**Module 1**

1.1 Introduction to AI

1.2 Basic Python programming

1.3 SQL Fundamentals

1.4 Java Fundamentals

1.5 Introduction to cloud and AWS Basics

**Total Hours: 67**

**Module Outcomes**

* 1. **Introduction to AI**
* Understand what AI is
* Explain how AI at the core works
* Classify the types of AI Applications
* Understand the Social impact of AI and the Ethics to be followed
* Gain knowledge on the future of AI, career opportunities in AI

**1.2 Python Programming**

* Develop and Execute Simple Python Programs
* Ability to use different control structures for solving problems
* Apply modular programming
* Apply concepts of classes and Objects
  1. **SQL Fundamentals**
* Understand the various Data Models
* Perform CRUD operations
* Use various queries pertaining to filtering, sorting, and aggregation
* Understand primary and foreign Keys

**1.4 Java Fundamentals**

* Apply the Concepts of Class and objects to solve Simple problems
* Develop programs using object oriented concepts
* Make use of Exception Handling
  1. **Introduction to cloud and AWS Basics**
* Understand what a cloud environment is
* Ability to setup a free tier account in AWS and explore it
* Understand the various AWS services
* Explore Google Cloud Platform

**Contents**

* 1. **Introduction to AI**

Hours 2: Defining AI, History of AI

Hours 1: Understanding Intelligent Agents

Hours 2: Types of AI: Narrow AI vs. General AI vs. Super AI. Explore current AI applications.

Hours 2: Ethical considerations and societal impact. Discuss AI bias and fairness.

Hours 2: Future of AI: trends, predictions, and the road ahead. Career prospects in AI.

Hours 2: Recap and assessment: quiz or short assignment to consolidate learning.

* 1. **Basic Python Programming**

Hours 1: Installing Python and setting up the development environment. Writing your first Python script.

Hours 1: Python syntax , variables., data types and operators.

Hours 1: Control structures: if statements

Hours 1: For Loops

Hours 1: While Loop

Hours 1: Functions

Hours 1: Passing parameters to Functions

Hours 1: Returning Values from the Functions

Hours 1: understanding Modules.

Hours 1: Classes and objects in python

Hours 1: Understanding Inheritance in Python

Hours 1: Mini-Project: Building a Simple Calculator. Apply the basics learned to create a functioning calculator.

* 1. **SQL Fundamentals**

Hours 2: Introduction to SQL, Data Models – Evolution and Types

Hours 2: Data Types and Tables. CREATE, DROP, and data insertion with INSERT INTO.

Hours 2: Selecting and retrieving Data

Hours 2: Filtering and Sorting

Hours 2: Aggregate Functions

Hours 2: understanding Primary Keys and Foreign Keys

Hours 2: Sub Queries and join Operations

Hours 1: Mini-Project: Constructing and Querying a Simple Database. Hands-on application of SQL skills.

* 1. **Java Fundamentals**

Hours 1: Programming Paradigms , Functional Programming Vs object oriented Programming

Introduction to Java, Flavors of java, How Java Works

Hours 1: Introduction to Classes and Objects

Hours 1: Variables ,Data Types, Operators

Hours 1: Control Structures

Hours 1: Arrays and Strings

Hours 1: Multidimensional Arrays

Hours 1:Methods

Hours 1: Introducing Object Oriented Concepts, Encapsulation

Hours 1: Inheritance

Hours 1: Understanding Super and This

Hours 1: Polymorphism –Compile Time, Run Time

Hours 1: Interfaces

Hours 1: Abstract Classes

Hours 1: Inner Class, Nested Class

Hours 1: Static, Final

Hours 1: Packages

Hours 1:Exception Handling

Hours 1:Project

Hours 1: Project

* 1. Introduction to cloud and AWS Basics

Hours 2: Overview of cloud computing, service models (IaaS, PaaS, SaaS).

Teaching Material: Infographics on cloud service models, comparative analysis.

Hours 2: Introduction to AWS, setting up a free tier account, and navigating the console.

Teaching Material: AWS guidebook, tutorial videos.

Hours 2: Basic services in AWS: EC2, S3. Launching and managing an EC2 instance.

Teaching Material: Hands-on lab exercises, AWS documentation.

Hours 2: Exploring Google Cloud and Azure: setting up, comparing features with AWS.

Teaching Material: Account setup guides, feature comparison sheets.

Hours 2: Recap and assessment: multiple-choice test on cloud fundamentals.

• Teaching Material: Online test platform, discussion session to clarify doubts.

**Module 2**

**2.1 Data Privacy in AI**

**2.2 Python Data Structures**

**2.3 Intermediate Java**

**2.4 Advanced SQL, NoSQL Databases & Big Data**

**2.5 Tableau Basics**

**Total Hours :92**

**Learning Outcomes**

**2.1 Data Privacy in AI**

* Understand the privacy concerns in using the Data
* Understand and follow the ethics in collection and usage of Data
* Gain knowledge on Tools and techniques pertaining to Privacy and ethics in AI

**2.2 Python data structures**

* Ability to use the different data structures in python effectively
* Ability to solve search and Sorting Problems
* Perform algorithm analysis

**2.3 Intermediate Java**

* Work with collection classes in java
* Understand the memory management with garbage collections
* Ability to implement multi-thread programs

**2.4 NoSQL Databases and BigData**

* Understand the Concept of NoSQL
* Perform CRUD operations in MongoDB
* Explore the Hadoop Environment

**Content**

**2.1 Data Privacy in AI 12 Hours**

Hours 2 : Understanding data privacy, GDPR, and CCPA guidelines. The importance of data anonymization.

