Machine Learning Sem-5

UNIT 1: Introduction to Machine Learning

1. What is Machine Learning? How is it different from traditional programming?
2. Explain types of Machine Learning:
    - Supervised
    - Unsupervised
    - Reinforcement
3. Describe the **ML pipeline/stages** from data collection to model evaluation.
4. What is overfitting and underfitting? How can they be avoided?
5. Compare Machine Learning, Deep Learning, and Artificial Intelligence.
6. What are features and labels in an ML dataset?

UNIT 2: Supervised Learning Algorithms

1. Explain **Linear Regression** with Python example and plot.
2. What is Logistic Regression? When is it used?
3. Describe the **K-Nearest Neighbors (KNN)** algorithm with example.
4. What is a Decision Tree? How is it built using scikit-learn?
5. Compare classification vs regression with examples.
6. What are performance metrics in classification? (Accuracy, Precision, Recall, F1-score)

UNIT 3: Unsupervised Learning

1. What is Unsupervised Learning? List its applications.
2. Explain **K-Means Clustering** with Python example.
3. How does Hierarchical Clustering work? Explain with a diagram.
4. What is dimensionality reduction? Explain **PCA**.
5. Compare K-Means vs Hierarchical Clustering.
6. How is clustering evaluated without labels? (Silhouette score, etc.)

UNIT 4: Model Evaluation and Optimization

1. What is cross-validation? Explain **k-fold cross-validation**.

2. What is confusion matrix? How do you interpret it?
3. Explain train-test split in scikit-learn.
4. What is hyperparameter tuning? Use of GridSearchCV.
5. What is bias-variance tradeoff in machine learning?
6. How do you choose the best algorithm for a given dataset?

UNIT 5: Real-Time ML Applications & Tools

1. What are common real-life applications of ML?
2. Describe the steps to build and deploy an ML model.
3. Write a simple Python code using scikit-learn to build a classifier.
4. How is ML used in:
    - Email spam detection
    - Movie recommendation
    - Image classification
5. List important Python libraries used in ML and their purposes:
    - scikit-learn
    - numpy
    - pandas
    - matplotlib
6. What are the ethical concerns in using machine learning?

🔍 **Frequently Asked 10-Marks Questions**

- Explain the process of building a classification model using any supervised algorithm.
- Compare supervised and unsupervised learning with examples.
- Explain the working of Decision Trees and KNN algorithms.
- Discuss the K-Means clustering algorithm with a practical Python example.
- Describe model evaluation techniques and metrics.
- Evaluate a classifier using accuracy and confusion matrix.
- Load a dataset with pandas and visualize it with matplotlib/seaborn.
- Use scikit-learn to train and test a decision tree classifier.