Course No	Title of the course	Course Structure	Pre-Requisite	No of Hours
BTBID08	**Machine Learning**	**3L-0T-2P**	**Data Structures, Programming,**	

COURSE OUTCOMES (CO)

1. To understand the characteristics of data-driven machine learning approach for solving problems
2. To develop and refine different ML models for specific applications, implement and evaluate them and finally apply them for the given task.
3. To conduct team projects and/or exploratory work in different domains, with emphasis on ethical means of acquiring and processing data

UNIT I - Introduction: Definition of learning systems, Importance of Data in ML, Workflow of ML, Types of learning models - supervised, unsupervised and reinforcement learning models, Regression and Classification tasks, Challenges in ML: Avoiding over-learning, Applications of ML	**3**
UNIT II: Regression and Classification models:- Regression - Linear Regression – introduction, types of LR, and model assumptions, Linear Regression gradient descent learning, Model Estimation, Performance metrics - R-Square and adjusted R-Square, L1 and L2 Regularization. Classification - Logistic Regression – log-odds, odds ratio, Logit function, Performance metrics for classification - Cross-entropy, Confusion matrix – Recall, Precision, Accuracy, F1 measure, specificity, ROC-AUC curves.	**4** **3**
UNIT III - Supervised, Unsupervised and Ensemble learning models: Supervised - Decision trees – Entropy, Information gain, ID3 algorithm for DTs, Regularization – pruning and stopping DT growth methods, Gini Index for CART algorithms, Unsupervised: K-means clustering, Principal Component Analysis Ensemble Learning – Bias and variance error. Bagging, Random Forest, Adaboost	**6** **3** **3**
UNIT IV – Bayesian Classification – A Generative Model and Support Vector Machines – A Discriminative Model Generative and Discriminative ML models - comparison Generative - Bayesian Classification, Naïve-Bayes Classifier, Bayesian Networks. Discriminative – Support Vector Machines Curse of dimensionality, complexity analysis	**4** **3** **3**
UNIT V - Neural Learning and advanced architectures: Neural Learning - Artificial Neural Network versus Biological Neural networks - Perceptron, Multi-Layer Feed Forward Neural Network, Back Propagation. Deep Neural Networks – Convolutional Neural Networks, RNN, LSTM, recent advances	**4** **3**
PRACTICALS, PROJECT / PRESENTATIONs **1. Make a project Statement in any domain and collect its dataset** **2. Implement Linear regression in Python** **3. Implement Linear Regression using Library functions** **4. Implement Decision Tree and Ensemble using Bagging and Random Forest**	**3**

5. Implement Bayesian classification ML model and apply on a given dataset 6. Work in pairs to prepare presentations of exploratory work on specific topics such as KNN, Q-Learning, PCM, HMM, CRF, LSA.	
SUGGESTED READINGS **Books:** 1. Richard Duda, Peter Hart and David Stork, Pattern Classification, 2nd ed. John Wiley & Sons, 2001. 2. Tom Mitchell, Machine Learning. McGraw-Hill, 1997. **Websites for Tutorials:** 1. Datasciencemastery.com 2. Towardsdatascience.com 3. Analyticsvidya.com	
Tests 1. Short Test 1: Units 1 and 2 – Viva 2. Long Test 1: Units 1,2,3 – Long Viva 3. Practical Demos 1 4. Short Test 2: Unit 4 – Viva 5. Practical demos-2 6. Short test 3: Unit 5 – Viva 7. Long Test 2: All Units 1-5	8