| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Applied Statistics and Time Series Forecasting | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Basic understanding of linear algebra, probability, and descriptive statistics. Familiarity with tools for statistical analysis | | | | | | | | |
| **Course Objective**  Students will be able to refresh the statistical knowledge learnt earlier with hands-on practical expertise | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Refresh the mathematics knowledge with respect to algebra, probability, and statistics 2. Refresh the knowledge on continuous random variables, distributions, and hypothesis 3. Perform time series analysis and the various factors to be accounted 4. Apply software tools to perform statistical operations | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Linear Algebra, Probability & Descriptive Statistics**  Systems of linear equations - Solving systems of linear equations - Vectors and linear transformation - Determinants and Eigenvectors - Probability Distribution Function, Probability mass function, Cumulative distribution function - Types of Probability distribution, Central limit theorem and normal distribution - Measure of Central Tendency(Mean, Median and Mode) - Covariance and correlation, Pearson Correlation Coefficient, Spearman Rank Correlation - Measure of dispersion(variance and standard deviation | | | | | | | **09** |
|  | **Continuous Random Variables**  What is Random Variable,Types of Random Variables: Discrete vs. Continuous - Properties and Characteristics of Continuous Random Variables - Common Continous Probability Distributions:Uniform Distribution,Normal Distribution, Exponential Distribution - Probability Density Functions (PDFs): Definition, properties, and examples of PDFs for continuous random variables. - Cumulative Distribution Functions (CDFs): Definition, properties, and examples of CDFs for continuous random variables. - Continuous Uniform Distribution: Properties, probability density function, and applications of the continuous uniform distribution. | | | | | | | **09** |
|  | **Common Continuous Distributions & Hypothesis Testing**  Continuous Uniform Distribution - Normal Distribution - Log-normal Distribution - Student’s T Distribution - Chi-square Distribution - z test, t test - Chi Square test, ANNOVA test - Null vs Alternate Hypothesis - Statistical Significance, P value - Type 1 and Type 2 error - Statistical tests, choosing the right test, assumptions for hypothesis testing | | | | | | | **09** |
|  | **Time Series Analysis**  What is Time Series? Time Series vs Non-Time Series, Interpolation vs Extrapolation, Examples of time series - Components of Time Series: Trend, Season, Cycle, Noise - Moving Average, Types of Moving Average (SMA, CMA and EMA) - Stationary and Non-Stationary Time Series, how to convert non-stationary to stationary test - Auto Correlation Function, Partial Correlation Function, Auto Regression - ARIMA, SARIMA, SARIMAX; | | | | | | | **09** |
|  | **Statistics Using software tools**  Descriptive Statistics: Calculating mean, median, mode, and standard deviation using Excel formulas - Inferential Statistics: Hypothesis testing using Excel's T.TEST and F.TEST functions - Time Series Analysis: Calculating moving averages and exponential smoothing using Excel formulas - Creating time series plots and forecasting using Excel's TREND and FORECAST functions - Inferential Statistics: Hypothesis testing using MATLAB's ttest and ftest functions - Data Visualization: Creating histograms, box plots, and scatter plots using MATLAB's plotting tools (e.g., hist, boxplot, scatter | | | | | | | **09** |
| **Total** | | | | | | | | **45** |
| **Text & Reference Books** James D. Miller, *Statistics for Data Science*, Packt Publishing, 2017.James D. Hamilton, *Time Series Analysi*s, Levant Books, 2012. | | | | | | | | |
| **E-resources**   1. [**https://www.coursera.org/learn/machine-learning-linear-algebra?specialization=mathematics-for-machine-learning-and-data-science#modules**](https://www.coursera.org/learn/machine-learning-linear-algebra?specialization=mathematics-for-machine-learning-and-data-science#modules) 2. [**https://www.coursera.org/learn/machine-learning-probability-and-statistics?specialization=mathematics-for-machine-learning-and-data-science**](https://www.coursera.org/learn/machine-learning-probability-and-statistics?specialization=mathematics-for-machine-learning-and-data-science) 3. [**https://www.coursera.org/learn/statistics-fundamentals-using-excel**](https://www.coursera.org/learn/statistics-fundamentals-using-excel) | | | | | | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Advanced Data Analysis and Programming | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Basic understanding of programming concepts and syntax. Fundamentals of data structures & OOPS concept | | | | | | | | |
| **Course Objective**  Students will be able to learn about two widely used programming languages in the field of data science and how to go about choosing any language | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Understand the basics of python and standard modules used for data science with hands-on 2. Understand the basics of Scala and standard modules used for data science with hands-on 3. Understand how to choose a programming language which is applicable for any given use case with various parameters | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Python - Data Structures, OOPS & Modules**  Introduction for Python - Python Installation using Windows/Linux/Anaconda Navigator - Python Fundamentals - Hello World Program - Condition and branching statements - Iterative Statements - Types of Data structure in Python - Built in data structures - List, Tuple, Dictionary, Set - User defined data structures - Stack , Queue , Priority Queue - Python Strings and its method - Functions - Built-in and Custom Functions - Exception Handling - Print Exception in Python - Introduction to Object Oriented Concepts and Design - Define OO core concept and its Methodology - Objects and classes - Polymorphism in OOPs programming - APIs and Data Collection - Simple API – REST APIs & HTTP Requests - HTML for Web Scraping - Web Scraping - Working with different file formats - Django - Hash Tables; Array Data Structures – Records – Structs - Data Transfer Objects - Python Libraries; Top 10 Python Libraries - Install NumPy in Python - Python Pandas - Python Matplotlib - Python Seaborn - Python SciPy - Chatbot in Python - Machine Learning using Python - Exploratory Data Analysis in Python - Open CV Python - Tkinter – Pythons Turtle Module - Python Programs; | | | | | | | **09** |
