CO3:	Utilize SQL proficiently to address diverse query challenges.
CO4:	Employ normalization methods to enhance database structure.
CO5:	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

UNIT – I

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

UNIT – II

Entity Relationship Model: Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, IS A relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modelling.

UNIT – III

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

UNIT – IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

UNIT – V

PL/SQL: Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create a PL/SQL, Program, Iterative Control, Procedure, Function, Database Triggers, Types of Triggers.

Text Books:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,
3. SQL: The Ultimate Beginners Guide by Steve Tale

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282 02 2456_shared/overview
3. Oracle SQL Developer - Full Course
4. https://www.youtube.com/watch?v=9ic3KEH4Ah4

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.

CYBER SECURITY (CS)

VII 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
OE708	OE-III	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:	Classify the cybercrimes and understand the Indian ITA 2000.
CO2:	Analyse the vulnerabilities in any computing system and find the solutions.
CO3:	Predict the security threats of the future.
CO4:	Investigate the protection mechanisms.
CO5:	Design security solutions for organizations

UNIT – I

Introduction to Cyber crime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, and Cybercrime: The Legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III

Cyber crime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones.

UNIT – IV

Tools and Methods Used in Cyber crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan –Hwa (john) Wu ,J. DavidIrwin.CRC Press T&F Group

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://www.udemy.com/course/cybersecurity-from-beginner-to-expert

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.

MODERN C++ (MC)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE709	**OE-III**	**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:	Distinguish the procedural and object oriented paradigm along with principles
CO2:	Understand dynamic memory management techniques using pointers, constructors, destructors
CO3:	Understand the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO4:	Classify inheritance with the understanding of early and late binding.
CO5:	Illustrate the process of data file manipulations using C++.
CO6:	Analyze an ability to incorporate Exception handling in Object Oriented program.

UNIT – I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts Abstraction, Encapsulation, Inheritance and Polymorphism

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, go to statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions

UNIT – II

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT – III

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

UNIT – IV

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT – V

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Overloading operators, Error handling during file operations, Formatted I/O

Exception Handling:

Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications.

Text Books:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2. Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch,

Pearson Education.

Reference Books:

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press
3. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd

Online Learning Resources:

1. https://nptel.ac.in/courses/106105234
2. https://www.geeksforgeeks.org/cpp/c-plus-plus/
3. https://www.tutorialspoint.com/cplusplus/index.htm

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.

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WAVELET TRANSFORMS AND ITS APPLICATIONS (WTA)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE710	OE-III	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 wavelets and wavelet basis and characterize continuous and discrete wavelet transforms.
CO2:	Illustrate the multi resolution analysis ad scaling functions.
CO3:	Implement discrete wavelet transforms with multirate digital filters.
CO4:	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
CO5:	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

UNIT – I

Wavelets: Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete Time and Continuous Wavelet Transforms.

UNIT – II

A Multi resolution Formulation of Wavelet Systems: Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III

Filter Banks and the Discrete Wavelet Transform: Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - - Different Points of View.

UNIT – IV

Time-Frequency and Complexity: Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform-Numerical Complexity of the Discrete Wavelet Transform.

UNIT – V

Bases and Matrix Examples: Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Text Books:

1. C. Sidney Burrus, Ramesh A. Gopinath, —Introduction to Wavelets and Wavelets Transforms‖, Prentice Hall, (1997).
2. James S. Walker, —A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999).

Reference Books:

1. Raghuveer Rao, —"Wavelet Transforms", Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

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.

