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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M. Tech (Regular-Full Time)

I M.Tech – I-SEMESTER (CSE)

S.No.	Course Code	Course Name	Hours per week			Credits
			L	T	P	C
1.	25CS5801	Advanced Data Structures & Algorithms	3	0	0	3
2.	25CS5802	Distributed Operating Systems	3	0	0	3
Program Elective-I						
3.	25CS5803	Advanced Computer Architecture	3	0	0	3
	25CS5804	Enterprise Cloud Concepts	3	0	0	3
	25CS5805	Applied Machine Learning	3	0	0	3
Program Elective-II						
4.	25CS5806	Natural Language Processing	3	0	0	3
	25CS5807	Smart Sensor Networks &IoT	3	0	0	3
	25CS5808	Computing for Data Analytics	3	0	0	3
5.	25CS5809	Advanced Data Structures & Algorithms Lab	0	0	4	2
6.	25CS5810	Distributed Operating Systems Lab	0	0	4	2
7.	25HS0867	Research Methodology and IPR	2	0	0	2
8.	25CS5811	Full stack Development Using MERN	0	1	2	2
Audit Course – I						
9.	25EC4232	English for Research Paper Writing	2	0	0	0
	25CE1031	Disaster Management	2	0	0	0
	25CS5831	Essence of Indian Traditional Knowledge	2	0	0	0
Total						20

I M.Tech – II-SEMESTER (CSE)

S.No.	Course Code	Course Name	L	T	P	Credits
1.	25CS5812	Advances in Software Engineering	3	0	0	3
2.	25CS5813	Advanced Databases	3	0	0	3
Program Elective – III						
3.	25CS5814	Block Chain Technology	3	0	0	3
	25CS5815	Advanced Computer Networks	3	0	0	3
	25CS5816	Deep Learning and Applications	3	0	0	3
Program Elective – IV						
4.	25CS5817	Generative AI	3	0	0	3
	25CS5818	Digital Forensics	3	0	0	3
	25CS5819	Robotic Process Automation	3	0	0	3
5.	25CS5820	Advance in Software Engineering Lab	0	0	4	2
6.	25CS5821	Advanced Databases Lab	0	0	4	2
7.	25CS5822	Quantum Technologies And Applications	2	0	0	2
8.	25CS5823	Comprehensive Viva Voce	0	0	0	2
Audit Course – II						
9.	25EE2130	Pedagogy Studies	2	0	0	0
	25EE2131	Personality Development Through Life Enlightenment Skills	2	0	0	0
	25CS5832	Yoga For Stress Management	2	0	0	0
Total						20

Hours per week: L, T, P columns

**Students have to undergo an Industry Internship after I Year II Semester for a duration of 6 to 8 weeks

II M.Tech – I-SEMESTER (CSE)

S.No.	Course Code	Course Name	Hours per week			Credits
			L	T	P	
		Program Elective – V				
1.	25CS5824	**1.** Software Defined Networks	3	0	0	3
	25CS5825	2. Reinforcement Learning	3	0	0	3
	25CS5826	3. Data Science	3	0	0	3
2.		Open Elective-I	3	0	0	3
3.	25CS5827	Dissertation Phase – I	0	0	20	10
4.	25CS5828	Industry Internship	0	0	0	2
5.	25CS0829	Co- Curricular Activities	0	0	0	1
Total						19

II M.Tech – II- SEMESTER(CSE)

S.No.	Course Codes	Course Name	Hours per			Credits
			L	T	P	
1.	25CS5830	**Dissertation Phase – II**	0	0	32	16
Total						16

OPEN ELECTIVE OFFERED TO OTHER DEPARTMENS

- Advanced Data Structures & Algorithms
- Cloud Computing

Total No .of Credits: 20 + 20 + 19 + 16 = 75

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I M.Tech – I Sem.

L	T	P	C
3	0	0	3

(25CS5801) ADVANCED DATA STRUCTURES & ALGORITHMS

Course Objectives:

This course is aimed at enabling the students to
1. *Introduce fundamental data structures including linked lists, stacks, queues, trees, graphs, dictionaries, and hashing techniques.*
2. *Develop algorithmic skills for designing and analyzing searching, sorting, and traversal methods.*
3. *Teach implementation of priority queues, binary search trees, and balanced trees (AVL, Red-Black, Splay, B-Trees).*
4. *Enable students to select and apply appropriate data structures for solving computational problems efficiently.*
5. *Foster understanding of the performance analysis and comparative evaluation of data structures and algorithms.*

Course Outcomes:

After completing this course, students will be able to:
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.*
6. *Evaluate algorithm performance and efficiency using time and space complexity analysis to select optimal solutions for real-world problems.*

UNIT I: Introduction

Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. 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.

Textbooks
1. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudo Code Approach*, 2nd Edition, Cengage Learning.
2. Sartaj Sahni, *Data Structures, Algorithms and Applications in Java*, 2nd Edition, University Press.

References books:
1. Mark Allen Weiss, *Data Structures and Algorithm Analysis*, 2nd Edition, Pearson Education.
2. Adam Drozdek, *Data Structures and Algorithms*, 3rd Edition, Cengage Learning.
3. N. B. Venkateswarulu and E. V. Prasad, *C and Data Structures: A Snapshot-Oriented Treatise Using Live Engineering Examples*, S. Chand & Company.

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L	T	P	C
3	0	0	3

(25CS5802) DISTRIBUTED OPERATING SYSTEMS

Course Objectives:

This course is aimed at enabling the students to

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.*

Course Outcomes:

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

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.*
6. *Design and simulate distributed system components and services, demonstrating scalability, efficiency, and fault tolerance in practical scenarios.*

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, cuts of a distributed computation, termination detection.

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's Heuristic Algorithm, Raymond's Heuristic Algorithm.

