MACHINE LEARNING SYLLABUS

Module 1: Introduction to Machine Learning and Prerequisites

- Introduction to Machine Learning
- Learning Paradigms
- Probably Approximately Correct (PAC) Learning
- Version Spaces
- Role of Machine Learning in Artificial Intelligence Applications

Module 2: Supervised Learning – I

- Linear and Non-Linear Examples
- Multi-Class & Multi-Label Classification
- Linear Regression
- Multiple Linear Regression
- Naïve Bayes Classifier
- Decision Trees
    - ID3
    - CART
- Error Bounds

Module 3: Supervised Learning – II

- K-Nearest Neighbors (K-NN) Classifier
- Logistic Regression
- Perceptron
    - Single Layer
    - Multi-Layer
- Support Vector Machines (SVM)
    - Linear
    - Non-Linear
- Metrics & Error Correction

Module 4: Unsupervised Learning

- Clustering Basics
  - Partitioned
  - Hierarchical
  - Density-Based
- K-Means Clustering
- K-Mode Clustering
- Self-Organizing Maps
- Expectation-Maximization
- Principal Component Analysis (PCA)
- Kernel PCA
- t-Distributed Stochastic Neighbor Embedding (t-SNE)
- Metrics & Error Correction

Module 5: Ensemble Learning

- Bias-Variance Tradeoff
- Bagging and Boosting
  - Random Forests
  - AdaBoost
  - XGBoost
- Metrics & Error Correction

Module 6: Machine Learning in Practice

- Class Imbalance
- Synthetic Minority Over-sampling Technique (SMOTE)
- One-Class SVM
- Optimization of Hyperparameters

Module 7: Reinforcement Learning (RL)

- Basics of RL
- RL Framework
- Markov Decision Process (MDP)
- Exploration vs. Exploitation
- Policies, Value Functions, and Bellman Equations
- Solution Methods
- Q-Learning