SMART MATERIALS AND DEVICES (SMD)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE711	OE-III	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:	Provide exposure to smart materials and their engineering applications.
CO2:	Impart knowledge on the basics and phenomenon behind the working of smart materials
CO3:	Explain the properties exhibited by smart materials.
CO4:	Educate various techniques used to synthesize and characterize smart materials
CO5:	Identify the required smart material for distinct applications/devices

UNIT – I

Introduction to Smart Materials: Historical account of the discovery and development of smart materials, Shape memory materials, chromo active materials, magnet orheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT – II

Properties of Smart Materials: Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT – III

Synthesis of Smart Materials: Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT – IV

Characterization Techniques: Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT – V

Smart Materials Based Devices: Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Text Books:

1. Yaser Dahman, Nanotechnology and Functional Materials for Engineers-,Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. P Gauenzi, Smart Structures, Wiley, 2009.
2. Mahmood Ali of khazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhery Mustansar Hussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials, Mohsen Shahinpoor, Royal Society of Chemistry, 2020

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.

GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (GCSE)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE712	**OE-III**	**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 principle and concepts of green chemistry.
CO2:	Understand the types of catalysis and industrial applications.
CO3:	Apply green solvents in chemical synthesis.
CO4:	Enumerate different sourced of green energy.
CO5:	Apply alternative greener methods foe chemical reactions.

UNIT – I

Principles And Concepts of Green Chemistry: Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un- economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT – II

Catalysis And Green Chemistry: Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio- catalysis and Photo-catalysis with examples.

UNIT – III

Green Solvents In Chemical Synthesis: Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethyleneglycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT – IV

Emerging Greener Technologies: Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock‘s, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Bio refinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT – V

Alternative Greener Methods: Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books:

1. M. Lancaster,Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

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.

EMPLOYABILITY SKILLS (ESK)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE713	**OE-III**	**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 goals and try to achieve them.
CO2:	Explain the significance of self-management.
CO3:	Apply the knowledge of writing skills in preparing eye-catchy resumes.
CO4:	Analyse various forms of Presentation skills.
CO5:	Judge the group behaviour appropriately.
CO6:	Develop skills required for employability

UNIT – I

Goal Setting and Self-Management: Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT – II

Writing Skills: Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT – III

Technical Presentation Skills: Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT – IV

Group Presentation Skills: Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

UNIT – V

Job Cracking Skills: Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Text Books:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills,2014.Cambridge Publisher
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback , Sage Publications. 2015
2. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics f Communication Skills A Relational Perspective, Sage press, 2012

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

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 MECHANICS (IQM)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE714	OE-III	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:	Explain the key principles of quantum mechanics and wave-particle duality
CO2:	Apply Schrödinger equations to solve one-dimensional quantum problems
CO3:	Solve quantum mechanical problems using operator and matrix methods.
CO4:	Evaluate quantum states using Dirac notation and expectation values.
CO5:	Analyze angular momentum and spin systems using Pauli matrices and operators.

UNIT – I

Principles of Quantum Mechanics: Introduction, Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT – II

One Dimensional Problems and Solutions: Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT – III

Operator Formalism: Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT – IV

Mathematical Tools for Quantum Mechanics: The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT – V

Angular Momentum and Spin: Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half (1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Text Books:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam, 1961.
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi.
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co. Inc., London, (1960).
4. Quantum Mechanics. S L Gupta, V Kumar, H V Sarama and R C Sharma, Jai Prakash Nath & Co, Meerut, (1996).

Reference Books:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).

2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.), 2003.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

Question Paper Pattern:

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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 – IV

S.No.	Course Name	Offering Department	Eligible Branches
1	Geo-Spatial Technologies	CE	All Branches Except CE
2	Solid Waste Management	CE	All Branches
3	Electric Vehicles	EEE	All Branches Except EEE
4	Total Quality Management	ME	All Branches Except ME
5	Safety in Engineering Industry	ME	All Branches
6	Transducers and Sensors	ECE	All Branches Except ECE
7	Drone Technology	ECE	All Branches
8	Introduction to Computer Networks	CSE	CE, EEE, ME and ECE
9	Internet of Things	CSE	CE, EEE, ME and ECE
10	Multimedia & Animation	CSE	All Branches
11	Advanced Information Systems	CSE	CE, EEE, ME and ECE
12	Quantum Computing	CSE	All Branches
13	Financial Mathematics	HBS	All Branches
14	Sensors and Actuators for Engineering Applications		
15	Chemistry of Nanomaterials and Applications		
16	Literary Vibes		

GEO-SPATIAL TECHNOLOGIES (GST)

VII 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
OE715	OE-IV	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 raster-based spatial analysis techniques, including query, overlay, and cost- distance analysis.
CO2:	Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
CO3:	Apply network analysis techniques for geocoding, shortest path analysis, and location- allocation problems.
CO4:	Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
CO5:	Assess GIS customization, WebGIS, and mobile mapping techniques for real-world applications.

