Faculty of Engineering & Technology
Master of Technology (M. Tech)
(W. E. F.: 2023-24)

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Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M.Tech.) – Artificial Intelligence and Data Science
Course Code	:	1MAI02
Course Title	:	Introduction to Machine Learning
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	Maths, logic and most importantly zeal to learn
Course Objective	:	This course aims to impart candidates for introducing the field of Machine Learning, focusing on the core concepts of supervised and unsupervised learning.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand different learning-based applications.
	CO2	To Learn to creating training and test sets, managing categorical data, Managing missing features.
	CO3	To learn Regression and Naïve Bayes and support Vector machine.
	CO4	To implement hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering Dendrograms, Agglomerative clustering in Scikit- learn.
	CO5	To learn to implement Decision Trees, Classification with Scikit learn, Ensemble Learning- Random Forest, Gradient Tree Boosting.
	CO6	To learn to find Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth-Homogeneity.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
3	0	2	4	70	30	30	20	150

*Legends: **L**-Lecture; **T**–Tutorial/Teacher Guided Theory Practice; **P** – Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists ofAssignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	**Introduction to Machine learning** Basic terminologies of machine learning, Types of machine learning: Supervised, Unsupervised and Reinforcement, learning rate, activation function, ANN, Classic and adaptive machines, Adaptive systems, Machine learning and Big data. Important Elements of Machine Learning: Data formats, Learnability, Statistical learning approaches, Elements of information theory, Applications of machine learning.	12	20%	CO1
2	**Feature Selection** Scikit- learn Dataset, creating training and test sets, managing categorical data, Managing missing features,Data scaling and normalization, Feature selection and Filtering, Principal Component Analysis (PCA)- nonnegative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning.	12	20%	CO2
3	**Regression and Naïve Bayes and Support Vector Machine:** Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Logistic regression, Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descendent algorithms, Finding the optimal hyper- parameters through grid search, Classification metric, ROC Curve, Bayes‟ Theorem, Types of Naïve Bayes‟ , SVM - Linear SVM, Kernel-based classification. Controlled SVM, Support Vector Regression	12	20%	CO3 CO2

4	**Decision Trees and Ensemble Learning:** Introduction to Decision Trees, Classification with Scikit learn, Ensemble Learning- Random Forest, Gradient Tree Boosting. Clustering Fundamentals Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index. Introduction to Meta Classifier, Ensemble methods, Bagging, Boosting, Random Forests.	12	20%	CO5 CO4
5	**Clustering Techniques:** Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints	12	20%	CO5 CO6

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**20**	**30**	**30**	**20**	**0**	**0**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Learning Websites

Sr. No.	Name of Website
1	https://www.javatpoint.com/machine-learning
2	https://www.geeksforgeeks.org/introduction-machine-learning/
3	https://www.digitalocean.com/community/tutorials/an-introduction-to-machine-learning

Reference Books

Sr. No.	Name of Reference Books
1	T. Hastie, R. Tibshirani, and J. Friedman. The Elements of Statistical Learning. Springer 2011.
2	Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press 2012. (Electronic copy available through the Bodleian library.)
3	Christopher M. Bishop. Pattern Recognition and Machine Learning, Springer 2007.