COURSE CONTENT

MACHINE LEARNING

V Semester: CSD/CSM
VI Semester : CSE

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24X0515	Core	3	0	0	3	40	60	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

Prerequisites: Discrete Mathematics, Data Structures

Course Overview:

Machine learning is a subset of AI, which uses algorithms that learn from data to make predictions. These predictions can be generated through supervised learning, where algorithms learn patterns from existing data, or unsupervised learning, where they discover general patterns in data.

Course Objectives:

1. To introduce the fundamental concepts, types, and issues of machine learning, along with the theoretical foundations of supervised and unsupervised learning.
2. To develop the ability to design and implement learning systems using models such as perceptrons, multilayer neural networks, decision trees, and support vector machines.
3. To explore advanced machine learning techniques including ensemble methods, radial basis functions, and dimensionality reduction approaches.
4. To provide insights into evolutionary and probabilistic learning models such as genetic algorithms, Bayesian networks, and hidden Markov models.
5. To enable students to apply reinforcement learning and modern optimization strategies for solving real-world machine learning problems effectively.

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

1. Distinguish between, supervised, unsupervised and semi-supervised learning
2. Describe the relationship between the brain, neuron models, and learning systems, highlighting their computational perspectives.
3. Formulate concept learning tasks and apply hypothesis search techniques such as maximally specific hypothesis and version spaces.
4. Implement linear models including linear discriminants, perceptron learning, and linear regression for classification and prediction.
5. Evaluate issues and perspectives in machine learning system design by considering challenges such as linear separability and algorithm limitations.

Module – I **[10]**

Learning: Types of Machine Learning, Supervised Learning, The Brain and the Neuron, design a Learning System – Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search – Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability, Linear Regression, Logistic Regression.

Module – II **[10]**

Multi-layer Perceptron, Going Forwards, Going Backwards: Back Propagation Error, Multi-layer Perceptron in Practice Examples of using the MLP, Overview , Deriving Back-Propagation, Radial Basis Functions and Splines, Concepts, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machines

Module – III **[8]**

Learning with Trees, Decision Trees, Constructing Decision Trees, Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Basic Statistics, Gaussian Mixture Models, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms Evaluation Metrics in Machine Learning: Confusion Matrix, Accuracy, Precision, Recall, F1 score.

Module – IV **[10]**

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Least Squares Optimization Evolutionary Learning: Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms

Module – V **[10]**

Reinforcement Learning: Overview – Getting Lost Example, Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Methods

TEXT BOOKS:

1. Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series.

REFERENCE BOOKS:

1. Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
3. Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals , First Edition, Wiley, 2014
4. Ethem Alpaydin, —Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014

ELECTRONIC RESOURCES:

1. https://www.coursera.org/specializations/machine-learning
2. https://www.amazon.science/tag/machine-learning-university-mlu
3. https://onlinecourses.nptel.ac.in/noc21_cs70/preview
4. https://onlinecourses.nptel.ac.in/noc25_ee181/preview

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Definitions and terminology
5. Lab Manual
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos