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REGULATIONS: R-25

Santhiram Engineering College (Autonomous)

Approved by A.I.C.T.E., New Delhi, Permanently Affiliated to JNT University, Ananthapuramu
Accredited by NAAC with Grade-A, Accredited by NBA (ECE & CSE)
An ISO 9001:2015 Certified Institution,2(f) &12(B) recognition by UGC Act, 1956
NH-40, NANDYAL-518501 (Dist), A.P.

ACCADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABI

M.TECH (COMPUTER SCIENCE & ENGINEERING)

(Applicable for the Admitted Batch 2025-26)

Learn-Grow-Empower

YEAR 18th OF EXCELLENCE

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Counselling Code: SREC

17 Years of Excellence

SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech
I-Semester Course Structure

SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week				Marks		
				Lecture	Tutorial	Practical	Credits	Internal	External	Total
1	25D58101	PC	ADVANCED DATA STRUCTURES & ALGORITHMS	3	0	0	3	40	60	100
2	25D58201	PC	ADVANCES IN SOFTWARE ENGINEERING	3	0	0	3	40	60	100
3	25D58202	PC	ADVANCED DATABASES	3	0	0	3	40	60	100
4	25D58102	PC	DISTRIBUTED OPERATING SYSTEMS	3	0	0	3	40	60	100
5	25D58103A	PE	ADVANCED COMPUTER ARCHITECTURE (PE-I)	3	0	0	3	40	60	100
6	25D58103B	PE	ENTERPRISE CLOUD CONCEPTS (PE-I)	3	0	0	3	40	60	100
7	25D58103C	PE	APPLIED MACHINE LEARNING (PE-I)	3	0	0	3	40	60	100
8	25D58203C	PE	DEEP LEARNING (PE-III)	3	0	0	3	40	60	100
9	25D58103D	PE	PARALLEL COMPUTER ARCHITECTURE (PE-I)	3	0	0	3	40	60	100
10	25D58103E	PE	ARTIFICIAL INTELLIGENCE: KNOWLEDGE REPRESENTATION AND REASONING (PE-I)	3	0	0	3	40	60	100
11	25D58104A	PE	NATURAL LANGUAGE PROCESSING (PE-II)	3	0	0	3	40	60	100
12	25D58104B	PE	SMART SENSOR NETWORKS &IOT (PE-II)	3	0	0	3	40	60	100
13	25D58104C	PE	COMPUTING FOR DATA ANALYTICS (PE-II)	3	0	0	3	40	60	100
14	25D13204E	PE	INTRODUCTION TO LARGE LANGUAGE MODELS (PE-IV)	3	0	0	3	40	60	100
15	25D58205	PC	ADVANCES IN SOFTWARE ENGINEERING LAB	0	0	4	2	40	60	100
16	25D58206	PC	ADVANCED DATABASES MANAGEMENT SYSTEMS LAB	0	0	4	2	40	60	100

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17	25D58104E	PE	CRYPTOGRAPHY AND NETWORKS SECURITY (PE-II)	3	0	0	3	40	60	100
18	25D57207	MC(C)	QUANTUM TECHNOLOGIES AND APPLICATIONS	2	0	0	2	40	60	100
19	25D58105	PC	ADVANCED DATA STRUCTURES & ALGORITHMS LAB	0	0	4	2	40	60	100
20	25D58106	PC	DISTRIBUTED OPERATING SYSTEMS LAB	0	0	4	2	40	60	100
21	25D57107	MC(C)	RESEARCH METHODOLOGY AND IPR	2	0	0	2	40	60	100
22	25D57209B	MC(NC)	PEDAGOGY STUDIES (AC-II)	2	0	0	0	40	60	100
23	25D58107	SC	FULL STACK DEVELOPMENT USING MERN	0	1	2	2	40	60	100
24	25D57109A	MC(NC)	ENGLISH FOR RESEARCH PAPER WRITING (AC-I)	2	0	0	0	40	0	40
25	25D57109C	MC(NC)	DISASTER MANAGEMENT (AC-I)	2	0	0	0	40	0	40
26	25D57109D	MC(NC)	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AC-I)	2	0	0	0	40	0	40

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech
I -Semester Syllabus

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58101) ADVANCED DATA STRUCTURES & ALGORITHMS

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I INTRODUCTION

Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular ListsAlgorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.

UNIT-II SEARCHING AND SORTING

:

Linear and Binary Search Methods, Sorting: -Basic sorting techniques, Radix Sort, Bucket Sort, Shell Sort Trees- Binary trees, Properties, Representation and Traversals, Expression Trees (Infix, prefix, postfix). Graphs-Basic Concepts, Storage structures and Traversals.

UNIT-III DICTIONARIES AND HASHING

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing

UNIT-IV PRIORITY QUEUES

Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations-Searching, Insertion, Deletion.

UNIT-V SEARCH TREES

AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

TEXT BOOKS:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, University Press

REFERENCE BOOKS:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage

3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad and S Chand & Co.

COURSE OUTCOMES:

1. Implement and manipulate linear data structures like singly/doubly linked lists, circular lists, stacks, and queues using dynamic memory allocation.
2. Apply and analyze searching and sorting algorithms including linear, binary search, bubble, selection, insertion, quick, and merge sort.
3. Design and implement dictionaries and hashing techniques to efficiently store and retrieve data.
4. Construct and operate on trees and priority queues, performing insertion, deletion, and traversal operations.
5. Compare and implement balanced search trees (AVL, Red-Black, Splay, B-Trees) for optimized data access and storage.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58201) ADVANCES IN SOFTWARE ENGINEERING

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I SOFTWARE PROCESS AND PROJECT MANAGEMENT

Software Engineering – A Layered Technology, Process Models: Waterfall, Incremental, Evolutionary, Spiral, Agile Development, Unified Process Framework.

Software Project Management Concepts: Estimation, Scheduling, Risk Analysis, Process Improvement and Capability Maturity (CMMI, ISO Standards).

UNIT-II REQUIREMENTS ENGINEERING AND MODELING

Requirement Engineering Tasks: Inception, Elicitation, Elaboration, Negotiation, Specification, Validation.

System Modeling with UML, Scenario-based, Flow-oriented, Behavioral and Class-based modelling, Design Concepts and Principles, Architectural Design ??? Styles and Patterns

UNIT-III ADVANCED DESIGN AND DEVELOPMENT CONCEPTS

Component-level Design, Object-Oriented Design using UML, Design Patterns and Frameworks, Aspect-Oriented Software Engineering, Reuse-oriented Software Engineering.

UNIT-IV SOFTWARE QUALITY, TESTING AND MAINTENANCE

Quality Concepts and Quality Assurance, Software Reviews, Formal Technical Reviews, Software Testing Strategies: Unit, Integration, System, Regression Testing, Black-box and White-box Testing, Software Maintenance and Reengineering.

UNIT-V ADVANCED TOPICS AND EMERGING TRENDS

Software Configuration Management (SCM) and Version Control, Software Reliability and Safety Engineering, Agile Software Development and DevOps, Software Metrics and Measurement. Emerging Areas: AI in Software Engineering, Cloud-based SE, Secure Software Development.

TEXT BOOKS:

1. Software Engineering A Practitioner???s Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

REFERENCE BOOKS:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

COURSE OUTCOMES:

1. Demonstrate understanding of advanced software process models and project management practices.
2. Apply requirement engineering and advanced modeling techniques to software system design.
3. Develop robust designs using object-oriented, component-based, and aspect-oriented approaches.
4. Evaluate software quality through systematic testing, reviews, and maintenance strategies.
5. Analyze emerging research challenges and apply metrics, configuration management, and agile practices in modern software engineering.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58102) DISTRIBUTED OPERATING SYSTEMS

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the architectures, principles, and design issues of distributed, database, and multiprocessor operating systems.
2. Develop an understanding of communication, synchronization, deadlock handling, and agreement protocols in distributed environments.
3. Explain distributed resource management, shared memory, scheduling, and fault tolerance techniques
4. Provide knowledge of security and protection models, and cryptographic methods for secure distributed computing.
5. Explore the structure and design issues of multiprocessor and database operating systems with concurrency control mechanisms.

UNIT-I UNIT I

Architectures of Distributed Systems, System Architecture types, issues in distributed operatingsystems,communicationnetworks,communicationprimitives.TheoreticalFoundations,inherentlimitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages,global state, cutsof adistributed computation, termination detection.

UNIT-II UNIT – II

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, Non-Token – Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal'sHeurisric Algorithm, Raymond's Heuristic Algorithm.

UNIT-III UNIT – III

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT-IV UNIT – IV

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling. Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V UNIT V

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

TEXT BOOKS:

1. Advancedconceptsinoperatingsystems:Distributed,Databaseandmultiprocessoroperating systems",MukeshSinghal, Niranjan andG.Shivaratri,TMH, 2001
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006. 2. 3. 4. 5. 6.
2. Silberschatz, Galvin, Gagne, Operating System Concepts, Wiley, 9th Edition, 2018.
3. M. Mitzenmacher, E. Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 2005.
4. Alan Tucker, Applied Combinatorics, John Wiley & Sons, 5th Edition, 2007.
6. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems: Concepts and Design, Pearson, 5th Edition, 2011.

e-Resources and Digital Material:

COURSE OUTCOMES:

1. Explain the architectures, limitations, and synchronization mechanisms (logical clocks, mutual exclusion) in distributed systems.
2. Analyze distributed deadlock detection methods, agreement protocols, and distributed resource management techniques
3. Apply concepts of distributed shared memory, scheduling, and fault-tolerance techniques for reliable system design.
4. Evaluate models of protection, access control, and cryptographic algorithms for ensuring data security in distributed systems
5. Compare multiprocessor and database operating systems, and analyze concurrency control algorithms for distributed databases.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58202) ADVANCED DATABASES

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

UNIT-I UNIT-1

Database System Architectures Centralized and Client ???Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intra Query Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors

UNIT-II UNIT II

Distributed Databases Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems

UNIT-III UNIT III

Data Warehousing and Mining Decision-Support Systems, Data Warehousing, Data Mining, Classification, Association Rules, Other Types of Associations, Clustering, Other Forms of Data Mining

UNIT-IV UNIT IV

Object-Based Databases Introduction, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

UNIT-V UNIT V

Motivation, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications Applications Advanced database models and applications: Active Database Concepts and Triggers, Temporal database concepts, Spatial database concepts, Multimedia database concepts, Deductive databases

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition

2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming

COURSE OUTCOMES:

1. Understand Database system Architectures and parallel databases
2. Analyze transactions, Concurrency Control in Distributed Databases
3. Understand the importance of Data Warehousing and Mining
4. Illustrate concepts of object based databases

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58103A) ADVANCED COMPUTER ARCHITECTURE (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To impart the concepts and principles of parallel and advanced computer architectures.
2. To develop the design techniques of Scalable and multithreaded Architectures.
3. To apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems

UNIT-I MICRO PROCESSORS

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multi computers, Multi vector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT-II PARALLEL PROCESSING

Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors

UNIT-III PIPELINE PROCESSORS

Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT-IV ARCHITECTURE OF MICROPROCESSORS

Parallel and Scalable Architectures, Multiprocessors and Multi computers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multi computers, Message-passing Mechanisms, Multi vector and SIMD computers.

