Semester: VII	
Programme: B.Sc. Computer Science (Hons) (Minor – ARTIFICIAL INTELLIGENCE)	
Course: Machine Learning	
Paper code: B4CS250722T / B4CS250722P	**Credits: 4**
Hours/week: Theory: 3 / Practical: 2	
Category: Core/MDC/SEC/VAC/Minor: Minor	
Theory / Practical / Composite: Composite	
No of Modules: 1	

Course Overview: This course introduces the fundamental concepts and techniques of Machine Learning, focusing on how data-driven models are built and evaluated. It begins with an overview of machine learning paradigms and the importance of data preprocessing, including cleaning, integration, and reduction. The course then explores pattern discovery through association rule mining and the Apriori algorithm. It covers predictive modelling techniques such as linear, logistic, and polynomial regression, followed by classification methods including decision trees and Naive Bayes along with error estimation metrics. The course also introduces clustering techniques, particularly partitioning methods, to uncover hidden structures in data. Overall, the course equips students with both theoretical understanding and practical insight into core machine learning approaches.

Course Outcomes:

1. **Recall** fundamental concepts of Machine Learning, including definitions, types of learning, and key terminology.
2. **Explain** data preprocessing techniques such as data cleaning, integration, and reduction, and their role in improving model performance.
3. **Apply** association rule mining techniques, including the Apriori algorithm, to discover frequent patterns and relationships in datasets.
4. **Analyze** regression and classification models (linear, logistic, decision tree, Naive Bayes) based on their behaviour and performance metrics.
5. **Evaluate** machine learning models using appropriate error estimation metrics and justify the choice of model for a given problem.
6. **Create** machine learning solutions by selecting and integrating suitable preprocessing, modelling, and clustering techniques.

Prerequisites: Mathematical techniques and data visualization

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	Introduction to ML, definitions, types of learning	5	CO1	K1, K2 (Remember/Understand)
II.	Data preprocessing: cleaning, integration, reduction	7	CO2, CO3	K2, K3 (Understand/Apply)
III.	Association rule mining, Apriori algorithm	7	CO3, CO4	K3, K4 (Apply/Analyze)
IV.	Regression: linear, logistic, polynomial	7	CO3, CO4	K3, K4 (Apply/Analyze)
V.	Classification: decision tree, Naive Bayes, metrics	7	CO4, CO5	K4, K5 (Analyze/Evaluate)

VI.	Clustering: partitioning methods and variants	6	CO5, CO6	K5, K6 (Evaluate/Create)

Text Books		
1. Introduction to Machine Learning by Ethem Alpaydin. 2. Machine Learning by Tom M. Mitchell. 3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media		
Suggested readings		
1. Pattern Recognition and Machine Learning – Christopher M. Bishop		
Web Resources		
1. Machine Learning – Prof. Balaraman Ravindran (IIT Madras) [NPTEL]		
Evaluation	Theory CIA: 12 Attendance: 3 Semester Exam: 45	Practical CA: 38 Attendance: 2
Paper Structure for Theory Semester Exam Module: Answer 3 out of 5 of 15 marks each		

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Recall fundamental concepts of Machine Learning, including definitions, types of learning, and key terminology	K1–K2 (Remember / Understand)
CO2	Explain data preprocessing techniques such as data cleaning, integration, and reduction	K2 (Understand)
CO3	Apply association rule mining and regression techniques (linear, logistic, polynomial) to solve problems	K3 (Apply)
CO4	Analyze and compare classification methods (decision tree, Naive Bayes) and interpret their performance	K4 (Analyze)
CO5	Evaluate machine learning models using appropriate error estimation metrics and justify model selection	K5 (Evaluate)
CO6	Design and develop machine learning solutions incorporating preprocessing, modeling, and clustering techniques	K6 (Create)