|  | **Python - Pandas & DS Libraries** Introduction to Pandas - Pandas Series - Python Built-In Functions – sort\_values() – sort\_index() - get() - copy() - apply() - map() - Pandas Math Functions - Pandas Dataframe - Methods and Attributes between Series and DataFrames - Pandas Missing VAlue- fillna Method - The astype Method - Rank Series Values with the rank Method - Filtering data and methods in Dataframe - Data Extraction in dataframes - Working with Text Data - Common string methods - The split method - Multi Index Module - Transpose method - Stack method - Unstack method - The melt method - Group by module - Merging Dataframes - Data Mining(Scrapy – Beautiful Soup) - Data Processing and Modelling(Numpy – Scipy – Pandas – Keras – Scikit learn – PyTorch – TensorFlow – XGBoost) - Data Visualization(Matplotlib – Seaborn – Bokeh – Plotly – Folium) | | | | | | | **09** |
|  | **Scala - Data Structures, OOPS & Modules**  Basic data structures - Arrays - Lists, Sets, Tuples, Maps - Option - Functional Combinators - Map - forEach - filter - zip - partition - find - drop and dropWhile - foldRight and foldLeft - flatten - flatMap - Generalized functional combinators - Map - Scala Object and Class - Scala Anonymous object - Singleton and Companion Object - Case Classes & Objects - Scala Constructors - Scala Method Overloading - Scala This Keyword - Scala Inheritance - Scala Field Overriding - Scala Final Scala Abstract Class - Scala Trait and Scala Trait Mixins - Scala Access Modifiers - Scala Array - REPL - Expanded function format - Variables and Strings - Getting user input - Numbers and Variable types - Operators and Booleans - Exception handling - Collections - Lists and Arrays - Set and HashSet | | | | | | | **09** |
|  | **Scala - DS Libraries & Spark**  Top 15 Scala Libraries - Apache Spark Architecture - Spark Big Data - Apache Spark Components - Apache Spark RDD - Apache Spark Installation - Spark Java - Spark SQL - Apache Spark first function - Apache Spark map function - Apache Spark Distinct function - Apache Spark RDD shared variables - Apache Spark take() - Apache Spark filter() - Apache Spark union() - Apache Spark cogroup() - Difference between MapReduce and Apache Spark - Apache Spark RDD Persistence | | | | | | | **09** |
|  | **Factors to be considered for choosing language**  Size of the Deployment: Data, Resource and Load - Security - Skill Set - The targeted platform - The elasticity of a language - The time to production - The performance - The support and community – Purpose - Programmer experience - Ease of Development and Maintenance - Efficiency - Availability of an IDE - Error Checking and Diagnosis - The Takeaway | | | | | | | **09** |
| **Total** | | | | | | | | **45** |
| **Text & Reference Books** [Alvaro Fuentes](https://www.amazon.in/Alvaro-Fuentes/e/B07K1JMFJ1/ref=dp_byline_cont_ebooks_1), *Become a Python Data Analyst*, Packt Publishing, 2018.[Bharti Motwani](https://www.amazon.in/s/ref=dp_byline_sr_ebooks_1?ie=UTF8&field-author=Bharti+Motwani&text=Bharti+Motwani&sort=relevancerank&search-alias=digital-text), *Data Analytics using Python,* Wiley, 2020.Jules S. Damji, *Learning Spark: Lightning-Fast Data Analytics,* 2nd Edition,Shroff/O'Reilly, 2020. | | | | | | | | |
| **E-resources**   | 1. [*https://realpython.com/python-data-structures/*](https://realpython.com/python-data-structures/) | | --- | | 1. [*https://www.edureka.co/blog/data-structures-in-python/*](https://www.edureka.co/blog/data-structures-in-python/) | | 1. [*https://www.youtube.com/playlist?list=PLzgPDYo\_3xukPJdH6hVQ6Iic7KiJuoA-l*](https://www.youtube.com/playlist?list=PLzgPDYo_3xukPJdH6hVQ6Iic7KiJuoA-l) | | 1. [*https://www.coursera.org/learn/concepts-of-object-oriented-programming#modules*](https://www.coursera.org/learn/concepts-of-object-oriented-programming#modules) | | 1. [*https://www.youtube.com/watch?v=Mf2RdpEiXjU*](https://www.youtube.com/watch?v=Mf2RdpEiXjU) | | 1. [*https://www.coursera.org/learn/python-for-applied-data-science-ai*](https://www.coursera.org/learn/python-for-applied-data-science-ai) | | 1. [*https://www.udemy.com/course/data-analysis-with-pandas/?couponCode=24T4FS22124*](https://www.udemy.com/course/data-analysis-with-pandas/?couponCode=24T4FS22124) | | 1. [*https://www.datacamp.com/courses/data-manipulation-with-pandas*](https://www.datacamp.com/courses/data-manipulation-with-pandas) | | 1. [*https://www.dataquest.io/blog/15-python-libraries-for-data-science/*](https://www.dataquest.io/blog/15-python-libraries-for-data-science/) | | 1. [*https://www.datacamp.com/blog/top-python-libraries-for-data-science*](https://www.datacamp.com/blog/top-python-libraries-for-data-science) | | 1. [*https://twitter.github.io/scala\_school/collections.html*](https://twitter.github.io/scala_school/collections.html) | | 1. [*https://www.scaler.com/topics/scala/scala-oops/*](https://www.scaler.com/topics/scala/scala-oops/) | | 1. [*https://www.javatpoint.com/scala-object-and-class*](https://www.javatpoint.com/scala-object-and-class) | | 1. [*https://www.udemy.com/course/completescala3/?couponCode=IND21PM*](https://www.udemy.com/course/completescala3/?couponCode=IND21PM) | | 1. [*https://scalac.io/blog/top-15-scala-libraries-for-data-science-in-2021/*](https://scalac.io/blog/top-15-scala-libraries-for-data-science-in-2021/) | | 1. [*https://activewizards.com/blog/top-15-scala-libraries-for-data-science/*](https://activewizards.com/blog/top-15-scala-libraries-for-data-science/) | | 1. [*https://www.javatpoint.com/apache-spark-tutorial*](https://www.javatpoint.com/apache-spark-tutorial) | | 1. [*https://www.youtube.com/watch?v=S2MUhGA3lEw*](https://www.youtube.com/watch?v=S2MUhGA3lEw) | | 1. [*https://www.aalpha.net/blog/factors-to-consider-when-choosing-a-programming-language/*](https://www.aalpha.net/blog/factors-to-consider-when-choosing-a-programming-language/) | | | | | | | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Data Engineering | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Basic understanding of data handling and storage concepts. Familiarity with ETL (Extract, Transform, Load) processes | | | | | | | | |
