SEMESTER S7

MACHINE LEARNING

Course Code	PEMRT742	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	Course Type	Theory

Course Objectives:

1. Equip students with the skills to understand, apply, and evaluate various machine learning algorithms and techniques, and to address real-world problems using these tools while considering ethical implications

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Overview of machine learning** Machine learning paradigms-supervised, semi-supervised, unsupervised, reinforcement learning. Basics of parameter estimation - maximum likelihood estimation (MLE) and maximum a posteriori estimation(MAP). Introduction to Bayesian formulation.	9
2	**Supervised Learning** Regression - Linear regression with one variable, Linear regression with multiple variables, solution using gradient descent algorithm and matrix method, basic idea of overfitting in regression. Linear Methods for Classification- Logistic regression, Naive Bayes, Decision tree algorithm ID3.	9
3	**Unsupervised Learning** Clustering - Similarity measures, Hierarchical Agglomerative Clustering, K-means partitional clustering, Expectation maximization (EM) for soft clustering. Dimensionality reduction – Principal Component Analysis.	9
4	**Neural Networks (NN) and Support Vector Machines (SVM)** Perceptron, Neural Network - Multilayer feed forward network, Activation functions (Sigmoid, ReLU, Tanh), Backpropagation algorithm.	9

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	SVM - Introduction, Maximum Margin Classification, Mathematics behind Maximum Margin Classification, Maximum Margin linear separators, soft margin SVM classifier, non-linear SVM, Kernels for learning non-linear functions, polynomial kernel, Radial Basis Function(RBF)	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

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Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Illustrate Machine Learning concepts and basic parameter estimation methods.	**K2**
CO2	Demonstrate supervised learning concepts (regression, linear classification).	**K2**
CO3	Illustrate the concepts of Multilayer neural network and Support Vector Machine	**K2**
CO4	Describe unsupervised learning concepts and dimensionality reduction techniques.	**K2**
CO5	Solve real life problems using appropriate machine learning models and evaluate the performance measures	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Machine Learning	Ethem Alpaydin	MIT Press	2nd Edition, 2010
2	Data Mining and Analysis: Fundamental Concepts and Algorithms,	Mohammed J. Zaki and Wagner Meira	Cambridge University Press	First South Asia edition, 2016
3	Python Data Science Handbook	Jake Vander Plas	O'Reilly Media	1st Edition, 2016
4	Machine Learning	Tom Mitchel	McGraw-Hill	1st Edition, 1997

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools	Davy Cielen, Arno D. B. Meysman, and Mohamed Ali	Dreamtech Press	1st Edition, 2016
2	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy	MIT Press	1st Edition, 2012
3	Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools	Davy Cielen, Arno D.B. Meysman, and Mohamed Ali	Dreamtech Press	2016
4	Building Machine Learning Systems with Python	Willi Richert and Luis Pedro Coelho	Packt Publishing	2nd Edition, 2015
5	Elements of Machine Learning	Pat Langley	Morgan Kaufmann	1995

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs87/preview
3	https://onlinecourses.nptel.ac.in/noc19_ee56/preview
4	https://onlinecourses.nptel.ac.in/noc20_cs62/preview

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