JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., ACT No.30 of 2008)

ANANTHAPURAMU – 515 002 (A.P) INDIA

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M. Tech (Regular-Full Time)

(Effective for the students admitted into I year I Sem from the Academic Year **2025-26** onwards)

M.TECH. - COMPUTER SCIENCE & ENGINEERING(COMPUTER SCIENCE)

I SEMESTER COURSE STRUCTURE & SYLLABUS

JNTUACEA M.Tech (CS) R25 Regulation Course Structure

SEMESTER – I

S.No.	Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	25D51101	Advanced Data Structures & Algorithms	PC	3	0	0	3
2.	25D51102	Distributed Operating Systems	PC	3	0	0	3
3.	25D51103A 25D51103B 25D51103C	Program Elective I Advanced Computer Architecture Enterprise Cloud Concepts Applied Machine Learning	PE	3	0	0	3
4.	25D51104A 25D51104B 25D51104C	Program Elective II Natural Language Processing Smart Sensor Networks & IoT Computing for Data Analytics	PE	3	0	0	3
5.	25D5 1105	Advanced Data Structures & Algorithms Lab	PC	0	0	4	2
6.	25D51106	Distributed Operating Systems Lab	PC	0	0	4	2
7.	25D11107	Research Methodology and IPR	MC	1	0	2	2
8.	25D51107	Full Stack Development Using MERN	SE	0	1	2	2
9.	25D59101A 25D59101B 25D59101C	**Audit Course - I** English for Research Paper Writing Disaster Management Essence of Indian Traditional Knowledge	AC	2	0	0	0
Total							20

25D51101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:
By the end of the course, students will be able to:

1. Understand the principles of basic and advanced data structures, their organization, and their applications.
2. Analyze and apply advanced tree and heap structures for efficient problem solving.
3. Develop searching and sorting algorithms suitable for large and complex data sets.
4. Design and implement graph algorithms, network flow, and mesh-based computational models.
5. Explore approximation algorithms and parallel algorithms (PRAM) to solve computationally hard problems efficiently.

Course Outcomes:
After completing this course, students will be able to:
CO1: Implement and evaluate the performance of fundamental data structures (L3,L4)
CO2: Apply advanced trees (AVL, Red-Black, Splay, B+ Trees) and heap structures to solve complex problems. (L3, L4)
CO3: Design and analyze advanced searching and sorting techniques for specialized and large-scale applications. (L4, L5)
CO4: Solve graph and mesh problems using flow algorithms, matching, and packet routing models.(L3,L4,L5)
CO5: Apply approximation algorithms and PRAM-based parallel algorithms for scalability and performance optimization. (l4,L5, L6)

UNIT I:
Overview of Basic Data Structures and Algorithms: Arrays, Singly Linked Lists, Doubly Linked Lists, Circular Lists, Stacks and Queues, Binary Search Trees, AVL Trees, Graphs: Representation, BFS and DFS.

UNIT II:
Advanced Trees and Algorithms: Threaded Binary Trees, Selection Trees, Single and Double ended priority queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Red-Black Trees, Splay Trees, B^+-Trees.

UNIT III:
Advanced Searching and Sorting Techniques: Interpolation Search, Fibonacci Search, Exponential Search, Fractional Cascading, Digital search trees, Binary tries and Patricia, Multiway tries, Suffix Trees, Tries and Internet Packet Forwarding.
Sorting Methods: External, Tim, Introspective, Bitonic, Parallel Quick Sort and Topological Sorting.

UNIT IV:
Graph and Mesh Algorithms: Network Flow and Matching: Ford-Fulkerson, Edmonds-Karp.
Activity Networks- Activity on Vertex (AOV) Networks, Activity on Edge(AOE) Networks.
Mesh Algorithms: Computational Model, Packet Routing- Packet Routing on a Linear Arrray, A Greedy Algorithm for PPP on Mesh, A Randomized Algorithm with Small Queues, Fundamental Algorithms- Broad Casting, Prefix Computation, Data Concentration, Sparse Enumeration Sort.