| **Course Objective**  Students to understand the fundamentals of data engineering and its importance in modern data-driven applications | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Identify and explain different data formats and their use cases, including structured, semi-structured, and unstructured data 2. Describe various data ingestion techniques, such as ETL, and stream processing, and their advantages and limitations 3. Perform data profiling and analyse data quality metrics to ensure data accuracy, completeness, and consistency 4. Design and implement effective storage and retrieval methods for large-scale data sets, including relational databases, NoSQL databases, and distributed file systems 5. Apply data engineering principles to real-world scenarios, such as data warehousing, big data analytics, and machine learning | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Data Types & Formats**  Introduction to Data Types and Formats - Types of Data - Structured vs. Unstructured Data - Formats of Data - Semi-Structured Data - Data Type Conversion and Transformation - Data Serialization - Choosing the Right Data Type and Format - Tools and Technologies for Data Types and Formats. | | | | | | | **09** |
|  | **Data Ingestion Techniques**  Introduction to Data Ingestion - Streaming Data Ingestion - Batch Data Ingestion - Hybrid Data Ingestion - Data Ingestion vs. Data Integration - Data Ingestion Challenges - Tools and Solutions for Data Ingestion - StreamSets DataOps Platform - Benefits of Data Ingestion - Data Ingestion Framework. | | | | | | | **09** |
|  | **Data Profiling & Visual Representation via various tools (Pandas)**  Introduction to Data Profiling and Visualization - Exploratory Data Analysis (EDA) with Pandas - Steps Involved in Exploratory Data Analysis (EDA) Data Analysis (EDA) with Pandas - Market Analysis with Exploratory Data Analysis (EDA) - Data Analytics and Its Future Scope - Data Analytics with Python - Top Business Intelligence Tools - Application of Data Analytics - Retrieving and Cleaning Data - Exploratory Data Analysis and Feature Engineering - Inferential Statistics and Hypothesis Testing - Descriptive Statistics - Types of Descriptive Statistics - Concepts of Populations, Samples, and Variables - Statistical Methods for Describing Data Characteristics - Real-World Applications of Descriptive Statistics using Excel - Types of Missing Data and Handling Techniques | | | | | | | **09** |
|  | **Storage and Retrieval Methods**  Introduction to Storage and Retrieval - Types of Data and Storage Methods - Local vs. Distributed Storage & Retrieval - Hardware Aspects of Storage & Retrieval - Choosing Storage Methods - Data Partitioning and Sharding - Data Replication and Redundancy - Data Compression and Encoding - Data Archiving and Retrieval - Backup and Disaster Recovery - Data Lifecycle Management. | | | | | | | **09** |
|  | **Data Lineage Analysis**  Introduction to Data Lineage Analysis - Building a Data Flow - ETL (Extract, Transform, Load) Process - Usage of Data Warehouse - Edge Intelligence in Data Flow - Understanding Data Lineage - How Data Lineage Works - Benefits of Data Lineage - Data Lineage Tool Features. | | | | | | | **09** |
| **Total** | | | | | | | | **45** |
| **Text & Reference Books** Charles M.Judd, *Data Analysis: A Model Comparison Approach To Regression, ANOVA, and Beyond*, 3rd Edition, Routledge, 2017.Pierre-Yves Bonnefoy, Emeric Chaize, Raphaël Mansuy & Mehdi TAZI, The *Definitive Guide to Data Integration*, 1st Edition, Packt Publishing, 2024. | | | | | | | | |
| **E-resources**   1. [*Structured vs. Unstructured Data: Differences, Uses, and More (trustradius.com)*](https://solutions.trustradius.com/buyer-blog/structured-vs-unstructured-data) 2. [**https://intellipaat.com/blog/tutorial/hadoop-tutorial/big-data-overview/#no2**](https://intellipaat.com/blog/tutorial/hadoop-tutorial/big-data-overview/#no2) 3. [**https://www.synlabs.io/post/7-unique-use-cases-of-audio-video-data-mining**](https://www.synlabs.io/post/7-unique-use-cases-of-audio-video-data-mining) 4. [**https://www.geeksforgeeks.org/understand-audio-data/**](https://www.geeksforgeeks.org/understand-audio-data/) 5. [**https://streamsets.com/learn/data-ingestion/**](https://streamsets.com/learn/data-ingestion/) 6. [**https://www.simplilearn.com/data-ingestion-article**](https://www.simplilearn.com/data-ingestion-article) 7. [**https://www.simplilearn.com/tutorials/data-analytics-tutorial/exploratory-data-analysis**](https://www.simplilearn.com/tutorials/data-analytics-tutorial/exploratory-data-analysis) 8. [**https://www.coursera.org/learn/ibm-exploratory-data-analysis-for-machine-learning**](https://www.coursera.org/learn/ibm-exploratory-data-analysis-for-machine-learning) 9. [**https://www.cuemath.com/data/descriptive-statistics/**](https://www.cuemath.com/data/descriptive-statistics/) 10. [**https://www.udemy.com/course/introductory-statistics-part1-descriptive-statistics/?couponCode=24T4FS22124**](https://www.udemy.com/course/introductory-statistics-part1-descriptive-statistics/?couponCode=24T4FS22124) 11. [**https://www.scribbr.com/statistics/missing-data/**](https://www.scribbr.com/statistics/missing-data/) 12. [**https://towardsdatascience.com/why-you-should-handle-missing-data-and-heres-how-to-do-it-270c321a4d6f**](https://towardsdatascience.com/why-you-should-handle-missing-data-and-heres-how-to-do-it-270c321a4d6f) | | | | | | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Artificial Intelligence with ML | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Basic understanding of machine learning & neural network concepts. Familiarity with python programming and algorithms | | | | | | | | |
