

**Curricula of M. Tech (AI & DS) Programme – 2 Year Program
2025 Onwards Curricula**

FIRST SEMESTER

S. No.	Course		Contact Hours				Credits
	Course Code	Course Title	L	T	P	Total	
1	XXXXXXXX	Fundamental of Artificial Intelligence	3	0	0	3	3
2	XXXXXXXX	Fundamental of Data Science	3	0	0	3	3
3	XXXXXXXX	Elective–I	3	0	0	3	3
4	XXXXXXXX	Elective–II	3	0	0	3	3
5	XXXXXXXX	Research Methodology and Intellectual Property Rights	2	0	0	2	2
6	XXXXXXXX	Artificial Intelligence Lab	0	0	2	2	1
7	XXXXXXXX	Data Science Lab	0	0	2	2	1
8	XXXXXXXX	Advanced Data Structures and Programming Lab	0	0	2	2	1
TOTAL						20	17

SECOND SEMESTER

S. No.	Course		Contact Hours				Credits
	Course Code	Course Title	L	T	P	Total	
1	XXXXXXXX	Soft Computing	3	0	0	3	3
2	XXXXXXXX	Big Data Analytics	3	0	0	3	3
3	XXXXXXXX	Elective–III	3	0	0	3	3
4	XXXXXXXX	Elective–IV	3	0	0	3	3
5	XXXXXXXX	Elective–V	3	0	0	3	3
6	XXXXXXXX	Audit-I (To be offered by HSS Dept)	2	0	0	2	Qualifying
7	XXXXXXXX	Project Based Learning-I	0	0	4	4	2
8	XXXXXXXX	Soft Computing Lab	0	0	2	2	1
9	XXXXXXXX	Performance Engineering Lab	0	0	2	2	1
10	XXXXXXXX	Big Data using Hadoop Lab	0	0	2	2	1
TOTAL						27	20

THIRD SEMESTER

S. No.	Course		Contact Hours				Credits
	Course Code	Course Title	L	T	P	Total	
1	XXXXXXXX	Open Elective	3	0	0	3	3
2	XXXXXXXX	Seminar & Term Paper OR Earn credits by transfer, e.g., MOOCs, Course Work at another Institute, Supervised Study				4	4
3	XXXXXXXX	Project Based Learning-II				8	4
4	XXXXXXXX	Dissertation /Industrial Project/Entrepreneurial Project				8	4
5	XXXXXXXX	Audit-II (To be offered by HSS Dept)	2	0	0	2	Qualifying
TOTAL						25	15

FOURTH SEMESTER

S. No.	Course		Contact Hours				Credits
	Course Code	Course Title	L	T	P	Total	
1	XXXXXXXX	Dissertation / Industrial Project / Entrepreneurial Project				32	16
TOTAL						32	16

Total Credits: 68 (17+20+15+16)

Tentative list of MTech (AI & DS) Electives (To be updated time to time)

Meta Heuristics Modeling

Advanced Programming using R and Python

Introduction to Statistical Learning

Natural Language Processing

Reinforcement Learning

Text Analytics

Essential Statistics for Data Science

Deep Learning

Cognitive Systems

Data Visualization

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Course Outlines (Core Courses)

Core Courses offered by Dept. of CS&E and IT in First Semester of M. Tech. (AI & DS)

1. Fundamental of Artificial Intelligence (3-0-0)

Introduction: Scope; History, Trends and Future Directions [4 Lectures]; Problem Solving by Search: Production Systems and AI; Graph-Search Strategies: Uninformed Search, Heuristic Search Techniques; Constraint Satisfaction Problems; Stochastic Search Methods; Searching Game Trees: Minimax, Alpha-Beta Pruning [8 Lectures]; Knowledge Representation and Reasoning: Predicate Calculus in AI: Syntax and Semantics, Expressivity, Unification, Resolution; Resolution Refutation Systems; Situation Calculus [8 Lectures]; Reasoning under uncertainty: Notion of Uncertainty; Uncertain Knowledge and Reasoning, Probabilities; Bayesian Networks [8 Lectures]; Planning: Planning with State Space Search; Planning Graphs; Partial Order Planning. Decision Making: Sequential Decision Problems, Algorithms for optimal Policies [4 Lectures]. Machine Learning: Learning from Observations: Overview of different forms of Learning, Learning Decision Trees, Computational Learning Theory, Statistical Learning Methods, Neural Networks and Connectionist Learning [8 Lectures];

