राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUE OF TECHNOLOGY PATNA
संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
अशोक राजपथ, पटना-८००००५, बिहार / ASHOK RAJPATH, PATNA-800005, BIHAR
Phone No.: 0612-2372715, 2370419, 2370843, 2371929 Ext- 200, 202 Fax-0612-2670631 Website: www.nitp.ac.in

No:- **Date:**

CS031903 ***Machine Learning*** **L-T-P-Cr: 3-0-2-4**

Pre-requisites: Fundamental knowledge of AI, linear algebra, probability & statistics, and algorithms

Objectives/Overview:

- To learn and understand machine learning and its types.
- To familiarize with Python programming language.
- To learn common unsupervised machine learning approaches.
- To learn common supervised machine learning approaches.
- To understand single layer and multi-layer neural network models.
- To learn to apply common machine learning techniques for solving real world problems.

Course Outcomes:

At the end of the course, a student should:

Sl. No.	Outcome	Mapping to POs
1.	Have knowledge of fundamental aspects of machine learning approach.	PO2
2.	Be able to choose appropriate regression technique for modelling real life problems.	PO1, PO2,PO3
3.	Have algorithmic knowledge of common clustering techniques.	PO3
4.	Understand the purpose of dimensionality reduction and unsupervised PCA technique	PO2,PO3
5.	Have knowledge of simple classification techniques and able to classify simple datasets using them.	PO1, PO2
6.	Conceptual understand the working of SVM and “Kernel Trick”	PO1, PO2
7.	Have algorithmic knowledge of supervised LDA dimensionality reduction technique.	PO1, PO3
8.	Understand of the purpose of ensemble learning.	PO1, PO2
9.	Conceptually understand reinforcement learning and be able to iterate on simple problem datasets	PO2
10.	Algorithmic knowledge of working of common neural network models and be able to iterate on simple problem datasets.	PO1, PO2
11.	Be able to derive back-propagation of error for multi-layer neural networks.	PO1, PO3, PO12

UNIT I: Introduction **Lectures:6**

Introduction to machine learning, types of learning, common aspects of machine learning approach: model, parameters, Bias-Variance. Test, train and validation datasets, error function. Curse of dimensionality. Predictive analysis using regression.

UNIT II: Python Basics **Lectures: 6**

Fundamental data types in Python, looping and decision making constructs, functions, classes, file handling, database access, output formatting, classes, modules, statistics module, numpy, introduction to popular machine learning libraries TensorFlow & Keras.

UNIT III: Neural Networks **Lectures: 12**

Introduction, perceptron model, gradient descent algorithm, learning mechanisms and activation functions, multi-layer feed forward, back-propagation, introduction to feed-back networks.

UNIT IV: Supervised Learning **Lectures: 6**

Types of supervised learning, classification: KNN, Bayes, Decision Tree. SVM: soft and hard margin, kernel trick. LDA – supervised dimensionality reduction technique.

UNIT V: Unsupervised Learning **Lectures: 6**

Types of unsupervised learning, clustering, K-means, GMM & EM Algorithm. Eigen values and Eigen vectors, PCA – unsupervised dimensionality reduction technique.

UNIT V: Ensemble and Reinforcement Learning **Lectures: 6**

Introduction to reinforcement learning, bagging, Random Forest and Boosting. Q-learning and SARSA algorithms

Text/Reference Books

1) Machine Learning. Tom Mitchell, McGraw-Hill.
2) Machine learning: an algorithmic perspective. Marsland, Stephen. Chapman and Hall/CRC, 2011.
3) Introduction to artificial neural systems. Zurada, Jacek M. Vol. 8. St. Paul: West publishing company, 1992.
4) A Tutorial on Support Vector Machines for Pattern Recognition. Christopher Burges, Data Mining and Knowledge Discovery, 1998.