| **Course Objective**  Students to get a comprehensive understanding of machine learning algorithms, techniques, and applications | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Understand the fundamental concepts of machine learning, including supervised and unsupervised learning, and their applications in various domains 2. Implement and apply various machine learning algorithms and techniques 3. Evaluate and compare the performance of machine learning models with various metrics and techniques 4. Understand the importance of need of dimensionality reduction techniques in ML | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Machine Learning: Supervised**  Definition and purpose of supervised learning - Different types of supervised learning algorithms - Distinction between classification and regression - Definition and Importance of Classification - Applications of classification in machine learning - Challenges and limitations of classification in machine learning - Logistic Regression - Basics, Advantages & Limitations - K-Nearest Neighbors (KNN) - Introduction, Advantages & Limitations - SVM - Introduction, Advantages & Limitations - Decision Tree Classification - Introduction, Advantages & Limitations - Random Forest Classification - Introduction, Advantages & Limitations - Comparing algorithms: Decision Tree vs Random Forest Classifier, KNN vs SVM. - Definition and Importance of regression - Applications of regression in machine learning - Challenges and limitations of regression in machine learning - Linear Regression - Introduction, Advantages & Limitations - Polynomial Regression - Linear Regression - Introduction, Advantages & Limitations - Multiple Linear Regression - Linear Regression - Introduction, Advantages & Limitations - Comparison of Linear and Polynomial Regression. | | | | | | | **09** |
|  | **Machine Learning: Un-Supervised & Semi-Supervised**  Definition and purpose of Unsupervised Learning - Different types of Unsupervised Learning algorithms - Applications of Unsupervised Learning - Definition and Importance of Clustering Algorithms - Applications of Clustering Algorithms in machine learning - Challenges and limitations of Clustering Algorithms in machine learning - K-Means Clustering - Introduction, Advantages & Limitations - Hierarchical Clustering - Introduction, Advantages & Limitations - Definition and their significance - Applications of association rules - Introduction to Apriori Algorithm - Advantages and limitations of the algorithm - Introduction to FP-Growth Algorithm - Advantages and limitations of the algorithm - Overview of evaluation metrics - Importance of evaluation metrics - Real-world examples - Definition and purpose of Semi-Supervised Learning - Advantages of Semi-Supervised Learning - Disadvantages of Semi-Supervised Learning - Comparison with Supervised Learning - Comparison with Unsupervised Learning - Applications of Semi-Supervised Learning - Self-Training Algorithm - Self-Training with Confidence Threshold - Label Spreading Algorithm - Label Propagation Algorithm - Co-Training with Naive Bayes - Co-Training with Support Vector Machines (SVM) - Multi-view Co-Training - Introduction to Graph-Based Semi-Supervised Learning - Label Propagation on Graphs - Application and challenges | | | | | | | **09** |
|  | **Machine Learning: Reinforcement Learning**  Definition, Importance & Applications of Reinforcement Learning & Its Types Overview - Introduction to Policy-Based RL - Applications of Policy-Based RL - Policy Gradient Methods - Policy Optimization Methods - Introduction to Value-Based RL - Value Functions - Q-Learning - Introduction to Model-Based RL - Model-based RL with model-free RL - Model-based RL with planning - Compare the performance of different RL algorithms. | | | | | | | **09** |
|  | **Machine Learning: Dimensionality Reduction**  Definition of Dimensionality Reduction - Motivation of Dimensionality Reduction - Importance and applications of Dimensionality Reduction - Introduction to Principal Component Analysis (PCA) - Applications of PCA - Variants of PCA - LLE Algorithm - Advantages and Limitations of LLE - Applications of LLE - Introduction to t-SNE - Underlying Principles - Comparison with PCA and LLE - Performance Metrics. | | | | | | | **09** |
|  | **Model Evaluation and Hyperparameter Tuning**  Regression Metrics - Interpreting Regression Metrics - Interpreting Classification Metrics - Importance of Cross Validation - Types of Cross Validation - Model Evaluation: Evaluation of regression models – Evaluation of binary classification models – Evaluation of multi-class classification models; Performance Metrics: Classification Metrics - Regression Metrics - Creating your own metrics - Using Scikit-learn metrics; Cross Validation: Cross-Validation schemes - Estimating the model generalization error with CV - Cross-Validation for Hyperparameter Tuning - Special Cross-Validation schemes - Group Cross-Validation | | | | | | | **09** |
| **Total** | | | | | | | | **45** |
| **Text & Reference Books** [Lavika Goel](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Lavika+Goel&search-alias=stripbooks), *Artificial Intelligence: Concepts and Applications,* Wiley, 2021.[Andreas Muller](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Andreas+Muller&search-alias=stripbooks), *Introduction to Machine Learning with Python: A Guide for Data Scientists*, 1st Edition, Shroff/O'Reilly, 2016. | | | | | | | | |
| **E-resources**   1. [**https://app.pluralsight.com/library/courses/building-classification-models-scikit-learn/table-of-contents**](https://app.pluralsight.com/library/courses/building-classification-models-scikit-learn/table-of-contents) 2. [**https://www.udemy.com/course/data-science-in-python-regression/?couponCode=24T4FS22124**](https://www.udemy.com/course/data-science-in-python-regression/?couponCode=24T4FS22124) 3. [**https://www.udemy.com/course/association-rule-mining-basic-theory-practice/?couponCode=LETSLEARNNOWPP**](https://www.udemy.com/course/association-rule-mining-basic-theory-practice/?couponCode=LETSLEARNNOWPP) 4. [**https://www.udemy.com/course/cluster-analysis-unsupervised-machine-learning-python/**](https://www.udemy.com/course/cluster-analysis-unsupervised-machine-learning-python/) 5. [**https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/**](https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/) 6. [**https://www.udemy.com/course/dimensionality-reduction-machine-learning-with-python/?couponCode=IND21PM**](https://www.udemy.com/course/dimensionality-reduction-machine-learning-with-python/?couponCode=IND21PM) 7. [**https://www.udemy.com/course/machine-learning-model-evaluation-in-python/?couponCode=IND21PM**](https://www.udemy.com/course/machine-learning-model-evaluation-in-python/?couponCode=IND21PM) 8. [**https://www.udemy.com/course/hyperparameter-optimization-for-machine-learning/?couponCode=IND21PM**](https://www.udemy.com/course/hyperparameter-optimization-for-machine-learning/?couponCode=IND21PM) | | | | | | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Natural Language Processing | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 2 | | 0 | 0 | 2 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Fundamental knowledge on AI ML concepts | | | | | | | | |
