

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	ECD411	Machine Learning and AI	3	0	0	9

Course Objective
The objective of the course is to introduce Machine Learning, focusing on the core mathematical concepts of supervised and unsupervised learning, to understand how to apply and analyze some popularly used ML algorithms.
Learning Outcomes
Upon successful completion of this course, students will: • Be able to understand the mathematical theories and concepts behind the ML algorithms and AI systems • Be able to design and implement various ML algorithms in a range of real-world applications • Be able to use commercial ML software based on these algorithms in a useful way for different datasets.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction: concept of machine learning and Artificial Intelligence; Supervised, unsupervised and reinforcement learning; Types of ML problems: classification and regression; Design of a general learning system. Evaluation methods, concepts of cross-validation, Over fitting	6	Will be able to identify any problem to its type and formulate its appropriate ML model. Will learn how to compare the performance of learning models.
2	Perceptron Training rule on linearly separable dataset, realization of Boolean functions. Linear algebra of Hyper planes using TLU. The motivation of Artificial neurons from biological neurons. The use of activation functions.	7	Work with hand on simple LS datasets to see how they converge and learn a HP-decision boundary and classify.
3	Non-linearly separable data set and the use of Kernel mapping. Importance of Dot-product in learning.	3	Feature mapping to higher dimension, and perform some simple kernel computations
4	Support Vector Machines as a maximum margin classifier: theory background of constrained optimization, Lagrange multiplier method, Primal and dual form, Linear and Non-linear (Kernel) SVM.	7	Learn the detailed mathematical steps of how a Kernel SVM finds support vectors and classifies
5	Principal component Analysis as an approach of Unsupervised learning, feature extraction, dimensionality reduction	4	Steps of applying PCA to a data, computing covariance matrix, Eigen features.
6	Gradient Descent and Delta Rule: Multilayer Perceptron: Neural networks, Back-propagation algorithm and introduction to Deep Learning and Convolutional Neural networks.	7	Will be able to update the weights of a multi-layer ANN and understand the motivation of deep learning and design of simple CNN.
7	Bayesian learning and use of Naïve Bayes Classifier: concepts of conditional probability and conditional independence. Bayesian Networks	6	Given any dataset, will be able to construct the probabilistic model and predict the class of a new feature set.
8	Class Tests, Quizzes etc	2	Practice simple illustrative Problems

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Publication (S No 4 and 5, notes will be provided)

Reference Books:

1. Christopher M. Bishop. Pattern Recognition and Machine Learning, Springer 2007.
2. S. Haykin. Neural networks and learning machines. Pearson 2008.