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

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

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. Mukesh Singhal, Niranjan G. Shivaratri, *Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems*, Tata McGraw-Hill, 2001.
2. Andrew S. Tanenbaum, Maarten Van Steen, *Distributed Systems: Principles and Paradigms*, Pearson Education, 2nd Edition, 2006.

REFERENCES

1. Andrew S. Tanenbaum, Maarten Van Steen, *Distributed Systems: Principles and Paradigms*, Pearson Education, 2nd Edition, 2006.
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.
5. Nancy A. Lynch, *Distributed Algorithms*, Morgan Kaufmann, 1996.
6. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, *Distributed Systems: Concepts and Design*, Pearson, 5th Edition, 2011.

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I M.Tech – I Sem.

L	T	P	C
3	0	0	3

(25CS5803) ADVANCED COMPUTER ARCHITECTURE
(Program Elective-I)

Pre-requisites: Computer Organization

Course Objectives:
This course is aimed at enabling the students to
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*

Course Outcomes:
After the completion of the course, student will be able to
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. *Evaluate vector and SIMD processing principles through case studies like CM-5 to identify their effectiveness in solving computationally intensive applications.*
6. *Integrate advanced memory hierarchies, and parallel processing techniques to optimize system performance for real-world computational workloads.*

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

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

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L	T	P	C
3	0	0	3

(25CS5804) ENTERPRISE CLOUD CONCEPTS
(Program Elective-I)

Course Objectives:

This course is aimed at enabling the students to

1. *Knowledge on significance of cloud computing and its fundamental concepts and models.*
2. *Familiarize students with key terminology, characteristics, and delivery/deployment models of cloud computing.*
3. *Enable students to understand how architecture and management mechanisms together support efficient cloud service delivery.*
4. *Explore the mechanisms that enable smart enterprise operations through cloud technologies.*
5. *Highlight the role and relevance of private and enterprise clouds in ensuring business resilience and transformation.*

Course Outcomes:

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

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.*
5. *Analyze the role of cloud technologies in enabling smart enterprise mechanisms and digital transformation..*
6. *Assess cloud infrastructure solutions and their impact on business continuity and operational efficiency.*

UNIT–I:

Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

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:

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:

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:

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. James Bond, The Enterprise Cloud, O'Reilly Media, Inc..

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L	T	P	C
3	0	0	3

(25CS5805) APPLIED MACHINE LEARNING
(Program Elective-I)

Course Objectives:

This course is aimed at enabling the students to
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.*

Course Outcomes:

After the completion of the course, student will be able to
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.*
5. *Evaluate model performance using metrics and validation techniques.*
6. *Implement machine learning solutions with standard tools and frameworks.*

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:

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:

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:

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:

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

Text Books:

1. Peter Flach, *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*, Cambridge University Press, 2012.
2. Tom M. Mitchell, *Machine Learning*, India Edition, McGraw Hill Education, 2013.

Reference Books:

1. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, 2nd Edition.
2. Stephen Marsland, *Machine Learning – An Algorithmic Perspective*, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Ethem Alpaydın, *Introduction to Machine Learning*, 2nd Edition, MIT Press.
4. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, *The Elements of Statistical Learning*, 2nd Edition, Springer Series.

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L	T	P	C
3	0	0	3

(25CS5806) NATURAL LANGUAGE PROCESSING
(Program Elective-II)

Course Objectives :

This course is aimed at enabling the students to

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.*

Course Outcomes :

   After completing this course, students will be able to:

1. *Understand linguistic foundations of English syntax and various levels of language analysis for Natural Language Processing.*
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 parsing.*
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, applying appropriate pre-processing, evaluation metrics, and tools for cross-lingual retrieval.*

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:

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:
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.

UNIT-IV:
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:
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.

Textbooks:
1. James Allen, *Natural Language Understanding*, 2nd Edition, Pearson Education, 2003.
2. Daniel M. Bikel and Imed Zitouni, *Multilingual Natural Language Processing Applications: From Theory to Practice*, Pearson Publications.
3. Akshar Bharathi and Vineet Chaitanya, *Natural Language Processing: A Paninian Perspective*, Prentice–Hall of India.

Reference Books:
1. Eugene Charniack, *Statistical Language Learning*, MIT Press, 1993.
2. Dan Jurafsky and James Martin, *Speech and Language Processing*, 2nd Edition, Prentice Hall, 2008.
3. Christopher Manning and Hinrich Schütze, *Foundations of Statistical Natural Language Processing*, MIT Press, 1999.

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I M.Tech – I Sem.

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(25CS5807) SMART SENSOR NETWORKS &IoT
(Program Elective-II)

Course Objectives:

This course is aimed at enabling the students to

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 analyze IoT 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.*

Course Outcomes:

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

1. *Explain the fundamental concepts, applications, and research areas of IoT across various domains.*
2. *Analyze IoT 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.*
6. *Design IoT solutions integrating sensors, networks, and analytics for real-world applications*

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

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:

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.

Textbooks:

1. B. Mandler, J. Barja, M.E. Mitre Campista, D. Cagáová, H. Chaouchi, S. Zeadally, M. Badra, S. Giordano, M. Fazio, A. Somov, and R.-L. Vieriu, *Internet of Things: IoT Infrastructures*, Springer International Publication.
2. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Paperback Edition, 2015.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, and Rob Barton, *IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things*, Pearson, Paperback Edition, August 16, 2017.

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L	T	P	C
3	0	0	3

(25CS5808) COMPUTING FOR DATA ANALYTICS
(Program Elective-II)

Course Objectives

This course is aimed at enabling the students to

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.*

Course Outcomes

After completing this course, students will be able to:

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.*
6. *Implement data analytics solutions using programming tools to extract insights from 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, χ^2 distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.

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).
7. David Hand, HeikkiMannila, Padhraic Smyth, ―Principles of Data mining, PHI 2013.