Total: 42 Lectures

2. Fundamental of Data Science (3-0-0)

Data Science an Introduction: Computer Science, Data Science, and Real Science, What is Data Science? Need for Data Science, Data Science Components, Tools for Data Science, Data Science Lifecycle, Applications of Data Science [2 Lectures]; Python and R Programming for Data Science for Data Science: Introduction to Python Programming (Python Basics, Python Data Structures, Python Programming Fundamentals, Working with Data in Python, Working with NumPy, Pandas, SciPy, and Matplotlib). Introduction to R Programming (R basics, Data structures in R, R Programming fundamentals, Working with Data in R, Stings, and Dates in R, Discover R's packages to do graphics) [6 Lectures]; Data Processing: Data Operations, Data cleansing, Processing CSV Data, Processing JSON Data, Processing XLS Data, Relational databases, NoSQL Databases, Date and Time, Data Wrangling, Data Aggregation, Reading HTML Pages, Processing Unstructured Data, Word tokenization, Stemming and Lemmatization [6 Lectures]; Data Visualization: Chart Properties, Chart Styling, Box Plots, Heat Maps, Scatter Plots, Bubble Charts, 3D Charts, Time Series, Geographical Data, Graph Data [6 Lectures]; Statistical Data Analysis: Measuring Central Tendency, Measuring Variance, Normal Distribution, Binomial Distribution, Poisson Distribution, Bernoulli Distribution, P- Value, Correlation, Chi-square Test, Linear Regression [8 Lectures]; Supervised and Unsupervised Learning: Classification and Regression, Generalization, over fitting and under fitting, Supervised Machine learning algorithms, Types of unsupervised learning, preprocessing and scaling, clustering [8 Lectures]; Working with text data: types of data represented as strings, representing text data as a bag of words, stop words, rescaling, advanced tokenization, stemming and lemmatization [6 Lectures].

Total: 42 Lectures

3. Artificial Intelligence Lab (0-0-1)

Prolog: Introduction to Prolog programming language and its use in AI [1 Lab]; Assignment on Logistic regression [1 Lab]; Assignment on k-means clustering [1 Lab]; Introduction to TensorFlow [1 Lab]; PyTorch [1 Lab]; Keras [1 Lab]; Usage of TensorFlow [1 Lab]; Hands-on labs to implement simple machine learning models (e.g., linear regression, classification) using TensorFlow, PyTorch, or Keras [2 Lab]; Assignments on NNs [1 Lab]; Assignments on CNNs [1 Lab]; Assignments on RNN [1 Lab]; Assignment on LSTM [1 Lab]; GRU [1 Lab].

Total:14 Labs

4. Data Science Lab (0-0-1)

Program on R and Python [2 Labs]; Statistical Data Analysis: Measuring Central Tendency, Variance, Normal Distribution, Binomial Distribution, Poisson Distribution, Bernoulli Distribution, P-Value, Correlation, Chi-square Test, Linear Regression [2 Labs]; Data Visualization Construct a revealing visualization of some aspect of data set, using: A well-designed table. A dot and or line plot. A scatter plot. A heatmap. A bar plot or pie chart. A histogram. A data map [1 Lab]; Data Visualization Create ten different versions of line charts for a particular set of (x, y) points. Which ones are best and which one's worst? Explain why [1 Lab]; Data Visualization Construct scatter plots for sets of 10, 100, 1000, and 10,000 points. Experiment with the point size to find the most revealing value for each data set [1 Lab]; Supervised Learning K-Nearest Neighbor, Linear models, Naïve Bayes classifiers, Decision tree, Neural Network [2 Labs]; Unsupervised Learning Principal component analysis, Non-negative matrix factorization, K-means clustering, Agglomerative clustering, Comparison and evaluating clustering algorithms [1 Lab]; Working with text data Rescaling data with tf-idf, clustering topic modeling and document [2 Labs]; Approaching a machine learning problem, Testing production systems, machine learning frameworks and packages, probabilistic programming, neural networks, scaling to larger datasets [2 Labs].