Teaching Material: Summaries of privacy laws, real-world case studies.

Hours 2: Techniques for data anonymization and privacy-preserving AI.

Teaching Material: Technical papers, software tools for anonymization.

Hours 2: Building ethical AI: considerations for data collection and usage.

Teaching Material: Ethical AI frameworks, industry best practices.

Hours 2: Tools and technologies for ensuring data privacy in AI applications.

Teaching Material: Demos of privacy tools, expert talks on data privacy.

Hours 2: Group discussion and presentation on data privacy challenges in AI.

Teaching Material: Research topics, presentation templates.

Hours 2 : Quiz

**2.2 Python Data Structures 26 Hours**

Introduction to Python data structures: Lists, Tuples, dictionaries, and sets.

Hours 1: Working with Lists and Tuples

Hours 1: Working with Dictionaries and Sets

Hours 1: List and Tuple Functions

Hours 1: Searching and Sorting Introduction

Hours 1: Linear Search, Sentinel Linear Search

Hours 1:Binary Search

Hours 1: Ternary Search

Hours 1 Jump search

Hours 1: Interpolation Search

Hours 1: Exponential Search

Hours 1: Fibonacci Search

Hours 1: Selection Sort

Hours 1: Bubble sort

Hours 1: Insertion sort

Hours 1: Merge Sort

Hours 1: Quick sort

Hours 1: Understanding Trees

Hours 1: Traversing through the Trees

Hours 1: Understanding Graphs

Hours 1: Traversing through Graphs

Hours 1: Depth first and breadth first

Hours 1: Algorithm Analysis –Introduction

Hours 1: Understanding Asymptotic Notation

Hours 1: Time Complexity

Hours 1: Space Complexity

Hours 1: Mini-Project: Algorithm Complexity Analysis. Implement and analyze the efficiency of various algorithms.

**2.3 Intermediate Java 24 Hours**

Hours 1: Understanding java I/O Streams, Reading and writing files from Java

Understanding collections

Hours 1: List, Array List

Hours 1: Linked List

Hours 1: Vector

Hours 1: Stack

Hours 1: Queue

Hours 1: Priority Queue

Hours 1: Deque

Hours 1: Arraydeque

Hours 1: Set

Hours 1: Hashset

Hours 1: LinkedHashset

Hours 1: SortedSet

Hours 1: TreeSet

Hours 1: Map, Hashmap

Hours 1: Treemap

Hours 1: Linked Hashmap

Hours 1: Java Streams: leveraging streams for data processing Operations on Streams

Hours 1: Threads in Java

Hours 2: Multithreading in Java: concurrency models, thread management.

Hours 1: Garbage collection in Java: understanding memory management.

Hours 2: Mini-Project: Multithreaded Sorting Algorithm. Implement sorting using threads to improve performance.

**2.4 Advanced SQL, NoSQL Databases 20 Hours**

Hours 2: Indexing for performance: creating, using, and managing indexes.

• Teaching Material: Case studies on database performance, indexing exercises.

Hours 2: Stored procedures and triggers: definition, creation, and use cases.

• Teaching Material: SQL scripts for stored procedures, interactive database environment for practice.

Hours 2: Mini-Project: Database Optimization. Analyze a given database and implement performance improvements.

• Teaching Material: Project guidelines, a poorly optimized database for practice.

Hours 2: Introduction to NoSQL databases: key-value, document, column, graph.

Teaching Material: Comparison of NoSQL databases, use case discussions.

Hours 2: Working with MongoDB: database creation, CRUD operations.

Teaching Material: MongoDB tutorials, sample projects for practice.

Hours 2: Introduction to Big Data technologies: understanding Hadoop ecosystem.

Teaching Material: Hadoop overview, hands-on exercises with Hadoop components.

Hours 2: Data modeling for NoSQL: best practices, schema design.

Teaching Material: NoSQL design guidelines, practical schema design exercises.

Hours 2: Mini-Project: MongoDB Database Creation and Querying. Design and interact with a NoSQL database.

Teaching Material: Project brief, access to MongoDB instance.

Hours 2: Accessing MongoDB from Python

Hours 2:Accessing MongoDB from Java

**2.5 Tableau Basics 10 Hours**

Hours 2: Introduction to Tableau: Navigating the interface, connecting to data sources.

Teaching Material: Interactive tutorial on Tableau, sample datasets.

Hours 2: Creating basic visualizations: bar charts, line graphs, and pie charts.

Teaching Material: Step-by-step guides, practice exercises with Tableau.

Hours 2: Organizing and simplifying data: sorting, filtering, and grouping.