UNIT-V APPLICATIONS

Vector Processing Principles, Multi vector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

TEXT BOOKS:

1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers.

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REFERENCE BOOKS:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G.Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

COURSE OUTCOMES:

1. Analyze various parallel computer models, program partitioning techniques, and system interconnect architectures to evaluate conditions for parallelism.
2. Apply performance metrics and scalability analysis to assess parallel processing applications using advanced processor and memory technologies
3. Design and differentiate linear, non-linear, instruction, and arithmetic pipelines to enhance execution performance in modern processors.
4. Examine multiprocessor and multicomputer architectures, cache coherence protocols, and synchronization mechanisms for scalable system design.
5. Design and differentiate linear, non-linear, instruction, and arithmetic pipelines to enhance execution performance in modern processors.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem. L T P C

(25D58203A) BLOCK CHAIN & ITS APPLICATIONS (PE-III)

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

COURSE OUTCOMES:

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58103B) ENTERPRISE CLOUD CONCEPTS (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Knowledge on significance of cloud computing and its fundamental concepts and models.

UNIT-I UNIT 1

and Challenges. Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT-II UNIT II

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology CLOUD COMPUTING MECHANISMS: Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication

UNIT-III UNIT III

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example
Cloud Computing Architecture Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example

UNIT-IV UNIT IV

Cloud-Enabled Smart Enterprises Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises Cloud-Inspired Enterprise Transformations Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy

UNIT-V UNIT V

Transitioning to Cloud-Centric Enterprises The Tuning Methodology, Contract Management in the Cloud Cloud Instigated IT Transformations Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds

TEXT BOOKS:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition.
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press

REFERENCE BOOKS:

1. Pethuru Raj, Cloud Enterprise Architecture, CRC Press

COURSE OUTCOMES:

1. Understand importance of cloud architecture
2. Illustrating the fundamental concepts of cloud security
3. Analyze various cloud computing mechanisms
4. Understanding the architecture and working of cloud computing.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem. L T P C

(25D58203B) ADVANCED COMPUTER NETWORKS (PE-III)

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

COURSE OUTCOMES:

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58103C) APPLIED MACHINE LEARNING (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To know the fundamental concepts of Machine Learning.
2. To understand linear, distance based, and decision tree based models
3. To explore tools and practices for Machine learning in Real world situation.
4. To know the Artificial Neural Network and Reinforcement Learning.

UNIT-I UNIT I

Introduction to Machine Learning: Introduction. Different types of learning, Examples of Machine Learning Applications Supervised Learning: Learning a Class from Examples, Probably Approximately Correct Learning, Learning multiple classes, Model selection and generalization Regression: Linear regression, Multiple Linear regression, Logistic Regression.

UNIT-II UNIT II

The ingredients of machine learning: Tasks, Models, Features Binary classification and related tasks: Classification, Assessing classification performance, Visualizing classification performance Beyond binary classification: Multi-class classification, Regression, Unsupervised and descriptive learning

UNIT-III UNIT III

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Inductive bias in decision tree, Issues in decision tree learning. Linear models: The least-squares method, Multivariate linear regression, The perceptron, Support vector machines, Soft margin SVM, Going beyond linearity with kernel methods.

UNIT-IV UNIT IV

Distance Based Models: Introduction, Neighbours and exemplars, Nearest Neighbours classification, K-Means algorithms, Clustering around medoids Probabilistic Models: Using Naïve Bayes Model for classification, Expectation Maximization, Gaussian Mixture models

UNIT-V UNIT V

Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation, Advanced topics in Artificial Neural Networks Reinforcement Learning: Introduction, Learning tasks, Q-learning

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TEXT BOOKS:

1. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education

REFERENCE BOOKS:

1. AurélienGéron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition
2. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.
4. T. Hastie, R. Tibshirani and J. Friedman, “Elements of Statistical Learning”, Springer Series, 2nd edition

COURSE OUTCOMES:

1. Understand the fundamental concepts of machine learning
2. Apply linear, distance based, and decision tree based models
3. Analyze probabilistic, neural network models
4. Design a suitable machine learning model for a given scenario

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D58203C) DEEP LEARNING (PE-III)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals and historical development of deep learning.
2. Explain perceptrons, multilayer neural networks, and learning algorithms.
3. Provide understanding of optimization techniques and regularization methods.
4. Develop knowledge of representation learning using autoencoders and embeddings.
5. Familiarize students with convolutional and recurrent neural networks and their applications.

UNIT-I FUNDAMENTALS OF NEURAL NETWORKS

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.

UNIT-II TRAINING AND OPTIMIZATION TECHNIQUES

Feedforward Neural Networks, Backpropagation Algorithm, Gradient Descent (GD), Momentum-based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and Eigenvectors, Eigenvalue Decomposition, Basis.

UNIT-III DIMENSIONALITY REDUCTION AND AUTOENCODERS

Principal Component Analysis (PCA) and its interpretations, Singular Value Decomposition (SVD), Autoencoders and relation to PCA, Regularization in Autoencoders, Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders.

UNIT-IV REGULARIZATION AND PERFORMANCE IMPROVEMENT

Regularization: Bias-Variance Tradeoff, L2 Regularization, Early Stopping, Dataset Augmentation, Parameter Sharing and Tying, Injecting Noise at Input, Ensemble Methods, Dropout, Greedy Layerwise Pre-training, Better Activation Functions, Better Weight Initialization Methods, Batch Normalization.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V ADVANCED DEEP LEARNING ARCHITECTURES

Learning Vectorial Representations of Words, Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling CNNs, Recurrent Neural Networks, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM, Encoder???Decoder Models, Attention Mechanism, Attention over Images.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Simon Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson, 2009.

REFERENCE BOOKS:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer, 2018.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press.

e-Resources and Digital Material:

1. https://www.deeplearning.ai/
2. https://cs231n.github.io/
3. https://www.tensorflow.org/tutorials

COURSE OUTCOMES:

1. Explain the evolution of deep learning and the working of artificial neurons and perceptrons.
2. Design and analyze multilayer feedforward neural networks using backpropagation.
3. Apply optimization and dimensionality reduction techniques for deep learning models.
4. Use autoencoders and regularization methods to improve model generalization.
5. Build CNN and RNN architectures for vision and sequence learning tasks.

SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D58103D) PARALLEL COMPUTER ARCHITECTURE (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Entrepreneurship**

COURSE OBJECTIVES:

1. Understand Parallel Architectures: Learn the fundamentals of parallel computer architectures, including shared-memory and distributed-memory systems.
2. Explore Parallel Programming Models: Study different programming models and architectural approaches for efficient parallel computation.
3. Analyze Memory Hierarchy and Coherence: Examine cache design, memory hierarchy, cache coherence protocols (MSI, MESI, Dragon), and correctness of coherence mechanisms.
4. Study Scalable Shared Memory and Consistency Models: Understand scalable coherence protocols, NUMA architectures, and memory consistency models (sequential and relaxed).
5. Learn Synchronization and Interconnection Mechanisms: Explore synchronization techniques (LL-SC, barriers) and interconnection network.

UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND SYMBOLIC REASONING

Introduction to Parallel Architectures, Parallel Programming models and Architectures, Memory Hierarchy-Cache and Virtual memory.

UNIT-II PROPOSITIONAL AND FIRST-ORDER LOGIC

Overview of Cache coherence, Coherence Protocols- Snooping, Directory based protocols, VI protocol MSI, MESI, Dragon protocol and Correctness of coherence protocols- Types of cache misses, update vs invalidate protocol.

UNIT-III INFERENCE MECHANISMS AND LOGIC PROGRAMMING

Snoop based multiprocessor design, Single and multi-level cache with atomic bus Snoop based multiprocessor design, Single and multi-level cache with split transaction bus Scalable shared memory systems: Directory coherence protocols- Memory based, cache based, correctness.

UNIT-IV KNOWLEDGE REPRESENTATION TECHNIQUES

Case study: Origin- Architecture, protocol, correctness; Sequent NUMA Q- Architecture, protocol, correctness

UNIT-V ADVANCED REASONING AND EPISTEMIC LOGIC

Memory consistency models- Sequential, Relaxed consistency models, Synchronization- LL-SC, point to point, barrier synchronization, Interconnects- Introduction, Topologies, routing, flow control.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

TEXT BOOKS:

1. D. E. Culler and J. P. Singh with A. Gupta. Parallel Computer Architecture. Morgan- Kaufmann publishers.
2. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan- Kaufmann publishers.
3. M. Dubois, M. Annavaram, Per Stenstrom. Parallel Computer Organisation and Design. Cambridge University Press.

REFERENCE BOOKS:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw Hill.
3. David E. Culler and Jaswinder Pal Singh, Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann
4. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson.
5. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw Hill.

COURSE OUTCOMES:

1. Demonstrate knowledge of different parallel architectures, programming models, and their design principles.
2. Explain cache and virtual memory concepts, cache coherence mechanisms, and protocols such as MSI, MESI, and Dragon.
3. Compare snoop-based and directory-based coherence protocols in single and multi-level cache systems, and assess scalability in shared memory systems.
4. Understand and apply various memory consistency models (sequential and relaxed) and synchronization mechanisms like LL-SC, barriers, and point-to-point methods.
5. Analyze interconnection topologies, routing techniques, and flow control strategies for efficient communication in parallel systems.

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M.Tech. I Sem.

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(25D58103E) ARTIFICIAL INTELLIGENCE: KNOWLEDGE REPRESENTATION AND REASONING (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To understand the foundations, history, and philosophy of Artificial Intelligence and symbolic reasoning.
2. To learn propositional and first-order logic for formal knowledge representation and inference.
3. To study inference mechanisms and logic programming using Prolog and rule-based systems.
4. To explore various knowledge representation techniques like frames, semantic networks, and description logics.
5. To understand advanced reasoning approaches such as non-monotonic, temporal, and epistemic reasoning.

UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND SYMBOLIC REASONING

Introduction to AI, History, and Philosophy, Foundations of Knowledge Representation and
Reasoning, Symbolic Reasoning and Logic, Truth, Logic, and Provability, Syntax and Semantics of
Logic, Logical Entailment and Proof Systems.

UNIT-II INTRODUCTION TO AI, HISTORY, AND PHILOSOPHY, FOUNDATIONS OF KNOWLEDGE REPRESENTATION AND REASONING, SYMBOLIC REASONING AND LOGIC, TRUTH, LOGIC, AND PROVABILITY, SYNTAX AND SEMANTICS OF LOGIC, LOGICAL ENTAILMENT AND PROOF SYSTEMS.

Propositional Logic: Syntax, Semantics, and Direct Proofs, The Tableau Method for Satisfiability,
First-Order Logic (FOL): Syntax and Semantics, Quantifiers and Inference Rules, Universal
Instantiation and Generalization, The Unification Algorithm.

UNIT-III INFERENCE MECHANISMS AND LOGIC PROGRAMMING

Forward and Backward Chaining, The Resolution Refutation Method, Horn Clauses and Logic
Programming, The Prolog Language: Syntax and Semantics, Rule-Based Systems and the OPS5
Language, Pattern Matching and the RETE Algorithm.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-IV KNOWLEDGE REPRESENTATION TECHNIQUES

Representation in First-Order Logic, Conceptual Dependency Theory (Schank's Model), Frame
Based Knowledge Representation, Description Logics and the Web Ontology Language (OWL),
Taxonomies and Inheritance, Default Reasoning and Exceptions

UNIT-V ADVANCED REASONING AND EPISTEMIC LOGIC

Circumscription and Non-Monotonic Reasoning, Auto-epistemic Reasoning, Event Calculus and
Temporal Reasoning, Epistemic Logic: Knowledge and Belief, Modal Logic and Applications in
AI.