UNIT V:

Introduction to Approximation Algorithms, Absolute Approximations, ϵ- Approximations, Polynomial Time Approximation Schemes, Fully Polynomial Time Approximation Schemes, Introduction to PRAM Algorithms, Computational Model, Prefix Computation, List Ranking, Maximal Selection With n^2 Processors, Finding the Maximum Using n Processors, Maximal Selection among Integers.

Text Books:
1. Fundamentals of Computer Algorithms Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran 2nd Edition University Press
2. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press

Reference Books:
1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. Introduction to Algorithms, fourth edition by Thomas H. Cormen , Charles E. Leiserson , Ronald L. Rivest , Clifford Stein
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin, PEA
4. Design and Analysis of Algorithms, Pearson Education Parag Himanshu Dave, Himansu Dave, Himansu Balach

25D51102	DISTRIBUTED OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives: This course is aimed at enabling the students to
- Introduce the architectures, principles, and design issues of distributed, database, and multiprocessor operating systems.
- Develop an understanding of communication, synchronization, deadlock handling, and agreement protocols in distributed environments.
- Explain distributed resource management, shared memory, scheduling, and fault tolerance techniques.
- Provide knowledge of security and protection models, and cryptographic methods for secure distributed computing.
- 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
CO1: Understand fundamental concepts and architectures of distributed systems, cloud computing, and edge computing.
CO2: Apply principles of parallel and distributed computing, including synchronization, consistency, and distributed algorithms.
CO3: Design and implement cloud computing solutions encompassing virtualization, resource management, and concurrent programming.
CO4: Analyze real-world applications of cloud, edge, and IoT computing in domains like healthcare, smart cities, and multimedia systems.
CO5: Evaluate security, fault tolerance, and scalability challenges and solutions in modern distributed and cloud-edge environments.

UNIT – I

Introduction: What is a distributed system? Goals of distributed systems, Types of distributed systems, Challenges and issues.
Architectures: Architectural styles (client-server, peer-to-peer, layered)Middleware and services, Cloud as a distributed system, Edge computing overview.
Processes: Threads and processes, Process creation and termination, Multiprocessor and multicore architectures.

UNIT – II

Principles of Parallel and Distributed Computing: Parallel vs distributed computing fundamentals, Performance metrics: speedup, scalability, Concurrency and synchronization, Distributed algorithms basics.
Virtualization: Types of virtualization (hardware, OS-level, application), Hypervisors, containers, and virtual machines, Virtualization management and deployment.

UNIT – III

Cloud Computing Architecture: Cloud architecture principles, Data center architecture and infrastructure, Cloud service models and platforms, Resource management and scheduling.
Concurrent Computing: Thread Programming: Multithreading concepts and synchronization, Thread pools and task scheduling, Concurrent programming patterns in the cloud.

UNIT – IV

Cloud Applications: Case studies of cloud-based applications, Cloud solutions for scientific computing, business, healthcare, SaaS application development.

IoT, Edge and Fog Computing: Internet of Things and cloud integration, Edge and fog computing architectures, Resource management at the edge, Use cases in smart cities, healthcare.

UNIT – V

Distributed Multimedia: Real-time streaming, Multimedia protocols, Quality of Service (QoS).
Distributed Web and Cloud Computing: Web as a distributed system, Cloud service models and infrastructure, Virtualization and containers, Scalability and elasticity in cloud systems.
Case Studies: Distributed systems in Google, Amazon, Microsoft Azure, Blockchain as distributed ledger, IoT and edge computing use cases.
Distributed scheduling

TEXT BOOKS

1. M. van Steen and A.S. Tanenbaum, Distributed Systems, 4th ed., distributed-systems.net, 2023.
2. Mastering Cloud Computing 2nd Edition 2024, by Rajkumar Buyya (Author), Christian Vecciola (Author), Thamarai Selvi (Author), Shivananda Poojara (Author), Satish N. Srirama (Author)

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.

