COURSE CODE	**CS- 471**
COURSE NAME	**MACHINE LEARNING**
CREDIT HOURS	Theory: 03
	Practical: 01
	Total: 04
CONTACT HOURS	Theory: 48
	Practical: 48
	Total: 96
PREREQUISITE	MATH-361 & MATH-222

MODE OF TEACHING:

Instruction:	Three hours of lecture per week	75%
	Three hours of Lab per week	25%

COURSE DESCRIPTION:

This course provides a broad introduction to machine learning, data mining, and statistical pattern recognition. Topics include:

- Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks).
- Unsupervised learning (clustering, dimensionality reduction, recommender systems, deep learning).
- Best practices in machine learning (bias/variance theory; innovation process in machine learning and AI).
- Reinforcement learning and Deep learning.

The course will also draw from numerous case studies and applications, so that you'll also learn how to apply learning algorithms to building smart robots (perception, control), text understanding (web search, anti-spam), computer vision, medical informatics, audio, database mining, and other areas.

COURSE OBJECTIVES:

Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars,

practical speech recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning is so pervasive today that you probably use it dozens of times a day without knowing it. Many researchers also think it is the best way to make progress towards human-level AI. In this class, you will learn about the most effective machine learning techniques, and gain practice implementing them and getting them to work for you. More importantly, you'll learn about not only the theoretical underpinnings of learning, but also gain the practical know-how needed to quickly and powerfully apply these techniques to new problems.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Teamwork:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the students will be able to:

No.	CLO	Domain	Taxonomy Level	PLO
1	Demonstrate an understanding of what is involved in learning from data	Cognitive	1	1
2	Describe a wide variety of learning algorithms	Cognitive	2	2
3	Apply a variety of learning algorithms to	Cognitive	3	3

	data for solution development.			
4	Evaluate various learning algorithms for optimal model selection.	Cognitive	6	4
5	Develop solutions by using modern machine learning tools / models to solve practical problems.	Cognitive	5	5

TOPICS COVERED:

Theory:

Week	**Topics**
1	Course Introduction, Machine Learning Overview, Supervised/Unsupervised Learning
2	Decision Tree Learning
3	Linear Regression with One Variable
4	Linear Regression with Multiple Variables
5-6	Logistic Regression
7	Regularization
8	Artificial Neural Networks
9	Machine Learning System Design
10	Support Vector Machines
11-12	Instance-Based Learning
13	Clustering
14	Dimensionality Reduction
15	Anomaly Detection
16	Recommender Systems
17-18	**ESE**

Practicals:

No.	Topics
1	Python basics
2	Linear regression in one variable
3	Linear regression in multiple variables
4	Logistic regression
5	Naïve Bayes Classifier
6	Nearest Neighbor Classifier
7	Support vector machine
8	Convolutional Neural Networks
9	Object Detection using Deep Neural Networks
10	Decision Tree / Ensemble Classification
11	Clustering, Unsupervised Learning
12	Principal Component Analysis (PCA) / Robust PCA
13	Reinforcement Learning (optional)

TEXT AND MATERIAL:

Textbook(s)

a. Pattern Recognition and Machine Learning by Christopher M. Bishop. 2007, Springer.

Reference Books:

a. Machine Learning by Tom M. Mitchell, 1997, McGraw-Hill.
b. Artificial Intelligence: A Modern Approach, (3rd Edition) by Stuart Russell and Peter Norvig, Prentice Hall.

ASSESMENT SYSTEM:

1. CLOs Assessment

Cognitive	Psychomotor	Affective
Spreadsheet	-	-

2. Relative Grading

Theoretical / Instruction			75%
	Assignments 10%		
	Quizzes 10%		
	Mid Exams 30%		
	End Semester Exam 50%		
Practical Work			25%
Laboratory Work		70%	
	Laboratory Attendance 20%		
	Laboratory Report 20%		
	Laboratory Quiz 30%		
Viva/Quiz		30%	
Total			100%