GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171617
Subject Name: Applied Machine Learning
Semester – VII

Type of course: Elective

Prerequisite: Familiarity with programming in Python, Linear Algebra, Probability and Statistics.

Rationale: The objective of the course is to introduce the students with concepts of machine learning, machine learning algorithms and building the applications using machine leaning for various domains.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Machine Learning:** Overview of Human Learning and Machine Learning, Types of Learning, Applications of Machine Learning, Tools and Technology for Machine Learning.	02
2	**Overview of Probability:** Statistical tools in Machine Learning, Concepts of probability, Random variables, Discrete distributions, Continuous distributions, Multiple random variables, Central limit theorem, Sampling distributions, Hypothesis space and inductive bias, Evaluation and Cross Validation, Hypothesis testing, Monte Carlo Approximation	05
3	**Bayesian Concept Learning:** Impotence of Bayesian methods, Bayesian theorem, Bayes' theorem and concept learning, Bayesian Belief Network	04
4	**Classification and Regression:** Supervised Learning vs Unsupervised Learning, Supervised Learning, Classification Model, Learning steps, Classification algorithms, Clustering, Association rules, Linear Regression, Multivariate Regression, Logistic Regression	13
5	**Neural Networks**-Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation	06
6	**Foundations of neural networks and deep learning, Techniques to improve neural networks:** Regularization and optimizations, hyperparameter tuning and deep learning frameworks (Tensorflow and Keras.), Convolutional Neural Networks, its applications, Recurrent Neural Networks and its applications	07
7	Generative Adversarial Networks, Deep Reinforcement Learning, Adversarial Attacks	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	12	20	14	10	7

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1) Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2) Pattern Recognition and Machine Learning, by Christopher Bishop
3) The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
4) Machine Learning with Python for Everyone, Mark E. Fenner, Pearson
5) Deep Learning: Methods and Applications, Li Deng and Dong Yu
6) Neural Networks and Deep Learning, Michael Nielsen
7) Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
8) Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
9) Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing
10) Machine Learning, Mitchell T, McGraw-Hill, 1997
11) A first course in Machine Learning, S. Rogers and M. Girolami, CRC Press, 2011
12) Pattern Classification, Duda, Hart and Stork, Wiley-Interscience.

Course Outcome:
After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity	15
CO-2	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms	15
CO-3	Evaluate the various Supervised and Unsupervised Learning algorithms using appropriate Dataset.	25
CO-4	Design and evaluate Deep learning Algorithms	25
CO-5	Design and implement various machine learning algorithms in a range of real-world applications.	20

List of Experiments:
Minimum 10 Experiments are to be designed covering various activities and algorithms in machine learning with datasets from different domains

List of Open Source Software/learning website:

1. Andrew Ng,"Machine Learning",Stanford University https://www.coursera.org/learn/machine-learning/home/info
2. Sudeshna Sarkar, "Introduction to Machine Learning", IIT Kharagpur. https://nptel.ac.in/courses/106105152/1
3. Prof. BalaramanRavindran,"Introduction to Machine Learning", IIT Madras. https://nptel.ac.in/courses/106106139/1
4. https://www.geeksforgeeks.org/machine-learning/
5. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
6. http://neuralnetworksanddeeplearning.com/