25D51103A	ADVANCED COMPUTER ARCHITECTURE (Program Elective I)	L	T	P	C
		3	0	0	3

Pre-requisites: Computer Organization

Course Objectives:
- To impart the concepts and principles of parallel and advanced computer architectures.
- To develop the design techniques of Scalable and multithreaded Architectures.
- 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
CO1: Analyze various parallel computer models, program partitioning techniques, and system interconnect architectures to evaluate conditions for parallelism.
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 solving computationally intensive applications.

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

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

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

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

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

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

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.

25D51103B	ENTERPRISE CLOUD CONCEPTS (Program Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:
Knowledge on significance of cloud computing and its fundamental concepts and models.

Course Outcomes:
CO1: Understand importance of cloud architecture.
CO2: Illustrating the fundamental concepts of cloud security.
CO3: Analyze various cloud computing mechanisms.
CO4: Understanding the architecture and working of cloud computing.

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

	APPLIED MACHINE LEARNING	L	T	P	C
25D51103C	**(Program Elective I)**	**3**	**0**	**0**	**3**

Course Objectives:
- To know the fundamental concepts of Machine Learning.
- To understand linear, distance based, and decision tree based models
- To explore tools and practices for Machine learning in Real world situation.
- To know the Artificial Neural Network and Reinforcement Learning.

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

CO1: Understand the fundamental concepts of machine learning

CO2: Apply linear, distance based, and decision tree based models

CO3: Analyze probabilistic, neural network models

CO4: Design a suitable machine learning model for a given scenario

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

REFERENCE BOOKS:

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

25D51104A	ADVANCED NATURAL LANGUAGE PROCESSING (Program Elective-II)	L	T	P	C
		3	0	0	3

Course Objectives:

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

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, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, Akshar Bharathi, Vineet chaitanya, 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.

25D51104B	SMART SENSOR NETWORKS & IOT (Program Elective-II)	L	T	P	C
		3	0	0	3

Course Objectives:
1. To provide a comprehensive understanding of IoT fundamentals, sensor technologies, and connectivity protocols used for real-world applications.

2. To enable learners to design, program, and integrate IoT devices using platforms like Arduino and Raspberry Pi for smart environments.

3. To analyze and apply IoT architectures, communication protocols, and emerging technologies such as Smart Grids, Industrial IoT (IIoT), Big Data, and Fog Computing.

Course Outcomes: After completing this course, students will be able to:
CO1: Explain the fundamental concepts, challenges, and interoperability issues of IoT systems and sensor technologies.

CO2: Classify and compare different sensors, transducers, and connectivity technologies (6LoWPAN, RFID, MQTT, CoAP, etc.) used in IoT.

CO3: Develop and demonstrate IoT applications using Arduino and Raspberry Pi for domains such as smart homes, cities, and transportation systems.

CO4: Analyze IoT communication protocols, architectures, and security aspects in Smart Grid and other real-time applications.

CO5: Evaluate the integration of IIoT, Big Data, and Fog Computing to handle data-driven IoT applications in fields such as agriculture, healthcare, and activity monitoring.

UNIT I:Introduction and applications: Current challenges in IOT, Interoperability in IOT, Introduction to Sensors, Types of Sensors, Servo motor, Sensing, Sensors Vs Transducer, Sensor features, Resolution, Sensor classes, Analog Sensors, Digital Sensors,
Connectivity Technologies: 6LOWPAN, RFID.
Basic IOT networks- MQTT, SMQTT, CoAP, XMPP, AMQP.

