SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech III (Semester VI)

Subject Name: Machine Learning Techniques **Subject code:** BTIT14607
Type of course: Professional Elective Course
Prerequisite (if any): Design and Analysis of Algorithms, Artificial Intelligence and Applications

Rationale: Machine Learning is a branch of Artificial Intelligence that allows computers to learn and improve automatically with experience. Machine learning can be used to solve real world problems that require classification, prediction and pattern recognition. This is an introductory course that covers important aspects of machine learning including problem representation, hypothesis evaluation, model selection and training using well-known machine learning techniques.

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 Hrs
1.	**Introduction**: Well-posed learning problems, Designing a learning system – selection of training data, choosing and representing the target function; Issues in machine learning; understanding supervised and un-supervised learning; Applications of machine learning	**10**
2.	**Concept Learning**: Learning generalized concepts from specific training examples, Inductive learning hypothesis, Find-S – finding a maximally specific hypothesis, Candidate-Elimination algorithm	**05**
3.	**Decision Tree Learning:** Decision Tree Representation, Appropriate problems for Decision Tree Learning, Algorithms for generating Decision trees – ID3, C4.5, Issues in Decision Tree Learning – Avoiding overfitting, incorporating continuous-valued attributes, handling missing values.	**08**
4.	**Bayesian Learning:** Probability and Bayes' theorem, Bayesian classification, Bayesian Belief Networks, Expectation Maximization algorithm	**05**
5.	**Artificial Neural Networks:** Perceptrons, activation function, multilayer network, network topology, Backpropagation algorithm	**04**

6.	**Support Vector Machines:** Linear discriminant, separating hyperplane, Maximum Margin Hyperplane, Support Vectors, Dual Optimization Problem.	**05**
7.	**Instance based Learning:** k-nearest neighbour learning, Distance-weighted nearest neighbour algorithm, lazy and eager learning	**04**
8.	**Reinforcement Learning:** Introduction to Reinforcement learning, value iteration, policy evaluation, temporal difference learning, Q learning	**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	20	10	5	5	5

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

Reference Books:

Sr No.	Title of book /article	Author(s)	Publisher and details like ISBN
1.	Machine Learning	Tom M. Mitchell	McGraw Hill
2.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press
3.	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer

Note: Students should refer to the latest editions of books

Course Outcomes (CO):

Sr. No.	CO statements	Marks % weightage
CO-1	Formulate well-posed learning problems	10%
CO-2	Describe various issues in machine learning	20%
CO-3	Explain machine learning methods useful for generating models from data	40%
CO-4	Select and apply suitable machine learning algorithms and tools to solve real world problems.	30%

List of Open learning websites:

- NPTEL course on: Introduction to Machine Learning (https://nptel.ac.in/courses/106106139)
- UCI Machine Learning Repository at https://archive.ics.uci.edu/ml/index.php
- WEKA machine learning toolkit https://waikato.github.io/weka-wiki/

List of Experiments:

1) Prepare a detailed note the following machine learning applications
    a. Self driving cars
    b. Dynamic pricing
    c. Google translate
2) Write a program to substitute missing values in the training dataset
3) Generate Decision Tree for given dataset (Use ID3 algorithm). Also generate a Rule Set from the tree and use it to evaluate the accuracy of the model. (eg. Buys_Computer dataset)
4) Generate a naïve Bayesian classifier for the given dataset. (eg. Car Evaluation dataset). Report the overall and class-wise accuracy on the basis of confusion matrix.
5) Design an ANN classifier for the given dataset. Clearly specify the topology of the network and values of parameters (epochs, learning rate). (eg. Iris Dataset)
6) Generate an SVM classifier for the given dataset
7) Simulate a k-NN classifier on the given dataset