NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M. Tech. in Electronics and Communication Engineering (Embedded System)
M.Tech. Semester - II
Department Elective III

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Course Code	**6EC278ME22**
Course Title	**Machine Learning for Embedded Systems**

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. Analyze and compare machine learning approaches as supervised, unsupervised, regression and ensemble algorithms.
2. Demonstrate the implementation of machine learning algorithms on embedded platform of GPU, CPU and FPGA and analyze the issues of computational complexity, memory and speed.
3. Apply machine learning concepts of Neural Network and Deep Learning for the given application.

Syllabus: **Teaching Hours:45**

UNIT I: Machine Learning Introduction **02**

Concept of learning, designing a learning system, perspective and issues in machine learning, classification, regression, clustering, supervised and unsupervised learning, applications of machine learning and ML in embedded systems

UNIT II: Regression Techniques **04**

Regression, Linear models for regression, Gradient Descent and Normal Equations Method, Multiple Linear Regression, Evaluation Measures for Regression Analysis

UNIT III: Supervised Learning **05**

Decision Trees, Bayesian Decision Theory, Parametric Methods, Dimensionality Reduction algorithms, kernel methods and reinforcement learning

UNIT IV: Ensemble Learning **05**

Techniques for generating base classifiers, techniques for combining classifiers, bootstrap, bagging, random forest, AdaBoost

UNIT V: Unsupervised Learning **05**

Clustering, k- means Algorithm, Linear models for classification, Expectation Maximization, Mixture of Gaussians

UNIT VI: Neural Networks **05**

Introduction, Biological motivation, NN representation and learning, Perceptron, multi-layer networks and back propagation, introduction to Convolutional Neural Networks and Deep Learning

UNIT VII: Machine Learning Hardware **04**

Machine Learning Hardware Tensor Flow TPU, machine learning algorithm implementation framework (open-source software libraries - Caffe, Torch, Theano), machine learning algorithms on hardware like GPU, CPU and FPGA.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

1. Mitchell, T. M., Machine Learning, McGraw-Hill.
2. Bishop, C., Pattern Recognition and Machine Learning, Springer.
3. Alpaydin, E., Introduction to Machine Learning, MIT Press.
4. Duda, R.O. and Hart, P.E., Pattern Classification and Scene Analysis, John Wiley.