D Y PATIL INTERNATIONAL UNIVERSITY
Sector 29, Pradhikaran, Akurdi, Pune - Maharashtra, INDIA 411044
(Establishment by Maharashtra Act No. LXIII of 2017)
School of Computer Science, Engineering & Applications

Course Name	Foundations of Artificial Intelligence and Machine Learning
Course Code	CSE3001
Credits	4
Prerequisites	AI-ML Fundamentals
L-T-P-C	3-0-2-4

COURSE OBJECTIVES

1. To understand the fundamentals of Machine Learning, its types, and how it relates to traditional statistical methods.
2. To explore core concepts and models of Artificial Neural Networks (ANN), including learning rules, network design, and activation mechanisms.
3. To gain foundational knowledge of Artificial Intelligence, including intelligent agents, environments, and rational decision-making processes.
4. To apply various optimization techniques, both constrained and unconstrained, in solving real-world AI/ML problems.
5. To design and implement AI and ML-based capstone projects that integrate theoretical knowledge with practical application.

COURSE SYLLABUS

Modules	**No. of Lectures**
Module-I: Fundamentals of Machine Learning: – Meaning of Machine Learning, Relationship between Machine Learning and Statistical Analysis, Process of Machine Learning, Types of Machine Learning Algorithms (Supervised learning, Semi-supervised learning, Unsupervised learning, Transduction, Reinforcement learning)	6
Module-II: Fundamental Models of ANN – Gradients Methods, Concept of Hessian matrix, Basics of Neural networks, Basic terminologies of neural networks: Weights, Biases, Activation Functions, Threshold, Designing and programming your own neural networks, Learning rules, Hebb's Net, Perceptron	8
Module-III: Introduction to Artificial Intelligence – AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	8

Module-IV: Optimization Techniques – Basic concepts of optimization, Constraint and unconstrained optimizations, Modelling of different problems using optimization techniques, Introduction and applications of non-gradient methods.	8
Module-V: Projects – Capstone Projects based on the learning from AI and ML	6
Total Lectures	36

LABORATORY	
Sr. No.	**Content**
1	Implement supervised learning (Linear Regression or Classification) using Python/Scikit-learn.
2	Apply unsupervised learning (K-Means Clustering or PCA) on a dataset.
3	Implement a basic Artificial Neural Network (ANN) from scratch.
4	Demonstrate activation functions (Sigmoid, ReLU, Tanh) with plots and analysis.
5	Design a problem-solving agent for a toy problem (e.g., vacuum cleaner agent).
6	Simulate a rational agent in a defined environment.
7	Solve a mathematical optimization problem using non-gradient-based techniques (e.g., Genetic Algorithm).
8	Apply constraint-based optimization for a real-world problem (e.g., resource allocation).
9	Mini Project: Train an ML model on real-world dataset (e.g., spam detection, movie recommendations).
10	Capstone Project: Build and deploy a small AI/ML application (e.g., chatbot, sentiment analysis, or fraud detection)

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1	Understand the fundamentals of Machine Learning, its types, and how it relates to traditional statistical methods.
CO2	Explore core concepts and models of Artificial Neural Networks (ANN), including learning rules, network design, and activation mechanisms.
CO3	Gain foundational knowledge of Artificial Intelligence, including intelligent agents, environments, and rational decision-making processes.
CO4	Apply various optimization techniques, both constrained and unconstrained, in solving real-world AI/ML problems.
CO5	Design and implement AI and ML-based capstone projects that integrate theoretical knowledge with practical application.

CO-PO Mapping:			3: Substantial			2: Moderate					1: Slight			
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	1	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	2	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3

TEXTBOOKS

1. Stuart J. Russell and Peter Norvig., *Artificial Intelligence: A Modern Approach*, Pearson
2. Chris Sebastian, *Machine Learning for Beginners*
3. Ethem Alpaydin, *Machine Learning: The New AI*

REFERENCES

1. Tom M. Mitchell, *Machine Learning*, McGraw-Hill
2. Wolfgang Ertel, *Introduction to Artificial Intelligence*, Springer.
3. V. Subramanian, *Fundamentals of Artificial Intelligence*, Springer.
4. Suvrit Sra, Sebastian Nowozin, Stephen Wright, *Optimization for Machine Learning*, MIT Press.

EVALUATION SCHEME

Theory: (70%)			
Continuous Assessment	**Mid-term**	**End-term**	**Total**
25	25	50	100

Practical: 30%				
Continuous Assessment			**End-term Practical**	**Total**
Lab Manual	**Lab Assessment**	**Internal Viva-voce**		
10	10	30	50	100