UNIT II:
Sensor Networks: WSNs, Basic components of Sensor Node, Node behavior in WSNs, Social sensing in WSNs, Applications of WSNs, WSN in agriculture, Wireless Multimedia Sensor networks, Stationary Wireless Sensor networks, Mobile Wireless Sensor networks.
IOT Physical Devices and Endpoints: Electronics, Arduino- Features, Types, IDE, Overview, Libraries, Arduino programming concepts-Content, operator, control statements, loops, arrays, string library, Interrupts, Programs: Blinking LED, Traffic control system.

UNIT III:
Raspberry Pi, Program Blinking LED, Smart Cities, Smart Homes(HAN), Smart Parking, Intelligent Connected Vehicles(ICVs), Connected Vehicles(V2X),VANETS-Features, applications, SDN, Software defined IOT Networks.

UNIT IV: Smart Grid: Benefits of Smart Grid, Properties, architecture, components, Smart home, Plug-In Electric vehicles, Smart grid communication, Smart Grid Security.
Communication Protocols: IEEE 802.15.4, Zigbee, HART, Wireless HART, NFC, Bluetooth ZWave, Zigbee Vs Zwave, ISA 100.11A.

UNIT V:
IIOT: Applications, Examples, Challenges, Data handling.
Big Data: Characteristics, Flow of Data, Hadoop.

Fog Computing- Architecture, Advantages of FOG, Applications of Fog, Challenges.
Case Study: Agriculture, Health Care, Activity Monitoring.

Text Books:
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton & Jerome Henry (Cisco Press, 2017).
2. Introduction to Industrial Internet of Things and Industry 4.0 by Sudip Misra, Chandana Roy & Anandarup Mukherjee (Taylor & Francis/CRC, 2021) Taylor & Francis
3. A 360-Degree View of IoT Technologies by John Soldatos (Artech House, 2020)

25D51104C	**COMPUTING FOR DATA ANALYTICS** **(Program Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

The course aims 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:
CO1: Understand the data analytics lifecycle and identify the roles and responsibilities of data scientists in business analytics projects.
CO2: Apply statistical techniques such as measures of central tendency, variation, skewness, and kurtosis for data summarization and interpretation.
CO3: Analyze probability distributions (binomial, Poisson, normal, exponential, gamma, etc.) and apply them in modeling uncertain events.
CO4: Perform hypothesis testing and predictive analytics using t-tests, chi-square tests, regression, correlation, and multiple correlation methods.
CO5: Design forecasting models (moving average, exponential smoothing, seasonal trends) and conduct design of experiments (ANOVA, Latin square, factorial design) for analytical problem solving.

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

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

UNIT – III PROBABILITY AND HYPOTHESIS TESTING
Random variable, distributions, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang - Normal distribution.

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

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.

25D51105	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	4	2

Course Objectives:
1. To provide students with a strong theoretical and practical foundation in fundamental data structures like Stacks, Linked Lists, and Trees.
2. To enable the design and implementation of advanced balanced search trees (AVL, Red-Black, B+ Trees) and specialized data structures like Tries.
3. Implementation of classical graph algorithms for traversal and network flow problems.
4. To introduce and implement concepts of parallel computing through models like PRAM and specialized routing and sorting algorithms.
5 To familiarize students with the design and analysis of approximation and randomization algorithms for solving NP-hard problems (e.g., Vertex Cover, Knapsack).

Course Outcomes: After completing these experiments, students will be able to:

No.	Course Outcome (CO)	Bloom's Level
CO1	Implement and analyze the time complexity of basic data structures and apply them to solve problems like infix-to-postfix conversion.	Applying (L3)
CO2	Design and execute tree-based data structures, including self-balancing AVL, Red-Black, and B+ Trees, demonstrating proficiency in their rotational and balancing mechanisms.	Creating (L6)
CO3	Apply graph traversal (BFS, DFS) and network flow (Ford-Fulkerson) algorithms to model and solve optimization problems.	Applying (L3)
CO4	Develop programs for parallel algorithms like Parallel Quick Sort and PRAM Prefix Computation and analyze their efficiency in a parallel computing context.	Creating (L6)
CO5	Evaluate the performance of approximation and fully polynomial time approximation schemes (FPTAS) for solving complex optimization problems like Vertex Cover and Knapsack.	Evaluating (L5)

Experiment 1:
Write a program to implement stack using arrays and linked lists; perform infix-to-postfix conversion and evaluation

Experiment 2:
Write a program to implement Binary Search Tree Operations

Experiment 3:
Write a program to implement AVL Tree Operations**.**

Experiment 4:
Write a program to implement Red-Black Tree insertion and balancing

Experiment 5:
Write a program to implement B+ Tree for insertion, searching and Deletion.

