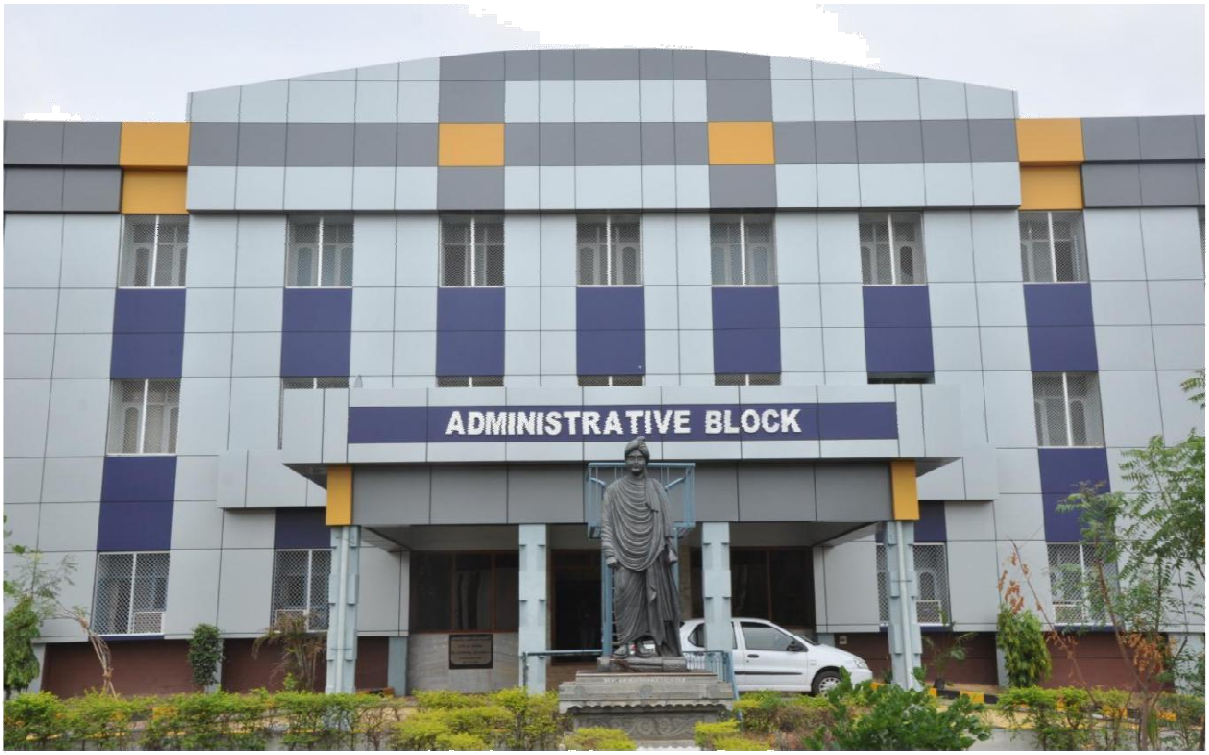

Scheme – 2025

Department of Computer Science & Engineering

G. Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for Two Year M.Tech. Program

in

Computer Science and Engineering(CSE)

(With Effect from the Batch Admitted in 2025-26)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
TWO YEAR M.TECH DEGREE PROGRAM
Scheme of Instruction and Examination
(Effective from 2025-2026)

M.Tech I Semester CSE **(Scheme-2025)**

S.No	Category	Course Title	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
				L	T	P	End Exam Marks	CIA Marks	Total Marks
I	**Theory**								
1.	PC	Advanced Data Structures & Algorithms	3	3	0	0	60	40	100
2.	PC	Distributed Operating Systems	3	3	0	0	60	40	100
3.	PE-1	Professional Elective - I	3	3	0	0	60	40	100
4.	PE-2	Professional Elective - II	3	3	0	0	60	40	100
5.	MC	Research Methodology and IPR	2	2	0	0	0	100	100
6.	AC	Audit Course - I	0	2	0	0	0	0	0
II	**Practical**								
7.	SC	Full Stack Development Using MERN	2	0	1	2	60	40	100
8.	PCL -1	Advanced Data structures & Algorithms Lab	2	0	0	4	60	40	100
9.	PCL -2	Distributed Operating Systems Lab	2	0	0	4	60	40	100
			20	16	1	10	360	380	800

