

Branch Name:	Information and Communication Technology
Program Code:	ET208
Course Name:	Advanced Machine Learning
Course Code:	2ET2080201T
Pre-requisite Course:	Artificial intelligence, Python programming for data science

Course Objectives:

1. The course will deepen the student's knowledge of how to build computer systems that learn from experience.
2. The course assumes basic knowledge of introductory machine learning, and a good background on probability and statistics, linear algebra, and optimization methods.
3. This subject covers the overview of the python with emphasis on various python data structures and various libraries like Pandas, NumPy, Matplotlib for performing various data science function including data preparation, cleaning, exploratory analysis and visualization.
4. Students will learn advanced topics such as learning theory, transfer learning, meta-learning, domain adaptation, self-adaptive learning algorithms, deep learning, Gaussian processes, and kernel methods.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCE		SEE		CCE		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)

1	Introduction to Artificial intelligence & Machine Learning: The AI Problems, The Underlying Assumption, AI techniques, AI Applications, Introduction to Machine Learning, Types of Learning, Applications of Machine Learning, Tools and Technology for Machine Learning	3	8
2	Preparing to Model, Exploring Structure of Data, Modelling and Evaluation, Selecting a Model, Training a Model, Basics of Feature Engineering	3	8
3	Supervised Learning: Introduction to Supervised Learning, Types of Supervised Learning, Classification Model, Learning steps, Classification algorithms, Regression Models	5	14
4	Unsupervised Learning: Introduction to Unsupervised Learning, Types of Unsupervised Learning	6	15
5	Neural Networks: Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation	6	15
6	Probabilistic Graphical Models Directed Graphical Models: Introduction, Bayesian Networks, Examples, Naive Bayes classifiers, Markov Models, Hidden Markov Models, Inference, Learning, Conditional independence properties of DGMs. Undirected graphical models: Markov random fields, Conditional independence properties, Parameterization of MRFs, Examples of MRF, Learning, Conditional random fields (CRFs), Structural SVMs.	8	20
7	Advanced Learning Sampling, Basic Sampling Methods, Monte Carlo. Reinforcement Learning: K-Armed Bandit, Elements of Reinforcement Learning, Model-Based Learning. Temporal Difference Learning, Exploration Strategies, Deterministic and Non-deterministic Rewards and Actions, Eligibility Traces, Generalization, Partially Observable States, The Setting, Example. Computational Learning Theory, Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting.	8	20

Text Books:

1. Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley

Reference Books:

1. Pattern Recognition and Machine Learning, by Christopher Bishop
2. Machine Learning with Python for Everyone, Mark E. Fenner, Pearson
3. Deep Learning: Methods and Applications, Li Deng and Dong Yu
4. Neural Networks and Deep Learning, Michael Nielsen
5. Machine Learning, AnuradhaSrinivasaraghavan, Vincy Joseph, Wiley
6. Python Machine Learning, Sebastian Raschka, VahidMirjalili, Packt Publishing
7. Machine Learning, Mitchell T, McGraw-Hill, 1997
8. A first course in Machine Learning, S. Rogers and M. Girolami, CRC Press, 2011

List of Open Source Software/learning website:

1. <https://www.geeksforgeeks.org/machine-learning/>
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. edX: Python For Data Science | <https://learning.edx.org/course/course-v1:IBM+PY0101EN+1T2020/home>
4. NPTEL: Introduction to Machine Learning | <https://nptel.ac.in/courses/106105152/1>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity	5 Evaluate, 4 Analyze
CLO2	Evaluate the various Supervised and Unsupervised Learning algorithms using appropriate Dataset	1 Evaluate, 2 Understanding
CLO3	Design and implement various machine learning algorithms in a range of real-world applications	6 Creating, 3 Applying, 4 Analyze
CLO4	Understand the definition of a range of neural network models.	2 Understanding
CLO5	Understand neural implementations of attention mechanisms and sequence embedding models and how these modular components can be combined to build state-of-the-art NLP systems.	5 Evaluate, 3 Applying, 4 Analyze 2 Understanding
CLO6	Know how to evaluate a learned model in practice.	5 Evaluate, 4 Analyze
CL07	Be able to design and implement various machine learning algorithms in a range of real-world applications.	6 Creating, 3 Applying, 4 Analyze

Mapping of CLOs with POs & PSOs

[illegible]

CLO4	M	L	M	L				H	L		L		L			
CLO5				M	L									M		
CLO6	H	M									L	M				
CLO7	M	L		L				H	L		L			L		

H:High, M:Medium, L:Low