TEXT BOOKS:

1. Ronald J. Brachman & Hector J. Levesque (2004) — Knowledge Representation and Reasoning, Morgan Kaufmann.
2. Deepak Khemani (2013) — A First Course in Artificial Intelligence, McGraw Hill Education (India).

REFERENCE BOOKS:

1. Roger C. Schank & Robert P. Abelson — Scripts, Plans, Goals, and Understanding, Lawrence Erlbaum, 1977.
2. R. C. Schank & C. K. Riesbeck — Inside Computer Understanding: Five Programs Plus Miniatures, Lawrence Erlbaum, 1981.
3. Murray Shanahan — A Circumscriptive Calculus of Events, Artificial Intelligence, 77(2), 249- 284, 1995.
4. Grigoris Antoniou & Frank van Harmelen — A Semantic Web Primer (2nd Ed.), MIT Press, 2008.
5. John F. Sowa — Conceptual Structures: Information Processing in Mind and Machine, Addison–Wesley, 1984.

COURSE OUTCOMES:

1. Understand the fundamental concepts, history, and role of reasoning in Artificial Intelligence.
2. Apply propositional and first-order logic for knowledge representation and inference.
3. Implement inference mechanisms and logic programming techniques using Prolog and rule□based systems.
4. Analyze and design various knowledge representation models such as frames, ontologies, and semantic networks
5. Evaluate advanced reasoning techniques including non-monotonic, temporal, and epistemic reasoning for intelligent systems.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D58104A) NATURAL LANGUAGE PROCESSING (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamental concepts of human language, linguistic structures, and their computational representation for Natural Language Processing.
2. Develop knowledge of grammars, parsing strategies, semantic interpretation, and language modelling techniques for designing NLP systems.
3. Explore advanced NLP applications such as machine translation, multilingual information retrieval, and cross-lingual language processing.

UNIT-I UNIT I

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems,
Different Levels of Language Analysis, Representations and Understanding, Organization of
Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT-II UNIT-II

:
Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature
Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with
Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.

UNIT-III UNIT III

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in
Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in
Parsing, Shift Reduce Parsers, Deterministic Parsers

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-IV SEMANTIC INTERPRETATION &LANGUAGE MODELLING

Semantic Interpretation: Semantic & Logical form, Word senses & ambiguity, The basic logical
form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic
roles, Speech acts &embedded sentences, Defining semantics structure model theory.

Language Modelling: Introduction, n-Gram Models, Language model Evaluation, Parameter
Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling
Problems, Multilingual and Cross lingual Language Modelling

UNIT-V UNIT-V

Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine
Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language
Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System,
User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Multilingual Information Retrieval: Introduction, Document Pre-processing, Monolingual
Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and
Resources.

TEXT BOOKS:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

REFERENCE BOOKS:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993. 2. 3.
2. Jurafsky,Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

COURSE OUTCOMES:

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

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1. Understand linguistic foundations of English syntax and various levels of language analysis for Natural Language Processing. 2. 3. Analyse different grammar formalisms and parsing approaches to handle language phenomena like movement, ambiguity, and human preferences in parsing. 4.. 5.
2. Apply parsing techniques such as top-down, bottom-up, ATNs, and feature-based systems for grammatical analysis of natural language.
3. Analyse different grammar formalisms and parsing approaches to handle language phenomena like movement, ambiguity, and human preferences in parsin
4. Construct semantic representations using logical forms, thematic roles, and speech acts, and apply n-gram and statistical models for language modeling
5. Evaluate and compare machine translation approaches and demonstrate understanding of systems like Anusaraka for multilingual language processing.
6. Implement and analyze multilingual information retrieval systems, app

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M.Tech. I Sem.

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(25D58104B) SMART SENSOR NETWORKS &IOT (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To provide an in-depth understanding of IoT concepts, applications, and research areas in domains such as smart cities, smart health, smart energy, and smart transportation.
2. To analyzeIoT system architectures, design constraints, physical devices, communication protocols, and middleware for advanced implementation
3. To explore industrial and commercial IoT applications, including automation, sensor networks, and emerging trends like edge computing, cloud of things, and digital twins

UNIT-I INTRODUCTION AND APPLICATIONS

:

smart transportation, smart cities, smart living, smart energy,
smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive
Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors,
Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference
Architecture Introduction, Functional View, Information View, Deployment and Operational View,
Other Relevant architectural views.

UNIT-II REAL-WORLD DESIGN CONSTRAINTS-

Introduction, Technical Design constraints, hardware, Data
representation and visualization, Interaction and remote control.

UNIT-III IOT PHYSICAL DEVICES & ENDPOINTS

:

What is an IOT Device, Exemplary Device Board, Linux on
Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium
Access Control, Topology and Coverage Control, **Routing:** Transport Protocols, Network Security,
Middleware, Databases

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-IV UNIT IV

Industrial Automation-Service-oriented architecture-based device integration, SOCRADES:
realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the
Cloud of Things, Commercial Building Automation-Introduction,

UNIT-V UNIT V

Case study: phase one-commercial building automation today.
Case study: phase two commercial building automation in the future. Recent trends in sensor
network and IOT architecture, Automation in Industrial aspect of IOT.

TEXT BOOKS:

1. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication
2. Internet of Things: A Hands-On Approach Paperback – 2015, by ArsheepBahga (Author), Vijay Madisetti (Author) or), Barton Rob (Author)
3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Auth

REFERENCE BOOKS:

COURSE OUTCOMES:

1. Explain the fundamental concepts, applications, and research areas of IoT across various domains.
2. AnalyzeIoT reference architectures, functional and deployment views, and real-world design constraints including hardware, technical, and operational limitations.
3. Demonstrate practical knowledge of IoT devices, programming, operating systems, communication protocols, network security, and database management.
4. Apply IoT principles to industrial automation and enterprise integration using frameworks such as SOCRADES and IMC-AESOP.
5. Evaluate case studies in commercial building automation and emerging IoT trends, including edge/fog computing, predictive maintenance, and digital twin technologies.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D13204E) INTRODUCTION TO LARGE LANGUAGE MODELS (PE-IV)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To introduce the fundamentals of Large Language Models (LLMs), their characteristics, working mechanisms, and evolution.
2. To provide an overview of Natural Language Processing (NLP) and Neural Networks as foundational technologies for LLMs.
3. To explore various language models, including statistical and neural approaches, along with their limitations.
4. To understand different prompting strategies used in LLMs and their impact on performance.
5. To examine advanced topics such as reasoning, handling long contexts, model editing, and hallucination in LLMs.

UNIT-I INTRODUCTION

Definition of LLMs, Key Characteristics of LLMs, How LLMs work, Evolution of Language Modelling Technologies, Evolution of LLMs, Applications of LLMs.

UNIT-II AN OVERVIEW OF NLP AND NEURAL NETWORKS NLP

NLP Pipeline, Morphology, Tokenization. Neural Networks: The Perceptron, Multi layer Perceptron, Training Neural Networks.

UNIT-III LANGUAGE MODELS

Statistical Language Model, Smoothing, Evaluation of Language Model, Limitations of Statistical Language Models. Neural Language Models: Convolutional Neural Networks, Recurrent Neural Networks, Limitations of Neural Language Models.

UNIT-IV PROMPTING STRATEGIES IN LLMS

Prompt Engineering: Prompt shape, Manual Template Engineering, Automated Template Learning, Continuous Prompts, Prompt Application, Chain-of-Thoughts, Tree-of-Thoughts, Graph-of-Thoughts.

UNIT-V ADVANCED TOPICS IN LARGE LANGUAGE MODELS

Reasoning with LLMs, Handling long context in LLMs, Model Editing, Hallucination in LLMs, Self-Evolving LLMs

TEXT BOOKS:

1. Tanmoy Chakraborty, Introduction to Large Language Models, Wiley India, 1st Edition, 2025. ISBN : 9789363864740.

2. Dan Jurafsky and James H. Martin, Speech and Language Processing, 2nd edition, Pearson Press, 2008.

REFERENCE BOOKS:

1. Jacob Eisenstein, Natural Language Processing, First edition,The MIT Press, 2019.
2. Research papers published in conferences/journals likeAssociation for Computational Linguistics (ACL).

COURSE OUTCOMES:

1. Define Large Language Models (LLMs) and describe their key characteristics.
2. Explain the working principles of LLMs, including training and inference processes.
3. Analyze the evolution of language modeling technologies and their transition to modern LLMs.
4. Evaluate different applications of LLMs across various domains.
5. Compare different LLM architectures based on their capabilities and limitations.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D58104C) COMPUTING FOR DATA ANALYTICS (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Provide knowledge of the data analytics lifecycle, including business understanding, data science roles, and project deliverables.
2. Develop a strong foundation in statistical methods, probability, and hypothesis testing for data-driven decision-making
3. Equip students with skills to apply predictive analytics, regression, time series forecasting, and experimental design techniques to real-world datasets.

UNIT-I DATA ANALYTICS LIFE CYCLE

Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists
- Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables
for stakeholders.

UNIT-II STATISTICS

Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation -
Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median,
Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean
deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

UNIT-III PROBABILITY AND HYPOTHESIS TESTING

Random variable, distributions, joint probability function, marginal density function. Random
vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential,
normal, gamma and Erlang - Normal distribution.

UNIT-IV PREDICTIVE ANALYTICS

Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses
of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modeling and Analysis - Regression
Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS

Forecasting Models for Time series : MA, SES, TS with trend, season - Design of Experiments, one
way classification, two way classification, ANOVA, Latin square, Factorial Design.

TEXT BOOKS:

1. Chris Eaton, Dirk Deroos, Tom Deutsch et al., —Understanding Big Data, Mc Graw Hill, 2012.
2. Alberto Cordoba, —Understanding the Predictive Analytics Lifecycle, Wiley, 2014.
3. Eric Siegel, Thomas H. Davenport, —Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2013.

REFERENCE BOOKS:

1. James R Evans,—Business Analytics – Methods, Models and Decisions, Pearson 2013
2. R. N. Prasad, Seema Acharya, —Fundamentals of Business Analytics, Wiley, 2015
3. S M Ross, —Introduction to Probability and Statistics for Engineers and Scientists‖, Academic Foundation, 2011.
4. David Hand, HeikiMannila, Padhria Smyth, —Principles of Data Mining, PHI 2013
5. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, —Forecasting methods and applications Wiley 2013(Reprint).
6. David Hand, HeikkiMannila, Padhraic Smyth, —Principles of Data mining, PHI 2013.

e-Resources and Digital Material:

COURSE OUTCOMES:

1. Understand the data analytics lifecycle and identify the roles and responsibilities of data scientists in business analytics projects.
2. Apply statistical techniques such as measures of central tendency, variation, skewness, and kurtosis for data summarization and interpretation.
3. Analyze probability distributions (binomial, Poisson, normal, exponential, gamma, etc.) and apply them in modeling uncertain events.
4. Perform hypothesis testing and predictive analytics using t-tests, chi-square tests, regression, correlation, and multiple correlation methods.
5. Design forecasting models (moving average, exponential smoothing, seasonal trends) and conduct design of experiments (ANOVA, Latin square, factorial design) for analytical problem solving

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D58205) ADVANCES IN SOFTWARE ENGINEERING LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

Experiment 1: Comparative Study of Process Models Implement a simple project using Waterfall and Incremental models; compare effort, defects, and time taken.

