24ADI003	MACHINE LEARNING	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	24MAI234 Computational Probability and Statistics	Data Book / Code book (If any)	Nil

Course Objectives:

The purpose of taking this course is to:

1	Introduce the fundamental concepts of machine learning, its life cycle and ethical considerations.
2	Explore various supervised and unsupervised learning techniques and optimization strategies.
3	Examine recommendation systems, and its evaluation techniques.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply appropriate data pre-processing techniques to build machine learning models with ethical considerations.	Ap
CO2	Analyze and optimize regression models using estimation techniques, regularization, and gradient-based methods through error analysis.	An
CO3	Build and evaluate the effectiveness of different classification models and ensemble techniques.	E
CO4	Analyze complex datasets using advanced clustering, associative rule mining and dimensionality reduction algorithms to uncover meaningful patterns and groupings.	An
CO5	Develop recommendation systems to personalize user needs.	Ap

Course Outc	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)
	1	2	3	4	5	6	7	8	9	10	11	

omes (CO)	Engineering Knowledge	Problem Analysis	Design/ Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2					2	2					2	
2	3	2			2						2	3	2
3	3	2			2						2	3	2
4	3	2			2						2	3	2
5	3	2			2						2	3	2

Course Content

INTRODUCTION Introduction to Machine Learning-Types of machine learning: Supervised, Unsupervised, Semi supervised and Reinforcement Learning-Applications of machine learning in various fields- Ethics in machine learning- Fairness, accountability and interpretability -Machine learning workflow- Data Preprocessing-Feature engineering- Correlation analysis- Model training and evaluation- Model monitoring and maintenance. **Practical Component** Introduction to Python libraries for Machine Learning-Preprocessing of dataset	**7 Hours** **4 Hours**
REGRESSION MODELS Linear regression- Simple Regression-Least Square Estimator-Maximum Likelihood Estimator– Multiple Regression –Polynomial Regression-Performance Metrices-Bias	**8 Hours**

Variance Tradeoff- Information Criteria-Based Model Selection- Overfitting – Underfitting – Gradient descent – Regularization – Assumptions in linear regression – Error analysis **Practical Component** Implementation of multi variable regression problem- Optimization of regression model	**8 Hours**
CLASSIFICATION MODELS Logistic Regression-Naive Bayes Classifiers-Decision Tree-K-Nearest Neighbors-Support Vector Machine – Evaluation metrices – AUC ROC- Class Imbalance – SMOTE – Cross-Validation Techniques-Ensemble Learning-Bagging- Random Forests-Boosting - AdaBoost -Gradient Boosting **Practical Component** Implementation of classification models- Evaluation of models using performance metrices.	**12 Hours** **6 Hours**
UNSUPERVISED LEARNING Clustering- K-means Clustering- Gaussian Mixture Models -Hierarchical Clustering-Density-Based Clustering (DBSCAN)- Mean-Shift Clustering- Spectral Clustering-Association Rule Learning- Apriori Algorithm- FP-Growth Algorithm-Dimensionality Reduction- Principal Component Analysis (PCA)- Linear Discriminant Analysis (LDA) **Practical Component** Implementation of clustering algorithms- Identification of patterns- Detection of outliers	**10 Hours** **6 Hours**
RECOMMENDATION SYTEMS Introduction to Recommendation Systems-Types- Challenges- Collaborative Filtering Techniques- User-Based-Collaborative Filtering- Item-Based- Collaborative Filtering-Matrix Factorization Techniques- Content-Based Recommendation- Hybrid Recommendation Systems- Evaluation of Recommendation Systems **Practical Component** Implementation of Collaborative Filtering-based Recommendations- Implementation of Matrix Factorization-based recommendations- Building a Recommendation system based on item features	**8 hours** **6 Hours**

Theory Hours:45	Tutorial Hours:0	Practical Hours: 30	Project Hours:0	Total Hours: 75

Learning Resources

Textbooks

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Fourth Edition, (2020).
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, Second Edition, MIT Press, (2018).
3. Falk, Kim, Practical Recommender Systems, United States, Manning, (2019).

Reference

1. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition (1997).
2. Sebastain Raschka, Vahid Mirjalili , Python Machine Learning, Packt publishing 3rd Edition, (2019).
3. M.Gopal, Applied Machine Learning, McGraw Hill Education, New York, (2018).

Online Resources (Weblinks)

1. https://www.coursera.org/specializations/machine-learning-introduction
2. https://onlinecourses.nptel.ac.in/noc19_cs53/preview
3. https://pll.harvard.edu/course/data-science-machine-learning

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	Ms. Tharsanee R M, AP/Artificial Intelligence & Data Science

Recommended by BoS on	09.05.2025		
Academic Council Approval	No: 28	**Date**	26.06.2025