Teaching Material: Demonstrative videos, hands-on data manipulation tasks.

Hours 2: Dashboard fundamentals: designing effective dashboards, storytelling with data.

Teaching Material: Dashboard design principles, case studies.

Hours 2: Mini-Project: Dashboard Creation with Sample Data. Design a dashboard that highlights key data insights.

Teaching Material: Dashboard requirements, dataset with business metrics.

**Module 3**

3.1 Search Algorithms for AI

3.2 Statistics

3.3 Python for Data Analysis

3.4 Tableau Advanced

**Total Hours : 49 Hours**

**Learning Outcomes**

* Understand all search algorithms in AI
* Apply AI search Algorithm to solve real word problems
* Ability to apply both descriptive and inferential statistics in the given data
* Apply python for Data Analysis and Data preparation
* Create effective visualizations and dashboards with Tableau
* Using Tableau to process Bigdata

Contents

**3.1 Search Algorithms for AI 11 Hours**

1 hour – understanding Search algorithms in AI, Types of Search Algorithms

2 Hours – **Uniformed Search Algorithms**, Breadth First Search, Depth First Search

2 Hours - **Uniformed Search Algorithms**, Depth Limited Search, Iterative Deepening Search

2 Hours – **Uniform Search Algorithms,** Bi- directional Search, Uniform Search

2 Hours – **Informed Search**, A\*, Greedy Search

2 Hours – Mini Project

**3.2 Statistics 16 hours**

2 Hours Types of Data, Descriptive Vs inferential Statistics

2 Hours Numerical Data- Frequency Distribution, Central Tendency

2 Hours Quartiles and percentiles, Measurement of dispersion

2 Hours Categorical Data Description – Frequency Distribution, Median and Mode

2 Hours understanding Populations, Samples, random Sampling, Sampling Distribution

2 Hours Hypothesis Testing – Z-tests

2 Hours Analysis of Variance , t- tests, P-value , F-test

2 Hour Assignment/ Quiz

**3.3 Python for Data Analysis 12 Hours**

2 Hours: NumPy for numerical computing: arrays, matrix operations, and broadcasting.

• Teaching Material: Interactive NumPy tutorials, coding exercises.

2 Hours: Pandas for data manipulation: DataFrames, series, data wrangling techniques.

• Teaching Material: Pandas guide, exercises on dataset cleaning and manipulation.

2 Hours: Data cleaning and preparation: handling missing data, outliers, and errors.

• Teaching Material: Data cleaning walkthroughs, practice datasets.

2 Hours: Handling Categorical Data, Data Standardization

2 Hours: Data visualization in Python: using Matplotlib and Seaborn.

• Teaching Material: Visualization examples, coding exercises.

2 Hours : Mini-Project: Data Wrangling with Pandas. Clean and prepare a messy dataset for analysis.

• Teaching Material: Project specification, real-world dataset with common data issues.

**3.4 Advanced Tableau 10 Hours**

2 Hours: Advanced visualizations: heatmaps, tree maps, scatter plots.

• Teaching Material: Visualization techniques, Tableau practice activities.

2 Hours: Custom calculations in Tableau: creating calculated fields, parameters.

• Teaching Material: Calculations guide, Tableau exercise workbook.

2 Hours: Interactivity in Tableau: actions, dashboard animations, and tooltips.

• Teaching Material: Interactive Tableau tutorials, hands-on interactivity challenges.

2 Hours: Tableau and big data: connecting to big data sources, optimizing for performance.

• Teaching Material: Big data connectors in Tableau, performance tuning exercises.

2 Hours: Mini-Project: Interactive Dashboards for AI Data Interpretation. Create a dashboard with advanced interactivity.

• Teaching Material: Dashboard brief, AI-generated data for visualization.

**Module 4**

4.1 Machine Learning with Python

4.2 Intermediate Machine Learning

**Total Hours 44 Hours**

**4.1 Machine Learning with Python 30 Hours**

Hours 2: Introduction to machine learning, supervised vs. unsupervised learning

Regression Models

Hours 2 :Simple Linear regression

Hours 2: Multiple Linear Regression

Hours 2: Polynomial Regression

Hours 2: Support Vector Regression

Hours 2 : Decision Tree Regression

Hours 2: Random Forest Regression

Classification Models

Hours 2 Logistic Regression

Hours 2 K- Nearest Neighbor

Hours 2 Support Vector Machine, Kernel SVM

Hours 2 Naïve Bayes

Hours 2 Decision Tree

Hours 2 Random Forest

Clustering Models

Hours 2 K- Means Clustering

Hours 2 Hierarchical Clustering

**4.2 Intermediate Machine Learning 14 Hours**

Hours 2 Review of basic ML concepts. Introduction to regularization techniques.

Teaching Material: Slides on overfitting/underfitting, hands-on lab adjusting regularization parameters.

Hours 3: Optimization algorithms: Gradient Descent, Stochastic Gradient Descent, Mini-batch learning.

Teaching Material: Interactive visualizations of optimization algorithms, coding exercises in Python.