Experiment 2: Agile Development Simulation Develop a small software system using Scrum methodology with sprints, product backlog, sprint backlog, and daily scrums.

Experiment 3: Project Estimation and Scheduling Perform Function Point Analysis (FPA) or Use Case Points (UCP) to estimate size and effort, then prepare a Gantt chart and PERT chart.

Experiment 4: Risk Analysis in Software Projects Conduct risk identification, qualitative/quantitative assessment, and develop a risk mitigation plan for a given case study.

Experiment 5: Requirement Elicitation and SRS Document Conduct requirement gathering for a mini-project and prepare a Software Requirement Specification (SRS) document.

Experiment 6: UML Modeling (Scenario-based & Structural) Create Use Case diagrams, Activity diagrams, and Sequence diagrams for a given problem domain.

Experiment 7: UML Modeling (Class &Behavioral) Create Class diagrams, State machine diagrams, and Component diagrams to represent system architecture.

Experiment 8: Object-Oriented Design Using UML Design a software module using OO principles (encapsulation, inheritance, polymorphism) and illustrate with UML diagrams.

Experiment 9: Design Patterns Implementation Implement at least three design patterns (e.g., Singleton, Factory, Observer) in Java/Python.

Experiment 10: Reuse-Oriented Software Engineering Use existing open-source libraries/frameworks to develop a component-based application (e.g., web app using Django/Flask).

Experiment 11: Black-box and White-box Testing Perform equivalence partitioning and

boundary value analysis (black-box) and basis path testing (white-box) for a given program.

Experiment 12: Software Maintenance and Reengineering Take an existing open-source project (small module), analyze it, and perform refactoring/reengineering for improvement.

Experiment 13: Version Control and DevOps Pipeline Use Git & GitHub/GitLab for version control and demonstrate CI/CD pipeline setup with Jenkins/GitHub Actions.

Experiment 14: Software Metrics and AI in SE Compute software metrics (complexity, coupling, cohesion) for a given project and explore an AI tool (e.g., GitHub Copilot, SonarQube) for software quality analysis.

TEXT BOOKS:

1. Software Engineering A Practitioner???s Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

REFERENCE BOOKS:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

COURSE OUTCOMES:

1. Apply various software process models and project management techniques (estimation, scheduling, risk management) to plan and manage software development effectively.
2. Perform requirements elicitation, documentation, and system modeling using UML to capture, analyze, and validate software requirements.
3. Design software systems using object-oriented principles, design patterns, and component based approaches for modularity, reusability, and maintainability.
4. Implement software testing strategies, maintenance techniques, and reengineering practices to ensure software quality, reliability, and evolution.
5. Utilize modern software engineering tools and practices such as version control, DevOps pipelines, software metrics, and AI-based analysis to enhance development efficiency and quality assurance.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

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(25D58104E) CRYPTOGRAPHY AND NETWORKS SECURITY (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To introduce the fundamentals of cryptography, security goals, and classical encryption techniques
2. To study symmetric key cryptographic algorithms and understand their structure, operation, and applications.
3. To provide the mathematical foundation required for designing and analyzing cryptographic algorithms.
4. To explore public key cryptographic schemes, key management, and digital authentication mechanisms

UNIT-I INTRODUCTION AND CLASSICAL CRYPTOGRAPHY

Introduction to Cryptography, Security Goals, Cryptographic Primitives and Protocols, Types of
Cryptosystems, Cryptanalysis Overview, Classical Cryptosystems – Substitution Ciphers, Transposition Ciphers, Product Ciphers, Confusion and Diffusion, Cryptanalysis on Classical
Ciphers, Stream and Block Cipher Concepts, Shannon's Theory of Secrecy

UNIT-II SYMMETRIC KEY CRYPTOGRAPHY

Block Cipher Principles, Feistel Network, Substitution–Permutation Network, Data Encryption
Standard (DES) – Structure, Key Generation, Round Function, DES Weak Keys, Triple DES
(3DES), Modes of Operation – ECB, CBC, CFB, OFB, CTR, Stream Cipher Model, Linear
Feedback Shift Register (LFSR) based Stream Cipher, Modern Stream Ciphers – RC4, eSTREAM

UNIT-III MATHEMATICAL FOUNDATIONS FOR CRYPTOGRAPHY

Abstract Algebra – Groups, Rings, Fields, Modular Arithmetic, Modular Inverse, Extended
Euclidean Algorithm, Fermat's Little Theorem, Euler Phi Function, Euler's Theorem, Finite Fields
– GF(p), GF(2^n), Polynomial Arithmetic, Applications of Number Theory in Cryptography.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-IV PUBLIC KEY CRYPTOGRAPHY AND AUTHENTICATION MECHANISMS

Introduction to Public Key Cryptography, Key Distribution and Management, One-Way and
Trapdoor Functions, Diffie–Hellman Key Exchange, RSA Cryptosystem, Knapsack Cryptosystem,
ElGamal Cryptosystem, Rabin Cryptosystem, Elliptic Curve Cryptography – Elliptic Curves over
Reals and Modulo Prime, Generalized ElGamal Public Key Cryptosystem, Message Authentication
Codes (MAC), Digital Signature, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS),
Key Exchange Protocols.

UNIT-V ADVANCED AND MODERN CRYPTOGRAPHIC SYSTEMS

Cryptanalysis – Differential and Linear Cryptanalysis, Time-Memory Trade-off Attack,
Cryptanalysis on Stream Ciphers, Shamir's Secret Sharing, Identity-Based Encryption (IBE),
Attribute-Based Encryption (ABE), Side-Channel Attacks, The Secure Sockets Layer (SSL), Pretty
Good Privacy (PGP), Introduction to Quantum Cryptography, Blockchain Technology, Bitcoin and
Cryptocurrency

TEXT BOOKS:

1. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

REFERENCE BOOKS:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
3. Mathematics of Public Key Cryptography by Steven D. Galbraith.

COURSE OUTCOMES:

1. Students will Understand the basic principles of cryptography and classical encryption techniques
2. Students will Apply symmetric key cryptography methods like DES, Triple DES, and stream ciphers for secure data transmission.
3. Students will Demonstrate the mathematical foundations including number theory, modular arithmetic, and finite field concepts essential for constructing cryptographic algorithms

4. Students will implement public key cryptosystems such as RSA, Diffie–Hellman, and ECC, and evaluate authentication mechanisms like digital signatures and hash functions.
5. Students will analyse the advanced cryptographic systems, modern attacks, and emerging technologies like blockchain and quantum cryptography

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(25D58206) ADVANCED DATABASES MANAGEMENT SYSTEMS LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

1. Write a program to implement RDBMS - Cursors, Triggers

2. Write a Program to implement Range Partitioning sort.

3. Write a program to implement parallel hash join

4. Write a program to implement parallel nested join loop

5. Write a program to implement parallelize duplicate elimination by partitioning the tuples

6. Perform data fragmentation of distributed data(Horizontal, Vertical, Hybrid fragmentation)

7. Implement deadlock detection in distributed databases

8. Implement Semi Join algorithm.

9. DataCube Implementation - Aggregation

10. Perform data Integration - Extraction, Transformation, Loading

11. Implement any one classifier

12. Implement vector space models for Text corpus

13. Demonstrate type inheritance, table inheritance in object based databases

14. Write queries in XQueries on DTD

15. Write queries in SQL/XML to convert University data - XML Schema

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition
2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming.

COURSE OUTCOMES:

1. Understand Database system Architectures and parallel databases
2. Analyze transactions, Concurrency Control in Distributed Databases
3. Understand the importance of Data Warehousing and Mining
4. Illustrate concepts of object based databases

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(25D57207) QUANTUM TECHNOLOGIES AND APPLICATIONS

Course Category	**Mandatory Course (credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Present core quantum principles such as superposition and entanglement without mathematical formalism.
2. Develop conceptual clarity on qubits, quantum states, and information frameworks.
3. Examine the theoretical challenges in realizing scalable quantum systems.
4. Introduce foundational ideas in quantum communication and computing.
5. Highlight applications, industrial adoption, and future research directions in quantum technologies.

UNIT-I FOUNDATIONS OF QUANTUM THEORY AND TECHNOLOGIES

Transition from classical to quantum physics. Key conceptual principles: Superposition, Entanglement, Uncertainty, Wave-particle duality. Quantum states and measurement; the role of the observer. Representative quantum systems: electrons, photons, atoms. Concept of quantization and discrete energy levels. Strategic relevance of quantum technologies. Overview of major domains: Computing, Communication, Sensing. Global quantum initiatives: India’s National Quantum Mission, EU Quantum Flagship, USA, China.

UNIT-II CONCEPTUAL STRUCTURE OF QUANTUM INFORMATION

Qubits: qualitative understanding using spin and polarization. Classical bits vs quantum bits: distinctions and implications. Quantum systems (non-engineering perspective): trapped ions, superconducting qubits, photonics. Coherence and decoherence mechanisms. Abstract notions: quantum states, measurement operators, Hilbert space???interpretation without mathematics. Entanglement and non-locality as foundational resources. Quantum vs classical information principles; philosophical considerations.

UNIT-III BUILDING A QUANTUM COMPUTER ??? CHALLENGES AND REQUIREMENTS

Conceptual prerequisites for functional quantum hardware. Fragility of quantum states: decoherence, noise, stability issues. Requirements: isolation, error resilience, scalability, control. Why maintaining entanglement is difficult; theoretical necessity of quantum error correction. Comparative overview of hardware platforms (superconducting circuits, trapped ions, photonics).Current progress vs scientific constraints; conceptual view of quantum software???s role.

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UNIT-IV QUANTUM COMMUNICATION AND COMPUTING

(Redundant explanations removed, retaining only unique themes.)Quantum vs classical communication paradigms. Essentials of Quantum Key Distribution (QKD) and its security rationale. Entanglement-enabled communication protocols. Concept of the Quantum Internet and secure global networking. Introduction to quantum computing and quantum parallelism. Conceptual comparison of classical and quantum gate operations. Challenges: decoherence, noise, and the necessity of error correction frameworks.

UNIT-V APPLICATIONS, INDUSTRY, AND FUTURE DIRECTIONS

Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India???s strategic opportunity in the global quantum ecosystem.

TEXT BOOKS:

1. Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Rieffel & 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. Kaye, Laflamme, Mosca, An Introduction to Quantum Computing, OUP, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, CUP, 2013.
4. Susskind & Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
5. Rosenblum & Kuttner, Quantum Enigma, OUP, 2011.
6. Benenti et al., Principles of Quantum Computation and Information, World Scientific, 2004.
7. DST India and MeitY: Official Quantum Mission Reports, 2020 onwards.

COURSE OUTCOMES:

1. Upon completion, the learner will be able to:
2. Explain fundamental quantum concepts conceptually.
3. Distinguish classical information systems from quantum information frameworks.
4. Identify the principal theoretical limitations in building quantum computers.
5. Describe the conceptual basis of quantum communication and computation.
6. Discuss current applications, technological trajectories, and career opportunities in the quantum domain.

