

Course Name: Certificate Course in Artificial Intelligence & Machine Learning

Course Objective: This course provides a comprehensive and in-depth understanding about to the Big Data, Artificial intelligence and Machine Learning. It covers a global perspective, explores real-world examples, and delves into future trends. With case studies and hands-on projects, participants will gain practical experience and valuable insights to apply in real-world scenarios.

Pre – Requisite: No prior programming skills are required. This course is designed for professionals with no prior IT background.

Course Outcome: Participant will learn to build, train, and deploy machine-learning models to solve real-world problems, gaining expertise in algorithms, data analysis, and predictive modelling.

Course Duration: 80 Hrs (8 hours/ day for 2 Weeks)

Teaching Schema:

S. No.	Modules	Hours
1	Python for AI & Data Handling	8
2	Exploratory Data Analysis (EDA) & Visualization	12
3	Machine Learning Foundation	10
4	Classification & Model Evaluation	8
5	Unsupervised Learning + Dimensionality Reduction	8
6	Advanced ML & Explainable AI (XAI)	8
7	Deep Learning with Neural Networks	10
8	Natural Language Processing & LLMs	8
9	Generative AI & Advanced LLM Use	4
10	Capstone Projects + AI Ethics & Trends	4
	Total	80

Detailed Course Content:

Module 1: Python for AI & Data Handling

- Introduction to Python Programming: Syntax, Variables, Data Types, Input/ Output
- Python IDE setup: Anaconda, Jupyter Notebook, VS Code
- Core Data Structures: Lists, Tuples, Dictionaries, Sets with methods and use cases
- Conditional Statements and Loops (if, for, while)
- User-defined Functions and Lambda Functions
- Hands-on Exercises: Parsing and manipulating real-world data using Pandas.
- Data Cleaning: Handling Missing Values, Duplicates, Outliers
- EDA Techniques: Describe(), GroupBy(), Correlation
- Hands-on: Visual EDA using Matplotlib and Seaborn (histograms, box plots, pair plots)

Module 3: Machine Learning Foundation

- Overview: AI vs ML vs DL vs LLMs
- Types of ML: Supervised, Unsupervised, Reinforcement
- End-to-End Machine Learning Pipeline
- Evaluation Metrics: MAE, MSE, RMSE for regression
- Hands-on: Linear Regression project – Predicting house prices.

Module 2: Exploratory Data Analysis (EDA) & Visualization

- Introduction to NumPy: Arrays, Indexing, Broadcasting, Arithmetic operations
- Introduction to Pandas: Series and Data Frame

Module 4: Classification & Model Evaluation

- Logistic Regression: Theory and Implementation

- K- Nearest Neighbors (KNN): Concept and distance metrics
- Confusion Matrix, Precision, Recall, F1 Score, ROC-AUC
- Cross-Validation Techniques: k-Fold, Stratified CV
- Hands-on: Titanic dataset or IRIS flower classification

Module 5: Unsupervised Learning + Dimensionality Reduction

- Clustering Basics: Differences from supervised learning
- K-Means Clustering: Working, Elbow Method, Inertia
- Hierarchical Clustering and Dendrograms
- Principal Component Analysis (PCA): Theory and Visualization
- Hands-on: Customer Segmentation using K-Means + PCA

Module 6: Advanced ML & Explainable AI (XAI)

- Ensemble Techniques: Bagging, Boosting
- Random Forest: Structure, Feature Importance
- Gradient Boosting and XGBoost: Tuning and Interpretation
- Introduction to Explainable AI: Why it matters
- SHAP and LIME: Feature Importance Visualizations
- Hands-on: SHAP visualization for credit scoring model.

Module 7: Deep Learning with Neural Networks

- Deep Learning Overview: Comparison with ML
- Neural Network Architecture: Layers, Weights, Bias
- Activation Functions: ReLU, Sigmoid, Tanh

- Loss Functions and Optimizers
- Feedforward Neural Networks and Backpropagation
- Hands-on: MNIST digit recognition using Keras

Module 8: Natural Language Processing & LLMs

- Text Preprocessing: Tokenization, Stop Words, Lemmatization
- Text Representations: Bag-of-Words, TF-IDF
- Introduction to LLMs: GPT, BERT, LLaMA, Falcon
- Using HuggingFace Transformers for text classification
- Prompt Engineering Basics and Patterns
- Hands-on: Sentiment Analysis using BERT

Module 9: Generative AI & Advanced LLM Use

- Generative AI Introduction: DALL·E, Sora, ChatGPT
- Transformers and Attention Mechanism Overview
- Retrieval-Augmented Generation (RAG) Basics
- Fine-tuning vs Inference-only LLMs
- Hands-on: Create a QA Chatbot or Text Summarizer using LLM.

Module 10: Capstone Projects + AI Ethics & Trends

- Capstone Project Options:
- LLM-powered Conversational Chatbot
- SHAP-based Explainability Dashboard
- Customer Segmentation and Dashboard with PCA
- AI Ethics: Fairness, Bias, Transparency, Privacy
- Case Studies in AI: Healthcare, Education, Automotive, Smart Cities