CA654A3 **(2L + 1T Hrs./week)**

MACHINE LEARNING

Questions to be set: 05 (All Compulsory)

Objectives: This course is indent for understanding the core techniques behind the recent development in machine learning and pattern recognition. The machine learning part of the module aims to give students a good overview of the supervised classification mechanisms, which is the heart of pattern recognition. Further the machine learning is helpful for pattern recognition.

Pre-requisites: Fundamentals of probability & statistics and programming skills, data mining concepts.

Course Outcomes (CO):

CO1	Students will be able to understand the techniques behind the recent development in supervised classification
CO2	Students will be able to implement classification and outlier analysis program.
CO3	Students will be able to design small projects in related field.
CO4	Students will be able to learn the concepts in Bayesian analysis from probability models and methods
CO5	Students will be able to characterize the machine learning algorithms as supervised learning and unsupervised learning and apply and analyse the various algorithms of supervised and unsupervised learning

Module	Topics to be covered	Topics	Hrs
Module 1: Introduction & Decision Tree Learning	in class	Machine learning and its applications, Analysing Supervised and unsupervised learning, Designing a learning system, Issues of machine learning. Decision tree representation, Characteristics of decision trees, Basic decision tree algorithm, Inductive bias in decision tree, Issues in decision tree: Avoiding Overfitting the Data, Reduced error pruning, Rule post pruning, Incorporating Continuous-Valued Attributes, Alternative Measures for Selecting Attributes, Handling Training Examples with Missing Attribute Values, Handling Attributes with Differing Costs	[8]
	Assignment Topics	To be provided by the concern faculty members.	
Module 2: Artificial Neural Networks & Bayesian Learning	in class	Biological motivation, Neural network representations, Appropriate problems for neural network learning, Perceptron, Multilayer networks and the backpropagation, Hidden Layer Representation Bayes Theorem, Concept learning, Maximum likelihood and least-squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length	[8]

		principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes Classifier, Bayesian belief network, The EM algorithm	
	Assignment Topics	To be provided by the concern faculty members.	
Module 3: Instance based learning	in class	*k*-Nearest neighbour learning, Distance weighted nearest neighbour algorithm, Locally Weighted Regression, Radial Basis Function, Case based reasoning, Lazy vs Eager Learning.	[6]
	Assignment Topics	To be provided by the concern faculty members.	
Module 4: Genetic Algorithm & Learning sets of rules	in class	Basic Concepts and the algorithm, Genetic operators, Fitness function and selection, Hypothesis space search, Lamarckian Evolution, Baldwin Effect. Sequential covering algorithms, Learn one rule algorithm, Evaluation functions of learn one rule algorithm, Learning first order rules, learning sets of first-order rules: FOIL, Guiding the Search in FOIL, PROGOL,	[10]
	Assignment Topics	To be provided by the concern faculty members.	
Module 5: Analytical Learning	in class	Basic concepts, Inductive and Analytical Learning Problems, Learning with perfect domain theories: PROLOG-EB, Properties of explanation-based learning, Explanation-based learning of search control knowledge.	[8]
	Assignment Topics	To be provided by the concern faculty members.	

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Publishers
2. Ethem Alpaydın, Introduction to Machine Learning, The MIT Press Cambridge, Massachusetts, London, England

Reference Books:

1. Ian H. Witten, Eibe Frank, Data Mining Practical Machine Learning Tools and Techniques with Java Implementations, Morgan Kaufmann Publishers.
2. Sunila Gollapudi, Practical Machine Learning, Packt publication.
3. Richard O. Duda, Peter E. Hart, Pattern Recognition and Scene Analysis, Wiley.
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning series), MIT Press.