INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT. / CENTRE**:** **Computer Science and Engineering**

1. Subject Code**: CSN-382**   Course Title**: Machine Learning**

2. Contact Hours: **L: 3**   **T: 1**   **P: 1**

3. Examination Duration (Hrs.):   **Theory:3**   **Practical:0**

4. Relative Weightage**: CWS:25   PRS:0   MTE:25   ETE:50   PRE:0**

5. Credits**:4**   6. Semester **Spring**   7. Pre-requisite**: Nil**

8. Subject Area**: DEC**

9. Objective: To provide an understanding of the theoretical concepts of machine learning and a working knowledge of state-of-art techniques used in this area.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Introduction to Machine Learning, supervised learning, learning multiple classes, regression, model selection and generalization, Bayesian decision theory, losses and risks, discriminant functions, utility theory, association rules.	4
2.	Data Pre-processing and understanding, parametric methods, maximum likelihood estimation, bias and variance, multivariate data, parameter estimation, estimating missing values, multivariate normal distribution, multivariate classification and regression, dimensionality reduction, subset selection, PCA, LDA, Isomaps, LLE .	6
3.	Clustering, mixture densities, K-means algorithm, EM-algorithm, hierarchical clustering, choosing number of clusters. Non-parametric methods, non-parametric density estimation, non-parametric classification and regression.	6
4.	Classification Techniques, decision trees, pruning, rule extraction from trees, learning rules from data, Linear discrimination, two classes, multiple classes, pairwise separation. Perceptrons, multilayer perceptrons, backpropagation algorithm, training procedures and network tuning. Competitive learning, Radial basis functions, Incorporating rule based knowledge, Kernel machines, hyperplanes, SVM, kernel trick, kernel machines for regression, kernel dimensionality reduction.	8
5.	Bayesian Estimation, estimating parameter of Distributions and Functions. Graphical models, conditional independence, d-separation, belief propagation, Markov random fields, learning the structure of a graphical model, influence diagrams.	6

6.	Hidden Markov Models, discrete markov processes, HMM, three problems of HMM, evaluation problem, finding state sequence, learning model parameters, HMM with input.	**6**
7.	Reinforcement learning, single state case, elements of reinforcement learning, model based learning, temporal difference learning, generalization, partially observable states. Combining multiple learners, model combinations schemes, voting, error-correcting output codes, bagging, boosting, cascading.	**6**
	Total	**42**

11. Suggested Books:

Sl. No.	Name of Books / Authors	Year of Publication
1.	Ethem Alpaydin " Introduction to Machine Learning" Seond Edition, PHI Learning	2012
2.	Christopher M. Bishop " Pattern Recognition and Machine Learning", Springer	2013
3.	Trevor Hastie R. Tibshirani, J. Friedman "The Elements of Statistical Learning" Second Edition, Springer	2008