| **Course Objective**  Students to understand natural language processing in depth with various factors involved in it | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Understand the purpose of NLP and how to use it in real world applications with example 2. Understand how to solve a classification problem 3. Understand how deep learning is applied for NLP 4. Understand the transfer learning concepts for reusability of knowledge 5. Understand the applications of voice recognition system | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Introduction to NLP**  What is NLP and its components? - Phases of NLP - Challenges of natural language - Applications of NLP - Industries using NLP - NLP programming languages - NLP libraries and Development environments - Use of AI in NLP - Basic Text Processing and Linguistic Concepts: Tokenization - Stemming - Lemmatization - Part-of-Speech Tagging | | | | | | | **06** |
|  | **Text Classification**  Benefits of Text Classification - Types of Text classification - Challenges in text classification - Applications of text classification | | | | | | | **06** |
|  | **Deep Learning for NLP**  Convolutional Neural Networks (CNNs) for NLP - Recurrent Neural Networks (RNNs) for NLP - Recursive Neural Networks - Hybrid Models for NLP | | | | | | | **06** |
|  | **Transfer Learning for NLP**  Benefits of Transfer Learning for NLP - Fine Tuning techniques -    Fine-Tune BERT for Spam Classification | | | | | | | **06** |
|  | **Voice Recognition**  Basics of Voice Recognition: Difference between speech and voice recognition - Use of NLP in voice recognition and transformation: Speech recognition using NLP models (HMM, DTW) - Acoustic modelling - Error correction in voice recognition | | | | | | | **06** |
| **Total** | | | | | | | | **30** |
| **Text & Reference Books** [Sowmya Vajjala](https://www.amazon.in/Sowmya-Vajjala/e/B08B88819X/ref=dp_byline_cont_book_1), [Bodhisattwa Majumder](https://www.amazon.in/Bodhisattwa-Majumder/e/B08B7WZNYT/ref=dp_byline_cont_book_2), [Anuj Gupta](https://www.amazon.in/Anuj-Gupta/e/B08B7VLNFS/ref=dp_byline_cont_book_3) & [Harshit Surana](https://www.amazon.in/Harshit-Surana/e/B08BFNJ9VM/ref=dp_byline_cont_book_4), *Practical Natural Language Processing*, Shroff/O'Reilly, 2020.[Uday Kamath](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Uday+Kamath&search-alias=stripbooks), [John Liu](https://www.amazon.in/John-Liu/e/B07SZ9TKZV/ref=dp_byline_cont_book_2) & [James Whitaker](https://www.amazon.in/James-Whitaker/e/B07XXCX2J7/ref=dp_byline_cont_book_3), [*Deep Learning for NLP and Speech Recognition*](https://www.amazon.in/Deep-Learning-NLP-Speech-Recognition/dp/3030145956/ref=sr_1_2?crid=SI05ADZ822YR&dib=eyJ2IjoiMSJ9.3Aavk_d0ZaMbBgPn15FAfhfZAjy7t9QwxDuCeQGNutNoFgdorum8A9pLdYoJg__axqBSL-_wnK6EJl0uvK3-aZdz50Bo07qMaq02_okcaTfBN0BR4qfRssMDvSlf_gUVPqoqdF4gAoEXakBjnEPCiXsDvmPm0IdlmJhxUAqdTmPP1c5E13MLzPY64EWr9f6rsG4ODAtbVMIi3cbRU7i0RBcMJ_JL8_IwiMcZKSuCMi8.D35GLZT_SdSipJrhSDMenhb6utY6fb_R3nrFm_ACn9U&dib_tag=se&keywords=NLP+voice+recognition+books&qid=1712587037&s=books&sprefix=nlpvoice+recognition+books%2Cstripbooks%2C288&sr=1-2)*,* Springer 1st Edition, 2019. | | | | | | | | |
| **E-resources**   1. <https://sunscrapers.com/blog/deep-learning-for-nlp-an-overview/#recurrent-neural-networks-rnns-for-nlp> 2. <https://www.analyticsvidhya.com/blog/2020/07/transfer-learning-for-nlp-fine-tuning-bert-for-text-classification/> | | | | | | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester:** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Professional Elective - I **(**Application Architecture & Deployment) | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Knowledge on various types of software and web application architecture | | | | | | | | |
| **Course Objective**  Students to understand how architect and AI Application deployment with important aspects to be taken care of. | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Understand the differences between monolithic and microservices architecture and their respective advantages and disadvantages in AI applications 2. Understand the basics of Kubernetes and how it can be used to manage and deploy AI models in a production environment 3. Understand application programming interfaces (APIs) and their role in integrating AI models into larger systems 4. Understand MLOps and how it can be used to streamline the machine learning lifecycle, from data preparation to model deployment and monitoring | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Monolithic vs Microservices**  Introduction to Software Architecture and its types - What is Monolithic Architecture and its Importance - Characteristics of Monotithic Architecture - Limitations of Monolithic Architecture - What are Microservices - Working of Microservices - Main Components of Microservices Architecture - Advantages of Microservices - Monolithic vs Microservices - Real World Example of Microservices - Challenges in Microservices. | | | | | | | **09** |
|  | **Application Programming Interface**  What is an API - How do an API Work - WEB APIs - LOCAL APIs - PROGRAM APIs - SOAP, REST API - What are REST APIs - HTTP methods (GET, POST, PUT, DELETE) - Status Codes and URI structure - SOAP vs REST - What is API testing - Types of Testing - Tools for API Testing - Authentication Mechanisms - Authorization Mechanisms - Role Based Access Control (RBAC) | | | | | | | **09** |
|  | **Containers - An Introduction**  What is Virtualization - Virtualization in Cloud Computing - Introduction to containerization - Container Lifecycle - Virtualization vs Containerization - Container Security - Serverless Containers - Introduction to Docker - Docker Architecture - Components of Docker - Concept of Docker Images - Docker Commands - Advantages of Docker - Introduction to Orchestration tools | | | | | | | **09** |

|  | **Kubernetes - An Introduction**  What is Kubernetes (K8s) - Why Kubernetes and not only docker - Kubernetes Components - Node - Control Plane - Networking in Kubernetes - Kubernetes Resources - Pod, Deployment, Service, Volume, Namespace, node, cluster - Storage - Security - Monitoring, Logging, Scaling - Writing YAML files. | **09** |
| --- | --- | --- |
|  | **ML Operations**  Introduction to ML Operations - What is SDLC - Stages of SDLC - Waterfall Model - Agile Model - Iterative Model - Importance of Each Models - Model Training - Model Deployment. | **09** |