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(25CS5809) ADVANCED DATA STRUCTURES & ALGORITHMS LAB

Course Objectives :

This course is aimed at enabling the students to

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*

Course Outcomes:

After completing these experiments, students will be able to:

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.*

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

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.

References:

1. Ellis Horowitz, SartajSahni, and Sanguthevar Rajasekaran *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.

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(25CS5810) DISTRIBUTED OPERATING SYSTEMS LAB

Course Objectives:

This course is aimed at enabling the students to

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.*

Course Outcomes:

After completing this lab, students will be able to:

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.*

List of Experiments

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.

References

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.

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(25ME3111) RESEARCH METHODOLOGY AND IPR

Course Objectives:

This course is aimed at enabling the students to

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.*

Course Outcomes(CO):

After completing the course, the students will be able to:

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.*

UNIT - I   FUNDAMENTALS OF RESEARCH METHODOLOGY

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.

UNIT - II   DATA COLLECTION AND SOURCES

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   DATA ANALYSIS AND REPORTING

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.

UNIT - IV   UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS

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   PATENTS

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.

Reference Books

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
2. Ranjit Kumar , Research Methodology: A Step-by-Step Guide for Beginners. . David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007. Deborah E. Bouchoux , Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.
3. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
5. Peter Elbow, Writing With Power, Oxford University Press, 1998.

Online Resources (Free & Authentic)

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

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(25CS5811) FULL STACK DEVELOPMENT USING MERN

Course Objectives:

This course is aimed at enabling the students to

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.*
4. *Impart skills to design and develop interactive user interfaces using ReactJS.*
5. *Enhance problem-solving abilities through full-stack web application development experiments.*

Course Outcomes :

After completing the course, the students will be able to:

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. Develop and deploy full-stack applications by combining frontend, backend, and database skills.*
5. *Demonstrate problem-solving, debugging, and version control skills in web development projects.*
6. *Deploy and maintain full-stack web applications on cloud platforms with optimized performance and security*

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 :
- **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, 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.

Textbooks
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.

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(25EC4232) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course – I)

Course Objectives:

This course is aimed at enabling the students to

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.*

Course Outcomes :

After completing the course, the students will be able to:

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. *Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.*
7. *Develop a well-structured research paper that effectively communicates complex ideas.*

UNIT – I   Fundamentals of Academic English

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   Reading Skills for Researchers
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 Grammar Refinement for Research Writing
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   Mastery in Refining Written Content/Editing Skills
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.

UNIT – V   Technology and Language for Research
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.

Online Learning Resources:
1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite

4. Academic Phrasebank – University of Manchester
   [http://www.phrasebank.manchester.ac.uk]
   (http://www.phrasebank.manchester.ac.uk)

5. OWL (Online Writing Lab) – Purdue University,
   https://owl.purdue.edu*(Resources on APA/MLA formats,
   grammar, structure, paraphrasing)*

6. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations
   and sources.

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(25CE1031) DISASTER MANAGEMENT
(Audit Course – I)

Course Objectives:
This course is aimed at enabling the students to
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 analyse 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.*

Course Outcomes
On successful completion, students will be able to:
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.*

UNIT –I   Introduction
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   Repercussions of Disasters and Hazards

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   Disaster Preparedness and Management

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of Risk-Application of Remote Sensing - Data from Meteorological and Other Agencies - Media Reports- Governmental and Community Preparedness

UNIT - IV   Risk Assessment

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

UNIT - V   Disaster Mitigation

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.

Online Resources
1. National Disaster Management Authority (NDMA), India: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
2. United Nations Office for Disaster Risk Reduction (UNDRR): https://www.undrr.org – Sendai Framework, global risk reduction strategies.

3. Global Disaster Alert and Coordination System (GDACS): https://www.gdacs.org – real-time disaster alerts.

4. World Health Organization (WHO) – https://www.who.int/emergencies – disaster-related health guidelines.

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(25CS5831) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(Audit Course – I)

Course Objectives :

The objective of this course is

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*

Course Outcomes:

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

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*

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:

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

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:

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:

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, and 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*, Pratibha Prakashan, 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. Acharya, P.K., *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P., *Public Administration in Ancient India*, Macmillan, London, 1961.
7. Kapoor, Kapil and Singh, Avadhesh, *Indian Knowledge Systems*, Vol. I & II, Indian Institute of Advanced Study, Shimla, H.P., 2022.

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

I M.Tech – II-SEMESTER (CSE)

S.No.	Course Code	Course Name	L	T	P	Credits
			Hours per week			
1.	25CS5812	Advances in Software Engineering	3	0	0	3
2.	25CS5813	Advanced Databases	3	0	0	3
Program Elective – III						
3.	25CS5814	Block Chain Technology	3	0	0	3
	25CS5815	Advanced Computer Networks	3	0	0	3
	25CS5816	Deep Learning and Applications	3	0	0	3
Program Elective – IV						
4.	25CS5817	Generative AI	3	0	0	3
	25CS5818	Digital Forensics	3	0	0	3
	25CS5819	Robotic Process Automation	3	0	0	3
5.	25CS5820	Advance in Software Engineering Lab	0	0	4	2
6.	25CS5821	Advanced Databases Lab	0	0	4	2
7.	25CS5822	Quantum Technologies And Applications	2	0	0	2
8.	25CS5823	Comprehensive Viva Voce	0	0	0	2
Audit Course – II						
9.	25EE2130	Pedagogy Studies	2	0	0	0
	25EE2131	Personality Development Through Life Enlightenment Skills	2	0	0	0
	25CS5832	Yoga For Stress Management	2	0	0	0
Total						20

**Students have to undergo an Industry Internship after I Year II Semester for a duration of 6 to 8 weeks

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I M.Tech – II Sem.