UNIT – I

Raster Analysis

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering- Zonal Operations-Statistical Analysis–Cost- Distance Analysis-Least Cost Path.

UNIT – II

Vector Analysis

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance

Topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line- In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering.

UNIT – III

Network Analysis: Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path inA Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT – IV

Surface And Geostatistical Analysis: Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram

UNIT – V

Customisation, Webgis, Mobile Mapping:

Customisation of Gis: Need, Uses, Scripting Languages –Embedded Scripts

Web Gis: Web Gis Architecture, Advantages Of Web Gis, Web Applications-

Location Based Services: Emergency And Business Solutions.

Text Books:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008

2. Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

Reference Books:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009

2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, —An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

9. https://archive.nptel.ac.in/courses/105/105/105105202/

10. https://onlinecourses.nptel.ac.in/noc19_cs76/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.

SOLID WASTE MANAGEMENT (SWM)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE716	OE-IV	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 types, sources, and characteristics of solid waste, along with regulatory frameworks.
CO2:	Analyze engineering systems for solid waste collection, storage, and transportation.
CO3:	Apply resource and energy recovery techniques for sustainable solid waste management.
CO4:	Evaluate landfill design, construction, and environmental impact mitigation strategies
CO5:	Assess hazardous waste management techniques, including biomedical and e-waste

UNIT – I

Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes ,Elements of Solid Waste Management-Integrated Solid Waste Management, Solid Waste Management Rules 2016

UNIT – II

Engineering Systems for Solid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning- Transfer and Transport; Processing Techniques;

UNIT – III

Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products–Composting, Preand Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT – IV

Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills –Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT – V

Hazardous Waste Management: Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management.

Text Books:

1. Tchobanoglous G, Theisen Hand Vigil SA, Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, Solid Waste Engineering‘ Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering‘, McGraw Hill Inc., New York, 1985.

2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/103/105103205/
2. https://archive.nptel.ac.in/courses/120/108/120108005/

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.

ELECTRIC VEHICLES (EV)

VII 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
OE717	OE-IV	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 and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
CO2:	Understand Various dynamics of Electric Vehicles.
CO3:	Remember and understand various configurations in parameters of EV system and dynamic aspects of EV.
CO4:	Analyze fuel cell technologies in EV and HEV systems
CO5:	Analyze the battery charging and controls required of EVs.

UNIT – I

Introduction to EV Systems and Energy Sources: Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT – II

EV Propulsion and Dynamics: Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT – III

Fuel Cells: Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT – IV

Battery Charging and Control

Battery Charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller‘s designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT – V

Energy Storage Technologies: Role of Energy Storage Systems- Thermal- Mechanical- Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Text Books:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition.

2. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, 2017,1st Edition.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.

2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, “Energy Storage in Power Systems” Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition.

3. A.G.Ter-Gazarian, “Energy Storage for Power Systems”, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.

4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004,1st Edition.

5. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003,2nd Edition.

Online Learning Resources:

1. https://nptel.ac.in/courses/108/102/108102121/

2. https://nptel.ac.in/syllabus/108103009

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.