Hours 3: Hyperparameter tuning strategies: Grid Search, Random Search, Bayesian Optimization.

Teaching Material: Explanation of hyperparameter tuning, hands-on lab with Scikit-Learn.

Hours 2: Model validation techniques: k-fold cross-validation, stratified sampling, bootstrapping.

Teaching Material: Cross-validation exercises, sample code for different validation techniques.

Hours 2 : Dimensionality reduction techniques Principal Component analysis and Linear Discriminant Analysis

Hours 2: Mini-Project: Hyperparameter Tuning and Model Validation. Students will fine-tune and validate a machine learning model.

Teaching Material: Datasets for model training, guide on model evaluation metrics.

**Module 5**

5.1 Machine Learning with Weka

5.2 Working with MOA

5.3 Apache Kafa

**Total Hours 38**

**5.1 Machine Learning with WEKA 14 Hours**

2 Hours Installing Weka and Exploring the Environment

2 Hours Understanding the concept and Data Preparation

2 Hours **Bayes Theorem Algorithm** – Naïve Bayes, **Function Based Model** – Linear regression

2 Hours **Lazy Learning** – K-Nearest Neighbors, Ensemble Model

2 Hours **Rule bases Model** – One Rule, **Tree Based Model** Random Forest

2 Hours Cross Validation, Hyper-parameter Selection

2 Hours counting the Cost

2 Hours Java-based ML project structure: Organizing code, managing dependencies.

• Teaching Material: Project structure examples, Maven and Gradle exercises.

**ML models in Java: Implementing algorithms using Java libraries.**

2 Hours **Bayes Theorem Algorithm** – Naïve Bayes

2 Hours **Function Based Model** – Linear regression

2 Hours **Lazy Learning** – K-Nearest Neighbors

2 Hours Ensemble Model

2 Hours **Rule bases Model** – One Rule

2 Hours **Tree Based Model** Random Forest

**5.2 Working with MOA 12 Hours**

2 Hours Installing Exploring the MOA environment, understanding Data Streams

2 Hours Data Stream Algorithms

2 Hours Using MOA GUI to run Machine Learning Algorithms

2 Hours using MOA API in Java Code – Stream Classifier

2 Hours – Stream Clustering

2 Hours – Outlier Detection

2 Hours Project : Twitter Stream Mining

**5.3 Apache Kafa 12 Hours**

2 Hours installing Kafa and understanding its requirements

2 Hours understanding producer consumer

2 Hours creating Kafa Producer in Java

2 Hours Creating Kafa Consumer in Java

2 Hours Kafa Stream Processing

2 Hours Project

**Module 6**

6.1 Reinforcement Learning, Ensemble Learning with Python

6.2 Reinforcement learning with Java

6.3 Git

**Total Hours 29**

**6.1 Reinforcement Learning, Ensemble Learning with Python 15 Hours**

2 hours Understanding Reinforcement Learning, agents, and rewards

2 hours Upper Confidence Bound, Thompson Sampling

2 Hours Q-Learning

1 hour review of simple Ensemble Models, Max Voting, Averaging, Weighted Average

2 Hours Bagging

2 Hours Stacking, Blending

2 Hours Bagging, Boosting Ada Boost, XGBoost

2 Hours Mini-Project: Implementing an Ensemble Classifier. Build and evaluate an ensemble model using various algorithms.

• Teaching Material: Ensemble techniques workbook, dataset for classification.

**6.2 Reinforcement Learning with Java 8 Hours**

2 Hours: Q-Learning and policy gradients: Fundamental RL algorithms.

Teaching Material: Q-Learning exercises, policy gradient tutorials in Java.

2 Hours: Java-based RL libraries: Exploring libraries like RL4J.

Teaching Material: RL4J setup and examples, hands-on coding sessions.

2 Hours: Building a reinforcement learning agent in Java: Design and implementation.

Teaching Material: Step-by-step guide to building an RL agent, coding exercises.

2 Hours: Mini-Project: Building a Reinforcement Learning Agent in Java. Develop an RL agent to solve a specific problem.

Teaching Material: Project scenario, Java RL libraries.

**6.3 Git and Github 6 hours**

2 Hours : Git intro , New Files, Commit, branch, Merge

2 Hours : GitHub – Pull, Push , Branch

1. Hours : Page, Fork, Clone, undo operations

**Module 7**

7.1 Time Series Analysis with Python

7.2 Introduction to NLP (ML Model)

7.3 Machine Learning Explainability and interpretability

7.4 Apache Spark and BigData

7.5 Tableau for Machine Learning Insights

**Total Hours :60**

**7.1 Time Series Analysis –Conventional Models 10 Hours**

Hours 2: Fundamentals of time series data: Components of time series, stationary.

Teaching Material: Lecture notes on time series analysis, examples of time series data.

Hours 2: Time series forecasting methods: Moving average, exponential smoothing.

Teaching Material: Forecasting exercises, Python notebook templates.

Hours 2: ARIMA and Seasonal ARIMA models: Model identification, parameter estimation, model diagnostics.

Teaching Material: Step-by-step guide on building ARIMA models, case studies.

