SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech III (Semester VI)

Subject Name: Applied Machine Learning **Subject Code:** BTAI13603
Type of course: Professional Core course
Prerequisite (if any): Probability and Statistics

Rationale: Machine Learning is the field of study that gives computers the capability to learn, it makes computer more similar to humans: The ability to learn. Machine learning is actively being used today, perhaps in many more places than one would expect. Studying machine learning opens world of opportunities to develop cutting edge machine learning applications in various verticals – such as cyber security, image recognition, medicine, or face recognition

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments / projects / open book tests / closed book tests) CA2: Sincerity in attending classes / class tests / timely submissions of assignments / self-learning attitude / solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work / Quality of work submitted / Active participation in lab sessions / viva on practical skills learned in course.

Contents:

Sr. No.	Contents	Total Hours.
1	**Fundamentals of Machine Learning:** Introduction to Machine Learning, Forms of Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Semi-supervised learning, Example applications	03
2	**Feature Selection and Extraction:** Feature Selection, Feature Selection Methods, Feature Extraction, Dimensionality Reduction, Principal Component Analysis, Linear Discriminant Analysis, Single Value Decomposition	05
3	**Supervised learning-Regression Methods:** Introduction to Regression, Linear Regression, Multiple Linear Regression, Polynomial Regression, Regularization: Ridge and Lasso and Regression, Performance measures: Metrics for Assessing Regression Accuracy: Mean squared error, mean absolute error	05
4	**Supervised Learning-Classification:** Bayesian Learning- Probability and Bayes' theorem, Maximum Likelihood Estimation, Logistic regression, Decision Trees, Naive Bayes Classification, K-Nearest Neighbor, Ensemble Learning: Bagging, Random Forest, Boosting; Kernel Methods for non-linear data, Support Vector Machines, Decision Trees, Ensemble	12

	Learning: Bagging, Random Forest, Boosting; Metrics for Assessing classification: Misclassification error, confusion matrix, ROC curves	
5	**Unsupervised Learning:** Clustering: Major Clustering Approaches, K-means clustering, Hierarchical Clustering:, Cluster Quality Metrics, Applications of Unsupervised learning	**05**
6	**Reinforcement Learning :** Introduction to reinforcement learning, Elements of Reinforcement Learning, Basics of Dynamic Programming: Finding Optimal Policies, Value Iteration, Policy Iteration, Temporal difference learning, Q-Learning	**05**
7	**Artificial Neural Networks and Deep Learning:** Overview of Artificial Neural Networks, Perceptron, Multilayer Perceptions, Activation Functions, Introduction to Deep Learning, Convolutional Neural Network and Recurrent neural network	**06**
8	**Applications of Machine Learning:** Predictive analytics and intelligent decision-making, Cybersecurity and threat intelligence, Natural Language Processing and sentiment analysis, Image, speech and pattern recognition, E-commerce and product recommendations	**04**

Suggested Specification table with Marks (Theory): (For B.Tech. only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	25	15	5	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

Sr. No.	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**
1.	Applied Machine Learning	Madan Gopal	McGraw Hill Education
2	Machine Learning	Tom Mitchell	McGraw- Hill
3	Introduction to Machine Learning	Ethem Alpaydin	PHI Learning
4	Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork	Wiley
5	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer

Note: Students should refer to the latest editions of books

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe machine learning types and various feature selection extraction methods	15%
CO-2	Describe regression and classification supervised learning methods and metrics for performance assessment	40%
CO-3	Apply unsupervised methods for data clustering	15%
CO-4	Discuss learning models by reinforcement learning and deep learning techniques	20%
CO-5	Demonstrate usage of various machine learning techniques for solving some real world problems	10%

List of Open learning website:

- https://nptel.ac.in/courses/106/106/106106139/
- https://nptel.ac.in/courses/106/105/106105152/
- https://www.coursera.org/learn/machine-learning

List of Open Source Software:

- Python
- WEKA- Waikato Environment for Knowledge Analysis
- Orange

List of Experiments:

Sr. No.	Practical Statements
1.	Implement Linear Regression for the given dataset
2.	Implement Logistic Regression for any one application
3.	Implement PCA on the sample dataset.
4.	Implement k-means clustering on a sample unlabeled dataset.
5.	Implement Decision Tree (without using inbuilt libraries)

6. Implement K-Nearest Neighbor algorithm (without using inbuilt libraries).
7. Implement SVM algorithm for classification of the sample dataset
8. Design a basic feed-forward neural network and evaluate the error.
9. Implement any recommendation application.