DSM351Machine Learning Algorithms using Python

Semester: V	**Course Title:** Machine Learning Algorithms using Python	Credit: 4
Course Code: DSM351		(3 T + 1 P)

Course Outcomes: On successful completion of the course the learner will be able to

CO	COGNITIVEABILITIES	COURSEOUTCOMES
CO1	REMEMBERING	Recall key machine learning concepts, types, and terminology.
CO2	UNDERSTANDING	Explain the principles behind supervised, unsupervised, and ensemble learning techniques.
CO3	APPLYING	Implement ML algorithms for regression, classification, and clustering using Python libraries.
CO4	ANALYSING	Analyze model performance using appropriate metrics and validation techniques.
CO5	EVALUATING	Evaluate the suitability of various models and tune hyperparameters effectively.
CO6	CREATING	Develop complete machine learning solutions and deploy models using Python.

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	1
CO 2	2	3	3	2	1
CO 3	2	3	2	3	2
CO 4	3	3	3	3	2
CO 5	3	3	3	2	2
CO 6	3	3	3	3	2

Unit No.	Detailed Syllabus	Teaching Hours
I	**Introduction to Machine Learning** Introduction to AI and ML: definitions, real-world applications, Types of ML: Supervised, Unsupervised, Reinforcement Learning, ML Concepts: Model, Training, Testing, Overfitting, Underfitting, Evaluation Metrics: Accuracy, Precision, Recall, F1-score, ROC, Introduction to NumPy and Pandas for ML workflows	15
II	**Supervised Learning Algorithms** Regression Algorithms:Linear & Polynomial Regression, Cost functions and evaluation metrics: MAE, MSE, RMSEClassification Algorithms:K-Nearest Neighbors (KNN), Decision Trees, Logistic Regression, Naive Bayes, Support Vector Machine (SVM), Train-Test Split, Cross-validation, Confusion Matrix, ROC & AUC	15
III	**Ensemble & Unsupervised Learning:** Ensemble Learning:Bagging vs Boosting, Random Forest, AdaBoost, Gradient Boosting, Clustering Algorithms:K-Means (centroid update, elbow method)Hierarchical Clustering, DBSCAN, Dimensionality Reduction:Principal Component	15

	Analysis (PCA)	

IV	**Practical Component (Using Python)**
	
	• Python implementation using Scikit-learn:
	  o Regression (Linear, Polynomial)
	  o Classification (KNN, Decision Tree, Logistic Regression, SVM)
	  o Clustering (K-Means, Hierarchical)
	• Ensemble models (Random Forest, Gradient Boosting)
	• Performance evaluation using MAE, RMSE, F1-score
	• Model tuning: GridSearchCV
	• Model persistence: Saving/loading models with joblib
	• Datasets: Iris, Titanic, Boston Housing, MNIST
	• Mini projects covering full ML workflow
		15

Suggested Reference Books:

1. **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** – Aurélien Géron, O'Reilly
2. **Python Machine Learning** – Sebastian Raschka and Vahid Mirjalili, Packt Publishing
3. **Introduction to Machine Learning with Python** – Andreas C. Müller & Sarah Guido, O'Reilly
4. **Pattern Recognition and Machine Learning** – Christopher M. Bishop, Springer
5. **Machine Learning** – Tom M. Mitchell, McGraw Hill
6. **Data Science from Scratch** – Joel Grus, O'Reilly

H.O.D
Dept of DATA SCIENCE & ANALYTICS
M.G. Science Institute, Ahmedabad-9.