Hours 2: Trend and seasonality analysis: decomposition methods, analyzing and visualizing trends and seasonality.

Teaching Material: Time series decomposition exercises, practical examples in Python.

Hours 2: Mini-Project: Forecasting with Time Series Data. Students will create a forecast model for a time series dataset.

Teaching Material: Real-world time series datasets, project instructions

**7.2 Introduction to Natural Language Processing (NLP)(ML Models) 10 Hours**

Hours 2: Fundamentals of NLP: Language structure, preprocessing techniques.

• Teaching Material: Overview of NLP, hands-on lab with text preprocessing in Python.

Hours 2: Text representation techniques: Bag of Words, TF-IDF.

• Teaching Material: Interactive exercises on text representation, sample code for feature extraction.

Hours 2: Introduction to word embeddings: Word2Vec, GloVe.

• Teaching Material: Tutorials on training word embeddings, exercises using pre-trained models.

Hours 2: Building a basic NLP model: Text classification, sentiment analysis.

• Teaching Material: Guide on building NLP models, sentiment analysis lab with sample data.

Hours 2: Mini-Project: Sentiment Analysis Model. Develop a model to classify product reviews.

• Teaching Material: Dataset of product reviews, project guidelines.

**7.3 Machine Learning Explainability and Interpretability 8 Hours**

Hours 2: Importance of Model Interpretability

• Teaching Material: Lectures on interpretability, case examples.

Hours 2: Tools and Techniques for Explainability

• Teaching Material: SHAP, LIME tutorials, hands-on exercises.

Hours 2: Applying Interpretability in Industry

• Teaching Material: Industry-specific interpretability discussions.

Hours 2: Custom Explainability Solutions

• Teaching Material: Techniques for custom solutions, project-based learning.

Hours 2: Feature Importance

Hours 2: Mini-Project: Interpretable Model for High-Stakes Decisions

• Teaching Material: Model datasets, interpretability tools, project guidelines.

**7.4: Apache Spark and Big Data 12 Hours**

Hours 4: Introduction to Big Data Ecosystem and Hadoop

• Teaching Material: Presentations on Big Data, Hadoop exercises.

Hours 2: Apache Spark for Large-Scale Data Processing

• Teaching Material: Spark tutorials, exercises on data processing.

Hours 2: Machine Learning with Spark MLlib

• Teaching Material: MLlib case studies, hands-on analysis tasks.

Hours 2: Optimizing Big Data Processing

• Teaching Material: Performance optimization guides, exercises.

Hours 2: Mini-Project: Big Data Processing with Spark

• Teaching Material: Large dataset, Spark cluster setup, project instructions.

**7.5: Tableau for Machine Learning Insights and AI Visualization 20 Hours**

Hours 2: Advanced data prep for ML in Tableau: Data cleaning, transformation, and aggregation.

• Teaching Material: Tableau data prep tutorial, hands-on data transformation exercises.

Hours 2: Integration of ML models with Tableau: Embedding Python/R models into Tableau.

• Teaching Material: Guide on model integration, interactive labs.

Hours 2: Real-time data analytics in Tableau: Connecting Tableau to live data feeds.

• Teaching Material: Real-time analytics tutorial, live data connection setup.

Hours 2: Visualizing machine learning model outputs: Creating interpretative visualizations for model results.

• Teaching Material: Visualization design exercises, dashboard creation labs.

Hours 2: Mini-Project: Visualizing Machine Learning Model Outputs. Create a Tableau dashboard that showcases the insights from a machine learning model.

• Teaching Material: ML model outputs, project guide.

**Tableau for AI Visualization**

Hours 2: Advanced Visualization Design Principles

• Teaching Material: Visualization principles, Tableau exercises.

Hours 2: Predictive Model Integration in Tableau

• Teaching Material: Integration techniques, ML model visualization case studies.

Hours 2: Interactive Dashboard Creation

• Teaching Material: Dashboard creation tutorials, hands-on design.

Hours 2: Real-time Analytics in Tableau

• Teaching Material: Real-time analytics concepts, Tableau exercises.

Hours 2: Mini-Project: Interactive Dashboards for Model Insights

• Teaching Material: Project briefs, datasets, assessment criteria.

**Module 8**

**Deep Learning with Python 98 Hours**

Hours 2 Simple Neural Networks

Hours 2 Revisiting Matrices

Hours 2: Overview of TensorFlow 2.x and Keras. Introduction to the TensorFlow ecosystem and Keras for creating neural network models.

Teaching Material: TensorFlow tutorials, Keras documentation.

Hours 2: Understanding a Simple Artificial Neural Networks with Tensorflow

**Convolutional Neural Networks 12 hours**

Hours 2: Convolutional Neural Networks (CNNs): Understanding CNN architectures, feature learning.

Teaching Material: CNN tutorials, exercises on implementing CNNs with Keras.

Hours 2: Advanced Techniques in CNN Architectures

Teaching Material: CNN architectures, hands-on modeling exercises.

Hours 2: Object Detection and Image Segmentation

Teaching Material: State-of-the-art methods, project-based learning.

