MACHINE LEARNING

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSC03	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Machine learning is all about automatically learning a highly accurate predictive or classifier model, or finding unknown patterns in data, by leveraging learning algorithms and optimization techniques. Applications of machine learning includes image recognition, speech recognition, traffic prediction, product recommendations, email spam etc.

II. COURSE OBJECTIVES:

The students will try to learn:

1. Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2. Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. Explore Deep learning technique and various feature extraction strategies.

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to

CO 1	**Make use of** the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.	Understand
CO 2	**Summarize** decision trees, support vector machines in optimizing basic methods of regression	Understand
CO 3	**Sketch** the key issues and applications in clustering and dimensionality reduction.	Apply
CO 4	**Experiment** matrix factorization used to process reduction in unsupervised learning.	Apply
CO 5	**Develop** algorithms in optimizing statistical learning theory and methods in machine learning.	Apply

IV. SYLLABUS

MODULE-I: SUPERVISED LEARNING (REGRESSION/CLASSIFICATION) (10)

Basic methods: Distance-based methods, Nearest- Neighbors, Decision Trees, Naive Bayes, **Linear models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, **Beyond Binary Classification:** Multi-class/Structured Outputs, Ranking.

MODULE-II: UNSUPERVISED LEARNING (10)

Clustering: K-means/Kernel K-means, **Dimensionality Reduction:** PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models).

MODULE-III: MACHINE LEARNING (08)

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory,

Ensemble Methods (Boosting, Bagging, Random Forests).

MODULE-IV: MODELLING TECHNIQUES (09)
Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

MODULE-V: SCALABLE MACHINE LEARNING (08)
A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

V. TEXT BOOKS:

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer 2009 (freely available to online).

VI. REFERENCE BOOKS:

1. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.

VII. WEB REFERENCES:

1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

VIII E-TEXT BOOKS:

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. https://www.cs.bris.ac.uk/~flach/mlbook/.
3. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.