M.Tech II Semester CSE **(Scheme-2025)**

S.No	Category	Course Title	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
				L	T	P	End Exam Marks	CIA Marks	Total Marks
I	**Theory**								
1.	PC	Advances in Software Engineering	3	3	0	0	60	40	100
2.	PC	Advanced Databases	3	3	0	0	60	40	100
3.	PE -III	Professional Elective - III	3	3	0	0	60	40	100
4.	PE-IV	Professional Elective - IV	3	3	0	0	60	40	100
5.	MC	Quantum Technologies And Applications	2	2	0	0	60	40	100
6.	AC	Audit Course - II	0	2	0	0	0	0	0
7.	PC	Comprehensive Viva Voce	2	0	0	0	0	0	100
II	**Practical**								
8.	PCL -3	Advances in Software Engineering Lab	2	0	0	4	60	40	100
9.	PCL -4	Advanced Databases Lab	2	0	0	4	60	40	100
			20	8		8	420	280	700

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

M.Tech III Semester CSE **(Scheme-2025)**

S.No	Category	Course Title	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
				L	T	P	End Exam Marks	CIA Marks	Total Marks
1.	PE-5	Professional Elective - V	3	3	0	0	60	40	100
2.	OE-1	Open Elective-1	3	3	0	0	60	40	100
3.	PR	Dissertation Phase-I	10	0	0	20	0	100	100
4.	CAA	Co-Curricular Activities	1	0	0	0	0	100	100
5.		Industry Internship	2	0	0	0	0	100	100
			19	6	0	20	120	380	500

*Open Elective through MOOCS

M.Tech IV Semester CSE **(Scheme-2022)**

S.No	Category	Course Title	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
				L	T	P	End Exam Marks	CIA Marks	Total Marks
1.	PR	Dissertation Phase - II	8	0	0	16	-	100	100
2.	PR	Project Viva Voce	8	0	0	0	100	--	100

List of Professional Elective Courses

Description	Course Title
PE – I	Advanced Computer Architecture
	Smart Sensor Networks & IOT
	Applied Machine Learning
	Big Data Technologies
PE – II	Natural Language Processing
	Enterprise Cloud Concepts
	Computing for Data Analytics
	Cryptography & Network Security
PE – III	Block Chain Technology
	Advanced Computer Networks
	Deep Learning and Applications
	Object Oriented Analysis and Design
PE – IV	Generative AI
	Digital Forensics
	Robotic Process Automation
	Design Patterns
PE – V	Software Defined Networks
	Reinforcement Learning
	Data Science
	Image and Video Processing

List of Audit Courses

Description	Course Title
AC – I	English for Research Paper Writing
	Disaster Management
	Essence of Indian Traditional Knowledge

ADVANCED DATA STRUCTURES & ALGORITHMS (ADSA)

I Semester: M. Tech | **Scheme:** 2025

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS801	PC	3	-	-	3	40	60	100

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

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

CO1: Understand and implement linear data structures such as linked lists, stacks, and queues.

CO2: Apply various searching, sorting techniques, and tree operations effectively.

CO3: Analyze and implement graph traversal methods and hashing techniques.

CO4: Implement and apply different types of priority queues and heap operations.

CO5: Demonstrate operations on special trees like AVL, Red-Black, Splay, and B-Trees.

Unit-I

Introduction to algorithms: Definition, Characteristics of algorithm, Asymptotic notations. Asymptotic analysis.

Introduction to Data Structures: Linked List - Single linked list and Double linked list and its operations, circular linked list. Stack &Queue-implementation using linked list and its operations. Applications of Stacks: Conversion of infix expression into Postfix expression, Evaluation of Postfix expression.

Unit-II

Searching and Sorting:

Searching: Linear search, Binary search and its complexity

Sorting: Bubble sort, Merge sort, Quick Sort, Shell sort. Radix Sort

Trees: Binary tree, properties, representation, Binary Search Trees, Implementation, Operations-Searching, Insertion, Deletion and tree traversals-Preorder, In order and Post orders.

Unit-III

Graph: Basic Terminology and Concepts, Storage methods and Graph Traversals – BFS and DFS methods.