Experiment 6:
Write a program to implement Fibonacci Search, Exponential search. Compare their performance with sequential & binary search

Experiment 7:
Write a program for the following using Searching
   a) Suffix Tree / Multiway Trie for pattern matching.
   b) Binary Trie / Patricia Trie for dictionary storage.

Experiment 8:
Write a program for the following using Sorting
a) Parallel Quick Sort.

b) Topological Sorting of a directed acyclic graph.

c) Tim sort

Experiment 9:

Write a program to implement Edmonds-Karp Algorithm for maximum flow

Experiment 10:

Write a program to implement Ford-Fulkerson Algorithm for maximum flow problem.

Experiment 11:

Write a program to implement Greedy Algorithm for PPP (Permutation Packet Problem) on Mesh

Experiment 12:

Write a program to implement Parallel Prefix Computation (PRAM model)

Experiment 13:

Write a program to implement Greedy Approximation Algorithm for Vertex Cover or Set Cover.

Experiment 14:

Write a program to implement Fully Polynomial Time Approximation Scheme (FPTAS) for Knapsack problem

Text Books:

1. Introduction to Algorithms (CLRS) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
2. Data Structures and Algorithm Analysis Mark Allen Weiss.
3. Data Structures and Algorithms Made Easy Narasimha Karumanchi.
4. Algorthm Design Jon Kleinberg and Éva Tardos.
5. Advanced Data Structures Peter Brass or Similar advanced texts.
6. Introduction to Parallel Computing (or similar texts on Parallel Algorithms) Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kum.

		L	T	P	C
25D51106	**DISTRIBUTED OPERATING SYSTEMS LAB**	**0**	**0**	**4**	**2**

Course Objectives

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

Course Outcomes:

After completing this lab, students will be able to:

CO1: Implement and analyze synchronization mechanisms in distributed environments.
CO2: Develop and evaluate distributed deadlock detection techniques.
CO3: Design and implement distributed shared memory models and scheduling algorithms.
CO4: Apply security and cryptographic techniques to distributed systems.
CO5: Implement concurrency control algorithms in database operating systems.
CO6: 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.

Course Code		RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS (w.e.f academic year 2025-26)	L	T	P	C
25D11107			2	0	0	2
Semester	**I**					

Course Objectives:

   1. To understand the research design process and data collection methods.

   2. To develop skills in data analysis and reporting.

   3.To analyze multivariate data, and effectively communicate research findings through scientific writing.

   4. To familiarize students with intellectual property rights (IPR) and patents.

   5. To apply research skills in real-world contexts.

Course Outcomes(CO):

CO1- Recall key concepts and terminology related to research design, data collection, and intellectual property rights.

CO2 - Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.

CO3 - Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.

CO4 - Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods.

CO5- Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.

CO6 - Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property.

*B.T-Blooms Taxonomy

CO	B.T	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L1	3	2	-	-	-	-	-	-	1	-	-	-
CO2	L2	3	3	-	2	2	-	1	-	2	–	-	1
CO3	L3	3	3	1	2	3	2	-	2	3	2	3	2
CO4	L4	2	3	1	2	2	2	-	-	3	2	2	3
CO5	L5	2	3	1	1	3	2	-	3	2	2	2	3
CO6	L6	3	3	2	3	3	3	-	3	3	3	3	3

SYLLABUS

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.

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).

