GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Electronics & Communication Engineering

Course / Subject Code: ME01004051

Course / Subject Name: Applied Machine Learning

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite :	Familiarity with programming in Python, Basics of Probability and Statistical Theory, and Optimization Concepts.
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)	
4	0	2	5	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 Machine Learning, Applications of Machine Learning, Tools and Technology for Machine Learning .	06
2	**Basic Machine Learning Algorithms :** Linear Regression, Decision Trees, Learning Decision Trees, K-nearest Neighbour, Collaborative Filtering, Overfitting, Feature Selection, Feature Extraction.	10
3	**Preparing to Model :** Machine Learning activities, Types of data in Machine Learning, Structures of data, Data quality and remediation, Data Pre-Processing: Dimensionality reduction, Feature subset selection.	10
4	**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.	10

5	**Bayesian Concept of Learning :** Bayesian Learning, Naïve Bayes, Bayesian Network, Exercise on Naïve Bayes.	04
6	**Logistic Regression and Support Vector Machine :** Logistic Regression, Introduction to Support Vector Machine, The Dual Formation, Maximum Margin with Noise, Nonlinear SVM and Kernel Function, SVM: Solution to the Dual Problem.	06
7	**Introduction of Neural Network :** Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation.	10

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	40	10	10	10

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

Reference Books :

1. Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2. Machine Learning with Python for Everyone, Mark Fenner, Pearson
3. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
4. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
5. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing
6. Deep Learning: Methods and Applications, Li Deng and Dong Yu
7. Neural Networks and Deep Learning, Michael Nielsen
8. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)

List of Experiments (Programs can be written in Python or some other language) :

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

Course Outcomes :

Sr. No.	CO Statement	Marks % weightage
CO-1	Understand basic concepts of machine learning as well as challenges involved.	15
CO-2	Learn and implement various basic machine learning algorithms.	30
CO-3	Study dimensionality reduction concept and its role in machine learning techniques.	10
CO-4	Realize concepts of Deep learning Algorithms.	25
CO-5	Design and implement various machine learning algorithms in a range of real world applications.	20

List of e-Learning Resources :

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://nptel.ac.in/
4. https://www.coursera.org/
5. Andrew Ng,"Machine Learning",Stanford University
6. https://www.coursera.org/learn/machine-learning/home/info
7. 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
8. http://neuralnetworksanddeeplearning.com/

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