AMITY SCHOOL OF ENGINEERING & TECHNOLOGY

Machine Learning

Total teaching weeks: 14 **Semester – VIII**

Total Lectures: 40 **Credit – 3**

	TOPICS TO BE COVERED	LECTURE
1	**UNIT I** Definition of learning system, Goal and applications of Machine learning	2
2	Aspects of developing a learning system: training data, concept representation, function approximation.	2
3	Supervised learning, unsupervised learning, overview of classification.	2
4	Setup, training, test, validation test, over fitting, classification families	2
5	Linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor	2
6	**UNIT II** Logistic regression, perceptron, Exponential family	2
7	Generative learning algorithms, Gaussian discriminant analysis, Naïve Bayes,	3
8	Support vector machine: optimal hyper planes, kernels, Model selection and feature selection	2
9	Combining classifier: Bagging, boosting (The Ada Boost algorithm), Evaluating and debugging learning algorithms. Classification errors	3
	End of 1st Term	
10	**UNIT III** Clustering K means, EM Algorithm, Mixture of Gaussians	3
11	Factor Analysis, Principal Component Analysis, Independent Component Analysis	3
12	Latent Semantic Indexing, Spectral clustering, Markov Model, Hidden Markov Model	4
13	**UNIT IV**	
14	Reinforcement Learning, MDP, Bellman equations, Value iteration and policy iteration,	4
15	Linear quadratic regularization (LQR), LQG Q-learning	3
16	Value function approximation, Policy search, Reinforce, POMDPs	3
17	**End of 2nd Term**	

Text Books:

[T1] TOM M Mitchell, "Machine Learning, McGraw Hill Education
[T2] Bishop, C (2006) Pattern Recognition and Machine Learning, Berlin Springer Verlag
[T3] Duda, Richard, Peter Hart, and David stock. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000, ISBN:9780471056690.
[T4] Tom M.Mitchell, Machine Learning. ISBN-9781259096952, McGraw Hill series, Edition First.

Reference Books:

[R1] Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY:Oxford, University Press, 1995.
[R2] Introduction to Machine Learning – Ethem Alpaydin, MIT Press, PHI.

MACHINE LEARNING

Paper Code: ETCS-402	**L**	**T/P**	**C**
Paper: Machine Learning	**3**	**0**	**3**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the students about the knowledge of basic concepts of machine learning systems, types of learning etc.

UNIT-I

Introduction:

Basic concepts: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

Types of Learning: Supervised learning and unsupervised learning. Overview of classification: setup, training, test, validation dataset, over fitting.

Classification Families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor.

[T1, T2][No. of Hrs: 12]

UNIT-II

Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines: Optimal hyper plane, Kernels. Model selection and feature selection. Combining classifiers: Bagging, boosting (The Ada boost algorithm), Evaluating and debugging learning algorithms, Classification errors.

[T1, T2][No. of Hrs: 11]

UNIT-III

Unsupervised learning: Clustering. K-means. EM Algorithm. Mixture of Gaussians. Factor analysis. PCA (Principal components analysis), ICA (Independent components analysis), latent semantic indexing. Spectral clustering, Markov models Hidden Markov models (HMMs).

[T1, T2][No. of Hrs: 11]

UNIT-IV

Reinforcement Learning and Control: MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG. Q-learning. Value function approximation, Policy search. Reinforce. POMDPs.

[T1, T2][No. of Hrs: 10]

Text Books:

[T1] Tom M Mitchell, Machine Learning, McGraw Hill Education

[T2] Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

[T3] Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.

[T4] Tom M. Mitchell, Machine Learning .ISBN – 9781259096952, McGraw-Hill Series, Edition – First

Reference Books:

[R1] Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.

[R2] Introduction to Machine Learning - Ethem Alpaydin, MIT Press, Prentice hall of India.