TOTAL QUALITY MANAGEMENT (TQM)

VII 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
OE718	OE-IV	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 basic concepts and evolution of TQM ; Professional ethics and quality costs
CO2:	Understand the concepts of leadership, quality council, strategic planning and communications
CO3:	Apply the methods to improve costumers satisfactions
CO4:	Analyse motivational aspects of employees and functioning of teams
CO5:	Apply TQM tools like P-D-S-A cycle, Benchmarking, FMEA towards achieving TQM objectives

UNIT – I

Quality: Definition; Dimensions of Quality

Total Quality Management (TQM): Definition; basic concepts of / basic approach to TQM; Benefits of TQM, Barriers / Obstacles to TQM implementation; Evolution of TQM

Ethics: Route causes for unethical behaviour; Ethics Management Program

Quality costs

UNIT – II

Leadership: Characteristics of quality leaders; Leadership concepts; Stephen R. Covey's 7 habits of highly effective people; The Deming's philosophy (14 principles)

Quality Council: Composition; Duties of Quality Council

Quality Statements: The Vision and the Mission statements

Seven steps to Strategic Planning

Communications: Interactive and Formal

UNIT – III

Customer Satisfaction: Customer Satisfaction and its importance; Customer perception of quality; Methods to improve customer satisfaction; Customer Feedback; Handling the customer complaints; Service Quality; Customer Retention

UNIT – IV

Employee Involvement

Motivation: Maslow's hierarchy of needs; Achieving a motivated workforce, Employee empowerment

Teams: Characteristics of successful teams; Roles of team members; Common barriers to team progress; Suggestion system; Recognition and Reward; Gain sharing; Benefits of employee involvement

UNIT – V

TQM Tools

The Problem solving method and P-D-S-A cycle

Benchmarking: Reasons to Benchmark; Process of Benchmarking

Failure Modes and Effects Analysis (FMEA): Benefits; Stages of FMEA; Adapting FMEA to service sector

Pareto diagram; Cause and Effects diagram; Scatter diagram

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

Online Learning Resources

1. https://www.youtube.com/watch?v=VD6tXadibk0
2. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
3. https://blog.capterra.com/what-is-total-quality-management/
4. https://nptel.ac.in/courses/110/104/110104080/
5. https://onlinecourses.nptel.ac.in/noc21_mg03/preview
6. https://nptel.ac.in/courses/110/104/110104085/
7. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

Question Paper Pattern:

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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.

SAFETY IN ENGINEERING INDUSTRY (SEI)

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

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE719	OE-IV	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 principles of safety management including safety audit, safety education and accident investigation.
CO2:	Understand the causes and implication of fire and explosion and the preventive measures
CO3:	Understand machine and construction safety assessment and safeguarding methods
CO4:	Understand the effect of toxic substances and hazardous chemicals
CO5:	Understand the modes of electrical hazards and safety measures in electrical and information technology industries

UNIT – I

Safety in Engineering Industry: Safety need, General hazards and control measures in engineering industry, Four significant industrial disasters happened in the world (Bhopal, Chernobyl, Flixborough and Rana plaza), Safety audit procedure.

Accident Investigation: Learning from accident, Layered investigations, Investigation process and summary.

UNIT – II

Fire Safety: The fire triangle, Explosions, Distinction between fire and explosions, Flammability characteristics of liquids and vapours, Fire protection techniques, Fire extinguishers, Fire hazard and analysis, Prevention of fire, Steps after occurrence of fire, Fire detection, Fire alarm and firefighting systems, Explosion proof equipment and instruments.

UNIT – III

Machine Safety: Machine guarding, Machine guarding assessment, Safeguarding machines and equipment, Guards, Safeguarding devices, Other potential safeguards.

Construction Safety: Scope, Safety in - Underground works, Above ground works, Under waterworks, Demolition works.

UNIT – IV

Chemical Safety: Hazardous chemicals, Definition of a hazardous chemical, Toxic effects, Working with toxins, Storing hazardous chemicals, Process hazards, Transportation of hazardous chemicals, Chemical waste management, Hazardous chemical emergency procedures, Worker contamination, Chemicals and worker health.

UNIT – V

Electrical Safety: Electrical dangers, Electrical pathways, Static electricity, Result of electrical contact, Shock versus electrocution, Electrical burns, Handling electrical hazards, Controlling electrical hazards, Training, Safety and Health program.

IT Industry Safety: Hazardous in IT industry, General precautions, Employer's responsibility, Employees responsibilities, Office ergonomics, Computer workstation – health & safety tips, Laptop safety precautions.

Text Books:

1. L M Deshmukh, Industrial Safety and Management, McGraw Hill Education (India)

2. D A Crowl and J F Louvar, Chemical Process Safety (Fundamentals with Applications), Prentice Hall, 2011.

3. Charles D Reese, Industrial Safety and Health for People-oriented Services, CRC Press, 2008.

4. M P Poonia and S C Sharma. Industrial Safety and Maintenance Management, Khanna Book Publishing, 2019.

Reference Books:

1. Charles Reese, Industrial Safety and Health for Infrastructure Services, CRC Press, 2009

2. R K Jain and Sunil S Rao, Industrial Safety and Health and Environment Management Systems, Khanna Book Publishing, 2000.

3. K U Mistry, Fundamentals of Industrial safety and Health, Siddharth Prakashan Publisher, 2008.

Online Learning Resources

1. https://archive.nptel.ac.in/courses/110/105/110105094/

Question Paper Pattern:

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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.

TRANSDUCERS AND SENSORS (T&S)

VII 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
OE720	OE-IV	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 characteristics of Instrumentation System and the operating principle of motion transducers.
CO2:	Explore working principles, and applications of different temperature transducers and Piezo-electric sensors
CO3:	Gain knowledge on flow transducers and their applications.
CO4:	Learn the working principles of pressure transducers.
CO5:	Understand the working principle and applications of force and sound transducers.

UNIT – I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers

UNIT – II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT – III

Flow Transducers: Bernoulli‘s principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT – IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT – V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Text Books:

1. A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation‖, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

Reference Books:

1. Doebelin. E.O, ―Measurement Systems Application and Design‖, McGraw Hill International, New York, 2004.
2. Nakra B.Cand Chaudhary K.K , ―Instrumentation Measurement and Analysis‖, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

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.

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DRONE TECHNOLOGY (DT)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE721	OE-IV	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 historical development of unmanned aerial vehicles
CO2:	Understand different drone parts and their contribution for successful flight operation
CO3:	Identify the battery to be used for UAV application.
CO4:	Understand work in go f motor that can be used in UAV.
CO5:	Classify different microcontrollers and flight controllers.

UNIT – I

Introduction to Drones and Their Applications: Definition of drones, history of drones, Structural classification of drones: - fixed wing structure, lighter than air systems, rotary wings aircraft and applications of drones.

UNIT – II

Components of Drones: classifications of drone structures and their suitability, applications and uses of drone frame materials, classifications and applicability of propeller motors, drone materials, design parameters for propellers, composition and structuring of Electronic speed controller, flight control board, characteristics of FCB and their structure.

UNIT – III

Battery and its Management: Introduction of Battery, Description of Li-Po Battery, Charging / Discharging of Battery. Back up, Ratings, Shelf Life, Maintenance and safety of Battery. Selection criteria of Battery for Drone application

UNIT – IV

Sensors: Wi-Fi devices, RADAR and range finder, GPS receiver, Gyro sensor, Speed and Distance sensor, Image sensor, TOF sensor, Chemical sensor. Cameras in drones and selection criteria Of camera for different range. Barometers, Accelerometer, Magnetometer, remote control for drone.

Motors: Difference between AC and DC motors and stepper motor, Brushed and Brushless motors, brief idea of motor capabilities for a drone build. Selection criterion of motor for drone application. Working and application of BLDC motor

UNIT – V

Connections and Interfaces of Devices in Drone: Brief introduction of RS232, RS422, RS485, UART ports. Different types of connectors and their specifications. Microcontroller interfacing techniques.