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(25D58105) ADVANCED DATA STRUCTURES & ALGORITHMS LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To introduce students to the implementation of linear and non-linear data structures using linked representation
2. To provide practical knowledge on stack and queue operations and their applications in problem solving.
3. To enable students to implement tree structures and perform operations like traversal, insertion, deletion, and balancing.
4. To develop skills in implementing searching and sorting techniques to improve problem□solving efficiency.
5. To expose students to advanced data structures such as AVL Trees, B-Trees, and Hashing for efficient storage and retrieval.
6. To enhance the ability to design, test, and analyze algorithms for graph traversal and dictionary

Experiment 1:
Write a program to perform various operations on single linked list
Experiment 2:
Write a program for the following
a) Reverse a linked list
b) Sort the data in a linked list
c) Remove duplicates
d) Merge two linked lists
Experiment 3: Write a program to perform various operations on doubly linked list.
Experiment 4: Write a program to perform various operations on circular linked list.
Experiment 5: Write a program for performing various operations on stack using linked list.
Experiment 6: Write a program for performing various operations on queue using linked list.
Experiment 7: Write a program for the following using stack
a) Infix to postfix conversion.
b) Expression evaluation.
Experiment 8: Write a program to implement various operations on Binary Search Tree Using
Recursive and Non-Recursive methods.
Experiment 9: Write a program to implement the following for a graph. a) BFS b) DFS

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Experiment 10: Write a program to implement various Sorting Techniques
Experiment 11: Write a program to implement various Searching Techniques
Experiment 12: Write a program to implement various operations on AVL trees.
Experiment 13: Write a program to perform the following operations: a) Insertion into a B-tree
b) Searching in a B-tree
Experiment 15: Write a program to implement all the functions of Dictionary (ADT) using
Hashing.

REFERENCE BOOKS:

1. Ellis Horowitz, SartajSahni, and SanguthevarRajasekaran – Fundamentals of Computer Algorithms, Universities Press, 2008.
2. Mark Allen Weiss – Data Structures and Algorithm Analysis in C++ / Java, Pearson Education, 4th Edition, 2013.
3. Seymour Lipschutz – Data Structures with C, Schaum's Outline Series, McGraw Hill, 2011.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein – Introduction to Algorithms, MIT Press, 3rd Edition, 2009.

COURSE OUTCOMES:

1. Implement linear data structures such as single, double, and circular linked lists to perform insertion, deletion, searching, and traversal operations.
2. Apply stack and queue concepts using linked lists to solve real-world computational problems such as expression evaluation and infix-to-postfix conversion
3. Develop and test tree-based and Graph-based data structures including Binary Search Trees, AVL Trees, and B-Trees using recursive and iterative approaches, Graph traversals.
4. Implement and compare searching and sorting techniques to analyze their performance and efficiency.
5. Apply hashing techniques for efficient dictionary implementation and collision resolution
6. Analyze and evaluate the performance of different data structures to select appropriate techniques for given computational problems.

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(25D58106) DISTRIBUTED OPERATING SYSTEMS LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To provide hands-on experience in implementing synchronization, deadlock detection, and resource management algorithms in distributed and multiprocessor systems.
2. To develop the ability to design and simulate mechanisms for fault tolerance, load balancing, task migration, and secure communication using cryptographic techniques
3. To enable students to apply concurrency control methods in distributed databases and critically analyze the performance of various distributed algorithms.

Unit I: Architectures & Synchronization

1. **Implementation of Lamport's Logical Clocks** – Simulate logical clock updates in a distributed system.
2. **Vector Clocks and Causal Ordering** – Implement vector clocks and analyze message ordering.
3. **Distributed Mutual Exclusion Algorithms** – Implement Ricart-Agrawala and Maekawa's mutual exclusion algorithms.

Unit II: Deadlock Detection & Resource Management 4. **Simulation of Distributed Deadlock Detection Algorithms** – Implement centralized and distributed deadlock detection techniques.

5. **Hierarchical Deadlock Detection** – Implement a hierarchical approach to detecting deadlocks in a distributed system.

Unit III: Shared Memory, Scheduling & Fault Tolerance

6. **Implementation of Load Balancing Algorithms** – Compare load balancing techniques (static and dynamic).
7. **Task Migration Mechanism** – Implement and analyze task migration in a distributed system.

Unit IV: Security & Cryptography

8. **Access Matrix Model Implementation** – Simulate access control using an access

matrix.

9. **Implementation of Data Encryption Standard (DES) Algorithm** – Encrypt and decrypt
messages using DES.

10. **Public Key Cryptography using RSA** – Implement RSA encryption and authentication
mechanisms.

Unit V: Multiprocessor & Database OS

11. **Process Synchronization in Multiprocessor Systems** – Implement and analyze thread
synchronization.

12. **Concurrency Control using Lock-Based Algorithms** – Implement two-phase locking
protocol.

13. **Timestamp-Based Concurrency Control** – Develop a timestamp-based concurrency
control mechanism.

14. **Optimistic Concurrency Control Algorithm** – Implement an optimistic concurrency
control protocol.

REFERENCE BOOKS:

1. MukeshSinghal and Niranjan G. Shivaratri – Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems, McGraw Hill, 2001
2. Andrew S. Tanenbaum and Maarten Van Steen – Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2007
3. George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair – Distributed Systems: Concepts and Design, Pearson Education, 5th Edition, 2012
4. Pradeep K. Sinha – Distributed Operating Systems: Concepts and Design, PHI Learning, 2008.

COURSE OUTCOMES:

1. Implement and analyze synchronization mechanisms in distributed environments
2. Develop and evaluate distributed deadlock detection techniques.
3. Design and implement distributed shared memory models and scheduling algorithms
4. Apply security and cryptographic techniques to distributed systems.
5. Implement concurrency control algorithms in database operating systems
6. Gain hands-on experience in developing efficient multiprocessor operating system components.

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(25D58207) COMPREHENSIVE VIVA VOCE

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

Unit I: Architectures & Synchronization

1. **Implementation of Lamport's Logical Clocks** – Simulate logical clock updates in a distributed system.
2. **Vector Clocks and Causal Ordering** – Implement vector clocks and analyze message ordering.
3. **Distributed Mutual Exclusion Algorithms** – Implement Ricart-Agrawala and Maekawa's mutual exclusion algorithms.

Unit II: Deadlock Detection & Resource Management 4. **Simulation of Distributed Deadlock Detection Algorithms** – Implement centralized and distributed deadlock detection techniques.

5. **Hierarchical Deadlock Detection** – Implement a hierarchical approach to detecting deadlocks in a distributed system.

Unit III: Shared Memory, Scheduling & Fault Tolerance

6. **Implementation of Load Balancing Algorithms** – Compare load balancing techniques (static and dynamic).
7. **Task Migration Mechanism** – Implement and analyze task migration in a distributed system.

Unit IV: Security & Cryptography

8. **Access Matrix Model Implementation** – Simulate access control using an access matrix.
9. **Implementation of Data Encryption Standard (DES) Algorithm** – Encrypt and decrypt messages using DES.
10. **Public Key Cryptography using RSA** – Implement RSA encryption and authentication mechanisms.

Unit V: Multiprocessor & Database OS

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11. **Process Synchronization in Multiprocessor Systems** – Implement and analyze thread
synchronization.
12. **Concurrency Control using Lock-Based Algorithms** – Implement two-phase locking
protocol.
13. **Timestamp-Based Concurrency Control** – Develop a timestamp-based concurrency
control mechanism.
14. **Optimistic Concurrency Control Algorithm** – Implement an optimistic concurrency
control protocol.

COURSE OUTCOMES:

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(25D57107) RESEARCH METHODOLOGY AND IPR

Course Category	**Mandatory Course (credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To understand the research design process and data collection methods.
2. To develop skills in data analysis and reporting.
3. To familiarize students with intellectual property rights (IPR) and patents.
4. To apply research skills in real-world contexts.

UNIT-I UNIT I

Overview of research process and design - Types of Research - Approaches to Research (
Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning
in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its
consequences

Learning Outcomes

● Recall key concepts of the research process, including different types and approaches to
research, and the importance of ethics.
● Differentiate between qualitative and quantitative research approaches and the various uses
of secondary data.
● Identify the core principles of research design and ethics, including plagiarism and documentation styles.
● Explain the significance of reasoning and ethical conduct in all stages of the research
process.
● Apply knowledge of different documentation styles, such as APA and IEEE, to properly
cite sources and avoid plagiarism.

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UNIT-II UNIT II

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources -
primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data
Collection

Learning Outcomes

● Identify different types of data and the various methods for collecting both primary and
secondary data.
● Explain the importance of data quality and ethical considerations in data collection.
● Differentiate between primary, secondary, and Big Data sources.
● Describe the various tools and technologies used for effective data collection.
Analyze the ethical implications of data collection and ensure data quality in a research study

UNIT-III UNIT III

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and
development of hypotheses- Measurement systems analysis, error propagation, and validity of
experiments - Guidelines for writing abstracts, introductions, methodologies, results, and
discussions - Writing Research Papers & proposals

Learning Outcomes

● Apply knowledge of multivariate analysis and experimental research to develop hypotheses
and analyze data. ● Explain the process of measurement systems analysis and error propagation in experimental
design.
● Formulate clear and concise abstracts, introductions, and methodologies for research papers.
● Write effective results and discussion sections based on data analysis.
Develop comprehensive research papers and proposals based on proper data analysis and reporting
guidelines.

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UNIT-IV UNIT IV

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Learning Outcomes

- Recall the fundamental concepts of Intellectual Property (IP) and its evolution.
- Describe the roles of organizations like **WIPO** and **WTO** in the establishment of IPR.
- Differentiate between various types of IPR, including trade secrets and trademarks.
- Explain the common rules and features of IPR agreements and the role of UNESCO.
- Analyze the relationship between IPR and biodiversity, and its broader impact.

UNIT-V UNIT-V

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Learning Outcomes

- Explain the objectives, benefits, and key features of a patent, including the concept of an inventive step.
- Differentiate between the various types of patent applications and the e-filing process.
- Describe the process of patent examination, grant, and revocation.
- Identify the roles of patent agents and the process for their registration.

Analyze the concepts of equitable assignments, licenses, and licensing of related patents.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.
3. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education 11e (2012).
4. Ranjit Kumar , Research Methodology: A Step-by-Step Guide for Beginners. . David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007
5. Deborah E. Bouchoux , Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.

6. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024

REFERENCE BOOKS:

1. Coursera / edX – Research Methodology and Data Analysis courses
2. Springer Link & ScienceDirect – Latest journals on research design and statistics
3. Google Scholar – Free access to research papers
4. NCBI Bookshelf – Open-access research methodology resources
5. Khan Academy (Statistics & Probability) – For fundamentals of hypothesis testing, regression, and ANOVA.

COURSE OUTCOMES:

1. Recall key concepts and terminology related to research design, data collection, and intellectual property rights.
2. Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.
3. Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.
4. Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods
5. Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.
6. Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property

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(25D57209B) PEDAGOGY STUDIES (AC-II)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To enable the students to understand the aims, rationale, policy background, and conceptual frameworks in pedagogy, curriculum, and teacher education research.
2. To develop an understanding of diverse pedagogical practices
3. To make them learn the methodologies for assessing the effectiveness of pedagogical practices and teacher education models.
4. To enable them to learn professional development strategies, including peer support, community engagement, and alignment with curriculum and assessment.

UNIT-I FOUNDATIONS OF PEDAGOGY

Introduction to pedagogy and its importance in education - Historical and philosophical foundations of pedagogy - Theories of learning and teaching (behaviorist, cognitive, constructivist) - Role of pedagogy in shaping educational practices - Role of technology in modern pedagogy (ICT, e-learning, blended learning

UNIT-II TEACHING-LEARNING PROCESSES

Understanding the teaching-learning process - Lesson planning and curriculum design - Strategies for effective teaching and learning (expository, collaborative, experiential) - Use of technology to enhance teaching-learning processes (multimedia, simulations, gamification)

UNIT-III TECHNOLOGY INTEGRATION IN EDUCATION

Educational technology and system design - Instructional design models (ADDIE, ASSURE, Dick and Carey Model) - Emerging trends in e-learning (social learning, MOOCs, mobile learning) - ICT tools for teaching and learning (Learning Management Systems, online resources)

UNIT-IV PEDAGOGY AND ASSESSMENT

Pedagogy, pedagogical analysis, and assessment - Types of assessment (placement, formative, diagnostic, summative) - Technology-based assessment tools (online quizzes, polls, discussions) - Rubrics for self and peer evaluation- Reflective Practices

UNIT-V CONTEMPORARY ISSUES AND TRENDS

Inclusive education and technology (assistive technology, accessibility) - Change management and innovation in education - Quality assurance and evaluation in education (TQM, Six Sigma) - Future trends in pedagogy and technology (AI, AR, VR in education) - Personalized learning and adaptive teaching

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TEXT BOOKS:

1. Alexander, R. J. Essays on Pedagogy. Routledge, 2008.
2. Shulman, L. S. The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach. Jossey-Bass, 2004

COURSE OUTCOMES:

1. Define and explain key concepts, frameworks, and methodologies in pedagogy and teacher education research.
2. Critically analyze pedagogical practices used in diverse classroom settings, with reference to teacher education and curriculum design.
3. Evaluate the effectiveness of pedagogical approaches using quality assessment tools and theory of change models.
4. Apply evidence-based strategies to improve classroom practices, curriculum alignment, and teacher professional development.
5. Identify and address barriers to learning through innovative pedagogical strategies.
6. Design and propose research studies that contribute to filling gaps in pedagogy, curriculum, and teacher education, with focus on dissemination and impact.

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(25D58107) FULL STACK DEVELOPMENT USING MERN

Course Category	**Skill Oriented Course (SC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Provide strong foundations in web development technologies (HTML, CSS, JavaScript, ES6).
2. Introduce server-side programming with Node.js and Express.js for building scalable applications.
3. Enable students to work with relational (MySQL) and non-relational (MongoDB) databases. Impart skills to design and develop interactive user interfaces using ReactJS
4. Impart skills to design and develop interactive user interfaces using ReactJS
5. Enhance problem-solving abilities through full-stack web application development experiments.

Module 1: Web Development Fundamentals

Fundamentals of Web Design, Webpage and Website, Web application HTML Typography,
Images, Tables, Lists, Hyperlinks etc. CSS Syntax and usage, CSS Selectors, CSS on body, CSS on
Text, CSS on Links, CSS on Tables, CSS on Lists, CSS on Forms, CSS on Images, CSS on DIV,
W3.CSS Framework

List of Experiments :

 HTML & CSS Basics – Create a personal portfolio webpage using HTML (headings, lists,
tables, hyperlinks, forms) and style it with CSS selectors.

 Responsive Layout – Develop a responsive webpage using DIV, CSS box model, and W3.CSS framework.

 Styled Components – Design a webpage for a college event with images, tables, and styled
navigation menu using CSS. **Module 2: JavaScript and ECMA Script 6**

JavaScript Fundamentals - Grammar and types, Control flow and error handling - Loops, Function -
Objects, Arrays, Promises - ES6 Let and const, Template literals - Arrow Function, Default
parameter, Async Await

List of Experiments :

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 JavaScript Fundamentals – Build a simple calculator app using functions, loops, and control flow.
 Array & Object Manipulation – Write a program using ES6 features (let/const, arrow
functions, template literals) to manage student records.
 Async Programming – Create a webpage that fetches and displays random user data from a
public API using Promises and Async/Await.

Module 3: Node.js

overview, Node.js - basics and setup - Node.js console, Node.js command utilities - Node.js
modules, concepts - Node.js events, database access - Node.js with Express.js, Express.js
Request/Response - Express.js Get, Express.js Post - Express.js Routing, Express.js Cookies -
Express.js File Upload, Middleware - Express.js Scaffolding, Template

List of Experiments :

 Node.js Basics – Write a Node.js script to create a local server and display “Hello World” in
the browser.
 Express.js Routing – Build a REST API with Express.js that handles GET and POST requests for a student information system.
 File Handling – Develop a Node.js application to upload, read, and display a text/JSON file
using Express middleware.

Module 4: MySQL and MongoDB

MySQL Concepts - Create, Read, Update, Delete Operation - SQL and NoSQL concepts - Create
and manage MongoDB - Migration of data into MongoDB - MongoDB with NodeJS - Services
offered by MongoDB

List of Experiments :

 MySQL CRUD – Create a MySQL database for employee records and perform Create, Read, Update, Delete (CRUD) operations.
 MongoDB CRUD with Node.js – Build a Node.js application that connects to MongoDB
and manages student data.
 Migration Project – Write a script to migrate data from MySQL to MongoDB and display
it through a Node.js API.

Module 5: React JS

ReactJS introduction and overview - ReactJS installation and environment setup - Introducing JSX,

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Rendering Elements - Components and Props - State and Lifecycle - Handling Events - Conditional
Rendering - Lists and Keys, Forms - Lifting State Up

List of Experiments :

 React Components – Build a React app to display a list of courses using functional components and props.

 State & Events – Create a counter and a form component in React using useState and event
handling.

 Conditional Rendering & Lists – Develop a React to-do list application with add/delete
functionality and conditional rendering of completed tasks.

TEXT BOOKS:

1. Alex Banks, Eve Porcello – Learning React: Modern Patterns for Developing React Apps, O'Reilly.
2. StoyanStefanov – React Up & Running: Building Web Applications, O'Reilly.
3. Mario Casciaro, Luciano Mammino – Node.js Design Patterns, Packt.
4. Seyed M.M. Iravani – Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, O'Reilly.

REFERENCE BOOKS:

1. Robin Wieruch ??? The Road to React, Leanpub.
2. Carl Rippon ??? React 18 Design Patterns and Best Practices, Packt
3. KirupaChinnathambi ??? Learning React: A Hands-On Guide to Building Web Applications, Addison-Wesley.
4. Ethan Brown ??? Web Development with Node and Express: Leveraging the JavaScript Stack, O???Reilly.
5. Kristina Chodorow ??? MongoDB: The Definitive Guide, O???Reilly
6. Ben Forta ??? SQL in 10 Minutes, Sams Teach Yourself, Sams Publishing

COURSE OUTCOMES:

1. Apply fundamental web technologies (HTML, CSS, JavaScript, ES6) to design responsive web pages.
2. Develop server-side applications using Node.js and Express.js with REST API integration.
3. Perform database operations using MySQL and MongoDB and integrate them with backend services.
4. Design and implement dynamic, component-based user interfaces using ReactJS
5. Develop and deploy full-stack applications by combining frontend, backend, and database skills.
6. Demonstrate problem-solving, debugging, and version control skills in web development projects.

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(AUTONOMOUS)

DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
2	0	0	0

(25D57109A) ENGLISH FOR RESEARCH PAPER WRITING (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To equip students with the fundamentals of academic English for research paper writing.
2. To develop students' advanced reading skills for analyzing and evaluating research articles.
3. To refine students' grammar and language skills for clarity and precision in research writing.
4. To master the skills of revising, editing, and proofreading research papers.
5. To familiarize students with the role of technology and AI in research writing, including digital literacy and ethical considerations.

UNIT-I UNIT-I

:

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub headings

UNIT-II UNIT-II

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT-III UNIT-III

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences

UNIT-IV UNIT-IV

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V UNIT-V

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

TEXT BOOKS:

1. Bailey. S. Academic Writing: A Handbook for International Students. London and New York: Routledge,2015.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

REFERENCE BOOKS:

1. Craswell, G. Writing for Academic Success, Sage Publications, 2004.
2. Peter Elbow, Writing With Power, E-book, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. Writing Academic English, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
5. Goldbort R.Writing for Science, Yale University Press (available on Google Books), 2006
6. Day R.How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

COURSE OUTCOMES:

1. Recall the key language aspects and structural elements of academic writing in research papers.
2. Explain the importance of clarity, precision, and objectivity in research writing.
3. Apply critical reading strategies and advanced grammar skills to analyze and write research papers.
4. Analyze research articles and identify the strengths and limitations of different methodologies.
5. Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.
6. Develop a well-structured research paper that effectively communicates complex ideas.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
2	0	0	0

(25D57109C) DISASTER MANAGEMENT (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To enable the students to understand the fundamental concepts of disasters, hazards, their factors, and significance with special reference to India.
2. To prepare them to classify and analyze different types of natural and man-made disasters, their causes, magnitude, and impacts.
3. To foster them develop understanding of disaster preparedness, monitoring systems, and the role of government, community, and media.
4. To equip them in learning risk assessment techniques, disaster risk reduction strategies, and the importance of global and national cooperation.
5. To foster their ability to think critically and respond to disasters and design effective mitigation measures (structural and non-structural) with a focus on emerging trends and Indian disaster management programs.

UNIT-I UNIT-I

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man-made Disasters - Difference, Nature, Types and Magnitude - Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT-II UNIT-II

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT-III UNIT-III

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of RiskApplication of Remote Sensing - Data from Meteorological and Other Agencies - Media ReportsGovernmental and Community Preparedness

UNIT-IV UNIT-IV

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People’s participation in Risk Assessment – Strategies for Survival

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V UNIT-V

Meaning, Concept and Strategies of Disaster Mitigation - EmergingTrends in Mitigation - Structural Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India.

TEXT BOOKS:

1. Gupta, H. K. Disaster Management. Universities Press, 2003
2. Singh, R. B. Natural Hazards and Disaster Management. Rawat Publications, 2006.

REFERENCE BOOKS:

1. Coppola, D. P. (2020). Introduction to International Disaster Management (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). Science and Technology in Disaster Risk Reduction in Asia. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). Handbook of Hazards and Disaster Risk Reduction and Management (2nd ed.). Routledge.
4. Saini, V. K. (2021). Disaster Management in India: Policy, Issues and Perspectives. Sage India.
5. Kelman, I. Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. Disaster Mitigation: Experiences and Reflections. Prentice Hall of India, 2004.

COURSE OUTCOMES:

1. Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.
2. Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.
3. Assess the economic, social, and ecological repercussions of major natural and man-made disasters.
4. Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.
5. Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.
6. Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. I Sem.

