**Title of Course: Machine Learning**

**Course Code: 18B11CI843 L-T-P Scheme: 3-0-0 Course Credit: 3**

**Prerequisite:** Students must have knowledge of statistical techniques

**Objectives:** In this course we will study the basic component of an intelligence system i.e. machine learning, their functions, mechanisms, policies and techniques used in their implementation and examples.

**Learning Outcomes:**

The students will have

1. Detailed knowledge of the concepts of machine learning.

2. Hypotheses Generation

3. Classifications and Regression

4. Ensemble Learning Techniques

5. Unsupervised Learning Techniques

6. Various application of machine learning in AI and different fields.

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| **Course Outcome** | **Description** |
| CO1 | List various approaches of Machine Learning |
| CO2 | Describe machine learning algorithms to solve the real world problems |
| CO3 | Develop Hypothesis and machine learning models |
| CO4 | Identify appropriate models for solving machine learning problems. |
| CO5 | Apply learning techniques to solve real world machine learning problems |
| CO6 | Evaluate and interpret the results of the algorithms. |

**Course Details:**

1. Introduction: What Is Machine Learning?, Why Use Machine Learning? ,Types of Machine Learning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Hypothesis generation, Main Challenges of Machine Learning, Data sets and Testing and Validating.

2. Concept Learning: Introduction to Concept Learning, Concept Learning Task, Notation, Inductive Learning Hypotheses, Concept Learning as Search: Generic-to-Specific Ordering of Hypotheses, Finding a Maximally Specific Hypotheses, Version Spaces, Candidate-Elimination Algorithms.

3. Classification: MNIST Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label and Multi output classification

4. Training Models: Linear Regression, the Normal Equation, Computational Complexity, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Estimating Probabilities, Training and Cost Function, and Decision Boundaries

5. Support Vector Machines Linear SVM Classification, Soft Margin Classification, Nonlinear SVM Classification, Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, Decision Function and Predictions, and The Dual Problem

6. Decision Trees Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy, Regularization of hyper parameters, and Random Forests

7. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Choosing the Right Number of Dimensions

8. Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using clustering for image segmentation, Using Clustering for Pre-processing and for Semi-Supervised Learning

**Reference Books:**

1: Machine Learning, TOM M MITCHELL, TMH

2: Introduction to Machine Learning, 2nd Ed, Ethem Alpaydin, The MIT Press Cambridge, Massachusetts,London, England.

3. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Ed, Aurelien Geron, O’RIELLY