MANGALORE UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

CSS 456: MACHINE LEARNING

Hours/Week: 4 **Credits : 4**		**I.A. Marks: 30** **Exam. Marks: 70**

Course Outcomes:

CO1: Gain knowledge about basic concepts of Machine Learning
CO2: Identify machine learning techniques suitable for a given problem
CO3: Solve the problems using various machine learning techniques
CO4: Apply Dimensionality reduction techniques.
CO5: Design application using machine learning techniques.

	UNIT-I	**12 Hrs.**

INTRODUCTION - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias. Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

	UNIT-II	12 Hrs.

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning - Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

	UNIT-III	12 Hrs.

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

	UNIT-IV	12 Hrs.

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators, Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming.

REFERENCE BOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Science,1997
2. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Taylor & Francis (CRC), 2nd Edition
3. William W Hsieh, Machine Learning Methods in the Environmental Sciences, Neural Networks, Cambridge Univ Press, 2009
4. Richard O. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.2nd edition, 2001
5. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
6. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, 2012