MACHINE LEARNING

[Revised Credit System]

(Effective from the academic year 2021 onwards)

SEMESTER- VII

Number of Lecture Hours/Week	**03**	**Exam Marks**	**50**
Total Number of Lecture Hours	**36**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to

- To introduce the generic principle of learning.
- To introduce the basic principles, techniques, and applications of Machine Learning.
- To have basic proficiency in Python to write basic to intermediate programs for Machine Learning algorithm

Module -1	**Teaching Hours**
INTRODUCTION: Basic concepts of machine learning, some day to day examples of machine learning	**1 Hour**
MATHEMATICAL PRELIMINARIES: Review of Linear Algebra, Probability Theory Review, Overview of Convex Optimization, Hidden Markov Models, Multivariate Gaussian Distribution, Gaussian Processes	**4 Hours**
SUPERVISED LEANING: Supervised learning setup, LMS, Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting. Evaluating and debugging learning algorithms	**12 Hours**
LEARNING THEORY: Bias/variance tradeoff, Union and Chernoff and Hoeffding bounds, VC dimension, Worst case (online) learning, Practical advice on how to use learning algorithms	**4 Hours**
UNSUPERVISED LEARNING: Clustering, K-means, EM, Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), ICA (Independent components analysis).	**8 Hours**
REINFORCEMENT LEARNING: Markov Decision Processes (MDPs), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR), LQG, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs	**7 Hours**

Course outcomes:

After studying this course, students will be able to:

1. Have acquired a broad understanding of machine learning algorithms and their use in data-driven knowledge discovery.
2. Identify, formulate and solve machine learning problems that arise in practical applications.
3. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies
4. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniquestest
5. Implement several machine learning algorithms in Python

Reference Books:

1. Kevin P Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.
2. MehryarMohri, AfshinRostamizadeh, and AmeetTalwalkar, *Foundations of Machine Learning*, MIT Press, 2012.
3. Daphne Koller and Nir Friedman, *Probabilistic Graphical Models: Principles and Techniques*, MIT Press, 2009.
4. Christopher M.Bishop, *Pattern Recognition and Machine Learning*, (2e), Springer, 2013.