L	T	P	C
2	0	0	0

(25D57109D) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
2. To make them understand the need for protecting traditional knowledge and its significance in the global economy.
3. To make them understand the legal frame work and policies related to traditional knowledge protection.
4. To enable them to understand the relationship between traditional knowledge and intellectual property rights.
5. To make them explore the applications of traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology

UNIT-I UNIT-I

Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge.

Learning Outcomes: At the end of the unit the student will able to:

> Understand the concept of traditional knowledge.
> Contrast and compare characteristics, importance& kinds of traditional knowledge.
> Analyze physical and social contexts of traditional knowledge.
> Evaluate social change on traditional knowledge.

UNIT-II UNIT-II

Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

Learning Outcomes: At the end of the unit the student will able to:

> Know the need of protecting traditional knowledge.
>Apply significance of TK protection.
>Analyze the value of TK in global economy.
> Evaluate role of government

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-III UNIT-III

Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

Learning Outcomes: At the end of the unit the student will able to:

>Understand legal frame work of TK.

> Contrast and compare the ST and other traditional forest dwellers

> Analyze plant variant protections

> Understand the rights of farmers forest dwellers

UNIT-IV UNIT-IV

Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes: At the end of the unit the student will able to:

> Understand TK and IPR

> Apply systems of TK protection.

> Analyze legal concepts for the protection of TK.

>Evaluate strategies to increase the protection of TK.

UNIT-V UNIT-V

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Learning Outcomes: At the end of the unit the student will be able to:

> Know TK in different sectors.

> Apply TK in Engineering.

>Analyze TK in various sectors.

> Evaluate food security and protection of TK in the country.

TEXT BOOKS:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt.Ltd. Delhi, 2022.
2. Basanta Kumar Mohanta and Vipin Kumar Singh,Traditional Knowledge System and Technology in India, PratibhaPrakashan 2012.

REFERENCE BOOKS:

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.

2. Kak, S.C. “On Astronomy in Ancient India”, Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. Indian Astronomy: A Source Book, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. History of Technology in India, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. Public Administration in Ancient India, Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,Indian Knowledge Systems Vol – I & II, Indian Institute of Advanced Study, Shimla, H.P., 2022

COURSE OUTCOMES:

1. Define and explain the concept of traditional knowledge, its nature, characteristics, and scope
2. Understand the need for protecting traditional knowledge and its significance in the global economy
3. Explain the legal framework and policies related to traditional knowledge protection
4. Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology
5. Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change
6. Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech
II-Semester Course Structure

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week				Marks		
				Lecture	Tutorial	Practical	Credits	Internal	External	Total
1	25D58201	PC	ADVANCES IN SOFTWARE ENGINEERING	3	0	0	3	40	60	100
2	25D58202	PC	ADVANCED DATABASES	3	0	0	3	40	60	100
3	25D58203C	PE	DEEP LEARNING (PE-III)	3	0	0	3	40	60	100
4	25D13204E	PE	INTRODUCTION TO LARGE LANGUAGE MODELS (PE-IV)	3	0	0	3	40	60	100
5	25D58205	PC	ADVANCES IN SOFTWARE ENGINEERING LAB	0	0	4	2	40	60	100
6	25D58206	PC	ADVANCED DATABASES MANAGEMENT SYSTEMS LAB	0	0	4	2	40	60	100
7	25D57207	MC(C)	QUANTUM TECHNOLOGIES AND APPLICATIONS	2	0	0	2	40	60	100
8	25D57209B	MC(NC)	PEDAGOGY STUDIES (AC-II)	2	0	0	0	40	60	100

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech
II -Semester Syllabus

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem.

L	T	P	C
3	0	0	3

(25D58201) ADVANCES IN SOFTWARE ENGINEERING

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

UNIT-I SOFTWARE PROCESS AND PROJECT MANAGEMENT

Software Engineering – A Layered Technology, Process Models: Waterfall, Incremental, Evolutionary, Spiral, Agile Development, Unified Process Framework.

Software Project Management Concepts: Estimation, Scheduling, Risk Analysis, Process Improvement and Capability Maturity (CMMI, ISO Standards).

UNIT-II REQUIREMENTS ENGINEERING AND MODELING

Requirement Engineering Tasks: Inception, Elicitation, Elaboration, Negotiation, Specification, Validation.

System Modeling with UML, Scenario-based, Flow-oriented, Behavioral and Class-based modelling, Design Concepts and Principles, Architectural Design ??? Styles and Patterns

UNIT-III ADVANCED DESIGN AND DEVELOPMENT CONCEPTS

Component-level Design, Object-Oriented Design using UML, Design Patterns and Frameworks, Aspect-Oriented Software Engineering, Reuse-oriented Software Engineering.

UNIT-IV SOFTWARE QUALITY, TESTING AND MAINTENANCE

Quality Concepts and Quality Assurance, Software Reviews, Formal Technical Reviews, Software Testing Strategies: Unit, Integration, System, Regression Testing, Black-box and White-box Testing, Software Maintenance and Reengineering.

UNIT-V ADVANCED TOPICS AND EMERGING TRENDS

Software Configuration Management (SCM) and Version Control, Software Reliability and Safety Engineering, Agile Software Development and DevOps, Software Metrics and Measurement. Emerging Areas: AI in Software Engineering, Cloud-based SE, Secure Software Development.

TEXT BOOKS:

1. Software Engineering A Practitioner???s Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

REFERENCE BOOKS:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

COURSE OUTCOMES:

1. Demonstrate understanding of advanced software process models and project management practices.
2. Apply requirement engineering and advanced modeling techniques to software system design.
3. Develop robust designs using object-oriented, component-based, and aspect-oriented approaches.
4. Evaluate software quality through systematic testing, reviews, and maintenance strategies.
5. Analyze emerging research challenges and apply metrics, configuration management, and agile practices in modern software engineering.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem.

L	T	P	C
3	0	0	3

(25D58202) ADVANCED DATABASES

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

UNIT-I UNIT-1

Database System Architectures Centralized and Client ???Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intra Query Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors

UNIT-II UNIT II

Distributed Databases Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems

UNIT-III UNIT III

Data Warehousing and Mining Decision-Support Systems, Data Warehousing, Data Mining, Classification, Association Rules, Other Types of Associations, Clustering, Other Forms of Data Mining

UNIT-IV UNIT IV

Object-Based Databases Introduction, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

UNIT-V UNIT V

Motivation, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications Applications Advanced database models and applications: Active Database Concepts and Triggers, Temporal database concepts, Spatial database concepts, Multimedia database concepts, Deductive databases

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition

2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming

COURSE OUTCOMES:

1. Understand Database system Architectures and parallel databases
2. Analyze transactions, Concurrency Control in Distributed Databases
3. Understand the importance of Data Warehousing and Mining
4. Illustrate concepts of object based databases

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem.

L	T	P	C
3	0	0	3

(25D58203C) DEEP LEARNING (PE-III)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals and historical development of deep learning.
2. Explain perceptrons, multilayer neural networks, and learning algorithms.
3. Provide understanding of optimization techniques and regularization methods.
4. Develop knowledge of representation learning using autoencoders and embeddings.
5. Familiarize students with convolutional and recurrent neural networks and their applications.

UNIT-I FUNDAMENTALS OF NEURAL NETWORKS

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.

UNIT-II TRAINING AND OPTIMIZATION TECHNIQUES

Feedforward Neural Networks, Backpropagation Algorithm, Gradient Descent (GD), Momentum-based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and Eigenvectors, Eigenvalue Decomposition, Basis.

UNIT-III DIMENSIONALITY REDUCTION AND AUTOENCODERS

Principal Component Analysis (PCA) and its interpretations, Singular Value Decomposition (SVD), Autoencoders and relation to PCA, Regularization in Autoencoders, Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders.

UNIT-IV REGULARIZATION AND PERFORMANCE IMPROVEMENT

Regularization: Bias-Variance Tradeoff, L2 Regularization, Early Stopping, Dataset Augmentation, Parameter Sharing and Tying, Injecting Noise at Input, Ensemble Methods, Dropout, Greedy Layerwise Pre-training, Better Activation Functions, Better Weight Initialization Methods, Batch Normalization.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

UNIT-V ADVANCED DEEP LEARNING ARCHITECTURES

Learning Vectorial Representations of Words, Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling CNNs, Recurrent Neural Networks, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM, Encoder???Decoder Models, Attention Mechanism, Attention over Images.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Simon Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson, 2009.

REFERENCE BOOKS:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer, 2018.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press.

e-Resources and Digital Material:

1. https://www.deeplearning.ai/
2. https://cs231n.github.io/
3. https://www.tensorflow.org/tutorials

COURSE OUTCOMES:

1. Explain the evolution of deep learning and the working of artificial neurons and perceptrons.
2. Design and analyze multilayer feedforward neural networks using backpropagation.
3. Apply optimization and dimensionality reduction techniques for deep learning models.
4. Use autoencoders and regularization methods to improve model generalization.
5. Build CNN and RNN architectures for vision and sequence learning tasks.

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem.

L	T	P	C
3	0	0	3

(25D13204E) INTRODUCTION TO LARGE LANGUAGE MODELS (PE-IV)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To introduce the fundamentals of Large Language Models (LLMs), their characteristics, working mechanisms, and evolution.
2. To provide an overview of Natural Language Processing (NLP) and Neural Networks as foundational technologies for LLMs.
3. To explore various language models, including statistical and neural approaches, along with their limitations.
4. To understand different prompting strategies used in LLMs and their impact on performance.
5. To examine advanced topics such as reasoning, handling long contexts, model editing, and hallucination in LLMs.

UNIT-I INTRODUCTION

Definition of LLMs, Key Characteristics of LLMs, How LLMs work, Evolution of Language Modelling Technologies, Evolution of LLMs, Applications of LLMs.

UNIT-II AN OVERVIEW OF NLP AND NEURAL NETWORKS NLP

NLP Pipeline, Morphology, Tokenization. Neural Networks: The Perceptron, Multi layer Perceptron, Training Neural Networks.

UNIT-III LANGUAGE MODELS

Statistical Language Model, Smoothing, Evaluation of Language Model, Limitations of Statistical Language Models. Neural Language Models: Convolutional Neural Networks, Recurrent Neural Networks, Limitations of Neural Language Models.

UNIT-IV PROMPTING STRATEGIES IN LLMS

Prompt Engineering: Prompt shape, Manual Template Engineering, Automated Template Learning, Continuous Prompts, Prompt Application, Chain-of-Thoughts, Tree-of-Thoughts, Graph-of-Thoughts.

UNIT-V ADVANCED TOPICS IN LARGE LANGUAGE MODELS

Reasoning with LLMs, Handling long context in LLMs, Model Editing, Hallucination in LLMs, Self-Evolving LLMs

TEXT BOOKS:

1. Tanmoy Chakraborty, Introduction to Large Language Models, Wiley India, 1st Edition, 2025. ISBN : 9789363864740.

2. Dan Jurafsky and James H. Martin, Speech and Language Processing, 2nd edition, Pearson Press, 2008.

REFERENCE BOOKS:

1. Jacob Eisenstein, Natural Language Processing, First edition,The MIT Press, 2019.
2. Research papers published in conferences/journals likeAssociation for Computational Linguistics (ACL).

COURSE OUTCOMES:

1. Define Large Language Models (LLMs) and describe their key characteristics.
2. Explain the working principles of LLMs, including training and inference processes.
3. Analyze the evolution of language modeling technologies and their transition to modern LLMs.
4. Evaluate different applications of LLMs across various domains.
5. Compare different LLM architectures based on their capabilities and limitations.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem.