L	T	P	C
3	0	0	3

(25CS5812) Advances in Software Engineering

Course Objectives:
This course is aimed at enabling the students to
1. *Understand and evaluate modern software-engineering paradigms and emerging practices in complex system development.*
2. *Apply advanced techniques for requirements engineering, architecture design, testing, and maintenance of software systems.*
3. *Integrate and leverage contemporary tools, frameworks and methodologies in the software lifecycle.*
4. *Develop collaborative, ethical and professional skills required to lead software-engineering teams and manage projects in dynamic environments.*

Course Outcomes :
After completing the course, the students will be able to:
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.*
6. *Design and implement software solutions using modern tools and frameworks that ensure scalability, reliability, and maintainability.*

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.

Textbooks:

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 9th Edition, McGraw Hill International Edition.
2. Rajib Mall, *Fundamentals of Software Engineering*, 5th Edition, PHI Learning.

Reference Books:

1. Ian Sommerville, *Software Engineering*, 10th Edition, Pearson Education.
2. Waman S. Jawadekar, *Software Engineering: A Primer*, Tata McGraw-Hill, 2008.
3. Pankaj Jalote, *Software Engineering: A Precise Approach*, Wiley India, 2010.
4. Deepak Jain, *Software Engineering: Principles and Practices*, Oxford University Press.

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I M.Tech – II Sem.

L	T	P	C
3	0	0	3

(25CS5813) Advanced Databases

Course Objectives:
This course is aimed at enabling the students to

1. *Master advanced database architectures including distributed, parallel and NoSQL systems.*
2. *Develop expertise in query optimization, indexing and transaction management for high-performance systems.*
3. *Design and implement modern data warehousing, big-data and multimedia database applications.*
4. *Ensure proficiency in database security, recovery, scalability and emerging DBMS technologies.*

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

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*
5. *Analyze emerging research challenges and apply metrics, configuration management, and agile practices in modern software engineering.*
6. *Design and implement distributed, NoSQL, and big data solutions to handle large-scale and complex data management challenges.*

Unit I
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
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

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

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, NoSQL, Mongo DB

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

Textbooks:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, 6th Edition, McGraw-Hill Education, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems*, 7th Edition, Pearson Education, 2016.

Reference Books:

1. C. J. Date, *An Introduction to Database Systems*, 8th Edition, Pearson Education, 2004.
2. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw-Hill Education, 2003.
3. Thomas Connolly, Carolyn Begg, *Database Systems: A Practical Approach to Design, Implementation and Management*, 6th Edition, Pearson Education, 2015.

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I M.Tech – II Sem.

L	T	P	C
3	0	0	3

(25CS5814) Block Chain Technology
(Program Elective – III)

Prerequisites:
1. Knowledge in information security and applied cryptography.
2. Knowledge in Computer Networks

Course Objectives:
 This course is aimed at enabling the students to

1. *To learn the fundamentals of Blockchain and various types of block chain and consensus mechanisms.*
2. *To understand the public block chain system, Private block chain system and consortium blockchain.*
3. *Able to know the security issues of blockchain technology.*

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

1. *Understanding concepts behind crypto currency .*
2. *Applications of smart contracts in decentralized application development .*
3. *Understand frameworks related to public, private and hybrid blockchain.*
4. *Create blockchain for different application case studies*
5. *Analyze blockchain consensus mechanisms and evaluate their impact on security and*
   performance.
6. *Design and implement blockchain-based solutions using suitable platforms for real-world applications*

UNIT-I
Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain,The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. Cryptocurrency – Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT-II
Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. Smart Contracts: Introduction, Smart

UNIT-III

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT-IV

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain In Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT-V

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Textbooks:

1. Chandramouli Subramanian, Asha A. George, Abhilash K. A., and Meena Karthikeyan, *Blockchain Technology*, Universities Press.

References books:

1. Michael Juntao Yuan, *Building Blockchain Apps*, Pearson India.
2. Melanie Swan, *Blockchain: Blueprint for a New Economy*, SPD O'Reilly.
3. Jai Singh Arun, Jerry Cuomo, and Nitin Gaur, *Blockchain for Business*, Pearson.

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I M.Tech – II Sem.

L	T	P	C
3	0	0	3

(25CS5815) Advanced Computer Networks
(Program Elective – III)

Course Objective:
This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

Course Outcomes:
After completing the course, the students will be able to:
1. *Understanding of holistic approach to computer networking*
2. *Ability to understand the computer network protocols and their applications*
3. *Ability to design simulation concepts related to packet forwarding in networks.*
4. *Analyze network performance using QoS, and traffic management techniques.*
5. *Evaluate emerging technologies such as SDN, and 5G communication architectures.*
6. *Design and implement secure and efficient network solutions using simulation .*

UNIT - I
Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

UNIT - II
Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of Network Applications.

UNIT- III
The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, building a Simple Web Server Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

UNIT - IV
Wireless and Mobile Networks: Introduction, Wireless links and Network Characteristics -

CDMA, Wifi: 802.11 Wireless LANS, Cellular internet access, Mobility management: Principles

UNIT - V

Multimedia networking: Multimedia networking applications, streaming stored video, Voice-over-IP, Protocols for real-time conversational applications.

Text Books:

1. James F. Kuros and Keith W. Ross, *Computer Networking: A Top-Down Approach*, 6th Edition, Pearson, 2012.
2. Duglas E. Comer, *Computer Networks and Internets*, 6th Edition, Pearson.

References Books:

1. Jeffrey S. Beasley and Piyasat Nilkaew, *A Practical Guide to Advanced Networking*, 3rd Edition, Pearson, 2012.
2. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Prentice Hall.