| **Total** | | **45** |
| **Text & Reference Books** [Scott Surovich](https://www.amazon.in/Scott-Surovich/e/B09N5DHCQ6/ref=dp_byline_cont_book_1) & [Marc Boorshtein](https://www.amazon.in/Marc-Boorshtein/e/B09G3KYZGW/ref=dp_byline_cont_book_2), *Kubernetes and Docker*, Packt Publishing, 2021.[Mark Treveil](https://www.amazon.in/Mark-Treveil/e/B09CF3TDC1/ref=dp_byline_cont_book_1), [Nicolas Omont](https://www.amazon.in/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=Nicolas+Omont&search-alias=stripbooks) & [Clément Stenac](https://www.amazon.in/s/ref=dp_byline_sr_book_3?ie=UTF8&field-author=Cl%C3%A9ment+Stenac&search-alias=stripbooks), Intro*ducing MLOps: How to Scale Machine Learning in the Enterprise* (Grayscale Indian Edition), Shroff/O'Reilly, 2020. | | |
| **E-resources**   | 1. [*https://www.atlassian.com/microservices/microservices-architecture/microservices-vs-monolith*](https://www.atlassian.com/microservices/microservices-architecture/microservices-vs-monolith) | | --- | | 1. *https://www.tutorialspoint.com/docker/index.htm* | | 1. [*https://blog.postman.com/intro-to-apis-history-of-apis/*](https://blog.postman.com/intro-to-apis-history-of-apis/) | | 1. *https://swagger.io/specification/* | | 1. *https://flask.palletsprojects.com/en/3.0.x/api/* | | 1. *https://www.geeksforgeeks.org/difference-between-authentication-and-authorization/* | | 1. *https://www.tutorialspoint.com/kubernetes/index.htm* | | 1. *https://kubernetes.io/docs/home/* | | 1. *https://www.techtarget.com/searchitoperations/definition/service-mesh#:~:text=A%20service%20mesh%20architecture%20uses,sidecar%20attaches%20to%20each%20service.* | | 1. [*https://www.udemy.com/course/grafana-and-prometheus/?couponCode=24T4FS22124*](https://www.udemy.com/course/grafana-and-prometheus/?couponCode=24T4FS22124) | | | |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester :** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Professional Elective - I **(**Financial Analytics using time series and LSTM) | | | | | | **Code :** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture**  **(Hours per week)** | | **Practical**  **(Hours per week)** | **Tutorial**  **(Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks -50)** | | **Term End Examinations (TEE)**  **(Marks - 100)** | |
| 3 | | 0 | 0 | 3 | Marks Scaled to 50 | | Marks Scaled to 50 | |
| **Pre-requisite:** Basics Statistics | | | | | | | | |
| **Course Objective**  To provide students with a comprehensive understanding of neural networks and various time series models specifically applied in financial data analysis | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. Analyse time series data using neural networks and traditional models such as ARIMA and ARMA 2. Develop predictive models using LSTM 3. Apply model validation techniques to ensure the accuracy and reliability of financial predictions | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | Understanding Neural network | | | | | | | **02** |
|  | Understanding Time Series | | | | | | | **10** |
|  | Different models in time series (ARIMA, ARMA etc.) | | | | | | | **02** |
|  | AI Neural Network in financial Data | | | | | | | **02** |
|  | Recurrence Neural Network and its advantage and disadvantage | | | | | | | **02** |
|  | Long Short-term Memory Model | | | | | | | **05** |
|  | Model Building | | | | | | | **03** |
|  | Model Validation | | | | | | | **03** |
|  | Working with Time series data (Sensex) | | | | | | | **03** |
|  | Model Validation | | | | | | | **03** |
|  | Model Deployment | | | | | | | **05** |
|  | Conclusion with a project | | | | | | | **05** |
| **Total** | | | | | | | | **45** |

| **Text & Reference Books**   1. L. R. Medsker, L.C. Jain, RECURRENT NEURAL NETWORKS, Design and Applications, 2016. 2. Zhenjun Li, Yinping Liao, Bo Hu, Liangyu Ni, Yunting Lu, *A Financial Deep Learning Framework: Predicting the Values of Financial Time Series With ARIMA and LSTM*, International Journal of Web Services Research (IJWSR) 19(1), 2022. 3. Joseph Babcock, Raghav Bali, *Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models*, Packt Publishing, 2021. |
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| **Program:** M Tech Artificial Intelligence | | | | | | **Semester :** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Professional Skills | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | | **Practical (Hours per week)** | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 100)** | | **Term End Examinations (TEE)**  **(Marks- ---)** | |
| 0 | | 2 | 0 | 1 | Marks Scaled to 100 | | --- | |
| **Pre-requisite:** NIL | | | | | | | | |
| **Course Objective**  The aim of the course is to make the students understand professional, behavioral and presentation skills while working with team and practically experience important aspects of it | | | | | | | | |
| **Course Outcomes**  After completion of the course, students will be able to –   1. To help the students understand and implement positive outlook, interpret the body language of team members and stakeholders, better interpersonal relationships. Develop into self-motivated professionals with confidence. Practice Responding instead of Reacting 2. Create good Presentation and Present with confidence. Also, recognize and manage Stress, Prioritize and Plan 3. To listen to understand. To be able to ask good questions 4. To understand to be a good Team player, Team Dynamics and to understand the Business Ethics 5. To be able to write and speak correctly, forming grammatically correct sentences | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Unit** | **Description** | | | | | | | **Duration** |
|  | **Positive Attitude**  Attitude- Campus to Corporate attitude change, Recognizing Negative Attitude, Campus to Corporate attitude change; Attitude at work- Impact of Negative Attitude in the Workplace, Overcoming Negative Attitude, positive attitude, thought process, Building self-confidence and Assertiveness; Toxic positivity; 3Es, Motivation-Intrinsic and Extrinsic Motivation, Inspiration vs motivation; Emotional Intelligence-Intro to EI, Four clusters. Transactional Analysis (TA), SWOT analysis - Professional analysis | | | | | | | **06** |
