NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	BTech AI&ML
Course Code:	2CS101CC25
Course Title:	Machine Learning
Course Type:	Core
Year of Introduction:	2025-26

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Course Learning Outcomes (CLO):

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

1. explain the importance of data visualization and distinguish between supervised and unsupervised learning techniques (BL2)
2. utilise regression models and optimise them through regularization, and evaluate it (BL3)
3. compare the performance of classification and clustering algorithms in varied scenarios (BL4)
4. design artificial neural networks and apply advanced learning techniques. (BL6)

Unit	Contents	Teaching Hours (Total 30)
Unit-I	**Introduction to Machine Learning:** Motivation and Applications, importance of Data Visualisation, Basics of Supervised and Unsupervised Learning, Significance of Model Training	03
Unit-II	**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, Hyper-parameters tuning, Loss Functions, Evaluation Measures for Regression Techniques	10
Unit-III	**Classification Techniques:** Naïve Bayes Classification, Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K-Nearest Neighbours, Decision trees. **Support Vector Machines**: Hard Margin and Soft Margin, Kernels and Kernel Trick, Evaluation Measures for Classification Techniques	08
Unit-IV	**Artificial Neural Networks:** Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptrons, Back-propagation Neural Networks, Competitive Neural Networks	05
Unit-V	**Clustering:** Hierarchical Agglomerative Clustering, k-means Algorithm, Self-Organizing Maps	02
Unit- VI	**Advanced Concepts:** Basics of Semi-Supervised and Reinforcement Learning, Introduction to Deep Learning.	02

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

Suggested Readings/ References:

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. Kishan Mehrotra, Chilukuri Mohan, and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
5. Rajjan Shinghal, Pattern Recognition, Techniques and Applications, OXFORD
6. Athem Ealpaydin, Introduction to Machine Learning, Prentice Hall.

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Introduction to Python and Numpy	02
2	Introduction to Pandas, Matplotlib, and Sklearn	02
3	Simple and Multiple Linear Regression using Gradient Descent and normal Equation Methods (without using sklearn or equivalent library for both)	04
4	Linear Regression with Regularization (without using sklearn or equivalent library) and Simple and Multiple Linear Regression with and without regularization using Sklearn	04
5	Naïve-Bayes – Multivariate Bernoulli, Multinomial and Gaussian using sklearn	04
6	Decision Trees – ID3, C4.5 using sklearn	02
7	Support Vector Classification using sklearn	02
8	AND gate using Perceptron Learning without using libraries	04
9	Ex-OR Gate/any other problem using Backpropagation Neural Networks (self-implementation)	04
10	K-means clustering using sklearn.	02