INSTITUTE	**FACULTY OF ENGINEERING AND TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)**
SEMESTER	**3**
COURSE TITLE	**PYTHON PROGRAMMING FOR AI & ML**
COURSE CODE	**01ML0303**
COURSE CREDITS	**2**

Objective:

1 To develop the ability to apply Python and machine learning techniques for data analysis, model development, optimization, and deployment.

Course Outcomes: After completion of this course, student will be able to:

1 Apply Python programming constructs and libraries to perform data manipulation, transformation, and visualization for ML applications.

2 Implement and analyze machine learning algorithms and interpret model performance using appropriate evaluation metrics.

3 Evaluate the performance of ML models through cross-validation, hyperparameter tuning, and feature selection using libraries.

4 Design and create automated ML pipelines using and deploy trained models.

5 Design a mini-project demonstrating the end-to-end application of ML workflow from data ingestion to deployment using real-world datasets.

Pre-requisite of course: Fundamental of AI & ML, Python Programming

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	4	0	0	0	50	50

Contents : Unit	Topics	Contact Hours
Total Hours		

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Data Acquisition Techniques for Engineering Applications** Introduction to Data Set, Type of Data: Structure Data, Unstructured Data, Numerical Data and Categorical Data	4

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	**Data Loading and Cleaning of Structured data using Pandas** Load real-world datasets, handle missing values, detect outliers, and perform data transformation	4
3	**Data Loading of Unstructured data** Introduction to image data and its representation in digital form (grayscale and RGB images). Loading image datasets using Python libraries such as OpenCV, PIL, and Matplotlib, Understanding image dimensions, channels, and pixel intensity values.	4
4	**Feature Encoding and Scaling** Perform categorical encoding , feature scaling using StandardScaler, MinMaxScaler, and RobustScaler	4
5	**Exploratory Data Analysis (EDA)** Conduct EDA, visualization using matplotlib, seaborn, and pandas profiling tools	4
6	**Regression Modeling** Implement Linear and Polynomial Regression models, Evaluate regression metrics	4
7	**Classification Algorithms** Train and compare multiple classification models, accuracy, precision, recall, F1-score, and ROC-AUC	4
8	**Unsupervised Learning Techniques** Apply K-Means, DBSCAN clustering, PCA with visualization	4
9	**Model Optimization and Imbalance Handling** Perform hyperparameter tuning using GridSearchCV / RandomSearchCV , handle imbalanced data using SMOTE	4
10	**Automated ML Pipelines** Build end-to-end automated machine learning pipelines using scikit-learn , ML Model Deployment: Deploy trained ML models as REST APIs using Flask or FastAPI	4
11	**Mini Project (Regression)** CNC Tool Wear Prediction / Manufacturing Defect Detection using full ML workflow	4
12	**Mini Project (Classification)** Spam Detection / Heart Disease Prediction / Industrial Defect Classification	4
Total Hours		**48**

Textbook :

1 Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow , Aurélien Géron, O'Reilly,, 2023

2 Introduction to Machine Learning with Python , 2. Andreas C. Müller & Sarah Guido, O'Reilly,, 2017

References:

1. Machine Learning, Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017
2. Python Machine Learning , Python Machine Learning , Sebastian Raschka , Packt Publishing, 2022
3. Automate the Boring Stuff with Python , Automate the Boring Stuff with Python , Al Sweigart , No Starch Press, 2020
4. Python for Data Analysis , Python for Data Analysis , Wes McKinney , O'Reilly, 2023
5. Pattern Recognition and Machine Learning, Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2011

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
0.00	0.00	40.00	40.00	20.00	0.00

Instructional Method:

1. Demonstration-Based Laboratory Learning
2. Hands-on Experimental Learning
3. Problem-Based Learning (PBL)
4. Simulation-Assisted Learning

Supplementary Resources:

1. https://www.analyticsvidhya.com/blog/2025/06/machine-learning/
2. https://www.geeksforgeeks.org/machine-learning/machine-learning/