Hashing: Introduction 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, Basic model, General Priority Queue, Binary Heap Priority Queue - Insertion, Deletion and application (Heap Sort), leftist Heaps, Binomial Queues and its operations.

Unit-V

Special Trees:
AVL Trees and its Operations - Insertion, Deletion and Searching.
Red-Black Trees, Splay Trees, B-Trees and its operations - Insertion, Deletion, Searching.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage.
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press.
3. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson

Reference Books:

1. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage.
2. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B. Venkateswarulu, E.V.Prasad and S Chand & Co.
3. Design and Analysis of Algorithms by E. Horowitz.

Question Paper Pattern:

Sessional Examination:
The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:
The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

DISTRIBUTED OPERATING SYSTEMS (DOS)

I Semester: M. Tech						Scheme: 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS802	PC	3	-	-	3	40	60	100
Sessional Exam Duration: 2Hrs						End Exam Duration: 3 Hrs		

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

CO1: Explain distributed system architectures, communication primitives, and theoretical foundations such as logical clocks, vector clocks, global states, and termination detection.

CO2: Analyze the design, working principles, and performance of various distributed mutual exclusion algorithms to ensure safe and synchronized access to shared resources.

CO3: Evaluate distributed deadlock handling strategies and apply centralized, hierarchical, and fully distributed deadlock detection algorithms.

CO4: Examine multiprocessor system architectures, OS design issues, processor scheduling, and distributed file system mechanisms.

CO5: Apply concepts of distributed scheduling, load distribution, task migration, and distributed shared memory coherence protocols for efficient resource utilization.

UNIT– I

Architectures of Distributed Systems: System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations 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 Heurisric 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. Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", Mukesh Singhal, Niranjan and G.Shivaratri, TMH, 2001
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006.

Reference Books:

1. **Andrew S. Tanenbaum, Maarten Van Steen**, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006.
2. **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.

Question Paper Pattern:

Sessional Examination:
The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:
The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

ADVANCED COMPUTER ARCHITECTURE (ACA)

I Semester: M. Tech | **Scheme:2025**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS803	PE-I	3	0	0	3	40	60	100

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

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

CO1: Understand parallel computer models and analyse conditions for program partitioning and scheduling.

CO2: Apply performance metrics and scalability analysis to assess parallel processing applications using advanced processor and memory technologies..

CO3: Design and differentiate linear, non-linear, instruction, and arithmetic pipelines to enhance execution performance in modern processors.

CO4: Examine multiprocessor and multicomputer architectures, cache coherence protocols, and synchronization mechanisms for scalable system design.

CO5: Evaluate vector and SIMD processing principles through case studies like CM-5 to identify their effectiveness in computationally intensive applications..

Unit-I

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

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 organization, Sequential and weak consistency models, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline de-sign, superscalar pipeline design.

Unit-IV

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

Unit-V

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

Textbooks:
1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers..
Reference Books:
1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G.Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.
Question Paper Pattern:
Sessional Examination: The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks. **End Examination:** The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

SMART SENSOR NETWORKS & IOT (SSNIOT)

I Semester: M. Tech | **Scheme:** 2025

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS804	PE-I	3	-	-	3	40	60	100

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

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

CO1: Understand IoT concepts, architectures, and applications in smart environments such as cities, energy, and healthcare.

CO2: Identify and analyse real-world design constraints in IoT systems including hardware and data visualization.

CO3: Comprehend IoT physical devices, hardware platforms, networking, and communication protocols.

CO4: Apply service-oriented architectures for industrial automation and enterprise integration in IoT.

CO5: Analyse case studies and recent trends in IoT and sensor networks for industrial and commercial automation.

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.

Text Books:

1. Internet of Things: A Hands-On Approach Paperback – 2015, Arsheep Bahga,Vijay Madisetti

2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 , Hanes David, Salgueiro Gonzalo, Grossetete Patrick, Barton Rob.

Reference Books:

1. Mandler.B, Barja.J, Mitre Campista.M., Cagáová.D, Chaouchi.H, Zeadally. S, Badra.M,Giordano.S, Fazio.M, Somov.A,Vieriu.R L, Internet of Things. IoT Infrastructures, Springer International Publication.