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L	T	P	C
3	0	0	3

(25CS5816) Deep Learning and Applications
(Program Elective – III)

Course Objectives:
This course is aimed at enabling the students to
1. *To understand complexity of Deep Learning algorithms and their limitations*
2. *To be capable of performing experiments in Deep Learning using real-world data.*

Course Outcomes:
After completing the course, the students will be able to:
1. *Implement deep learning algorithms, understand neural networks and traverse the layers of data .*
2. *Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces .*
3. *Understand applications of Deep Learning to Computer Vision .*
4. *Understand and analyze Applications of Deep Learning to NLP.*
5. *Evaluate deep learning models using performance metrics and optimization techniques.*
6. *Design and deploy deep learning solutions for real-world problems using modern frameworks and tools.*

UNIT - I
Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout.

UNIT - II
Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models.

UNIT - III
Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks.

UNIT -IV
Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity.

UNIT -V
Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press.
2. T. Hastie, R. Tibshirani, and J. Friedman, *The Elements of Statistical Learning*, Springer.
3. Daphne Koller and Nir Friedman, *Probabilistic Graphical Models*, MIT Press.

References Books:

1. C. M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
2. B. Yegnanarayana, *Artificial Neural Networks*, PHI Learning Pvt. Ltd., 2009.
3. G. H. Golub and C. F. Van Loan, *Matrix Computations*, Johns Hopkins University Press, 2013.
4. Satish Kumar, *Neural Networks: A Classroom Approach*, Tata McGraw-Hill Education,2004

Online References:
1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
2. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
3. http://neuralnetworksanddeeplearning.com/

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L	T	P	C
3	0	0	3

(25CS5817) Generative AI
(Program Elective – IV)

Course Objectives

This course is aimed at enabling the students to

1. *To introduce the foundations, evolution, and core concepts of AI, ML, DL, NLP, and Generative AI.*
2. *To develop understanding of advanced neural architectures and generative models such as GANs, VAEs, and Transformers.*
3. *To explore Large Language Models, prompt engineering, and their real-world applications.*
4. *To familiarize learners with frameworks, multimodal applications, and ethical considerations in Generative AI.*

Course Outcomes :

After completing the course, the students will be able to:

1. *Demonstrate knowledge of AI foundations, generative models, and advanced neural architectures.*
2. *Apply generative AI techniques to create solutions for text, image, video, and multimodal tasks.*
3. *Design, fine-tune, and optimize Large Language Models for specific applications.*
4. *Evaluate ethical, social, and legal implications of Generative AI deployments and propose mitigation strategies.*
5. *Implement generative AI models using contemporary frameworks and tools for real-world applications.*
6. *Analyze emerging trends and research directions in generative AI for innovative solution development.*

UNIT 1

Foundations of AI and Generative Models

Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI.

UNIT 2

Advanced Neural Architectures for Generative AI

Variational Autoencoders (VAEs): principles and applications, Generative Adversarial

Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models.

UNIT 3

Large Language Models and Prompt Engineering

Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Prétraining and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine-tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development.

UNIT 4

Multi-Agent Systems and Generative AI Applications

Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges

UNIT 5

 Frameworks, Multimodal Applications, and Ethics LangChain framework: components and LLM application development, Retrieval-Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias, fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation strategies and real-world ethical case studies

Text Books:
1. Altaf Rehmani, *Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology.*
2. Charu C. Aggarwal, *Neural Networks and Deep Learning: A Textbook.*
3. Joseph Babcock and Raghav Bali, *Generative AI with Python and TensorFlow 2*, 2024.

Reference Books:
1. Josh Kalin, *Generative Adversarial Networks Cookbook.*
2. Jesse Sprinter, *Generative AI in Software Development: Beyond the Limitations of Traditional Coding*, 2024.

Online References

1. Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, NeurIPS 2017.

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I M.Tech – II Sem.

L	T	P	C
3	0	0	3

(25CS5818) Digital Forensics
(Program Elective – IV)

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:

This course is aimed at enabling the students to
1. *provides an in-depth study of the rapidly changing and fascinating field of computer forensics.*
2. *Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.*
3. *Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools*
4. *E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics*

Course Outcomes:

After completing the course, the students will be able to:
1. *Understand relevant legislation and codes of ethics.*
2. *Computer forensics and digital detective and various processes, policies and procedures.*
3. *E-discovery, guidelines and standards, E-evidence, tools and environment.*
4. *Email and web forensics and network forensics*
5. *Perform forensic analysis on various digital devices and recover evidence using standard tools and techniques.*
6. *Evaluate forensic findings and prepare comprehensive reports for legal and investigative purposes*

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT - II

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Text Books:
1. John Sammons, *The Basics of Digital Forensics*, Elsevier.
2. John Vacca, *Computer Forensics: Computer Crime Scene Investigation*, Laxmi Publications.

References Books:
1. William Oettinger, *Learn Computer Forensics: A Beginner's Guide to Searching, Analyzing, and Securing Digital Evidence*, Packt Publishing, 1st Edition (2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar, *Cybercrime and Digital Forensics: An Introduction*, Routledge.

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L	T	P	C
3	0	0	3

(25CS5819) Robotic Process Automation
(Program Elective – IV)

Course Objectives:
This course is aimed at enabling the students to
   1. To make learners familiar with the concepts of Robotic Process Automation.

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

1. *Describe RPA, where it can be applied and how it's implemented.*
2. *Identify and understand Web Control Room and Client Introduction*
3. *Understand how to handle various devices and the workload*
4. *Understand Bot creators, Web recorders and task editors*
5. *Design and develop automated workflows using RPA tools for business processes.*
6. *Evaluate and optimize RPA solutions for efficiency, reliability, and scalability in real-world applications.*

Unit I
Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots

Unit II
Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials)

Unit III
Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

Unit IV
Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command

Unit V
Terminal Emulator Command - PDF Integration Command - FTP Command - PGP

Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer

Text Books:

1. *Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath*, Kindle Edition.

Reference Books:

1. *Robotic Process Automation: A Complete Guide – 2020 Edition*, Kindle Edition.