Introduction to Drone Programming: Introduction to programming language used in drone: C and Python. Installation of cards. Auto Pilot software i.e. Ardupilot, Openpilot

Text Books:

1. Terry Kil by and Belinda Kil by, “Make: Getting Started with Drones“, Maker Media, Inc, 2016
2. Vasilis Tzivaras, “Buildinga Quadcopter with Arduino”, Packt Publishing, 2016
3. Donald Norris, “Build Your Own Quadcopter - Power Up Your Designs with the Parallax Elev - 8”, McGraw – Hill Education, 2014

Reference Books:

1. Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.

2. Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment. Wiley, 2010.

3. Sebbane, Smart Autonomous Aircraft: Flight Control and Planning for UAV. CRCPress,2015

4. Zavrsnik, Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance. Springer, 2015.

Online Learning Resources:

1. https://www.dronezon.com/learn-about-drones-quadcopters/

2. http://ardupilot.org/copter/docs/advanced-multicopter-design.html

Question Paper Pattern:

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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 COMPUTER NETWORKS (ICN)

VII 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
OE722	OE-IV	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:	Describe the architecture of the Internet, reference models, and explain different types of transmission media used in networking.
CO2:	Apply error detection and correction techniques and analyze data link layer protocols and LAN technologies.
CO3:	Explain routing algorithms and the structure of the network layer, including internetworking
CO4:	Analyze the working of transport layer protocols like TCP and UDP, including concepts of connection management and congestion control.
CO5:	Explain the principles of network applications and describe the functionality of protocols such as HTTP, SMTP, DNS, and peer-to-peer systems, including multimedia streaming and content delivery networks.

UNIT – I

Computer Networks and the Internet: What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission

UNIT – II

The Data Link Layer, Access Networks, and LANs: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols , Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and 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 Request

UNIT – III

The Network Layer: Routing Algorithms, Internetworking, The Network Layer in The Internet

UNIT – IV

The Transport Layer: Connectionless Transport: UDP , The Internet Transport Protocols: TCP, Congestion Control

UNIT – V

Principles of Network Applications: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, 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, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, —Computer Networking: A Top-Down Approach‖, 6thedition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications 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/106/105/106105183
2. https://gaia.cs.umass.edu/kurose_ross/interactive/
3. https://www.netacad.com/courses/packet-tracer
4. https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

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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.

INTERNET OF THINGS (IOT)

VII 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
OE723	OE-IV	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 general concepts of Internet of Things.
CO2:	Apply design concept to IoT solutions.
CO3:	Analyze various M2M and IoT architectures.
CO4:	Evaluate design issues in IoT applications.
CO5:	Create IoT solutions using sensors, actuators and Devices.

UNIT – I

Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, , Embedded Systems.

UNIT – II

Prototyping IoT Objects using Microprocessor/Microcontroller: Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors. Communication: communication through Bluetooth, Wi-Fi.

UNIT – III

IoT Architecture and Protocols: Architecture Reference Model- Introduction, , IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak

UNIT – IV

Device Discovery and Cloud Services for IoT: Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT – V

UAV IoT : Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software – Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study Flyt Base**.**

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, — Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016..

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, — From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
3. Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781-4493- 9357-1
5. DGCA RPAS Guidance Manual, Revision 3 – 2020

6. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/
3. https://nptel.ac.in/courses/106105166/5
4. https://nptel.ac.in/courses/108108098/4

Question Paper Pattern:

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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.

MULTIMEDIA & ANNIMATION (MMA)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE724	OE-IV	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 basic components of a multimedia project.
CO2:	Understand the usage of text and formats in multimedia.
CO3:	Understand the audio digitization, audio file format and audio software.
CO4:	Understand the colour, image, image formats and Correction in multimedia.
CO5:	Understand the digital video standards, formats and basic principles behind animation and Techniques.

UNIT – I

Introduction to Multimedia: What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media.

UNIT – II

Computer Fonts and Hypertext: Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap fonts, International character sets and hypertext, Digital fonts techniques.

UNIT – III

Audio fundamentals and representations: Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.