Hours 2: Video Analysis and Understanding

Teaching Material: Video datasets, implementation of video analysis techniques.

Hours 4: 3D Vision and Applications

Teaching Material: Introduction to 3D vision, practical exercises.

**Recurrent Neural Networks 8 hours**

Hours 4: Recurrent Neural Networks (RNNs) and Long Short-Term Memory Networks (LSTMs): Sequence modeling, memory in neural networks.

Teaching Material: RNN and LSTM exercises, sample sequential datasets.

Hours 2: Time series Analysis with RNN

Hours 2: NLP with RNN

**Other Deep Learning Networks 10 hours**

Hours 2: Advanced architectures and techniques: Attention mechanisms, skip connections.

Teaching Material: Deep-dive into modern neural network architectures, coding labs.

Hours 2: Self organizing Maps

Hours 2: Restricted Boltzman Machine

Hours 2 : Auto encoders

Hours 2: Deconvolutional networks

**Custom Models and Optimizing the Models 14 Hours**

Hours 2: Custom neural network architectures. Exploration of layers, structures, and their applications.

Teaching Material: Research papers on various neural network architectures, hands-on modeling exercises.

Mini-Project: Design a custom architecture for a specific dataset.

Hours 2: Techniques for improving neural network performance: Regularization, normalization, dropout.

Teaching Material: Interactive tutorials on model improvement techniques, coding labs.

Mini-Project: Improve an underfitting or overfitting model using the discussed techniques.

Hours 2: Optimization for deep learning: Adam, RMSprop, and learning rate schedules.

Teaching Material: Explanations of optimization algorithms, TensorFlow coding exercises.

Mini-Project: Experiment with different optimizers and learning rate schedules on a given dataset.

Hours 2: Design and train a deep neural network for image classification.

Teaching Material: Image dataset (e.g., CIFAR-10), project guidelines, evaluation criteria.

Hours 2: Deep Learning Optimization Techniques

Hours 2: Optimization algorithms, TensorFlow coding exercises.

Hours 2:Mini-Project: Build and train a model on the image dataset, then evaluate its performance.

Advanced Applications and Models 10 Hours

Hours 2: Transfer learning and fine-tuning: Leveraging pre-trained models for custom tasks.

Teaching Material: Guide on transfer learning, exercises using models like VGG, ResNet.

Hours 2: Deep Learning for Anomaly Detection

Teaching Material: Techniques and tools for anomaly detection, datasets.

Hours 2: Meta-Learning and Few-Shot Learning

Teaching Material: Seminars on meta-learning, practical tasks.

Hours 2: Mini-Project: Anomaly Detection System

Teaching Material: Anomaly datasets, model development guidelines.

Hours 2: Graph Neural Networks and Their Applications

Teaching Material: Introductory content, hands-on graph model exercises.

**Generative Adversarial Neural Networks 24 Hours**

Hours 2: Introduction to GANs. Understanding the concept and architecture of GANs.

Teaching Material: Lecture slides on GAN basics, simple GAN implementation in TensorFlow.

Hours 2: Implement a basic GAN to generate simple images (e.g., MNIST).

Hours 2: Training GANs: Challenges and best practices for stable training.

Teaching Material: Tutorials on training GANs, hands-on lab fixing common training issues.

Hours 2: Diagnose and fix issues in a GAN training process.

Hours 2: Variants of GANs: Conditional GANs, CycleGANs, and their applications.

Teaching Material: Overviews of various GAN architectures, coding tasks to implement different GAN types.

Hours 2: Creative AI for Art and Music Generation

Teaching Material: Case studies, project work on creative AI tasks.

Hours 4: Mini-Project: Generating Art with GANs

Teaching Material: Image data, GAN development guidelines.

Hours 2: Create a Conditional GAN to generate images based on given conditions.

Hours 2: Applications of GANs: Image synthesis, data augmentation, and creative AI.

Teaching Material: Case studies on GAN applications, creative AI tasks.

Hours 2: Use a CycleGAN for a cross-domain image-to-image translation task.

Hours 2: Develop a GAN that generates new images that mimic a provided dataset.

**Deep Reinforcement Learning 10 Hours**

Hours 2: Introduction to Deep Reinforcement Learning

• Teaching Material: Lectures on DRL, interactive simulations.

Hours 2: Implementing Deep Q-Networks (DQN)

• Teaching Material: Tutorials on DQN, Python exercises.

Hours 2: Policy Optimization Methods in DRL

• Teaching Material: In-depth policy method guides, coding labs.

Hours 2: Model-Based Reinforcement Learning Techniques

• Teaching Material: Content on model-based RL, simulation exercises.

Hours 2: Mini-Project: Training a DRL Agent

• Teaching Material: Environment setup, project guidelines, code templates.

**Advanced NLP with BERT and GPT 10 Hours**

Hours 2: Understanding transformer architectures: The mechanism behind BERT and GPT.

• Teaching Material: Scholarly articles on transformers, coding exercises with pre-trained models.

Hours 2: Mini-Project: Implement a transformer model to perform a simple text classification task.

Hours 2: Fine-tuning pretrained models: Using BERT for text classification and information extraction.

