Course Code	Course Title	L	T	P	C
PMCA507L	Machine Learning	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives:

1. To comprehend the concept of supervised and unsupervised learning techniques.
2. To differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:

1. Recognize the characteristics of machine learning that makes it useful to solve real-world problems
2. Provide solution for classification, regression and clustering approaches in real-world applications
3. Gain knowledge to combine machine learning models to achieve better results
4. Realize methods to reduce the dimension of the dataset used in machine learning algorithms

Module:1	Introduction to Machine Learning	5 hours

Machine Learning and its Applications – Learning Problems – Designing a Learning System – Perspectives and Issues in Machine Learning - Version Spaces – Finite and Infinite Hypothesis Spaces – PAC Learning

Module:2	Parametric Learning Algorithms	5 hours

Learning a Class from Examples – VC Dimension – Noise – Learning Multiple Classes – Regression: Linear Regression, Multiple Linear Regression, Logistic Regression – Bayes Classification – Introduction to Neural Networks – Perceptron – Multilayer Perceptron

Module:3	Non Parametric Learning Algorithms	7 hours

Decision Tree - Classification and Regression Trees - Pruning - Support Vector Machines - K-Nearest Neighbors - Evaluation Metrics of Classification Algorithms

Module:4	Combining Multiple Learners	6 hours

Generating Diverse Learners - Model Combination Schemes - Voting - Error Correcting Output Codes - Bagging - Boosting - The Mixture of Experts - Stacking - Random Forest Classifier

Module:5	Unsupervised Learning	7 hours

Introduction - K-Means Clustering - Expectation Maximization Algorithm - Supervised Learning after Clustering - Hierarchical Clustering - Density Based Clustering - Evaluation Metrics - Association Rule Learning

Module:6	Dimensionality Reduction	6 hours

Principal Component Analysis - Feature Embedding - Factor Analysis - Canonical Correlation Analysis - Linear Discriminant Analysis

Module:7	Reinforcement Learning	7 hours

Single State Case - K-Armed Bandit - Elements of Reinforcement Learning - Model Based Learning - Temporal Difference Learning - Generalization - Partially Observable States		
Module:8	**Contemporary Issues**	**2 hours**
Guest Lecture from Industry and R & D Organizations		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Ethem Alpaydin, "Introduction to Machine Learning", 2020, 4th Edition, MIT press.

Reference Books

1.	Mitchell, Tom M., "Machine Learning", 2007, Vol. 1, McGraw-Hill, New York.
2.	Marsland, Stephen, "Machine Learning: an Algorithmic Perspective", 2015, 2nd Edition, Chapman and Hall/CRC.
3.	Mohri, Mehryar, AfshinRostamizadeh, and Ameet Talwalkar, "Foundations of Machine Learning", 2018, 2nd Edition, MIT press.
4.	Doane, David P., and Lori E. Seward, "Applied Statistics in Business and Economics", 2016, 5th Edition, Mcgraw-Hill.

Mode of Evaluation: CAT, Written Assignment, Quiz, FAT and Seminar			
Recommended by Board of Studies	04-05-2023		
Approved by Academic Council	No. 70	Date	24-06-2023