L	T	P	C
0	0	4	2

(25D58205) ADVANCES IN SOFTWARE ENGINEERING LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

Experiment 1: Comparative Study of Process Models Implement a simple project using Waterfall and Incremental models; compare effort, defects, and time taken.

Experiment 2: Agile Development Simulation Develop a small software system using Scrum methodology with sprints, product backlog, sprint backlog, and daily scrums.

Experiment 3: Project Estimation and Scheduling Perform Function Point Analysis (FPA) or Use Case Points (UCP) to estimate size and effort, then prepare a Gantt chart and PERT chart.

Experiment 4: Risk Analysis in Software Projects Conduct risk identification, qualitative/quantitative assessment, and develop a risk mitigation plan for a given case study.

Experiment 5: Requirement Elicitation and SRS Document Conduct requirement gathering for a mini-project and prepare a Software Requirement Specification (SRS) document.

Experiment 6: UML Modeling (Scenario-based & Structural) Create Use Case diagrams, Activity diagrams, and Sequence diagrams for a given problem domain.

Experiment 7: UML Modeling (Class &Behavioral) Create Class diagrams, State machine diagrams, and Component diagrams to represent system architecture.

Experiment 8: Object-Oriented Design Using UML Design a software module using OO principles (encapsulation, inheritance, polymorphism) and illustrate with UML diagrams.

Experiment 9: Design Patterns Implementation Implement at least three design patterns (e.g., Singleton, Factory, Observer) in Java/Python.

Experiment 10: Reuse-Oriented Software Engineering Use existing open-source libraries/frameworks to develop a component-based application (e.g., web app using Django/Flask).

Experiment 11: Black-box and White-box Testing Perform equivalence partitioning and

boundary value analysis (black-box) and basis path testing (white-box) for a given program.

Experiment 12: Software Maintenance and Reengineering Take an existing open-source project (small module), analyze it, and perform refactoring/reengineering for improvement.

Experiment 13: Version Control and DevOps Pipeline Use Git & GitHub/GitLab for version control and demonstrate CI/CD pipeline setup with Jenkins/GitHub Actions.

Experiment 14: Software Metrics and AI in SE Compute software metrics (complexity, coupling, cohesion) for a given project and explore an AI tool (e.g., GitHub Copilot, SonarQube) for software quality analysis.

TEXT BOOKS:

1. Software Engineering A Practitioner???s Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

REFERENCE BOOKS:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

COURSE OUTCOMES:

1. Apply various software process models and project management techniques (estimation, scheduling, risk management) to plan and manage software development effectively.
2. Perform requirements elicitation, documentation, and system modeling using UML to capture, analyze, and validate software requirements.
3. Design software systems using object-oriented principles, design patterns, and component based approaches for modularity, reusability, and maintainability.
4. Implement software testing strategies, maintenance techniques, and reengineering practices to ensure software quality, reliability, and evolution.
5. Utilize modern software engineering tools and practices such as version control, DevOps pipelines, software metrics, and AI-based analysis to enhance development efficiency and quality assurance.

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M.Tech. II Sem.

L	T	P	C
0	0	4	2

(25D58206) ADVANCED DATABASES MANAGEMENT SYSTEMS LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

1. Write a program to implement RDBMS - Cursors, Triggers

2. Write a Program to implement Range Partitioning sort.

3. Write a program to implement parallel hash join

4. Write a program to implement parallel nested join loop

5. Write a program to implement parallelize duplicate elimination by partitioning the tuples

6. Perform data fragmentation of distributed data(Horizontal, Vertical, Hybrid fragmentation)

7. Implement deadlock detection in distributed databases

8. Implement Semi Join algorithm.

9. DataCube Implementation - Aggregation

10. Perform data Integration - Extraction, Transformation, Loading

11. Implement any one classifier

12. Implement vector space models for Text corpus

13. Demonstrate type inheritance, table inheritance in object based databases

14. Write queries in XQueries on DTD

15. Write queries in SQL/XML to convert University data - XML Schema

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition
2. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming.

COURSE OUTCOMES:

1. Understand Database system Architectures and parallel databases
2. Analyze transactions, Concurrency Control in Distributed Databases
3. Understand the importance of Data Warehousing and Mining
4. Illustrate concepts of object based databases

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L	T	P	C
2	0	0	2

(25D57207) QUANTUM TECHNOLOGIES AND APPLICATIONS

Course Category	**Mandatory Course (credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Present core quantum principles such as superposition and entanglement without mathematical formalism.
2. Develop conceptual clarity on qubits, quantum states, and information frameworks.
3. Examine the theoretical challenges in realizing scalable quantum systems.
4. Introduce foundational ideas in quantum communication and computing.
5. Highlight applications, industrial adoption, and future research directions in quantum technologies.

UNIT-I FOUNDATIONS OF QUANTUM THEORY AND TECHNOLOGIES

Transition from classical to quantum physics. Key conceptual principles: Superposition, Entanglement, Uncertainty, Wave-particle duality. Quantum states and measurement; the role of the observer. Representative quantum systems: electrons, photons, atoms. Concept of quantization and discrete energy levels. Strategic relevance of quantum technologies. Overview of major domains: Computing, Communication, Sensing. Global quantum initiatives: India’s National Quantum Mission, EU Quantum Flagship, USA, China.

UNIT-II CONCEPTUAL STRUCTURE OF QUANTUM INFORMATION

Qubits: qualitative understanding using spin and polarization. Classical bits vs quantum bits: distinctions and implications. Quantum systems (non-engineering perspective): trapped ions, superconducting qubits, photonics. Coherence and decoherence mechanisms. Abstract notions: quantum states, measurement operators, Hilbert space???interpretation without mathematics. Entanglement and non-locality as foundational resources. Quantum vs classical information principles; philosophical considerations.

UNIT-III BUILDING A QUANTUM COMPUTER ??? CHALLENGES AND REQUIREMENTS

Conceptual prerequisites for functional quantum hardware. Fragility of quantum states: decoherence, noise, stability issues. Requirements: isolation, error resilience, scalability, control. Why maintaining entanglement is difficult; theoretical necessity of quantum error correction. Comparative overview of hardware platforms (superconducting circuits, trapped ions, photonics).Current progress vs scientific constraints; conceptual view of quantum software???s role.

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UNIT-IV QUANTUM COMMUNICATION AND COMPUTING

(Redundant explanations removed, retaining only unique themes.)Quantum vs classical communication paradigms. Essentials of Quantum Key Distribution (QKD) and its security rationale. Entanglement-enabled communication protocols. Concept of the Quantum Internet and secure global networking. Introduction to quantum computing and quantum parallelism. Conceptual comparison of classical and quantum gate operations. Challenges: decoherence, noise, and the necessity of error correction frameworks.

UNIT-V APPLICATIONS, INDUSTRY, AND FUTURE DIRECTIONS

Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India???s strategic opportunity in the global quantum ecosystem.

TEXT BOOKS:

1. Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Rieffel & 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. Kaye, Laflamme, Mosca, An Introduction to Quantum Computing, OUP, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, CUP, 2013.
4. Susskind & Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
5. Rosenblum & Kuttner, Quantum Enigma, OUP, 2011.
6. Benenti et al., Principles of Quantum Computation and Information, World Scientific, 2004.
7. DST India and MeitY: Official Quantum Mission Reports, 2020 onwards.

COURSE OUTCOMES:

1. Upon completion, the learner will be able to:
2. Explain fundamental quantum concepts conceptually.
3. Distinguish classical information systems from quantum information frameworks.
4. Identify the principal theoretical limitations in building quantum computers.
5. Describe the conceptual basis of quantum communication and computation.
6. Discuss current applications, technological trajectories, and career opportunities in the quantum domain.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING

M.Tech. II Sem. L T P C

(25D58207) COMPREHENSIVE VIVA VOCE

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India???s strategic opportunity in the global quantum ecosystem.

COURSE OUTCOMES:

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L	T	P	C
2	0	0	0

(25D57209B) PEDAGOGY STUDIES (AC-II)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To enable the students to understand the aims, rationale, policy background, and conceptual frameworks in pedagogy, curriculum, and teacher education research.
2. To develop an understanding of diverse pedagogical practices
3. To make them learn the methodologies for assessing the effectiveness of pedagogical practices and teacher education models.
4. To enable them to learn professional development strategies, including peer support, community engagement, and alignment with curriculum and assessment.

UNIT-I FOUNDATIONS OF PEDAGOGY

Introduction to pedagogy and its importance in education - Historical and philosophical foundations of pedagogy - Theories of learning and teaching (behaviorist, cognitive, constructivist) - Role of pedagogy in shaping educational practices - Role of technology in modern pedagogy (ICT, e-learning, blended learning

UNIT-II TEACHING-LEARNING PROCESSES

Understanding the teaching-learning process - Lesson planning and curriculum design - Strategies for effective teaching and learning (expository, collaborative, experiential) - Use of technology to enhance teaching-learning processes (multimedia, simulations, gamification)

UNIT-III TECHNOLOGY INTEGRATION IN EDUCATION

Educational technology and system design - Instructional design models (ADDIE, ASSURE, Dick and Carey Model) - Emerging trends in e-learning (social learning, MOOCs, mobile learning) - ICT tools for teaching and learning (Learning Management Systems, online resources)

UNIT-IV PEDAGOGY AND ASSESSMENT

Pedagogy, pedagogical analysis, and assessment - Types of assessment (placement, formative, diagnostic, summative) - Technology-based assessment tools (online quizzes, polls, discussions) - Rubrics for self and peer evaluation- Reflective Practices

UNIT-V CONTEMPORARY ISSUES AND TRENDS

Inclusive education and technology (assistive technology, accessibility) - Change management and innovation in education - Quality assurance and evaluation in education (TQM, Six Sigma) - Future trends in pedagogy and technology (AI, AR, VR in education) - Personalized learning and adaptive teaching

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TEXT BOOKS:

1. Alexander, R. J. Essays on Pedagogy. Routledge, 2008.
2. Shulman, L. S. The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach. Jossey-Bass, 2004

COURSE OUTCOMES:

1. Define and explain key concepts, frameworks, and methodologies in pedagogy and teacher education research.
2. Critically analyze pedagogical practices used in diverse classroom settings, with reference to teacher education and curriculum design.
3. Evaluate the effectiveness of pedagogical approaches using quality assessment tools and theory of change models.
4. Apply evidence-based strategies to improve classroom practices, curriculum alignment, and teacher professional development.
5. Identify and address barriers to learning through innovative pedagogical strategies.
6. Design and propose research studies that contribute to filling gaps in pedagogy, curriculum, and teacher education, with focus on dissemination and impact.

SREC

VISION

- To become a nucleus for pursuing technical education and pool industrial research and developmental activities with social-conscious and global standards.

MISSION

- To provide Advanced Educational Programs and prepare students to achieve success and take leading roles in their chosen fields of specialization by arising a self-sustained University.
- To establish postgraduate programs in the current and Advanced Technologies.
- To establish an R&D Consultancy through developing Industry Institute Interaction, building up exceptional infrastructure.
- To propel every individual, realize and act for the technical development of the society.

MOTTO

- Education for peace and progress