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(25CS5820) Advance in Software Engineering Lab

Course Objectives:
This course is aimed at enabling the students to

1. *To provide hands-on experience in applying advanced software engineering concepts to real-world projects.*
2. *To develop skills in requirement analysis, modeling, design, and implementation using modern software engineering practices.*
3. *To enhance problem-solving and debugging abilities through systematic testing and maintenance of software systems.*
4. *To familiarize students with collaborative tools, version control, and project management techniques for team-based software development.*

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

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*
6. *To enhance development efficiency and quality assurance.*

List of Experiments:

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. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 9th Edition, McGraw-Hill International Edition.
2. Rajib Mall, *Fundamentals of Software Engineering*, 5th Edition, PHI.

Reference Books:

1. Ian Sommerville, *Software Engineering*, 10th Edition, Pearson Education.
2. Waman S. Jawadekar, *Software Engineering: A Primer*, Tata McGraw-Hill, 2008.
3. Pankaj Jalote, *Software Engineering: A Precise Approach*, Wiley India, 2010.

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(25CS5821)   Advanced Databases Lab

Course Objectives:

This course is aimed at enabling the students to

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

Course Outcomes:

After completing the course, the students will be able to:

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*
5. *Design and implement distributed and NoSQL database solutions for complex data management scenarios.*
6. *Develop practical skills in querying, optimizing, and managing large-scale databases using contemporary tools and platforms.*

List of Experiments

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 Node.js with MongoDB: Building a REST API using Node.js, Express, and Mongo DB to manage CRUD operations.
13. Implement vector space models for Text corpus
14. Demonstrate type inheritance, table inheritance in object based databases
15. Write queries in XQueries on DTD
16. Write queries in SQL/XML to convert University data - XML Schema

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, 6th Edition, McGraw-Hill Education.
2. Ramez Elmasri, Shamkant B. Navathe, *Database Systems: Models, Languages, Design and Application Programming*, Pearson Education.

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(25CS5822) Quantum Technologies And Applications

Course Objectives:
The objectives of this course
1. *To introduce the basic principles of quantum mechanics relevant to computing and communication.*
2. *To understand quantum information concepts and computational models.*
3. *To gain practical exposure to quantum circuit design and simulation using modern platforms.*
4. *To explore real-world applications in cryptography, optimization, and emerging quantum technologies.*

Course Outcomes:
On successful completion of this course, the student will be able to
1. *Understand basic quantum mechanics concepts relevant to computing and communication.*
2. *Explain and analyze simple quantum logic gates and basic algorithms.*
3. *Develop basic quantum circuits using Qiskit or similar tools.*
4. *Simulate and test the behavior of simple quantum circuits using appropriate simulators or cloud environments*
5. *Demonstrate understanding of quantum communication protocols and cryptographic principles.*
6. *Explore and discuss modern quantum technologies and their real-world applications.*

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.

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.
4. *Qiskit Textbook – IBM Quantum* (Free Online Reource).

Referencebook
1. Jack D. Hidary, *Quantum Computing: An Applied Approach*, Springer.
2. Benenti, Casati, and Strini, *Principles of Quantum Computation and Information*, World Scientific.
3. John Preskill, *Quantum Computing in the NISQ Era and Beyond*, *Quantum Journal*.

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(25CS5823) Comprehensive Viva Voce

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(25EE2130) Pedagogy Studies
(Audit Course – II)

Course Objectives:
This course is aimed at enabling the students to
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*

Course Outcomes :
After completing the course, the students will be able to:
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.*

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

Textbooks:

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

Reference Books:

1. Teaching for the Future: Effective Teacher Education and Pedagogical Practices. OECD Publishing., 2021
2. Fullan, M., & Edwards, M. System Change in Education: Sustainability and Impact. Routledge, 2022.
3. Coe, R., Rauch, C., Kime, S., & Singleton, D. Great Teaching Toolkit: Evidence Review. Evidence Based Education., 2020
4. Zeichner, K. M. The Struggle for the Soul of Teacher Education. Routledge, 2024
5. UNESCO. Global Education Monitoring Report: Pedagogy, Teachers and Learning. UNESCO Publishing, 2024
6. Hattie, J. Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. Routledge., 2009
7. Darling-Hammond, L. Teacher Education Around the World: What Can We Learn from International Practice? Routledge, 2007

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(25EE2131) PERSONALITY DEVELOPMENT THROUGH
LIFE ENLIGHTENMENT SKILLS
(Audit Course – II)

Course Objectives:
This course is aimed at enabling the students to
1. *To develop students' self-awareness by identifying their strengths, weaknesses, opportunities, and challenges (SWOC analysis).*
2. *To enable students to understand and apply the principles of emotional intelligence and effective interpersonal communication.*
3. *To cultivate positive thinking, resilience, mindfulness, and a growth-oriented mindset.*
4. *To enhance verbal and non-verbal communication skills, including confidence in public speaking and professional presentations.*
5. *To familiarize students with leadership styles, teamwork strategies, and collaborative problem-solving in personal and professional contexts.*

Course Outcomes :
After completing the course, the students will be able to:
1. *Define and explain key concepts of self-awareness, personality, and personal growth.*
2. *Identify and apply strategies of emotional intelligence to regulate emotions and build effective interpersonal relationships*
3. *Demonstrate positive thinking, gratitude, and resilience to overcome personal and professional challenges*
4. *Analyze barriers to effective communication and apply verbal and non-verbal communication techniques in diverse contexts.*
5. *Prepare, deliver, and evaluate effective presentations and public speeches with confidence*
6. *Develop leadership and teamwork skills to collaborate, negotiate, and solve problems in group settings.*

Unit I: Self-Awareness and Personal Growth
Understanding personality and its development- Identifying strengths, weaknesses, opportunities, and challenges (SWOC analysis)- Setting personal and professional goals- Practicing Self-Reflection and Journaling.
(Activities: Personalitya assessments, self reflection exercises, group discussions, SWOC analysis worksheet, Action Plan, SMART goal activities, Reflective journaling, Self-care Planning)

