<table>
<tr><td colspan="6">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering & Technology</td><td>III-Year
B.Tech.
(Electronics and Instrumentation Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="5">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">5REPC1

AI AND MACHINE LEARNING</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">90</td><td rowspan="2">3</td></tr>
<tr><td>20</td><td>10</td><td>-</td><td>60</td></tr>
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Course Learning Objectives:

1. To introduce the objectives, components, categories, intelligent agents, current trends and applications of artificial intelligence.
2. To apply appropriate search strategies and problem-solving techniques to solve AI-based problems.
3. To analyze data using statistical methods, probability concepts, and hypothesis space searching techniques to develop a predictive model.
4. To develop the ability to design, implement, and evaluate supervised learning models by effectively utilizing training, validation, and test datasets and applying classification and regression algorithms for solving real-world problems.
5. To apply, implement, and evaluate unsupervised, ensemble, reinforcement, and neural network-based learning techniques for solving complex real-world problems, and to develop these machine learning models using Python programming.

Prerequisites:

Knowledge of Python, Linear Algebra, Probability

COURSE CONTENTS

Unit –I

Introduction to artificial intelligence, objectives of AI, foundations of AI, categories of AI, components of AI, sub domains of artificial intelligence, applications of AI, current trends in artificial intelligence, Intelligent agents and environment: intelligent agents, concept of rationality, PEAS description of agents, types of environments, structure of intelligent agents: simple reflex agents, model-based reflex agents, goal-based agents and utility-based agents learning agents.

Unit-II

Problem solving methods, search strategies, uninformed search strategies: breadth first search, depth first search, depth limited search, iterative deepening depth first search, uniform cost search, bidirectional search, informed search strategies, heuristics functions, greedy best first search, A* search, Local Search Algorithms and Optimization Problems, Backtracking Search, Game Playing, Optimal Decisions in Games, Alpha, Beta Pruning. Natural language processing. Implementation of AI algorithms using python programming.

Unit-III

Understanding Data: training, validation, and test datasets; data preprocessing, data transformation techniques including Min–Max normalization and Z-score standardization; Descriptive statistics: Data types, univariate data analysis and visualization, Bivariate and multivariate statistics, Machine learning and probability of statistics, Bayes rule, Bayesian networks, hypothesis, hypothesis testing, basics of learning theory, Concept learning, representation of hypothesis, hypothesis space, hypothesis space searching algorithm. Induction biases, Implementation of statistical modules, data preprocessing and hypothesis space searching algorithm using python programming.

Unit-IV

Aspects of developing a learning system: Forms of learning, supervised learning, regression and classification learning methods: linear regression, multiple linear regression, logistic regression, polynomial regression, Lasso & Ridge regression, KNN algorithm, Weighted KNN algorithm, decision tree, ensemble learning, support vector machines, Naive Bayes algorithm, performance evaluation of models, Confusion matrix, Implementation of machine learning modules using python programming.

Unit-V

Unsupervised Learning, clustering and Association, K-means clustering algorithm, hierarchical clustering, Anomaly detection, Reinforcement learning, Artificial Neural Networks: introduction, biological neurons, simple model of artificial neurons, perceptron & learning theory, types of Artificial Neural Networks. Introduction to Deep learning: introduction to Deep Neural Network, loss function & optimization, Regularization methods, Convolutional Neural Network, Recurrent Neural Network, Long Short-Term Memory, Gated Recurrent Unit, Implementation of machine learning modules using python programming.

Course Outcomes:

CO. No.	CO	PO
CO1	Develop the ability to analyze, classify, and apply core Artificial Intelligence concepts, intelligent agent models, environments, and AI subdomains in practical scenarios to support intelligent decision-making applications.	PO-1, PO-2, PO-3, PO-12
CO2	Formulate and implement intelligent problem-solving models by applying search strategies, optimization methods, knowledge representation techniques, and adversarial algorithms to solve real-world computational problems.	PO-1, PO-2, PO-3, PO-5, PO-12
CO3	Analyze and model data preprocessing methods, statistical techniques, and hypothesis space search algorithms, and implement them using Python to support predictive modeling and intelligent data analysis.	PO-1, PO-2, PO-3, PO-5, PO-12
CO4	Apply and implement supervised learning techniques, including classification and regression algorithms to develop and evaluate predictive models for real-world datasets.	PO-1, PO-2, PO-3, PO-4, PO-5, PO-9, PO-12
CO5	Design and deploy unsupervised learning, reinforcement learning, and neural network techniques to build intelligent models for pattern recognition, predictive analytics, and decision-making applications.	PO-1, PO-2, PO-3, PO-4, PO-5, PO-9, PO-12

Books Recommended:

[1]. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2009.
[2]. Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE), Mc Graw Hill, 2008.
[3]. David L. Poole, Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
[4]. Mitchell Tom M., Machine Learning, Mc Graw Hill Education (India) Edition 2013.
[5]. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series). The MIT Press; second edition, 2009.
[6] Michael Bowles, Machine Learning in Python, John Wiley & Sons, Inc., 2015

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
5REPC1.CO1	3	3	2									2	1	3	1
5REPC1.CO2	3	3	2		2							2	1	3	2
5REPC1.CO3	3	3	3		3							2	1	3	1
5REPC1.CO4	3	3	3	2	3				2			2	1	3	2
5REPC1.CO5	3	2	3	2	3				2			2	2	3	3