2. RanjitKumar ,*Research Methodology: A Step-by-Step Guide for Beginners. .* David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.

3. Deborah E. Bouchoux ,*Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition,* Cengage 2024.

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

5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

6. 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.

25D51107	**FULL STACK DEVELOPMENT USING MERN** **(Skill Enhancement Course)**	**L**	**T**	**P**	**C**
		0	**1**	**2**	**2**

Course Objectives

The course aims to:

1. Introduce students to full stack web development using modern technologies like React, Node.js, and MongoDB.
2. Develop the ability to design, build, and deploy responsive and data-driven web applications.
3. Equip students with knowledge of integrating AI and ML models into full-stack systems for intelligent automation.
4. Provide hands-on experience in Python-based data analysis, visualization, and AI integration.
5. Enable students to apply algorithmic thinking and AI techniques to solve real-world problems using web platforms.

Course Outcomes (COs): After completing this course, the student will be able to:

CO Code	Course Outcome	Bloom's Level
CO1	Design and develop responsive web interfaces using HTML5, CSS3, JavaScript, and GitHub.	Apply
CO2	Implement server-side logic and RESTful APIs using Node.js, Express.js, and MongoDB.	Apply / Analyze
CO3	Build and deploy full-stack applications integrating React frontend with backend services.	Apply / Create
CO4	Apply AI and ML algorithms to automate and enhance user interactions within full-stack systems.	Analyze / Evaluate
CO5	Perform data analysis, visualization, and dashboard creation using Python libraries integrated with web data.	Evaluate / Create

Module - I – Web Foundations using HTML, CSS, JavaScript & GitHub

Overview of Web Development & Full Stack Architecture,HTML5: Structure, Forms, Tables, Multimedia, Semantic Tags,CSS3: Selectors, Layouts, Flexbox, Grid, Responsive Design, Tailwind CSS, JavaScript: Variables, Functions, Arrays, Events, DOM Manipulation, ES6+ Features, Form Elements & Validation: Input types, form handling, and client-side checks, Debugging: Console tools and browser developer utilities, Version Control: Git essentials, branching, merging, pull requests, Project Hosting: GitHub Pages, repository management.

Lab Exercises / Programs

1. Design a responsive Registration Form using HTML, CSS, and JavaScript.
2. Add client-side form validation (email, password strength, etc.).
3. Build an Interactive Survey Form storing form data locally (JSON).

4. Create and host your webpage on GitHub Pages using Git.

Module - II – Backend Development with Node.js, Express, Angular & MongoDB

Introduction to Server-Side Programming using Node.js,Express.js Framework: Routing, Middleware, Body Parsing, CORS, MongoDB: Database setup, Collections, CRUD Operations with Mongoose, AJAX & JSON: Asynchronous data exchange between client and server,Angular: Components, Forms, Two-Way Data Binding, API Integration, Connecting Frontend → Node.js Server → MongoDB, Authentication (JWT), Error Handling, and Security Best Practices.

Lab Exercises / Programs

Create a Student Registration Form using Angular → POST to Node.js → store in MongoDB.

1. Implement a Contact Form using Express routes and MongoDB backend.
2. Develop a Feedback Management System with input validation and database persistence.
3. Build a CRUD Dashboard (Add, Update, Delete, View) using Angular + Node + MongoDB.

Module - III – React Framework & Full-Stack Integration

React Fundamentals: Components, Props, State, Hooks, Lifecycle, Forms in React: Controlled vs Uncontrolled Components, Form Validation using React Hook Form / Formik, API Communication with Fetch/Axios, Connecting React → Express → MongoDB, Routing with React Router, State Management using Redux/Context API, Error Handling & Form Submission Feedback, Deployment using Netlify / Render.

Lab Exercises / Programs

1. Build a Registration Form in React integrated with Express & Mongo DB.
2. Create a Feedback Form that fetches and displays stored data dynamically.
3. Develop a MERN CRUD Application with add, update, search, and delete functionalities.
4. Implement File Upload (images/documents) to MongoDB Grid FS.
5. Deploy a MERN Form-Based App online.

