NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Technology**
Name of Programme:	**B.Tech. in Electronics & Communication Engineering**
Course Code:	4EC501ME25
Course Title:	**Machine Learning**
Course Type:	**Department Elective**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to

1	apply supervised techniques for classification and regression examples	(BL3)
2	employ unsupervised machine learning techniques for clustering	(BL3)
3	demonstrate the neural network for the given application	(BL4)
4	implement machine learning algorithms to solve real-world application problems.	(BL6)

Unit	Contents	Teaching hours (Total 45)
Unit I	**Introduction:** Motivation and applications, types of machine learning techniques, basics of supervised, unsupervised, semi-supervised and reinforcement learning, approaches of machine learning - classification, regression and clustering	**04**
Unit II	**Supervised Learning - Regression Techniques:** Basic concepts and applications of regression, simple linear & multiple regression, gradient descent, hyper-parameters tuning, evaluation measures for regression techniques	**09**
Unit III	**Supervised Learning - Classification Techniques:** Naïve bayes classification, Gaussian Naïve Bayes model, K-Nearest Neighbors (knn) algorithm, knn for classification and regression, different distance measures, decision trees, splitting criteria for decision trees, random forest classifier, bagging and boosting, support vector machines, kernels for SVM, evaluation measures for classification techniques	**12**
Unit IV	**Unsupervised Learning** - Clustering techniques: k-means clustering, evaluation metrics for clustering	**05**
Unit V	**Neural Networks:** Basics of neural networks, biological neurons and biological neural networks, perceptron learning, activation functions, multilayer perceptron, back-propagation neural networks, introduction to convolution neural network	**09**

Unit VI	**Applications and Case Studies:** Case studies on machine learning based on classification, regression and clustering, based on various domains and areas including signal processing, VLSI, IoT, defense, robotics, medical, healthcare, agriculture, vision-based applications, real-time processing, NLP, remote sensing, WSN	**06**

Self Study:
The self-study contents will be declared at the commencement of the semester. Around 10% of the question will be asked from self-study contents.

Tutorial Work: This shall consist of at least 10 tutorials based on the above syllabus.

Suggested Readings/ Reference:

1. Tom Mitchell, *Machine Learning*, Tata McGraw-Hill
2. C. Bishop, *Pattern Recognition and Machine Learning*, Springer
3. R. O. Duda, P. E. Hart and D. G. Stork, *Pattern Classification and Scene Analysis*, Wiley
4. Simon Rogers, Mark Girolami, *First Course in Machine Learning*, CRC Press
5. Athem Ealpaydin, *Introduction to Machine Learning*, Prentice Hall

Suggested List of Tutorials

Sr. No.	Name of Experiments/Exercises	Hours
1.	Getting started with Python	01
2.	To perform exploratory data analysis, including data visualisation, Summary statistics and identifying patterns	01
3.	To explore data preprocessing techniques such as handling missing values, encoding categorical variables and scaling features	01
4.	To implement Linear Regression and Multiple Linear Regression	01
5.	To perform classification using Naïve Bayes Classifier	01
6.	To implement k-means Clustering to group similar datapoints	01
7.	To implement k-nearest neighbor for classification, emphasising the impact of choosing an appropriate value for k	01
8.	To Implement Support Vector Machine (SVMs)	01
9.	To Implement Decision Trees and Random Forest Classifier	01
10.	Machine Learning Implementation using Virtual lab	01
11.	To Implement Neural Networks	01
12.	To Implement Convolutional Neural Networks using MATLAB and Python	01
13.	To perform image classification using CNN	01
14.	To explore transfer learning by fine-tuning a pre-trained neural network on a new dataset	01
15.	Apply machine learning concepts for implementation of solution to a real-life issue or problem	01