• Teaching Material: Tutorials on fine-tuning BERT, hands-on lab sessions with Jupyter Notebooks.

Hours 2:Mini-Project: Fine-tune a BERT model to improve the performance on a specific NLP task.

Hours 2: Exploring GPT: How to utilize GPT for generative tasks.

• Teaching Material: Introduction to GPT, exercises on generating text with GPT.

Hours 2: Mini-Project: Use a GPT model to generate creative writing prompts.

Hours 2: Advanced applications: Question answering, summarization, and translation with transformers.

• Teaching Material: Case studies and project work using transformer models for advanced NLP tasks.

Hours 2: Mini-Project: Build a system that can answer questions based on a given context using a transformer model.

Hours 2: Sentiment Analysis using BERT.

• Teaching Material: Dataset for sentiment analysis, project instructions, and evaluation rubric.

Hours 2: Mini-Project: Perform sentiment analysis on a dataset of reviews using a fine-tuned BERT model.

**Module 9**

**Total Hours 20**

**Special Topics in Machine Learning 8 Hours**

Hours 2: Quantum Machine Learning Basics

• Teaching Material: Introduction to quantum computing, QML exercises.

Hours 4: AI for Internet of Things (IoT) Applications

• Teaching Material: IoT datasets, implementation strategies.

Hours 2: Mini-Project: Forecasting with Advanced Models

• Teaching Material: Market data, project specifications.

**Java and AI Frameworks 8 Hours**

Hours 2: Introduction to Java-based AI libraries: TensorFlow Java, DL4J.

• Teaching Material: Library documentation, introductory projects.

Hours 2: Setting up Java for TensorFlow. Understanding Java API for TensorFlow. spark

• Teaching Material: Setup guides, TensorFlow Java code examples.

Hours 2: Deep Learning in Java with DL4J: neural network basics, data pipelines.

• Teaching Material: DL4J tutorials, hands-on neural network building exercises.

Hours 2: Real-world Java AI projects: analyzing project structure, industry use cases.

• Teaching Material: Case studies of Java in AI, project analysis.

**Deep Learning with Java(WEKA GUI) 4 Hours**

Hours 2 : CNN

Hours 2: RNN

**Module 10**

**Machine Learning at Scale - Cloud Computing, and MLOps**

**Total Hours :46**

**Cloud Services for AI 10 Hours**

Hours 2: Overview of Cloud AI Services

• Teaching Material: Comparative analysis of cloud services.

Hours 2: Building AI with AWS, Google Cloud, and Azure

• Teaching Material: Cloud service tutorials, ML model creation exercises.

Hours 2: Automating ML Workflows in the Cloud

• Teaching Material: Workflow automation guides, cloud projects.

Hours 2: Cloud Security and Compliance

• Teaching Material: Security best practices, implementation exercises.

Hours 2: Mini-Project: Cloud-based ML Model Deployment

• Teaching Material: Deployment guidelines, cloud platform project work.

**MLOps and AI in Production 10 Hours**

Hours 2: Introduction to MLOps

• Teaching Material: MLOps fundamentals, case studies.

Hours 2: CI/CD for AI with Jenkins and GitLab CI

• Teaching Material: CI/CD tutorials, hands-on pipeline setup.

Hours 2: Monitoring ML Systems for Performance and Data Drift

• Teaching Material: Monitoring tools, setup exercises.

Hours 2: Scaling ML Systems for High Load

• Teaching Material: Scalability strategies, load testing.

Hours 2: Mini-Project: Implementing MLOps for an ML Project

• Teaching Material: CI/CD tools, project scenarios, implementation guides.

**Advanced Cloud Architectures 10 Hours**

Hours 2: Serverless Architectures for ML with AWS Lambda and Others

• Teaching Material: Serverless concepts, hands-on exercises.

Hours 2: Edge Computing for AI with IoT Devices

• Teaching Material: Edge computing tutorials, projects with devices like Raspberry Pi.

Hours 2: Hybrid and Multi-Cloud Strategies

• Teaching Material: Strategy discussions, case studies.

Hours 2: Cloud Cost Optimization

• Teaching Material: Cost management techniques, optimization exercises.

Hours 2: Mini-Project: Serverless ML Application Setup

• Teaching Material: Application design, cloud setup instructions.

**Kubernetes and Scalable Deployments 10 Hours**

Hours 2: Containerization with Docker

• Teaching Material: Docker tutorials, containerization exercises.

Hours 2: Kubernetes Fundamentals

• Teaching Material: Kubernetes basics, hands-on exercises.

Hours 2: Deploying ML Models with Kubernetes

• Teaching Material: Deployment guides, Kubernetes exercises.

Hours 2: Advanced Kubernetes Features

• Teaching Material: Advanced concepts, implementation tasks.

Hours 2: Mini-Project: ML Model Deployment with Kubernetes

• Teaching Material: Containerization guidelines, Kubernetes setup.

**Specialized Big Data and ML Tools 6 Hours**

Hours 2: Introduction to MLFlow for ML Lifecycle Management

• Teaching Material: MLFlow tutorials, project integration exercises.

