COURSE TITLE	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**
COURSE CODE	**01EC0313**
COURSE CREDITS	**4**

Objective:

1 To provide students with foundational knowledge of Artificial Intelligence and Machine Learning, enabling them to understand data-driven problem solving, apply basic algorithms, and develop simple intelligent systems using scientific programming for applications in electronics and communication engineering

Course Outcomes: After completion of this course, student will be able to:

1 Explain the fundamental concepts of Artificial Intelligence and Machine Learning and their role in solving real-world problems.

2 Interpret and prepare data using appropriate preprocessing techniques for meaningful analysis

3 Demonstrate working of basic machine learning methods for classification, regression, and clustering tasks.

4 Examine the performance of machine learning models using suitable evaluation measures.

Pre-requisite of course: Basic knowledge of programming (preferably Python) and mathematics.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Fundamentals of Artificial Intelligence** Introduction to Artificial Intelligence, Computational Systems and Problem Formulation, Problem Solving Approaches in AI, Intelligence vs Artificial Intelligence, History and Evolution of AI, Data–Information–Knowledge Hierarchy and Knowledge Representation (Rule-Based, Structured) with Engineering Applications	6
2	**Data Exploration and Preprocessing** Types of Data, Data Collection Methods, Data Characteristics, Data Cleaning, Handling Missing Values, Data Transformation, Data Visualization, Introduction to Data Analysis and Data Engineering	8

DR. RAJENDRAKUMAR DAHYALAL PATEL
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Contents : Unit	Topics	Contact Hours
3	**State Space and Search Techniques** State and State Space, Problem Representation, State Space Search, Hill Climbing, Steepest Ascent Hill Climbing, Heuristic-Based Problem Solving	6
4	**Mathematical Foundations for Machine Learning** Basic Linear Algebra (Vectors, Matrices, Operations), Introduction to Probability (Random Variables, Distributions), Basics of Statistics (Mean, Variance, Standard Deviation), Concept of Correlation, Mathematical Foundations for Machine Learning Models, Role of Mathematics in Machine Learning	6
5	**Machine Learning Fundamentals** Role of Machine Learning in Artificial Intelligence, Applications of Machine Learning, Types of Learning Methods in Machine Learning, Supervised Learning Overview, Classification Techniques in Supervised Learning, Regression Techniques in Supervised Learning, K-Nearest Neighbors (KNN) Algorithm, Unsupervised Learning Overview, Clustering Concepts in Unsupervised Learning, K-Means Clustering Algorithm	10
6	**Introduction to Artificial Neural Networks** Biological Neurons vs Artificial Neurons, History and Evolution of Artificial Neural Networks (ANN), Fundamental Concepts of Neural Networks, Perceptron Learning, Basics of Reinforcement Learning (Q-Learning Concept), Single-Layer vs Multi-Layer Networks and Applications of ANN	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment No. 1** Write a program in Python/Matlab to demonstrate basic constructs, data types, and use of libraries required for AI/ML.	2
2	**Experiment No. 2** Write a program in Python/Matlab to calculate descriptive statistics measures such as mean, median, mode, variance, and standard deviation for a given dataset.	2
3	**Experiment No. 3** Write a program in Python/Matlab to perform data preprocessing, including handling missing values using appropriate techniques.	2
4	**Experiment No. 4** Write a program to solve the Travelling Salesman Problem (TSP) using a brute-force approach.	2
5	**Experiment No. 5** Write a program to solve the Travelling Salesman Problem (TSP) using the nearest neighbor heuristic.	2

DR. RAJENDRAKUMAR DAHYALAL PATEL
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Experiment No. 6** Write a program in Python/Matlab to perform dataset handling and splitting into training and testing sets.	2
7	**Experiment No. 7** Write a program in Python/Matlab to implement K-Nearest Neighbors (KNN) algorithm for classification using a standard dataset.	2
8	**Experiment No. 8** Write a program in Python/Matlab to compute performance measures such as accuracy, precision, recall, and F1-score.	2
9	**Experiment No. 9** Write a program in Python/Matlab to implement a regression model for prediction of continuous values.	2
10	**Experiment No. 10** Write a program in Python/Matlab to calculate error metrics such as MAE, MSE, RMSE, and MAPE.	2
11	**Experiment No. 11** Write a program in Python/Matlab to implement K-means clustering on a given dataset.	2
12	**Experiment No. 12** Write a program to analyze clustering results using appropriate performance indicators.	2
13	**Experiment No. 13** Write a program in Python/Matlab to implement the Perceptron Learning Algorithm.	2
14	**Experiment No. 14** Write a program using Perceptron model to realize basic logic gates such as AND/OR.	2
15	**Experiment No. 15** Write a program to implement XOR logic and analyze the limitation of single-layer perceptron.	2
Total Hours		**30**

Textbook :

1 Artificial Intelligence: A Modern Approach, S. Russell and P. Norvig, NJ: Pearson, 2010

2 Machine Learning, T. M. Mitchell, New York: McGraw-Hill, 1997

References:

1 Machine Learning: Theory and Practice, Machine Learning: Theory and Practice, M. N. Murty and V. S. Ananthanarayana, Universities Press, 2024

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	30.00	20.00	10.00	10.00

Instructional Method:

1. The internal evaluation will be done based on the continuous evaluation of students in the laboratory and class-room.
2. A practical examination will be conducted at the end of the semester for evaluation of practical performance.
3. Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
4. The course delivery method will depend upon the requirements of content and need of the students. The teacher in addition to conventional teaching methods (Chalk and Talk) may use any of the tools/techniques such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

Supplementary Resources:

1. https://nptel.ac.in/courses/106102220
2. https://www.coursera.org/specializations/machine-learning-introduction
3. https://python-iitk.vlabs.ac.in/

DR. RAJENDRAKUMAR DAHYALAL PATEL
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)