Unit II: Emotional Intelligence and Interpersonal Skills

Understanding emotional intelligence and its importance - Developing self-awareness, self-regulation, and motivation - Building effective communication and interpersonal skills - Conflict resolution and negotiation strategies.
(Activities: Emotional Intelligence Quiz, Self-Reflection exercises, feedback sessions, mindfulness exercises, Positive self-talk, Active Listening exercises, conflict-resolution Role-play, Case studies & Group activities)

Unit III: Positive Thinking and Attitude

Understanding the power of positive thinking- Developing a growth mindset and resilience - Practicing gratitude and mindfulness- Overcoming negative thoughts and behaviors.
(Activities on positive thinking, growth mindset, mindfulness and self-care plan for overcoming negative thoughts)

Unit IV: Effective Communication and Presentation Skills

Understanding the importance of effective communication- Developing verbal and non-verbal communication skills- Preparing and delivering effective presentations- Building confidence and public speaking skills.
(Activities: Group discussions, Case studies, Role-Play, Non-verbal communication exercises, Practice presentations, Peer feedback, Public speaking exercises, Storytelling, Debates)

Unit V: Leadership and Teamwork

Understanding leadership styles and qualities - Developing leadership skills and qualities- Building effective teams and teamwork strategies- Practicing collaboration and problem-solving
(Activities: Case studies, Group discussions, Debates, Leadership role-playing, team building activities, Group projects, Collaborative problem-solving exercies, feedback sessions)

Textbooks:

1. Daniel Goleman,Emotional Intelligence: Why It Can Matter More Than IQ, Bantam Books,
   2017.
2. Stephen R. Covey, The 7 Habits of Highly Effective People, Simon & Schuster, 2020.

Reference Books:

1. Dale Carnegie, How to Win Friends and Influence People, Simon & Schuster, 2020.
2. Brian Tracy, Goals!: How to Get Everything You Want Faster Than You Ever Thought Possible, Berrett-Koehler Publishers, 2021.
3. Robin Sharma, The 5 AM Club: Own Your Morning, Elevate Your Life, HarperCollins, 2020.
4. Carol S. Dweck, Mindset: The New Psychology of Success, Random House, 2016.
5. Daniel H. Pink,Drive: The Surprising Truth About What Motivates Us, Riverhead Books, 2018.
6. John C. Maxwell, Leadershift: 11 Essential Changes Every Leader Must Embrace, HarperCollins, 2019.

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(25CS5832) YOGA FOR STRESS MANAGEMENT
(Audit Course – II)

Course Objectives:

This course is aimed at enabling the students to

1. *To make the students understand the foundational concepts of Yoga, including Ashtanga (eight limbs) as prescribed in classical texts.*
2. *To enable them analyze the principles of Yama and Niyama, and their role in ethical, personal, and social development.*
3. *To make them learn do's and don'ts of life through the practice of ahimsa, satya, astheya, brahmacharya, aparigraha, shaucha, santosh, tapa, swadhyaya, and ishwar-pranidhana.*
4. *To make them practice asanas and pranayama techniques for physical fitness, mental balance, and spiritual awareness.*
5. *To make them understand the holistic lifestyle through regular yoga practice, leading to personality development.*

Course Outcomes :

After completing the course, the students will be able to:

1. *Explain the eight limbs of Yoga (Ashtanga) and their interrelationship in holistic development.*
2. *Demonstrate understanding of Yama and Niyama as ethical guidelines and apply them in personal and professional life.*
3. *Differentiate between do's and don'ts in daily life with reference to Yogic principles like ahimsa, satya, and swadhyaya.*
4. *Perform selected asanas and pranayama techniques with correct posture, breathing, and awareness.*
5. *Evaluate the physical, mental, and emotional benefits of yoga practices in stress reduction, concentration, and self-discipline.*
6. *Integrate yoga philosophy and practices into a personal routine for sustainable health and inner growth.*

Unit I:

Definitions of Eight parts of yoga.(Ashtanga)

Unit II:

Yam and Niyam

Unit III: Do's and Don'tsin life.

i)Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit IV: Asanand Pranayam

Unit V:

i) Various yoga poses and their benefits for mind and body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Textbooks:

1. Swami Prabhavananda and Christopher Isherwood (translation & commentary), Patanjali Yoga Sutras,Sri Ramakrishna Math, 1953.
2. B.K.S. Iyengar, Light on Yoga, Thorsons, 2003.

Reference Books:

1. T.K.V. Desikachar, The Heart of Yoga: Developing a Personal Practice, Inner Traditions 2nd Edition, 1999.
2. Acharya Yatendra, Yoga & Stress Management, Fingerprint Publishers, 2019
3. Yamini Muthanna, The Power of Yoga, Om Books International, 2015.
4. Nayaswami Devarshi, Kriya Yoga: Spiritual Awakening for the New Age, Ananda Sangha Publications, 2023.

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(25CS5824) SOFTWARE DEFINED NETWORKS
(Program Elective – V)

Course Objectives:
This course is aimed at enabling the students to:

1. *Understand the evolution of Software Defined Networks (SDN) and its interoperability.*
2. *Examine the characteristics of SDN and its devices and controllers. Understand the OpenFlow specifications and its limitations.*
3. *Comparison of SDN, Overlays and APIs.*
4. *Design of network virtualization tunnels and offloading flows in data centers.*
5. *Design and development of switch and controller in SDN application*

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

1. *Analyze the implications of SDN for research and innovation data centers.*
2. *Brief the OpenFlow basics and optical transport protocols.*
3. *Develop the tunneling and path technologies for real world data center.*
4. *Implementation of the access control for the campus and traffic engineering for service providers. Simulation and testing of SDN in open-source cloud software.*
5. *Implementation of switch and controller in SDN applications*
6. *Design SDN-based scalable and secure networks.*

UNIT-I
Introduction: Evolution of Switches and Control Planes, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs. The Evolution of Networking Technology, Forerunners of SDN, Legacy Mechanisms Evolve Toward SDN, Software Defined Networking Is Born,Sustaining SDN Interoperability, Open Source Contributions, Network Virtualization

UNIT-II
Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Method. The OpenFlow Specification, OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.0 to 1.5, Improving OpenFlow Interoperability, Optical Transport Protocol Extensions, OpenFlow Limitations.