Question Paper Pattern:

Sessional Examination:
The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:
The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

APPLIED MACHINE LEARNING (AML)

I Semester: M. Tech | **Scheme:** 2025

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS805	PE-I	3	-	-	3	40	60	100

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

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

CO1: Understand the fundamentals of machine learning, types of learning, and apply regression techniques for prediction.

CO2: Identify various learning tasks, models, and evaluate classification and regression performance.

CO3: Apply decision tree and linear models for solving classification and regression problems.

CO4: Implement distance-based, clustering, and probabilistic models for data analysis and prediction.

CO5: Understand and apply artificial neural networks and reinforcement learning techniques for intelligent decision-making.

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 **(other descriptive models)**

Unit-III

Decision Tree learning:
Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space search in Decision tree learning 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.

Unit-IV

Distance Based Models:
Introduction, Neighbors and exemplars, Nearest Neighbors classification, K-Means algorithms, Clustering around medoids Probabilistic Models: Using Naive Bayes Model for classification, Training a Naive Bayes model, Expectation Maximization.

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. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012 (Covered unit-2, Unit-3 Linear models & Unit-4)
2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education (Unit-3 except linear models and Unit-5)

Reference Books:

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

Question Paper Pattern:

Sessional Examination:
The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:
The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

BIG DATA TECHNOLOGIES (BDT)								
I Semester: M. Tech						**Scheme: 2025**		
Course	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS806	**PE-I**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3			**3**	**40**	**60**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration:3 Hrs**		

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

CO1: Understand the fundamentals of big data, challenges of conventional systems, and analytic processes and tools.

CO2: Analyse data stream models, architectures, and real-time analytics applications using stream mining techniques.

CO3: Apply Hadoop ecosystem components and MapReduce programming for large-scale data processing.

CO4: Utilize Big Data frameworks such as Pig, Hive, HBase, and ZooKeeper for efficient data management and analysis.

CO5: Implement predictive analytics and visualization techniques for data interpretation and decision-making.

Unit-I

Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

Unit-II

Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis-Stock Market Predictions.

Unit-III

Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run-Failures, Job Scheduling-Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features, Hadoop environment.

Unit-IV

Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zookeeper, IBM Infosphere Big Insights and Streams.

Unit-V

Predictive Analytics: Simple linear regression, Multiple linear regression, Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques, interaction techniques, Systems and applications.

Text Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach", VPT, 2016

Question Paper Pattern:

Sessional Examination:
The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:
The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

NATURAL LANGUAGE PROCESSING (NLP)

I Semester: M. Tech | **Scheme: 2025**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS807	PE-II	3	-	-	3	40	60	100

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

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

CO1: Understand the fundamentals of Natural Language Processing and the linguistic structure of English syntax.

CO2: Apply parsing techniques and grammatical frameworks for morphological and syntactic analysis.

CO3: Analyse natural language grammars and implement parsing strategies for sentence understanding.

CO4: Develop and evaluate statistical language models for text processing and prediction.

CO5: Apply multilingual and cross-lingual information retrieval techniques using NLP tools and resources.

Unit-I

Introduction NLP:
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.

Unit-III

Grammars for Natural Language:
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

Language Modeling:
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 Modeling.

Unit-V

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

Text Books:

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

Reference Books:

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

Question Paper Pattern:

Sessional Examination:

The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:

The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

ENTERPRISE CLOUD CONCEPTS (ECC)

I Semester: M. Tech						Scheme: 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS808	PE-II	3	-	-	3	40	60	100
Sessional Exam Duration: 2Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand cloud computing concepts, architectures, and delivery models.

CO2: Analyze cloud-enabling and management technologies.

CO3: Evaluate enterprise transformation strategies in the context of cloud adoption.

CO4: Apply cloud architectural mechanisms to design scalable and resilient systems.

CO5: Integrate cloud-based solutions for business continuity and smart enterprise evolution.

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.
Question Paper Pattern:
Sessional Examination: The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks. **End Examination:** The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

COMPUTING FOR DATA ANALYTICS (CFDA)

I Semester: M. Tech | **Scheme: 2025**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS809	PE-II	3	-	-	3	40	60	100

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

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

CO1: Understand the data analytics lifecycle and the roles of data scientists in delivering actionable insights.

CO2: Apply statistical techniques to summarize, classify, and visualize data effectively.

