SUKKUR IBA UNIVERSITY

KANDHKOT CAMPUS

MERIT-QUALITY-EXCELLENCE

Course: Machine Learning	**Course Code:** CSC - 403
Instructor: Mansoor Ahmed	**Date:** 02/03/2025 ‖ **Points:** 05

1. Introduction to Supervised Learning

- Definition and Key Concepts
- Differences Between Supervised and Unsupervised Learning
- Real-World Applications

2. Types of Supervised Learning

- Regression
- Classification

3. Key Algorithms in Supervised Learning

- Linear Regression
- Logistic Regression
- Decision Trees
- Random Forests
- Support Vector Machines (SVM)
- k-Nearest Neighbors (k-NN)
- Naive Baye

4. Model Evaluation Metrics

- **For Regression:** Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R-squared
- **For Classification:** Accuracy, Precision, Recall, F1 Score, ROC-AUC

5. Data Preprocessing for Supervised Learning

- Handling Missing Data
- **Feature Scaling:** Normalization and Standardization
- **Encoding Categorical Variables:** One-Hot Encoding, Label Encoding
- Feature Selection and Dimensionality Reduction

6. Model Training and Validation

- **Splitting Data:** Training, Validation, and Test Sets
- **Cross-Validation Techniques:** k-Fold Cross-Validation
- **Overfitting and Underfitting:** Causes and Solutions

7. Hyperparameter Tuning

- Grid Search
- Random Search
- Bayesian Optimization

8. Advanced Topics in Supervised Learning

- **Ensemble Methods:** Bagging, Boosting (e.g., AdaBoost, Gradient Boosting, XGBoost)
- **Regularization Techniques:** L1 (Lasso), L2 (Ridge), Elastic Net
- **Handling Imbalanced Data:** SMOTE, ADASYN

9. Practical Considerations

- Choosing the Right Algorithm. How?
- Interpretability vs. Performance Trade-offs
- Deployment and Monitoring of Models

10. Case Studies and Real-World Applications

- Predictive Maintenance
- Credit Scoring
- Medical Diagnosis
- Sentiment Analysis

Instructions:

- This assignment requires self-learning and practical implementation.
- Explore online resources (articles, videos, courses) to understand key concepts.
- Make detailed notes on the given outline.
- Develop at least 5 projects using different supervised learning algorithms.
- Submit your notes and projects within one week.

Deadline: 02-03-2025
What to Submit?

- **Notes on the Outline** (PDF or Word format)
- **5 ML Projects** (Python Notebooks & Reports)
- **Project Summary** (Dataset used, methodology, results)

Submission Format: Upload your assignment to **Google Classroom** along with the project links uploaded on **GitHub**.