UNIT IV – Artificial Intelligence & Advanced Algorithms

Fundamentals of AI, ML & Data-Driven Systems, Classical Search Algorithms: BFS, DFS, A*, Hill Climbing, Best-First Search, Constraint Satisfaction Problems: 8-Puzzle, N-Queens, Water Jug, Machine Learning: Data Preprocessing, Linear Regression, K-Means, KNN, AI Libraries: NumPy, Pandas, Scikit-learn. Lang Chain & Open AI API: Prompt Engineering, RAG Pipelines, Integrating AI with Full Stack: Flask/React frontends for AI model interaction.

Lab Exercises / Programs

1. Implement BFS, DFS, and A* algorithms in Python.
2. Develop a Form Analyzer App – take user input → AI model predicts output (e.g., sentiment or rating).
3. Train & test a Linear Regression Model on form-submitted data stored in MongoDB.
4. Build an AI Chatbot to assist or auto-fill form data using OpenAI API / LangChain.

UNIT V – Python Implementation: Graphs, Data Analysis & Visualization

Python Review: OOP, File Handling, and Modules, Graph Algorithms: BFS, DFS, Dijkstra, Kruskal, Prim, Data Extraction: Fetching MongoDB data using PyMongo, Pandas & NumPy: Cleaning, Aggregation, and Statistical Analysis, Matplotlib & Seaborn: Visualization of user-

submitted form data, Streamlit / Flask: Interactive dashboard and analytics applications, Exploratory Data Analysis (EDA) on live datasets.

Lab Exercises / Programs

1. Connect Python to MongoDB and analyze stored form data.
2. Implement Graph Algorithms with visualization of traversal paths.
3. Create a Data Analytics Dashboard using Streamlit or Flask.
4. Final Project – "Form-to-Insight Pipeline":
   User fills form → Data stored in MongoDB → Python AI backend processes → Visualization dashboard.

Reference Books:

1. Full-Stack JavaScript Development by Eric Bush.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, APress, 2019.
3. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill.
4. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.

Course Code	DISASTER MANAGEMENT (w.e.f academic year 2025-26)	L	T	P	C
25D59101A		2	0	0	0
Semester	**I**				

Course Objectives:

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

Course Outcomes

On successful completion, students will be able to:

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

CO2 - Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.

CO3 - Assess the economic, social, and ecological repercussions of major natural and man-made disasters.

CO4 - Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.

CO5 -Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.

CO6: Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

SYLLABUS

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 - GlobalCo-Operation in Risk Assessment and Warning - People's participation inRiskAssessment - StrategiesforSurvival

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

- **National Disaster Management Authority (NDMA), India**: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
- **United Nations Office for Disaster Risk Reduction (UNDRR)**: https://www.undrr.org – Sendai Framework, global risk reduction strategies.
- **Global Disaster Alert and Coordination System (GDACS)**: https://www.gdacs.org – real-time disaster alerts.
- **World Health Organization (WHO)** – https://www.who.int/emergencies – disaster-related health guidelines.

Course Code	25D59101B	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
Semester	I	(w.e.f academic year 2025-26)	2	0	0	0

Course Objectives:

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

Course Outcomes (CO): Student 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.

CO4 – Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.

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.

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
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

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(w.e.f academic year 2025-26)

Course Code	Title of the Subject	L	T	P	C
25D59101C	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

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

SYLLABUS

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 Traditional Knowledge

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.

Prescribed Books:

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

Reference Books

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

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define and explain the concept of traditional knowledge, its nature, characteristics, and scope.
CO2	Understand the need for protecting traditional knowledge and its

	significance in the global economy.
CO3	Explain the legal framework and policies related to traditional knowledge protection.
CO4	Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology.
CO5	Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change.
CO6	Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms.

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