CO3: Analyse probability distributions and perform hypothesis testing for data-driven decision-making.

CO4: Develop predictive analytics models using regression, correlation, and significance testing.

CO5: Apply time series forecasting and experimental design techniques for data analysis and planning.

UNIT–I

DATA ANALYTICS LIFE CYCLE

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

UNIT–II

STATISTICS

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

UNIT–III

PROBABILITY AND HYPOTHESIS TESTING

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

UNIT–IV

PREDICTIVE ANALYTICS

Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modelling 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).
6. David Hand, HeikkiMannila, Padhraic Smyth, —Principles of Data mining, PHI 2013.

Question Paper Pattern:

Sessional Examination:

The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks.

End Examination:

The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

CRYPTOGRAPHY & NETWORK SECURITY (CNS)

I Semester: M. Tech | **Scheme: 2022**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
CS810	PE-II	3	-	-	3	40	60	100

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

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

CO1: Understand fundamental computer security concepts, OSI security architecture, and number theory for cryptography.

CO2: Apply symmetric encryption techniques, including classical ciphers, block ciphers, and DES for secure communication.

CO3: Implement Advanced Encryption Standard (AES) and understand block cipher operation modes for data confidentiality.

CO4: Analyse asymmetric cryptosystems, including RSA, Diffie-Hellman, and ElGamal for secure key exchange.

CO5: Apply cryptographic hash functions, message authentication codes, and digital signature schemes for data integrity and authentication.

Unit-I

Introduction to Security concepts: Computer Security concepts, OSI Security Architecture, Security attacks, Security services, Security mechanisms, Fundamental security design principles, A model for Network Security.

Number Theory: Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorem, Testing for primality

Unit-II

Symmetric Ciphers: Classical Encryption Techniques: Symmetric Cipher model, Substitution techniques, Transposition techniques, Steganography.

Block Ciphers and DES: Traditional block cipher structure, Data Encryption Standard, DES Example, Strength of DES, Block cipher design principles.

Unit-III

Advanced Encryption Standard: AES Structure, AES transformation functions, AES Key Expansion, AES Example, AES Implementation.

Block Cipher Operation Modes: Multiple Encryption and Triple DES, Electronic codebook, Cipher Block Chaining Mode, Cipher feedback mode, output feedback mode.

Unit-IV

Asymmetric Ciphers and Public key cryptosystems: Public-Key Cryptography and RSA: Principles of Public-key cryptosystems, RSA Algorithm. Daffier Hellman Key Exchange, Elgamal Cryptographic systems.

Unit-V

Cryptographic Hash Functions: Applications of cryptographic hash functions, Hash functions based on cipher block chaining, SHA.

Message Authentication codes: Requirements, Message authentication functions, security of MACs.

Digital Signatures: Digital Signature requirements, Elgamal Digital Signature, Schnorr Digital Signature scheme.
Text Books:
1. William Stallings, [7th Edition], Cryptography and Network Security, Pearson, 2017
2. Behrouz A. Forouzan, D Mukhopadhayay, [2nd Edition], Cryptography and Network Security, MC Graw Hill, 2010
Reference Books:
1. Eric Cole, Dr. Ronald Kurtz and James W. Conley, Network Security Bible, Wiley Publishers, 2009
2. Bruce C. Berndt, Number Theory in the Spirit of Ramanujan, University Press, American Mathematical Society, 2006
3. V.K. Jain, Cryptography and Network Security, Khanna Publishing House, 2017
4. Atul Kahate, Cryptography and Network Security, TMH, 4th Edition, 2019
Question Paper Pattern:
Sessional Examination: The Sessional Examination question paper shall be for 30 marks. The question paper shall consist of Three questions and students must answer all three questions (Without choice). Each question carries 10 Marks. **End Examination:** The End-Examination question paper shall be for 60 marks. Two questions of EITHER/OR Type shall be framed from each Unit. Each question may contain sub-questions. Students shall answer any One question from each Unit, i.e a total of Five questions, with each question carrying 12 Marks.

ADVANCED DATA STRUCTURES & ALGORITHMS LAB(ADSA(P))								
I Semester: M. Tech						**Scheme: 2025**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS811	**PCL**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		-	**-**	**4**	**2**	**40**	**60**	**100**

End Exam Duration: 3 Hrs

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

CO1: Implement and perform operations on linear data structures like single, doubly, and circular linked lists.