Hours 2: Data Warehousing Solutions for ML

• Teaching Material: Data warehousing concepts, SQL server exercises.

Hours 2: NoSQL Databases for Unstructured ML Data

• Teaching Material: NoSQL database tutorials, practical implementation.

**Module 11**

**Ethics , Fairness and bias , Industry Applications**

**Total Hours :40**

**Ethics and AI 10 Hours**

Hours 2: Introduction to AI Ethics

• Teaching Material: Ethical principles presentations, case studies.

Hours 2:: AI’s Societal Impacts and Public Policy

• Teaching Material: Articles, debates, discussion prompts.

Hours 2:: Regulatory Landscape: GDPR, CCPA, and AI Regulation

• Teaching Material: Regulation summaries, compliance workshops.

Hours 2:: Ethical AI Design and Development

• Teaching Material: Design thinking for ethical AI, workshops.

Hours 2:: Mini-Project: Ethical Audit of an AI Project

• Teaching Material: Audit guidelines, ethical checklist, scenario analysis.

**Bias and Fairness in AI 10 Hours**

Hours 2: Identifying and Understanding Bias

• Teaching Material: Bias types presentations, data analysis exercises.

Hours 2: Techniques for Mitigating Bias

• Teaching Material: Bias mitigation strategies, hands-on implementation.

Hours 2: Fairness Metrics and Assessment Methods

• Teaching Material: Fairness metrics overview, case studies.

Hours 2: Implementing Fairness in AI Systems

• Teaching Material: Fair AI practices workshops, checklists.

Hours 2: Mini-Project: Bias and Fairness Audit

• Teaching Material: Audit report templates, fairness toolkit, datasets.

**AI in Finance and Healthcare 10 Hours**

Hours 2: AI for Financial Risk and Fraud Detection

• Teaching Material: Financial AI models, fraud detection studies.

Hours 2: AI in Personalized Medicine and Healthcare

• Teaching Material: AI healthcare overviews, personalized medicine case studies.

Hours 2: Navigating AI Regulations in Sensitive Industries

• Teaching Material: Regulatory challenges discussions, compliance exercises.

Hours 2: Deployment Challenges and Success Stories

• Teaching Material: Case studies in finance and healthcare AI.

Hours 2: Mini-Project: AI Solution for Healthcare or Finance

• Teaching Material: Industry data, project briefs, evaluation rubrics.

**AI in Agriculture and Smart Cities 10 Hours**

Hours 2: Precision Agriculture with AI

• Teaching Material: Precision agriculture presentations, technology demos.

Hours 2: AI for Urban Planning and Smart Cities

• Teaching Material: Smart city guides, urban AI case studies.

Hours 2: Deploying AI Solutions in Urban Environments

• Teaching Material: Deployment strategies, exercises for urban AI.

Hours 2: Global Case Studies in AI for Smart Cities

• Teaching Material: International smart city projects, analysis tasks.

Hours 2: Mini-Project: AI for Traffic Optimization in Smart Cities

• Teaching Material: Traffic data, simulation software, project guidelines.

**Module 12**

**Capstone Projects and Career Development**

**Total Hours 30**

**Capstone Project Preparation 10 Hours**

Hours 2 : Introduction to Capstone Projects

• Teaching Material: Overview of capstone project expectations, brainstorming guides.

Hours 2: Ideation and Proposal Development

• Teaching Material: Ideation techniques, proposal writing workshops.

Hours 2 : Research and Feasibility Studies

• Teaching Material: Research methodologies, feasibility assessment tools.

Hours 2: Project Planning and Design Thinking

• Teaching Material: Project planning strategies, design thinking workshops.

Hours 2 : Work on Capstone Project Proposal

• Teaching Material: Mentor consultations, project design templates, feedback sessions.

**Capstone Project Execution 4 Hours**

Hours 2: Capstone Project Development Phase 1

• Teaching Material: Daily stand-ups, development sprints, peer reviews.

Hours 2: Capstone Project Development Phase 2

• Teaching Material: Continued sprints, intermediate presentations, revision tools.

**Capstone Project Finalization and Presentation 6 Hours**

Hours 2: Capstone Project Polishing

• Teaching Material: UI/UX best practices, performance optimization guides.

Hours 2: Capstone Project Rehearsals

• Teaching Material: Presentation rehearsals, feedback collection.

Hours 2: Capstone Project Presentations

• Teaching Material: Final presentation setup, evaluation criteria.

**Career Development and Course Wrap-up 10 Hours**

Hours 2: Building Your Personal Brand in AI

• Teaching Material: Branding strategies, professional networking tips.

Hours 2: Resume and LinkedIn Optimization

• Teaching Material: Resume building workshops, LinkedIn profile strategies.

Hours 2: Interview Preparation for AI Roles

• Teaching Material: Mock interviews, technical interview preparation.

Hours 2: Negotiation Skills for Job Offers

• Teaching Material: Negotiation tactics, role-playing simulations.

Hours 2: Graduation and Next Steps

• Teaching Material: Alumni network introduction, continuous learning resources.