UNIT – IV

Image fundamentals and representations: Colour Science, Colour, Colour Models, Colour palettes, Dithering, 2D Graphics.

Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

UNIT – V

Video and Animation: Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video, Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.

Text Books:

1. Tay Vaughan, “Multimedia making it work”, Tata McGraw-Hill, 2008.
2. Rajneesh Aggarwal & B. B Tiwari, “ Multimedia Systems”, Excel Publication, New Delhi, 2007.
3. Li & Drew, “ Fundamentals of Multimedia” , Pearson Education, 2009

Reference Books:

1. Parekh Ranjan, “Principles of Multimedia”, Tata McGraw-Hill, 2007
2. Anirban Mukhopadhyay and Arup Chattopadhyay, “Introduction to Computer Graphics and Multimedia”, Second Edition, Vikas Publishing House.

Online Learning Resources:

1. https://www.wisdomjobs.com/e-university/multimedia-tutorial-270.html
2. http://www.multimediatrainingvideos.com/
3. https://www.tutpad.com/tag/multimedia

Question Paper Pattern:

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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.

ADVANCED INFORMATION SYSTEMS (AIS)

VII 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
OE725	OE-IV	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:	Demonstrate the Object oriented concepts.
CO2:	Interpret different types of Inheritance and Polymorphism.
CO3:	Classify layer functionalities of OSI reference model and TCP Protocol suite.
CO4:	Summarize the concepts of internetworking, security and IP addressing.
CO5:	Demonstrate different types of protocols and web contents used in web design

UNIT – I

Introduction to Object Oriented Concepts: Introduction, Programming Techniques, Introduction to Object Oriented Concepts, Concept of Structured Procedural Programming, Class, Object

Characteristics of Objects: Data Abstraction, Classification, Encapsulation and Message Passing. Access Specifiers in Class, UML Class Diagrams.

UNIT – II

Advanced Concepts in Object Oriented Technology: Relationships, Inheritance- Protected Access Specifier, Multiple and Multilevel Inheritance, Generalization and Specialization, Abstract classes, Polymorphism, Implementation of OOC through C++.

UNIT – III

Introduction to Computer Networks: Introduction, Network Topology, OSI Reference Model, TCP Protocol Suite, Routing Devices, Types of Networks.

UNIT – IV

Internetworking: Protocols for Internetworking, Internet Address and Domains, Packets, Packet Switched Networks, Virtual Private Networks, and Working of Internet.

UNIT – V

Introduction to Web Technology: Introduction, Hyper Text Transfer Protocol (HTTP), File Transfer Protocol (FTP), Domain Name Server (DNS), Web Applications, Types of Web Content, Multi-Tier Web Applications, Performance of Web Applications.

Text Books:

1. Campus Connect Foundation Programme – Object Oriented Concepts – System
2. Campus Connect Foundation Programme – Computer Hardware and System Software - Vol. – 3, INFOSYS Concepts

Reference Books:

1. Campus Connect Foundation Programme – Relational Database Management System,Client Server

Online Learning Resources:

1. https://www.tutorialspoint.com/cplusplus/
2. https://www.geeksforgeeks.org/computer-network-tutorials/

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 COMPUTING (QC)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE726	OE-IV	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:	Explain the fundamental concepts of quantum mechanics used in computing.
CO2:	Construct and analyze quantum circuits using standard gates.
CO3:	Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
CO4:	Develop simple quantum programs using Qiskit or similar platforms.
CO5:	Analyze applications and challenges of quantum computing in real-world domains.

UNIT – I

Fundamentals of Quantum Mechanics and Linear Algebra: Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT – II

Quantum Gates and Circuits: Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT – III

Quantum Algorithms and Complexity: Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT – IV

Quantum Programming and Simulation Platforms: Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT – V

Applications and Future of Quantum Computing: Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Text Books:

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

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

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.