CO2: Develop stack and queue applications using linked lists, including expression evaluation and conversion.

CO3: Apply searching and sorting algorithms to organize and retrieve data efficiently.

CO4: Implement binary search trees, AVL trees, and B-trees for hierarchical data storage and manipulation.

CO5: Implement graph traversal algorithms such as BFS and DFS.

List of Experiments

1. Write a program to perform various operations on single linked list.
2. Write a program for the following
   a) Remove duplicates b) Merge two linked lists
3. Write a program to perform various operations on doubly linked list.
4. Write a program to convert a single linked list into circular linked list.
5. Implementation of Operations on Stack using Linked Lists.
6. Write a program for performing various operations on queue using linked list.
7. Write a program for the following using stack
   a) Infix to postfix conversion. b) Expression evaluation.
8. Implementation of Operations on Binary Search Trees.
9. Write a program to implement the following for a graph.
   a) BFS b) DFS
10. Write a program to implement various Sorting Techniques.
11. Write a program to implement various Searching Techniques
12. Write a program to implement various operations on AVL tree.
13. Write a program to implement various operations on B-Tree.

DISTRIBUTED OPERATING SYSTEMS LAB(DOS(P))								
I Semester: M. Tech						**Scheme: 2025**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS812	**PCL**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		-	**-**	**4**	**2**	**40**	**60**	**100**

End Exam Duration: 3 Hrs

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

CO1: Implement and analyze synchronization mechanisms in distributed environments.

CO2: Develop and implement distributed deadlock detection techniques, distributed shared memory models.

CO3: Implement distributed shared memory models and scheduling algorithms.

CO4: Apply security and cryptographic techniques in distributed systems.

CO5: Implement concurrency control algorithms in database operating systems.

List of Experiments

1. Write a program to **simulate** logical clock updates in a distributed system.
2. Implement Ricart-Agarwala and Maekawa's distributed mutual exclusion algorithms.
3. Implement the following distributed deadlock techniques.
   a)centralized b)distributed c)Hierarchical
4. Write a program to implement load balancing algorithms.
5. Write a program to implement and analyze task migration in a distributed system.
6. Simulation of Access Control using an Access Matrix
7. Write a program to encrypt and decrypt message using DES algorithm.
8. Implement process synchronization in multiprocessor system.
9. Write a program to implement Two phase locking protocol.
10. Write a program **to** implement a timestamp-based protocol.

FULL STACK DEVELOPMENT USING MERN(FSDM)								
I Semester: M. TECH						**Scheme: 2025**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CS813	SEC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		0	1	2	2	40	60	100
End Exam Duration: 3 Hrs								
Course Outcomes: At the end of the course the student will be able to								
CO1:	Apply fundamental web technologies (HTML, CSS, JavaScript, ES6) to design responsive web pages.							
CO2:	Develop server-side applications using Node.js and Express.js with REST API integration.							
CO3:	Perform database operations using MySQL and MongoDB and integrate them with backend services.							
CO4:	Design and implement dynamic, component-based user interfaces using ReactJS.							
CO5:	Develop and deploy full-stack applications by combining frontend, backend, and database skills.							
CO6:	Demonstrate problem-solving, debugging, and version control skills in web development projects.							

LIST OF EXPERIMENTS

Module 1: Web Development Fundamentals

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

List of Experiments:

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

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

Styled Components – Design a webpage for a college event with images, tables, and styled navigation menu using CSS.

Module 2: JavaScript and ECMA Script 6

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

List of Experiments:

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, and 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 use State and event handling.

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

Text Books:

1. **Alex Banks, Eve Porcello** – *Learning React: Modern Patterns for Developing React Apps*, O'Reilly.
2. **Stoyan Stefanov** – *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.