UNIT-III
Alternative Definitions of SDN: Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization and Alternatives Overlap and Ranking.

UNIT-IV
SDN in the Data Center: Data Center Demands, Tunnelling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations

UNIT-V
SDN Applications: Application Types, A Brief History of SDN Controllers, Using Floodlight for Training Purposes, A Simple Reactive Java Application, Controller Considerations, Network Device Considerations,12.9. Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers

Text Books:
1. Paul Goransson and Chuck Black, *Software Defined Networks: A Comprehensive Approach*, Morgan Kaufmann Publications, 2014.

Reference Books:
1. Thomas D. Nadeau and Ken Gray, *SDN – Software Defined Networks*, O'Reilly, 2013.
2. Siamak Azodolmolky, *Software Defined Networking with OpenFlow*, Packt Publishing, 2013.

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(25CS5825) REINFORCEMENT LEARNING
(Program Elective – V)

Course Objectives:
This course is aimed at enabling the students to:
1. *Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.*

Course Outcomes :
After completing the course, the students will be able to:
1. *Understand basics of RL*
2. *Understand RL Framework and Markov Decision Process*
3. *Analyzing ning through the use of Dynamic Programming and Monte Carlo*
4. *Understand TD(0) algorithm, TD(λ) algorithm*
5. *Apply policy gradient and actor-critic methods to solve complex reinforcement learning problems.*
6. *Implement and evaluate reinforcement learning algorithms using suitable frameworks and real-world applications.*

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

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

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

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

Unit V

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

Text Books:
1. Richard S. Sutton and Andrew G. Barto, *Reinforcement Learning: An Introduction*, First Edition, MIT Press, 2020.
2. Masashi Sugiyama, *Statistical Reinforcement Learning: Modern Machine Learning Approaches*, First Edition, CRC Press, 2015.

Reference Books:
1. Tor Lattimore and Csaba Szepesvári, *Bandit Algorithms*, First Edition, Cambridge University Press, 2020.
2. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters, *Reinforcement Learning Algorithms: Analysis and Applications*, First Edition, Springer, 2021.
3. Alexander Zai and Brandon Brown, *Deep Reinforcement Learning in Action*, First Edition, Manning Publications, 2020.

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(25CS5826) DATA SCIENCE
(Program Elective – V)

Course Objectives:
1. *To understand about Data Science .*
2. *To understand big data, to learn the analytics of Big Data how data is stored and processed in Hadoop.*
3. *To learn about Machine Learning Algorithms .*
4. *To learn model evaluation and how data is analyzed using R features .*

Course Outcomes:
1. Understand the fundamentals of data science, including data types, collection, and pre-processing techniques.
2. Apply statistical and probabilistic methods for data analysis and interpretation.
3. Perform exploratory data analysis using visualization and descriptive analytics techniques.
4. Develop predictive models using machine learning algorithms for classification and regression tasks.
5. Evaluate model performance using metrics, cross-validation, and optimization techniques.
6. Implement data science solutions using programming languages and tools (Python, R, SQL) for real-world applications.

UNIT I
Introduction to Data, Data Science, Data Process: Introduction to Data Science and data science process – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields ,data science profile , Types of Digital data: Classification of Digital Data, Introduction to Big Data: What is big data, Evolution of Big Data, Traditional Business Intelligence vs Big Data, Coexistence of Big Data and Data Warehouse.

UNIT II
Data Collection and Data Preprocessing: Processing data with hadoop, interfacing with hadoop ecosystem. Hadoop: Features of Hadoop, Key advantages of hadoop, versions of hadoop, overview of hadoop ecosystem, Hadoop distributions. Why hadoop? RDBMS vs Hadoop, Distribution computing challenges, History of hadoop, Hadoop overview,HDFS NoSQL: Where it is used? What is it? Types of NoSQL Databases, Why NoSQL? Advantages of NoSQL, What we miss with NoSQL? Use of NoSQL in industry,SQL vs NoSQL.

UNIT III

Exploratory Data Analytics: Descriptive Statistics – Mean, Standard Deviation, dispersion, Skewness and Kurtosis , statistical-interference-Correlation Statistics – ANOVA.

UNIT IV

Algorithms/Model Development: Basic machine learning algorithms, Simple and Multiple Regression – naivebayes, k-.means ,KNN ,decision tree, random forest, LDA ,Prediction and Decision Making, Evaluation Metrics – Cross Validation – Overfitting.

UNIT V

Data Visualization: using R, What is R? Why use R for analytics? How to run R? First R example, functions a short programming example, some important R data structures, vectors, matrices, lists, R programming structures, Charts, pie –charst, Barchart, boxplots, scatterplots ,linechart, Histograms, scatterplots ,Box plot.

Text Books:
1. BIG DATA and ANALYTICS, Seema Acharya, Subhashini Chellappan, Wiley Publications. 2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015

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(25CS5827) DISSERTATION PHASE – I

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(AUTONOMOUS)

II M.Tech – III Sem.

L	T	P	C
0	0	0	2

(25CS5828) INDUSTRY INTERNSHIP

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

II M.Tech – III Sem.

L	T	P	C
0	0	0	1

(25CS5829) CO- CURRICULAR ACTIVITIES

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

II M.Tech – IV Sem.

L	T	P	C
0	0	32	16

(25CS5830) DISSERTATION PHASE – II