NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	Master of Computer Application (2-Years Programme)
Course Code:	3MCA301
Course Title:	Machine Learning
Course Type:	Core
Year of Introduction:	2021-22

Credit Scheme

L	T	Practical Component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLO):

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

1. extend the statistical methods as a basis of machine learning domain
2. apply variety of learning algorithms for appropriate applications
3. implement machine learning techniques to solve problems in applicable domains
4. evaluate performance of a variety of learning algorithms to solve problems in applicable domains.

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**Introduction:** Motivation and Applications, the importance of Data Visualization, Basics of Supervised and Unsupervised Learning, Introduction to Machine Learning Libraries and tools	05
Unit-II	**Data Pre-processing:** Data Normalization methods, Resampling Techniques, and Feature Selection methods	04
Unit-III	**Regression Methods:** Basic concepts and applications of Regression, Simple Linear Regression – Gradient Descent and Normal Equation Method, Multiple Linear Regression, Non-Linear Regression, Logistic Regression, Hyper-parameters tuning, Loss Functions, Evaluation Measures for Regression Techniques. Applications of Regression Techniques	10
Unit-IV	**Classification Methods:** Naïve Bayes Classification, Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K-Nearest Neighbours, Decision trees. Random Forests, Support Vector Machines, Evaluation Measures for Classification Techniques, Application of Classification Methods	10
Unit-V	**Artificial Neural Networks:** Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptron, Back-propagation Neural Networks, Competitive Neural Networks	09
Unit-VI	**Clustering:** Hierarchical Clustering, K-means and K-medoids clustering, Self-Organizing Maps and evaluation of clustering results. Applications of Clustering Methods	04

Unit-VII	**Advanced Concepts:** Basics of Semi-Supervised and Reinforcement Learning, Linear Discriminant Analysis, Introduction to Deep Learning	03

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

Suggested Readings/ References:

1. Tom Mitchell, Machine Learning, TMH
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, PHI
7. George Argyrous, Statistics for Research, Sage Publications
8. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, Machine Learning, Pearson

Suggested List of Experiments:

Sr. No.	Title	Hours
1	To introduce with the Python language and Numpy library	02
2	To introduce with Pandas, Matplotlib and Sklearn library	04
3	To implement Simple and Multiple Linear Regression using Gradient Descent & Normal Equation Method (without using sklearn or equivalent library)	04
4	To implement Simple and Multiple Linear Regression with and without regularization using Sklearn	02
5	To implement K-NN classification algorithm	02
6	To implement Naïve-Bayes – Multivariate Bernoulli, Multinomial and Gaussian using sklearn	04
7	To implement Decision Trees – ID3, C4.5 using sklearn	04
8	To implement Support Vector Classification and Regression with Grid Search for Hyper-parameter tuning using sklearn	02
9	To implement K-means using sklearn	02
10	To implement AND gate using Perceptron Learning	04

Suggested Case List: -NA-