Computer Science Paper II
Machine Learning
[Compulsory Course]

Semester: III	Credits: 4	Subject Code: MS32002	Lectures: 48

Course Outcomes:

At the end of this course, the learner will be able to:
- Recognize the characteristics of machine learning
- Develop an ability to estimate machine learning model efficiency using suitable metrics
- Evaluate real world problems using different machine learning techniques
- Process data using libraries and predict the outcome using machine learning algorithms
- Construct a machine learning model to solve real world problem.

Unit 1: Importance of Machine Learning	11

• **Chapter 1: Introduction to Machine Learning**
  ○ Data Science, Artificial Intelligence and Machine Learning
  ○ Why Learn and What is Learning, What is Machine Learning? Traditional Programming Vs. Machine Learning, Machine Learning Process, Types of Data, Key Elements of Machine Learning (Representation, Evaluation and Optimization) , Dimensionality Reduction (Feature Reduction)
  ○ Types of analytics: Descriptive, Diagnostic, Inferential and Prescriptive
  ○ Descriptive and Inferential Statistics: Probability, Distribution, Distance Measures (Euclidean and Manhattan), Correlation and Regression, Hypothesis Testing.
  ○ Creating our own dataset, Importing the dataset, Handling Missing Data, Splitting the dataset into the Training set and Test set, Feature Scaling
• **Chapter 2: Machine Learning Models**
  ○ Type of Learning- Supervised, Unsupervised and Reinforcement Learning
  ○ Components of Generalization Error (Bias, Variance, underfitting, overfitting)
  ○ A Learning System Cycle and Design Cycle Metrics for evaluation viz. accuracy, scalability, squared error, precision and recall, likelihood, posterior probability
  ○ Classification Accuracy and Performance
	6
	
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Unit 2: Supervised Learning	22

• **Chapter 3: Regression Models**
  o Linear Regression - Simple, Multiple, Polynomial
  o Non-linear Regression – Decision Tree, Support Vector, Random Forest
	6

• **Chapter 4: Classification Models**
  o K – Nearest Neighbours (KNN)
  o Logistic Regression
  o Naive Bayes Theorem
  o Support Vector Machine
  o Decision Forest Classification
  o Random Tree Classification
	10

• **Chapter 5: Clustering Models**
  o K-means
  o Hierarchical Clustering (Agglomerative, Divisive), Dendrogram
  o Selecting optimal number of clusters: Within Clusters Sum
  o of Squares (WCSS) by Elbow Method
	6

Unit 3: Unsupervised Learning	5

• **Chapter 6: Association Rules**
  o Key Terms: Support, Confidence and Lift
  o Large Item Set
  o Apriori Algorithm
  o Measuring the quality of association rules
	5

Unit 4: Reinforcement Learning	5

• **Chapter 7: Reinforcement Learning**
  o Upper Confidence Bound (UCB)
  o Thompson Sampling
  o Q-Learning
	5

Unit 5: Artificial Neural Network	5

• **Chapter 8: Artificial Neural Network**
  o Introduction to Artificial Neural Network
  o Architecture of ANN
  o Introduction to Deep learning
	5

Contact Hours: 12 Hrs.

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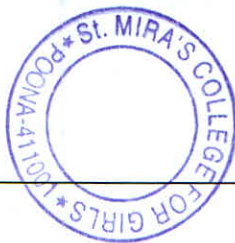
Reference Books:

- Andriy Burkov ,*The Hundred-Page Machine Learning Book* , Andriy Burkov
- Andreas C Muller and Sarah Guido, Introduction to Machine Learning with Python, Orielly
- Friedman, Jerome, Trevor Hastie, and Robert Tibshirani, The elements of statistical learning, Vol.1. Springer
- Rogers, Simon, and Mark Girolami. A first course in machine learning, CRC Press, 20
- Sutton, Richard S., and Andrew G. Barto, Reinforcement learning: An introduction, Vol.1. No. 1. Cambridge: MIT press
- Tom M Mitchell , Machine Learning, MC Graw Hill Education publication(Indian Edition)

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