**ML Syllabus**

**Introduction to Machine Learning**

* Fundamentals of ML
* Feature Engineering
* Learning Paradigms
* Generalization of Hypothesis, VC Dimension, PAC Learning
* Applications of ML

**Data Handling and Artificial Neural Networks (ANN)**

* Feature Selection Mechanisms
* Imbalanced Data Handling
* Outlier Detection
* Artificial Neural Networks (including Backpropagation)
* ANN Applications

**Regression**

* Multi-variable Regression
* Model Evaluation
* Least Squares Regression
* Regularization (including LASSO)
* Applications of Regression

**Classification**

* K-Nearest Neighbors (KNN)
* Naïve Bayes
* Support Vector Machines (SVM)
* Decision Trees
* Training and Testing Classifier Models
* Cross-Validation
* Model Evaluation Metrics (Precision, Recall, F1-Score, Accuracy, AUC)
* Statistical Decision Theory (Discriminant Functions, Decision Surfaces)

**Model Assessment and Inference**

* Model Assessment and Selection
* Ensemble Learning: Boosting, Bagging
* Model Inference and Averaging
* Bayesian Theory
* Expectation-Maximization (EM) Algorithm

**Hidden Markov Models**

* HMM with Forward-Backward and Viterbi Algorithms
* Sequence Classification using HMM
* Conditional Random Fields (CRFs)
* Applications of Sequence Classification (e.g., Part-of-Speech Tagging)

**Association Rules**

* Mining Association Rules in Large Databases
* Frequent Pattern Mining Concepts
* Efficient and Scalable Frequent Item Set Mining
* Apriori Algorithm
* FP-Growth Algorithm

**Clustering**

* K-Means Clustering
* Hierarchical Clustering (Single, Complete, Average Linkage)
* Ward’s Algorithm
* Minimum Spanning Tree Clustering
* BIRCH Clustering