Course Code:	UCSC0502	L	T	P	Credit
Course Name:	Machine Learning	3			3

Course Prerequsites:

Discrete Mathematics, Mathematics for Computer Science, Probability and Statistics.

Course Description:

This course provides an introduction to machine learning and covers the key concepts, algorithms, and techniques used in the field. Topics include supervised and unsupervised learning, linear and logistic regression, decision trees, clustering, and neural networks. Emphasis is placed on both theoretical understanding and practical applications.

Course Outcomes: After the completion of the course the student should be able to –

CO1	Explain various concepts and terminology used in machine learning.
CO2	Explain the applications and limitations of different types of machine learning algorithms.
CO3	Analyze the different types of machine learning models.
CO4	Evaluate the performance of different machine learning algorithms.
CO5	Design custom machine learning algorithms to solve specific problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2								1			3	1	1
CO2	2	1							1			3	1	1
CO3		1							1			3	3	2
CO4		2			3				1			3	3	1
CO5	2	1	2	3	3				3	3	1	3	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1 Introduction to Machine Learning **7 Hours**

Introduction to machine learning – definition, terminology. Types of machine learning – supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning. Machine learning process. Performance metric in machine learning. Tools and frameworks. Data preprocessing (overview). Data visualization.

Unit 2 Regression **6 Hours**

Simple linear regression – hypothesis, cost function, parameter learning with gradient descent, learning rate, gradient descent for linear regression, examples. Simple linear regression in matrix form. Multivariate linear regression – multiple features, hypothesis functions. Gradient descent for multiple variables, feature scaling, polynomial regression.

Unit 3 Classification – Logistic Regression & Neural Network **7 Hours**

Logistic regression – definition, hypothesis representation, decision boundary, cost function, gradient descent for logistic regression. Multiclass classification. Regularization – overfitting & underfitting, cost function, regularized linear regression, regularized logistic Regression.

Neural networks – neuron representation and model, hypothesis for neuron, cost function, solution of a problem using single neuron, gradient descent for a neuron. Multiclass classification with neural network. Learning in neural networks – feedforward neural network, backpropagation algorithm. Loss function – support vector machines (SVMs), softmax regression.

Unit 4 Classification – Decision Trees and Naïve Bayes **8 Hours**

Decision trees – definition, terminology, the need, advantages, and limitations. Constructing and understanding decision trees. Common problems with decision trees. Decision tree algorithms – ID3, CART, random forest, examples. Naïve Bayes classifier. Instance-based classifier – K–Nearest Neighbour classifier.

Unit 5	Unsupervised Learning and Reinforcement Learning	7 Hours
Unsupervised learning: Introduction to clustering, K Means clustering, Hierarchical clustering, Association rule mining. Introduction to reinforcement learning – Q learning.		
Unit 6	**Applications of Machine Learning**	**4 Hours**
Introduction to machine learning libraries, applications in structured data, applications in unstructured data – Image, Text, Speech.		

Text Books:

1. Machine Learning with Python - an approach to applied ML, by Abhishek Vijayvargia, BPB publications
2. Practical Machine Learning by Sunila Gollapudi Packt Publishing Ltd
3. Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition

Reference Books:

1. Machine Learning for dummies John Paul Muller, Wiley Publication
2. Ethem Alpaydin - Introduction to Machine Learning, PHI 2nd Edition-2013
3. http://neuralnetworksanddeeplearning.com

Note:

- The syllabus is subject to minor changes depending on how the course proceeds.

- The inclusion of neural networks can be optional, depending on how the course progresses.