Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M.Tech.) - Artificial Intelligence and Data science
Course Code	:	2MAI03
Course Title	:	Advance Machine Learning
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	Machine Learning, Probability Theory
Course Objective	:	Master advanced pattern recognition concepts, tools, and algorithms while gaining practical skills to solve real-world machine learning problems and understanding the underlying theoretical frameworks.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Key concepts, tools and approaches for pattern recognition on complex data sets
	CO2	Key concepts, tools and approaches for pattern recognition on complex data sets
	CO3	State-of-the-art algorithms such as Support Vector Machines and Bayesian networks.
	CO4	Solve real-world machine learning tasks: from data to inference
	CO5	Theoretical concepts and the motivations behind different learning frameworks

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 of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	**Introduction:** Key concepts, Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory Ensemble	10	10%	CO1

	Learning, Bagging, Boosting, Random Forest			
2	**Kernel Methods:** Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis	12	18%	CO2
3	**Bayesian methods:** Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent Semantic Analysis, The Expectation-Maximisation (EM) algorithm, Gaussian Processes	08	14%	CO3
4	**Dimensionality Reduction:** CCA, LDA, ICA, NMF - Canonical Variates - Feature Selection vs Feature Extraction	10	25%	CO4
5	**Filter Methods:** Filter Methods - Sub-space approaches - Embedded methods Low-Rank approaches - Recommender Systems .Application areas - Security - Business – Scientific	12	18%	CO4
6	**Recent trends:** Recent trends in supervised and unsupervised learning algorithm, dimensional reducibility, feature selection and extraction	08	15%	CO5

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 List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	Demonstrate supervised and unsupervised learning	04
2	Demonstrate an example of support vector machine	04
3	Demonstrate any example of Bayesian interface and Gaussian process	04
4	Demonstrate any dimensionality reduction feature	04
5	Demonstrate a filter method on any live data	04
6	Demonstrate a recent trade example for supervise and unsupervised learning	06

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Python
2	Jupiter notebook

Suggested Learning Websites

Sr. No.	Name of Website
1	https://www.springboard.com/resources/learning-paths/machine-learning-python/
2	https://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-learn-data-science-python-scratch-2/
3	https://www.rstudio.com/online-learning/

Reference Books

Sr. No.	Name of Reference Books
1	Pattern Recognition and Machine Learning, Christopher M. Bishop
2	The Elements of Statistical Learning, Springer 2009
3	Machine Learning Algorithms, 2nd Edition, Giuseppe Bonaccorso, Packt Publication
4	TensorFlow Machine Learning, Nick McClure, Packt Publication