FINANCIAL MATHEMATICS (FM)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE727	OE-IV	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:	Explain fundamental financial concepts, including arbitrage, valuation, and risk.
CO2:	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts..
CO3:	Analyze mathematical techniques for pricing options and financial derivatives.
CO4:	Evaluate interest rate models and bond pricing methodologies.
CO5:	Utilize computational techniques such as Monte Carlo simulations for financial modeling.

UNIT – I

Asset Pricing and Risk Management: Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT – II

Stochastic Models in Finance: Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT – III

Interest Rate and Credit Modelling: Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR),Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT – IV

Fixed-Income Securities and Bond Pricing: Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT – V

Exotic Options and Computational Finance: Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Text Books:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas& Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

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.

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (SAEA)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE728	**OE-IV**	**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:	To provide exposure to various kinds of sensors and actuators and their engineering applications.
CO2:	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
CO3:	To explain the operating principles of various sensors and actuators
CO4:	To educate the fabrication of sensors
CO5:	To explain the required sensor and actuator for interdisciplinary application

UNIT – I

Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT – II

Temperature and Mechanical Sensors

TemperatureSensors: Typesoftemperaturesensorsandtheirbasicprincipleofworking:Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT – III

Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonicsensors, Piezo-electricresonators, Microphones

UNIT – IV

Magnetic and Electromagnetic Sensors: Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT – V

Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors,

Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)
Text Books:
1. Sensors andActuators– Clarence W.deSilva, CRC Press, 2nd Edition, 2015
2. Sensors andActuators, D.A. Halland C.E.Millar, CRC Press, 1999
Reference Books:
1. Sensors and Transducers-D.Patranabhis,Prentice Hall of India(Pvt)Ltd.2003
2. Measurement, Instrumentation, and Sensors Handbook John G.Webster, CRC Press 1999
3. Sensors–A Comprehensive Sensors-Henry Bolte, John Wiley.
4. Hand book of modern sensors, Springer, Stefan Johann Rupitsch
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 NANO MATERIALS AND APPLICATIONS (CNMA)

VII Semester: All Branches						Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE729	OE-IV	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:	Classify the nano structur ematerials; describe scope of nano science and importance of technology.
CO2:	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling.
CO3:	Discuss different technique for characterization of nano material, Explain electron Microscopy techniques for characterization of nano material, Describe BET method for surface area analysis.
CO4:	Explain synthesis and properties and applications of nanao materials, Discuss about fullerenes and carbon nano tubes, Differentiate nano magnetic materials and thermo electric materials, nonlinear optical materials.
CO5:	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

UNIT – I

Basics and Characterization of Nano materials: Introduction, Scope of nano science and nano technology, nano science in nature, classification of nano structured materials, importance of nano materials.

UNIT – II

Synthesis of Nano Materials: Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electro deposition method, high energy ball milling method.

Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, micro emulsions orrever semicelles, co-precipitation method, solvo thermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis

UNIT – III

Techniques for Characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination

UNIT – IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT – V

Advanced Engineering Applications of Nanomaterials: Applications ofNano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation

Text Books:

1.	NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.
2.	Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, B B Rath and James Murday, Univ. Press, 2012.
Reference Books:	
1.	Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2.	Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
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.

LITERARY VIBES (LB)								
VII Semester: All Branches						**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE730	**OE-IV**	**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 genres, literary techniques and creative uses of language in literary texts.
CO2:	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces
CO3:	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments
CO4:	Analyze the underlying meanings of the text by using the elements of literary texts
CO5:	Evaluate their own work and that of others critically
CO6:	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance

UNIT – I

Poetry:

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT – II

Drama: Twelfth Night- William Shakespeare

Shakespeare -life and works

1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT – III

Short Story:

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT – IV

Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT – V

Novel: Hard Times- Charles Dickens

1. Charles Dickens-Life and works

2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens.Hard Times.(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

1. WJ Long.History of English Literature, Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University,2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008.

Online Learning Resources:

1. https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
2. https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
3. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
4. https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
5. https://www.litcharts.com/lit/twelfth-night/themes
6. https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

Question Paper Pattern:

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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.