|  | **Body Language**  Importance of Body Language, Five Cs of Body Language, Body language in different cultures, Positive Body Language; Voice Control- Pace. Pause and Pitch; Culture-Inclusivity and Proxemics across Global Cultures, Understanding POSH; Stress Management-What is Stress, Eustress, Reasons of stress (work/ personal); Stress Management Techniques | | | | | | | **06** |
|  | **Presentation Skills**  Self-introduction – Exercises, Why Give Presentations; Craft your message-Plan the visuals, Manage the Response; How to create an effective presentation - Virtual & Physical, Do’s & Don'ts of Presentation Skills, Objection handling, Stage Fear – Causes and Cure, Practice the Delivery; Time Management-Common Time & Energy Wasters, Planning & Prioritizing Time Matrix & Analysis | | | | | | | **06** |
|  | **Listening & Questioning skills**  Barriers to effective listening - how to overcome them; Exercises - Customer Call Flow – Role-play, Cust calls amongst the team; How to frame Questions, Different kinds of questions, asking appropriate questions; Spoken English-Introduction to Parts of Speech and its usage; Subject - Verb Agreement; Basic conversation skills-sentence construction -SVO | | | | | | | **06** |
|  | **Teamwork**  Teamwork and Ethics - Definition of TEAM - Team vs Groups. Difference b/w Healthy competition and cut throat competition, Importance of working in teams, Evolution of a TEAM, Benefits of team work; Virtual teams- Challenges and ways to overcome it, Diversity and Inclusion in a team; Development of Teams Stages of team development; Team dynamics-its importance & Interpersonal Skills Development Ethics- to enable students to identify and deal with ethical problems, develop their moral intuitions, which are implicit in everyday choices and actions; Conflict Management: Team building Activities- Predetermined/ Predesigned Indoor/ Outdoor activities to build a team, enhance language and inter personal skills | | | | | | | **06** |
| **Total** | | | | | | | | **30** |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester :** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Lab – 1: Visual Analytics Lab | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | **Practical (Hours per week)** | | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- ---)** | |
| 0 | 4 | | 0 | 2 | Marks Scaled to 50 | | --- | |
| **Pre-requisite:** NIL | | | | | | | | |
| **Course Objective**  The primary goal of this lab is to equip students with the skills and knowledge necessary to comprehend and dissect individual data points effectively. By doing so, students will be able to uncover and interpret the inherent patterns, trends, and relationships concealed within complex datasets | | | | | | | | |
| **Course Outcomes**  After completion of the lab, students will be able to –   1. Develop a comprehensive understanding of the fundamental principles, theories, and methodologies underpinning visual analytics 2. Apply various techniques and tools essential for data visualization, statistical analysis, and interactive exploration 3. Demonstrate proficiency in applying visual analytics techniques to real-world datasets, enabling them to derive actionable insights and make informed decisions | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Experiment No.** | | **Description** | | | | | | **Duration** |
| Experiment 1 | | Setting up environment and connecting to data source. Objective: Install PowerBI Desktop- SQL Server - Loading and previewing data | | | | | | **02** |
| Experiment 2 | | Data cleansing and transformation in Power BI Objective: Apply transformations to data- load queries to data model with sales data set | | | | | | **02** |
| Experiment 3 | | Designing a data model in PowerBI Objective: Creating model relationships- configuring table and column properties and creating hierarchies using sales data set | | | | | | **04** |
| Experiment 4 | | Calculated tables using Data analysis expressions. Objective: Creating calculated tables- calculated columns and measures (To answer questions like top sold product- average sales of product category- etc.) | | | | | | **04** |
| Experiment 5 | | Advanced DAX Calculations in Power BI Objective: Use the CALCULATE () function to manipulate filter context- Use Time Intelligence functions for sales data (Ex: calculate the total sales revenue for each product category- calculate YoY growth trend of a product category) | | | | | | **04** |
| Experiment 6 | | Design a report in power BI Objective: Create and publish a report with sales data and publish the report with basic visualizations | | | | | | **04** |
| Experiment 7 | | Design a report in Power BI - part 2  Objective: Enhancing the report with advanced visualizations and features interactive elements to the dashboard- such as filters- slicers- and drill-down capabilities- to allow users to explore the data in more detail | | | | | | **04** |
| Experiment 8 | | Create a dashboard in Power BI Objective: Create a dashboard and share the dashboard through colExperimentoration features in Power BI- colExperimentorate with others on the dashboard- including adding comments and feedback- to improve its content and usability | | | | | | **04** |
| Experiment 9 | | Visual analytics using HTML- CSS Objective: Create a basic structure for our dashboard- including a header- navigation- and a main content area. Use CSS to style the frontend- including colours- fonts- and layout. | | | | | | **04** |
| Experiment 10 | | Create Charts and graphs. Objective: Use a charting library eCharts to create interactive charts and graphs that display sales data. Include a variety of chart types- such as line charts- bar charts- and pie charts- to provide different perspectives on the data. | | | | | | **04** |
| Experiment 11 | | Flask backend Objective: Use Flask to create a backend API that connects to a data source Excel file and SQL database containing sales data. Create endpoints to expose data required for charts using pandas and dataframes. | | | | | | **04** |
| Experiment 12 | | Dashboard integration Objective: Integrate the front end and backend to get data from backend. Add interactive elements to the dashboard- such as filters- slicers- and drill-down capabilities- to allow users to explore the data in more detail. Customize the dashboard's appearance- including colors- fonts- and layout- to make it visually appealing and easy to read. | | | | | | **04** |
| Experiment 13 | | Streamlit - creating an application. Objective: Create a basic application in stream lit | | | | | | **04** |
