

Code No.: **MDS 556**

Paper: **Artificial Intelligence**

Nature: Theory + Practical (Elective)

Full Marks: 75

Credit: 3

***Course Description:***

This course covers the underlying principles and theories of artificial intelligence. The course covers the design of intelligent agents, problem solving, searching techniques, knowledge representation systems, concepts of neural networks, machine learning techniques. It covers applications of AI in the field of natural language processing, expert systems, machine vision as well.

***Course Objectives:***

The main objectives of the course are to

- Understand concepts of artificial intelligence
- Learn about intelligent agents and design the agents,
- Identify AI problems and solve the problems using AI techniques,
- Design knowledge representation systems and expert systems,
- Understand concepts of machine learning
- Understand concepts of artificial neural networks
- Understand application of AI.

***Course Contents:***

**Unit 1: Introduction**

**[4Hrs.]**

Introduction of Artificial Intelligence

Defining Artificial Intelligence: acting and thinking humanly: Turing Test, acting and thinking rationally

Foundations of Artificial Intelligence

History of Artificial Intelligence

Applications of Artificial Intelligence

**Unit 2: Agents**

**[6Hrs.]**

Agent, Intelligent Agent, Rational Agent

Structure of Intelligent Agent: Agent Function, Agent Program

Configuration of Agents: PEAS/PAGE description of Agents

Agent Types

Environment Types

**Unit 3: Solving Problems by Searching**

**[10 Hrs.]**

Problem, State Space Representation,

Formulating Problems, Solving Problems by Searching, Types of Search

Blind Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bidirectional Search

Informed Search: Heuristic, Heuristic Function, Greedy Best first search, A\* search, Admissibility and Optimality of A\*

Local Search: Hill Climbing, Simulated Annealing

AND-OR Search Trees

Adversarial Search: Mini-max Algorithm, Alpha-Beta Pruning.

Constraint Satisfaction Problems

**Unit 4: Knowledge Representation and Reasoning****[15Hrs.]**

Knowledge, Knowledge Representation in agents

Knowledge Representation Systems

Types of Knowledge Representation Systems: Semantic Network, Frame, Conceptual Dependency, Script, Rule Based System, Propositional Logic, Predicate Logic

Propositional Logic(PL):Syntax and Semantics, Proof by Resolution, Conjunctive Normal Form, Resolution Algorithm

Predicate Logic: FOPL, Syntax and Semantics, Quantifiers, Unification and Lifting, Inference using Resolution Algorithm

Uncertain Knowledge: Uncertainty, Random Variables, Probability, Prior and Posterior Probability, Probabilistic Reasoning, Bayes' Rule and its use, Bayesian Networks

Fuzzy Logic and Fuzzy Rule Base System

**Unit 5: Concepts of Machine Learning****[7Hrs.]**

Introduction to Machine Learning

Supervised, Unsupervised and Reinforcement Learning

Learning with Neural Networks: Artificial Neural Networks (ANN), Mathematical Model of ANN, Types of ANN, ANN for simulation of gates, Learning by ANN, Perceptron Learning, Back-propagation Algorithm

Deep Learning

Statistical-based Learning: Naive Bayes Model

Learning by Evolutionary Approach: Genetic Algorithm

**Unit VI: Applications of AI****[6 Hrs.]**

Expert System

Natural Language Processing

Robotics

Machine Vision

AI in Data Science

**Laboratory Works:**

Students should implement intelligent agents, expert systems, various search techniques, knowledge representation systems and machine learning techniques using appropriate programming language.

**References:**

1. Russel, S.&Norvig, P..*Artificial Intelligence A Modern Approach*, Pearson.
2. Rich, E., Knight, K. &Nair, S. B. *Artificial Intelligence*, Tata McGraw Hill.
3. G. F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Addison Wesley.
4. Winston, P. H. *Artificial Intelligence*, Addison Wesley.
5. Jackson, P. C. *Introduction to Artificial Intelligence*, Dover Publications Inc.
6. Patterson, D. W. *Artificial Intelligence and Expert Systems*, Prentice Hall.
7. Konar, A..*Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain*, CRC Press.

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