Total: 14 Labs

5. Advance Data Structures and Programming Lab (0-0-1)

Implement the Dictionary data structures [1 Lab]; Implement the string data structures: Trie, Compact trie, patricia, suffix tree [2 Labs]; Implement Binomial heap [1 Lab]; Implement insertion, deletion and display operations in Binary Search Trees [1 Lab]; Implement insertion, deletion and display operations in Red Black Trees [1 Lab]; Implement insertion, deletion and display operations in B- Trees [1 Lab]; Implement Huffman Coding Algorithm [2 Labs]; Implement Distributed data structures: hash table, trees, stack and lists [2 Labs]; Implement string matching algorithm [1 Lab]; Implement Quad trees [2 Labs].

Total: 14 Labs

Core Courses offered by Dept. of CS&E and IT in Second Semester of M. Tech. (AI & DS)

6. Soft Computing (3-0-0)

Introduction to Soft Computing and Neural Networks: Evolution of Computing, Soft Computing Constituents, Conventional AI to Computational Intelligence, Machine Learning [6 Lectures]; Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making [8 Lectures]; Neural Networks: Machine Learning using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance Architectures, Advances in Neural networks [10 Lectures]; Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition [5 Lectures]; Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic Recent Trends in deep learning, Various Classifiers, Neural Networks and Genetic Algorithm [13 Lectures].

Total: 42 Lectures

7. Big Data Analytics (3-0-0)

Introduction to Big Data: Big data time line. Introduction to statistical modeling and machine learning, Ordinary data processing versus big data processing: Challenges and opportunities [3 Lectures]; Map Reduce and the New Software Stack: Distributed File Systems, Map Reduce, Algorithms Using Map Reduce, Complexity Theory for Map Reduce [3 Lectures]; Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments and Windowing, Decaying Windows [5 Lectures];

Link Analysis: Page Rank and Efficient Computation of Page Rank, Topic-Sensitive Page Rank, Link Spam, Hubs and Authorities **[5 Lectures]**; Frequent Item sets from Big Data: The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream **[7 Lectures]**; Clustering for Big Data: Introduction to Clustering Techniques, Hierarchical Clustering, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism **[8 Lectures]**; Mining Social Network Graphs: Social Networks as Graphs, Clustering of Social Network Graphs, Direct Discovery of Communities, Partitioning of Graphs, Finding Overlapping Communities, Neighborhood Properties of Graphs **[6 Lectures]**; Recommendation Systems: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering and Dimensionality Reduction **[5 Lectures]**.

Total: 42 Lectures

8. Soft Computing Lab (0-0-1)

Understanding Tensor flow **[1 Lab]**; Understanding keras **[1 Lab]**; Implement Union, Intersection, complement and difference operations on Fuzzy sets. 1 Lab] Create Fuzzy relation by Cartesian product of any two Fuzzy sets and perform Max- Min composition of any two Fuzzy re **[1 Lab]**; Build Logistic Regression Classifier using Neural Networks **[1 Lab]** Build Deep neural network for classification **[1 Lab]**; Build neural network for Regression **[1 Lab]**; Build a classification model using different parameter initialization techniques. **[1 Lab]**; Build classification model using Mini Batch gradient and Stochastic Gradient techniques **[3 Labs]**; Implement Genetic algorithm. **[3 Labs]**.

Total: 14 Labs

9. Performance Engineering Lab (0-0-1)

GNU Profiler: Use the Gprof (GNU Profiler) to analyze the performance and statistics of a program **[1 Lab]**; Data Science Tools Data analysis using WEKA tool **[2 Labs]**; Network Simulation: Introduction to Network simulator (NS2) and its various utilities NAM, XGraph etc. Creation of Wired and Wireless Network Scenarios and simulation of various protocols Wired and Wireless Network Performance Analysis using AWK and Python **[3 Labs]**; Queuing Analysis: Simulation of various queues in NS2 and analyzing their performances on various performance metrics such as throughput, average delay and packet loss **[4 Labs]**; Performance Evaluation and Process Algebra: Model computer systems using Markov Chain Theory and Perform Steady State Analysis **[4 Labs]**.

Total: 14 Labs

10. Big Data using Hadoop Lab (0-0-1)

Implement the following data structures in Java: Linked list, stacks, queues, Set and Map **[1 Lab]**; Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed Use web-based tools to monitor your Hadoop setup **[1 Lab]**; Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command-line utilities **[2 Labs]**; Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm **[2 Labs]**; Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce since it is semi-structured and record-oriented **[2 Labs]**; Implement Matrix Multiplication with Hadoop Map Reduce **[2 Labs]**; Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data **[2 Labs]**; Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes **[2 Labs]**.

Total: 14 Labs