| Experiment 14 | | Streamlit - Creating multipage app for sales dashboard using streamlit. Objective: Build dashboard app using streamlit | | | | | | **04** |
| Experiment 15 | | Containerize Workload - Docker Objective: Containerize the frontend and backend application using docker. Push the containerized images to a container registry. | | | | | | **04** |
| Experiment 16 | | Kubernetes deployment Objective: Deploying the containers to Kubernetes cluster as a deployment. Using services to connect backend deployment to data source (SQL) | | | | | | **04** |
| **Total** | | | | | | | | **60** |

| **Program:** M Tech Artificial Intelligence | | | | | | **Semester :** I | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course:** Lab – 2: AI ML Lab | | | | | | **Code:** | | |
| **Teaching Scheme** | | | | | **Evaluation Scheme** | | | |
| **Lecture (Hours per week)** | **Practical (Hours per week)** | | **Tutorial (Hours per week)** | **Credit** | **Internal Continuous Assessment (ICA)**  **(Marks - 50)** | | **Term End Examinations (TEE)**  **(Marks- ---)** | |
| 0 | 4 | | 0 | 2 | Marks Scaled to 50 | | --- | |
| **Pre-requisite:** NIL | | | | | | | | |
| **Course Objective**  Equip students with a deep understanding of machine learning concepts and practical skills to solve real-world problems effectively | | | | | | | | |
| **Course Outcomes**  After completion of the lab, students will be able to –   1. Describe foundational concepts in AI and ML, including supervised, unsupervised, reinforcement, and deep learning 2. Apply techniques for data preprocessing, including cleaning, feature selection, normalization, and handling missing values 3. Apply machine learning techniques to diverse datasets and real-world scenarios to derive insights and solutions | | | | | | | | |
| **Detailed Syllabus** | | | | | | | | |
| **Experiment No.** | | **Description** | | | | | | **Duration** |
| Experiment 1 | | Write a Python program that takes a list of integers as input and returns a list with all duplicate elements removed. Also, write a Python function to calculate the factorial of a given number using recursion. | | | | | | **04** |
| Experiment 2 | | Create a Python module named math\_utils.py with functions to calculate the area of a circle, rectangle, and triangle. Then, write a script to import these functions and use them. | | | | | | **04** |
| Experiment 3 | | Implement a dynamic array class in Python (similar to Python's list). Include methods for appending, inserting, and deleting elements. | | | | | | **02** |
| Experiment 4 | | Implement binary search algorithm and use it to search for an element in a sorted list. | | | | | | **02** |
| Experiment 5 | | Create a NumPy array of shape (3, 3) with random values. Write functions to compute the mean, median, and standard deviation of the array. | | | | | | **02** |
| Experiment 6 | | Load a CSV file into a Pandas DataFrame (e.g., ABC dataset). Perform basic data exploration: display the first few rows, summary statistics, and check for missing values. | | | | | | **02** |
| Experiment 7 | | Create a scatter plot showing the relationship between passengers' age and fare. Use different colors for different passenger classes. | | | | | | **02** |
| Experiment 8 | | Implement linear regression using gradient descent from scratch without using any libraries. Use a dataset (e.g., XYZ Dataset) to train your model and evaluate its performance. Plot the cost function versus the number of iterations. | | | | | | **02** |
| Experiment 9 | | Implement logistic regression from scratch and train it on the XYZ dataset to predict survival. Report accuracy, precision, and recall. | | | | | | **02** |
| Experiment 10 | | Implement a decision tree classifier from scratch and use it to classify the Iris dataset. Visualize the decision tree and discuss the feature importance. | | | | | | **02** |
| Experiment 11 | | Implement the K-Means algorithm from scratch. Apply it to a dataset (e.g., Iris dataset) and visualize the clusters. | | | | | | **02** |
| Experiment 12 | | Perform PCA on the same dataset and visualize the first two principal components. Compare the clustering results from K-Means with the PCA visualization. | | | | | | **02** |
| Experiment 13 | | Use Pandas to clean a messy dataset (e.g., ABC Data). Handle missing values, normalize numerical features, and encode categorical features. | | | | | | **02** |
| Experiment 14 | | Create various plots (e.g., histograms, scatter plots, box plots) using Matplotlib to visualize the cleaned dataset and uncover insights. | | | | | | **02** |
| Experiment 15 | | Implement the Q-learning algorithm to solve the XYZ environment in ABC Gym. Train your agent and plot the learning curve. Discuss how different parameters (learning rate, discount factor) affect the performance. | | | | | | **04** |
| Experiment 16 | | Data Type Detective Objective: To identify and classify different data types and formats. | | | | | | **02** |
| Experiment 17 | | Data Ingestion Challenge Objective: To design and implement a data ingestion solution for a given scenario. | | | | | | **02** |
| Experiment 18 | | Data Detective Objective: To apply exploratory data analysis (EDA) and descriptive statistics to understand and visualize a given dataset. | | | | | | **02** |
| Experiment 19 | | Data Storage Challenge Objective: To design and implement a data storage and retrieval solution for a given scenario. | | | | | | **02** |
| Experiment 20 | | Data Lineage Detective Objective: To analyze and visualize the data lineage of a given dataset. | | | | | | **02** |
| Experiment 21 | | Build a custom image for flask and publish it on a Container repository. | | | | | | **02** |
| Experiment 22 | | Build and Deploy a Simple Flask Application with Docker | | | | | | **02** |
| Experiment 23 | | Deploy a Simple Nginx Web Server | | | | | | **02** |
| Experiment 24 | | Deploying a Flask application with Statefulset, PVs and Ingress | | | | | | **02** |
| Experiment 25 | | Deploying one webserver as frontend and 2 flask aplication as microservice. where 2 flask application will communicate with each other using Kubernetes services. | | | | | | **02** |
| Experiment 26 | | Write any ML model and deploying it using docker and Kubernetes. | | | | | | **02** |
| Experiment 27 | | Using Lab 4 set Up and deploying ML models as 3rd flask application | | | | | | **02** |
| **Total** | | | | | | | | **60** |