Programme	**Bachelor of Technology in Computer Science and Engineering**	Year of Regulation	**2019-20**
Department	**Computer Science and Engineering**	Semester	**VI**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
CS 372	**Introduction to Machine Learning**	**2**	**0**	**0**	**2**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	To understand the different learning models and its usage in computer vision and data analytics.		CO1	Able to identify potential applications of machine learning in practice
	To understand the different classification algorithms and its application in image understanding and data clustering		CO2	Able to Describe the differences in approaches and applicability of regression, classification, and clustering
	To understand forecasting and different learning theory applied for prediction of desired conclusion in data analytics.		CO3	Able to use forecasting and prediction models using different learning theory
	Apply different unsupervised learning and reinforcement learning models in application areas like image forgery, image classification, data clustering and decision making process		CO4	Able to select the suitable machine learning models for decision making process
	To understand the dimension reduction process and handling of big data using machine learning models		CO5	Able to apply the dimension reduction process, feature selection process and use of machine learning models for big data

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	3	0	1	0	0	0	0	2	0	0	0	3	0	3
2	CO2	3	3	0	1	0	0	0	0	2	0	0	0	2	0	2
3	CO3	2	3	3	1	2	0	0	0	0	0	0	0	2	3	2
4	CO4	2	2	3	0	2	2	3	0	2	0	0	1	2	3	2
5	CO5	2	2	3	0	2	2	3	0	2	0	0	1	3	3	3

SYLLABUS			
No.	Content	Hours	COs
I	Introduction, Machine learning basics, Supervised Learning: Artificial Neural Network, classifying with k-Nearest Neighbour classifier, Support vector machine classifier, Decision Tree classifier.	06	CO1
II	Forecasting and Learning Theory: Predicting numeric values: regression, Linear Regression, Logistic regression, Tree-based regression. Bias/variance trade-off, Union and Chernoff / Hoeffding bounds, Vapnik–Chervonenkis (VC) dimension, Worst case (online) learning.	08	CO2
III	Unsupervised Learning: Grouping unlabeled items using k-means clustering, Association analysis with the Apriori algorithm, efficiently finding frequent item sets with FP-growth.	05	CO1 CO3
IV	Reinforcement learning: Markov decision process (MDP), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation, Linear Quadratic Gaussian, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs.	06	CO2 CO3
V	Dimensionality reduction: Feature extraction - Principal component analysis, Singular value decomposition. Feature selection – feature ranking and subset selection, filter, wrapper and embedded methods. Machine Learning for Big data: Big Data and Map Reduce.	05	CO4 CO5
	Total Hours	30	

Essential Readings

1. Title: Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, 2019, O'Reilly Media, Inc.
2. Title: Introduction to Machine Learning, Author E. Alpaydin, Publisher: MIT Press, 2nd Edition, 2009.
3. Title: Machine Learning, Author: T. M. Mitchell, Publisher: McGraw-Hill, 1997 Edition.

Supplementary Readings

1. Title: Machine learning in action, Author: P. Harrington, Publisher: Manning Publications, 2012 Edition.
2. Title: Pattern recognition and Machine Learning, Author C. M. Bishop, Publisher: Springer, 2007 Edition.
3. Title: Machine Learning for Big Data: Hands-On for Developers and Technical Professionals, Author: J. Bell, Publisher: Wiley, 2014 Edition.