UML501: MACHINE LEARNING

L	T	P	Cr
3	0	2	4.0

Course Objectives: This course provides a broad introduction to machine learning and statistical pattern recognition. It offers some of the most cost-effective approaches to automated knowledge acquisition in emerging data-rich disciplines and focuses on the theoretical understanding of these methods, as well as their computational implications.

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning and Reinforcement learning.

Data Pre-processing: Need of Data Pre-processing, Data Pre-processing Methods: Data Cleaning, Data Integration, Data Transformation, Data Reduction; Feature Scaling (Normalization and Standardization), Splitting dataset into Training and Testing set.

Regression: Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluating Regression Models' Performance (RMSE, Mean Absolute Error, Correlation, RSquare), Regularization Methods

Classification: Need and Applications of Classification, Logistic Regression, Decision tree, Tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; Random forest classification, Naïve Bayes algorithm; K-Nearest Neighbours (K-NN), Support Vector Machine (SVM), Evaluating Classification Models' Performance (Sensitivity, Specificity, Precision, Recall, etc).

Clustering: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density-based methods.

Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm.

Artificial Neural Network: Need and Application of Artificial Neural Network, Neural network representation and working, Activation Functions.

Laboratory Work:

Implement data preprocessing, Simple Linear Regression, Multiple Linear Regression, Decision Tree, Random forest classification, Naïve Bayes algorithm; K-Nearest Neighbors (K-NN), Support Vector Machine , k-Means, Apriori algorithm and ANN in Python/R/MATLAB/Mathematica/Weka.

Course Learning Outcomes (CLOs) / Course Objectives (COs):

After the completion of the course, the student will be able to:

1. Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, supervised, unsupervised and reinforcement learning.
2. Comprehend and apply regression techniques.
3. Comprehend and implement various classification and clustering methods.
4. Understand the concept of association rule mining and neural networks and their implementation in context of Machine Learning.