Online Learning Resources:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript
6. https://www.geeksforgeeks.org/mern/understand-mern-stack/

RESEARCH METHODOLOGY & IPR (RM & IPR)

<table>
<tr><td colspan="5">M.Tech I Semester: Common for all branches</td><td colspan="3">Scheme:2025</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">MC101</td><td rowspan="2">MC</td><td>L/D</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="3"></td></tr>
<tr><td colspan="8">Course Outcomes:</td></tr>
<tr><td colspan="8">After the completion of the course students will be able to</td></tr>
<tr><td colspan="8">CO1: Understand overview of research process, state the research problem and conduct a literature review of the concepts comprising the research questions</td></tr>
<tr><td colspan="8">CO2: Study the data collection methods and process the data statistically.</td></tr>
<tr><td colspan="8">CO3: Apply multivariate analysis and experimental research methods for reliable data interpretation</td></tr>
<tr><td colspan="8">CO4: Understand the principles , types and global framework of Intellectual property rights</td></tr>
<tr><td colspan="8">CO5: Explain the patent process, filing procedures and legal aspects of intellectual property</td></tr>
<tr><td colspan="8">UNIT – I</td></tr>
<tr><td colspan="8">FUNDAMENTALS OF RESEARCH METHODOLOGY: Overview of research process an design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observatio studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the researc question - Importance of Reasoning in Research and Research ethics - Documentation Style (APA/IEEE etc.) - Plagiarism and its consequences</td></tr>
<tr><td colspan="8">UNIT – II</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td colspan="8">UNIT – III</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td colspan="8">UNIT – IV</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT – V</td></tr>
<tr><td colspan="8">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</td></tr>
</table>

patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Text Books / Reference Books :

1. Stuart Melville and Wayne Goddard, *Research Methodology: An introduction for Science & Engineering students*, Juta and Company Ltd, 2004
2. Catherine J. Holland, *Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets*, Entrepreneur Press, 2007.
3. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
4. Ranjit Kumar , *Research Methodology: A Step-by-Step Guide for Beginners.* . David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007. Deborah E. Bouchoux , *Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition,* Cengage 2024.
5. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, *The Craft of Research*, 5th Edition, University of Chicago Press, 2024
6. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
7. Peter Elbow, *Writing With Power*, Oxford University Press, 1998.

ENGLISH FOR RESEARCH PAPER WRITING(ERPW)

M.Tech I Semester: Common for all branches						Scheme:2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC101	AC-I	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	0	-	-	-

Course Outcomes:

After the completion of the course students will be able to

CO1: Recall the key language aspects and structural elements of academic writing in research papers.

CO2: Explain the importance of clarity, precision, and objectivity in research writing.

CO3: Apply critical reading strategies and advanced grammar skills to analyze and write research papers.

CO4: Analyze research articles and identify the strengths and limitations of different methodologies.

CO5: Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.

CO6: 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
Textbooks:
1.Bailey. S. A*cademic 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.
References:
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

DISASTER MANAGEMENT(DM)

M. Tech I Semester: Common for all branches						Scheme:2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC102	AC-1	L/D	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	0	-	-	-

Course Outcomes:

After the completion of the course students will be able to

CO1: Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.

CO2: Assess the economic, social, and ecological repercussions of major natural and man-made disasters.

CO3: Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.

CO4: Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.

CO5: 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 Manmade 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, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT – III

Disaster Preparedness and Management: Preparedness :Monitoring of Phenomena Triggering a Disaster or 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, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Textbooks:

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

References:

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.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE(EITK)

<table>
<tr><td colspan="5">M. Tech I Semester: Common for all branches</td><td colspan="3">Scheme: 2025</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AC103</td><td rowspan="2">AC-I</td><td>L/D</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="9">Course Outcomes:</td></tr>
<tr><td colspan="9">After the completion of the course students will be able to</td></tr>
<tr><td colspan="9">CO1: Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change</td></tr>
<tr><td colspan="9">CO2:Understand the need for protecting traditional knowledge and its significance in the global economy</td></tr>
<tr><td colspan="9">CO3: Understand the legal framework and policies related to traditional knowledge protection</td></tr>
<tr><td colspan="9">CO4: Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms</td></tr>
<tr><td colspan="9">CO5: Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture and biotechnology</td></tr>
<tr><td colspan="9">UNIT – I</td></tr>
<tr><td colspan="9">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</td></tr>
<tr><td colspan="9">UNIT – II</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td colspan="9">UNIT – III</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td colspan="9">UNIT – IV</td></tr>
<tr><td colspan="9">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</td></tr>
</table>

Traditional Knowledge.

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

Textbooks:

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

References:

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi
2. 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.

E-Resources:

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