Course Title: **Machine Learning (3 Cr.)**
Course Code: **CACS456**
Year/Semester: **IV/VIII**
Class Load: **6 Hrs. / Week (Theory: 3Hrs. Practical: 3Hrs.)**

Course Description

This course presents comprehensive introduction to several topics on basic concepts and techniques of Machine Learning (ML). It also explores the understanding of the Supervised and unsupervised learning techniques, probability based learning techniques, performance evaluation of ML algorithms and applications of ML.

Course objectives

Upon completion of this course, students should be able to 1. Explain the concept of supervised, unsupervised and semi-supervised learning. 2. Develop algorithms to learn linear and non-linear models using software. 3. Perform creative work in the field machine learning to solve given problem.

Course Contents

	Hours
Unit 1: Introduction to machine learning History of machine learning, Brain-neuron learning system, Definition and types of learning, need of machine learning, Data and tools, review of statistics, training, validation and test data, theory of learning – feasibility of learning – error and noise – training versus testing, generalization bound – approximation-generalization tradeoff – bias and variance – learning curve	10
Unit 2 Introduction to Supervised Learning Classification problems, Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Perceptron, learning neural networks structures, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, support vector machines, Separating data with maximum margin, Finding the maximum margin,	11
Unit 3: Bayesian and instance based learning Probability theory and Bayes rule. Classifying with Bayes decision theory, Conditional Probability, Bayesian Belief Network, K-nearest neighbor	11
Unit 4:Introduction to un-supervised learning and dimensionality reduction Introduction to clustering, K- Mean clustering, different distance functions for clustering, Hierarchical clustering, Supervised learning after clustering, dimensionality reduction techniques, Principal component analysis	10
Unit 5: Measures for Performance Evaluation of ML algorithms Classification accuracy, Confusion matrix Misclassification costs, Sensitivity and specificity, ROC curve, Recall and precision, box plot, confidence interval	6

Evaluation

Evaluation Scheme

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Reference Books:

3. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.