COURSECONTENT

MACHINE LEARNING

II Semester: CSE

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
2425805	Foundation	3	0	0	3	40	60	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				TotalClasses:45		

Prerequisites: A course on "Data Structures", "Probability and Statistics" and "Artificial Intelligence".

Course Overview:

The course focuses on understanding how data is collected, processed, analyzed, and used to build intelligent predictive models. Students will gain hands-on experience with Machine Learning techniques including supervised learning, unsupervised learning, classification, regression, clustering, and model evaluation.

Course Objectives:

1. To understand the fundamental concepts, techniques, and applications of machine learning in intelligent systems.
2. To study supervised, unsupervised, and reinforcement learning methods for solving real-world problems.
3. To learn various machine learning models including decision trees, neural networks, Bayesian learning, and instance-based learning techniques.
4. To analyze computational learning theory, hypothesis evaluation, and optimization methods used in machine learning.
5. To develop the ability to design, implement, and evaluate machine learning algorithms for data-driven applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Analyze supervised and unsupervised learning paradigms, and apply concept learning and decision tree algorithms to design intelligent learning systems.
2. Compare supervised and unsupervised learning and develop intelligent systems using concept learning and decision trees
3. Apply Bayesian learning methods and computational learning theory principles to design and evaluate probabilistic classifiers for text and other data domains.
4. Make use of genetic algorithms, rule-learning systems, and reinforcement learning models to optimize search, decision-making, and learning tasks in complex problem domains.
5. Integrate analytical and inductive learning approaches to develop intelligent systems that leverage prior knowledge for hypothesis formation and search optimization.

UNIT I: Introduction:

Well-Posed Learning Problems, Designing a Learning System, Perspectives and Issues in Machine Learning, Supervised versus Unsupervised Learning. Concept Learning and the general to specific ordering – Introduction to Concept Learning task, Concept Learning as **Search, FIND-S:** finding a Maximally Specific Hypothesis, Version Spaces and Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.

Decision Tree Learning – Introduction, Decision Tree representation, the Basic Decision Tree Learning algorithm, Hypothesis space search in Decision Tree learning, Inductive bias in Decision Tree learning, Issues in Decision Tree learning.

UNIT - II: 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-III: 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, Gibbs Algorithm, Naïve Bayes Classifier, Learning to Classify Text Example, Bayesian Belief Networks.

Computational learning theory – Introduction, Probably Learning an Approximately Correct (PAC) Hypothesis, The Mistake Bound Model of Learning.

Instance-Based Learning- Introduction, k-Nearest Neighbor (KNN) algorithm, Locally Weighted Regression, Radial Basis Functions, remarks on lazy and eager learning.

UNIT - IV: **Genetic Algorithms**

Motivation, Genetic algorithms, an Illustrative Example, Hypothesis Space Search, Genetic Programming.

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule sets:

Learning First-Order rules, Learning Sets of First-Order rules: FOIL, Induction as Inverted Deduction, Inverting Resolution.

Reinforcement Learning – Introduction, the Learning Task, Q–learning.

UNIT - V: Analytical Learning-

Analytical Learning- Introduction, Learning with Perfect Domain Theories: PROLOG-EBG, Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

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.

TEXTBOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH

REFERENCEBOOKS:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

ELECTRONICRESOURCES:

1. https://www.coursera.org/specializations/machine-learning-introduction
2. https://www.shiksha.com/online-courses/machine-learning-courses-certification-training-st553
3. https://www.coursera.org/learn/machine-learning
4. https://developers.google.com/machine-learning/crash-course

MATERIALSONLINE:

1. Coursetemplate
2. Tutorialquestionbank
3. TechtalkandConceptVideotopics
4. Open-end experiment
5. Definitionsandterminology
6. Assignments
7. Modelquestionpaper–I
8. Modelquestionpaper–I
9. Lecturenotes
10. E-LearningReadinessVideos (ELRV)