<table>
<tr><td colspan="6">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td>III Year B.E.
(Mechanical Engg.)
(Full Time)</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">5RMPE2
Fundamentals of Artificial Intelligence and Machine Learning

Duration of Theory Paper- 03 Hours</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
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Learning Objectives:

1. Understand the fundamentals of AI and problem-solving techniques.
2. Represent knowledge and apply logical reasoning.
3. Understand the basic concepts of machine learning and apply them for the various problems
4. Implement learning algorithms for regression, classification, and distance-based models.
5. Apply unsupervised learning techniques and understand the basics of ANN and deep learning.

Pre requisites (s): Basic programming knowledge (Python/C++), Fundamentals of Probability.

COURSE CONTENT

Unit-I

Introduction to Artificial Intelligence: Introduction to Artificial Intelligence: Definition and scope of AI, History and evolution of AI, Human intelligence versus artificial intelligence, Task domains of AI, AI techniques and its applications, Limitations of AI, Problem Solving and Search Techniques: Problem-solving approaches, Search problems, Uninformed search: BFS (Breadth-first Search) and DFS (Depth-first Search), Informed search: Greedy Best-first Search, A* search and state space search for puzzle problem.

Unit-II

Knowledge Representation & Reasoning: Introduction and need for a good representation, ways of representing knowledge, syntactic and semantic systems, predicate logic, Nonmonotonic systems, statistical reasoning systems, semantic nets, frames, conceptual dependency and scripts, problem solving: inference and resolution, basics of constraint satisfaction problems (CSP).

Unit-III

Introduction to Machine Learning: Overview of machine learning, machine learning workflow, and applications of machine learning, supervised learning, unsupervised learning, semi-supervised learning and reinforcement learning, data preparation and model evaluation: training, testing and validation datasets, underfitting and overfitting, bias–variance tradeoff, performance evaluation metrics: accuracy, precision, recall, F1-score, confusion matrix and basics of ROC Curve.

Unit-IV

Supervised Learning Algorithms: Regression: linear regression multiple linear regression and logistic regression, distance based models: distance metrics (euclidean, manhattan, hamming, minkowski distance metric),classification algorithms: k-nearest neighbors (kNN), decision trees, random forest (RF), support vector machines (SVM) – basics ,Naïve Bayes Classifier, feature engineering and feature selection.

Unit-V

Unsupervised Learning & Neural Networks:

Clustering as learning task: k-means clustering, hierarchical clustering, perceptron learning– biological neuron, introduction to ANN, Mcculloch-Pitts Neuron, Perceptron and its learning algorithm, Sigmoid neuron, activation functions: Tanh and ReLU Multi-layer Perceptron Model and its architecture, Learning parameters: weight and bias in neural networks, loss function: mean square error (MSE), basic concepts and applications of deep learning.

LIST OF PRACTICAL ASSIGNMENTS

1. Implement BFS and DFS on a simple graph and print the traversal order.
2. Implement A* Search to find the shortest path between two nodes in a grid.
3. Implement 8-puzzle problem using best first search.
4. Implement Linear Regression on a house price dataset and plot the regression line.
5. Implement Support Vector Machine (SVM) on a binary classification dataset and report accuracy and confusion matrix.
6. Implement k-Nearest Neighbours (kNN) on the Iris dataset and evaluate using confusion matrix.
7. Implement a Decision Tree classifier on any simple dataset and visualise the tree.
8. Implement K-means clustering on a 2D dataset and visualise the clusters.

BOOKS RECOMMENDED:

[1]. Stuart Russell & Peter Norvig : Artificial Intelligence: A Modern Approach.
[2]. Rich Elaine, Knight Kevin, Nair Shivashankar B.: Artificial Intelligence, McGraw-Hill, 3e, 2009.
[3]. Tom Mitchell : Machine Learning**,** McGraw-Hill, First Edition.
[4]. Ethem Alpaydin: Introduction to Machine Learning, MIT Press.
[5]. Jack Zurada: Introduction to Artificial Neural Systems, PWS Publishing Co. Boston.

Course Outcomes (CO)	After completion of the course, students will be able to:
CO1	Acquire Knowledge and Understand the fundamentals of Artificial Intelligence, intelligent agents, search strategies, and problem-solving techniques for AI applications.
CO2	Apply knowledge representation, logical reasoning, inference mechanisms, and constraint satisfaction techniques to solve AI problems.
CO3	Analyze machine learning paradigms, data preprocessing techniques, model validation methods, and evaluation metrics for intelligent systems.
CO4	Develop and evaluate supervised machine learning models using regression, classification algorithms, and feature engineering techniques.
CO5	Apply clustering techniques and artificial neural network models to solve real-world problems and understand the fundamentals of deep learning.

CO-PO-PSO Mapping

Course Name: **Fundamentals of Artificial Intelligence and Machine Learning** Course Code: **5RMPE2**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	–	–	2	1	1
CO2	3	3	2	2	1	–	–	–	–	–	–	2	2	1
CO3	3	2	2	2	2	–	–	–	–	–	–	2	3	2
CO4	3	3	3	2	3	–	–	–	–	–	–	2	3	2
CO5	3	3	2	2	3	–	–	–	–	–	–	3	3	3
Average	3	2.6	2	1.6	2	0	0	0	0	0	0	2.2	2.4	1.8