INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING)**
SEMESTER	**6**
COURSE TITLE	**MACHINE LEARNING**
COURSE CODE	**01CE0617**
COURSE CREDITS	**4**

Objective:

1 To learn and implement Machine Learning Supervised, Unsupervised algorithms, and Neural Network concepts

Course Outcomes: After completion of this course, student will be able to:

1 Understand machine-learning concepts
2 Understand and implement Classification concepts
3 Understand and analyse the different Regression algorithms
4 Apply the concept of Unsupervised Learning
5 Apply the concepts of Artificial Neural Networks

Pre-requisite of course: Computer Programming, Python and Mathematics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to ML** Motivation and Applications, Importance of Data Visualization, Basics of Supervised, Unsupervised, and Reinforcement Learning, Current research trends in ML.	4
2	**Supervised Learning:** Naive Bayes Classification, Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K- Nearest Neighbours, Decision tree, Random Forest, Ensemble Learning, Support Vector Machines, Evaluation metrics for Classification Techniques, Confusion Matrix, Accuracy, Precision, Recall, F1 Score, Threshold, AUC-ROC	12

DR. KRUNAL NARUMAL VAGHELA
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DR. RAJENDRASINH BAHADURSINH JADEJA
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Contents : Unit	Topics	Contact Hours
3	**Regression Techniques** Basic concepts and applications of Regression, Simple Linear Regression, Gradient Descent and Normal Equation Method, Multiple Linear Regression, Non-Linear Regression, Linear Regression with Regularization, Overfitting and Underfitting, Hyperparameter tuning, Evaluation Measures for Regression Techniques, MSE, RMSE, MAE, R2	12
4	**Unsupervised Learning** Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering, Partitional Clustering, K-means clustering, Association rule mining, Apriori Algorithm and FP tree algorithm, Evaluation metrics for Clustering, Silhouette Coefficient, Dunn's Index	10
5	**Neural Network** Artificial Neural Networks, Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, MLP, Back-propagation Neural Networks, Competitive Neural Networks, Introduction to Transformer Neural Network	7
Total Hours		**45**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Practical 1** Implement Naïve Bayes algorithm using sample data.	2
2	**Practical 2** Implement Random Forest and ensemble learning techniques.	2
3	**Practical 3** Using a dataset implement SVM classifier.	2
4	**Practical 4** Implement classification techniques evaluation parameters using sample dataset.	2
5	**Practical 5** Develop a cost function of linear regression using sample dataset.	2
6	**Practical 6** Develop a Gradient descent of linear regression using sample dataset.	2
7	**Practical 7** Implement a linear regression and multi linear regression algorithm with regularization using sample dataset.	2
8	**Practical 8** Perform hyper parameter tuning using sample dataset.	2
9	**Practical 9** Using sample data implement the evaluation parameters of regression techniques.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
10	**Practical 10** Implement k-means clustering using a dataset.	2
11	**Practical 11** Explore the association rule mining techniques using sample data.	2
12	**Practical 12** Implement ANN using sample data.	2
13	**Practical 13** Exploring activation function in ANN.	2
14	**Practical 14** Implementation of Transformer Neural Network model.	2
Total Hours		**28**

Textbook :

1 Introduction to Machine Learning , Ethem Alpaydin , The MIT Press , 2014

References:

1 Engineering optimization: Theory and Practice, Engineering optimization: Theory and Practice, S. S. Rao, New Age publication, 2019

2 Optimization for Engineering Design: Algorithms and Examples, Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI Learning Private Limited, 2012

3 Engineering optimization: Methods and Applications, Engineering optimization: Methods and Applications, A. Ravindran, K. Ragsdell and G. Reklaiti, John Wiley and Sons, 2006

4 Machine Learning an algorithmic perspective, Machine Learning an algorithmic perspective, Stephen Marsland, CRC Press, 2015

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking**
10.00	30.00	20.00	20.00	10.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

DR. KRUNAL NARUMAL VAGHELA
Digitally signed by (Name of HOD)

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Digitally signed by (Name of Dean/ Principal)

Instructional Method:

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 https://machinelearningmastery.com/

2 https://www.geeksforgeeks.org/machine-learning/

3 https://www.javatpoint.com/machine-learning

4 https://huggingface.co/