MCA472 – Artificial Intelligence and Machine Learning

Total Teaching Hours for Trimester: 75

Max Marks: 150 **Credits: 5**

Course Objectives

This course introduces the fundamental concepts and techniques in Artificial Intelligence and Machine Learning. It covers both theoretical aspects and practical applications through hands-on labs.

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1: Understand the fundamental concepts of artificial intelligence and machine learning, including the difference between the two fields and their applications.
CO2: Apply the ethical and societal implications of artificial intelligence and machine learning.
CO3: Identify the various machine learning algorithms and techniques, such as supervised and unsupervised learning.
CO4: Analyze and integrate the complexities of bias, transparency, and privacy concerns.

Unit 1: INTRODUCTION TO AI **Teaching Hours: 15**

Introduction to AI, History of AI, The Foundations of AI, AI Technique -Tic-Tac-Toe. Problem characteristics, Production system characteristics, Production systems: 8-puzzle problem.

LOCAL SEARCH ALGORITHM

Searching: Uninformed search strategies – Breadth first search, depth first search. Generate and Test, Hill climbing, simulated annealing search, Greedy best first search, A* search, AO* search

Unit 2: ETHICS AND SOCIAL IMPLICATIONS OF AI

Ethical Considerations on AI – bias – privacy – philosophical challenge in human judgement – faulty algorithms - Social Implications of AI – Case studies Planning and Acting in the Real World

Unit 3: **Teaching Hours: 15**

Supervised Learning and Dimensionality Reduction Methods

Understanding Regression: Simple Linear regression - Ordinary least squares estimation - Gradient Descent - multiple linear regression - Understanding regression trees and model trees - Logistic regression - Bias and Variance Trade-off – Overfitting and underfitting models. Principal Component Analysis – Factor Analysis – Multidimensional Scaling - Linear Discriminant Analysis

Lab Exercises:

1. Open/create a dataset and write all its characteristics.
2. Exploratory data analysis
3. Implementation of Clustering Algorithms
4. Implement various types of linear regression techniques
5. Exploration of dimensionality reduction methods

Unit-4 **Teaching Hours: 15**

Neural Networks:

Application scope of Neural Networks – Fundamental Concept of ANN: The Artificial Neural Network – Biological Neural Network – Comparison between Biological neuron and Artificial Neuron – Evolution of Neural Network. Basic models of ANN – Learning Methods – Activation Functions – Importance Terminologies of ANN – Single / Multilayer perceptron

Lab Exercises:

1. Implementation of Classifiers

2. Calculate the output of a simple neuron using binary and bipolar sigmoidal activation functions
3. Demonstrate classification using MLP

Unit-5 **Teaching Hours: 15**

Reinforcement Learning

Introduction – Single State Case: K-Armed Bandit – Elements of Reinforcement Learning – Model-Based Learning – Temporal Difference Learning – Generalization – Partially Observable States

Lab Exercises:

1. Implementation of Reinforcement Algorithms

Text Books and Reference Books

[1] E. Rich and K. Knight, *Artificial Intelligence*, 2nd Edition. New york: TMH, 2012,ISBN: 9780070087705

[2] S. Russell and P. Norvig, *Artificial Intelligence A Modern Approach*, 2nd Edition. Pearson Education, 2007.

[3] E. Alpaydin, Introduction to Machine Learning, 3rd Edition, MIT Press, 2014.

Essential Reading / Recommended Reading

[1] C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2016.

[2] T. Hastie, R. Tibshirani and J. Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2nd Edition, 2009.

[3] K.P.Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Web Resources:

[1] https://data-flair.training/blogs/data-mining-tutorial/

[2] https://machinelearningmastery.com/

[3] https://towardsdatascience.com/

[4] https://scikit-learn.org/stable/

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	1	2	1	2	-	1	1	1	-
CO2	2	2	2	-	2	1	2	3	1	-	2	2
CO3	3	2	2	1	2	2	1	2	3	-	2	1
CO4	3	2	3	2	3	2	-	2	3	1	2	2