Artificial Intelligence

Elective II

EG3204CT.3

Year: III **Total: 7 hours /week**

Part: I **Lecture: 3 hours/week**

Tutorial: 1 hour/week

Practical: 0 hours/week

Lab: 3 hours/week

Course description:

This course is designed to introduce basics of artificial intelligent. It covers fundamental concepts artificial intelligence, problem solving, knowledge representation, neural networks, machine learning, natural language processing, machine vision and expert systems.

Course objectives:

The objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Upon the completion students will be able to:

1. Gain fundamental concepts of principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
2. Investigate applications of AI techniques in expert systems, artificial neural networks and other machine learning models.

Course Contents:

Theory

Unit 1. Introduction [6 Hrs.]

1.1. Artificial Intelligence,
1.2. Hard vs. Strong AI, Soft vs. Weak AI
1.3. Foundations and Applications
1.4. Intelligent Agents:
  1.4.1. Introduction of agents
  1.4.2. Structure of Intelligent agent
  1.4.3. Properties of Intelligent Agents
  1.4.4. PEAS description of Agents
  1.4.5. Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning agent, Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

Unit 2. Problem Solving Methods [12 Hrs.]

2.1. Definition of a Problem, Problem as a state space representation, Problem formulation, Well-defined problems
2.2. Constraint satisfaction problem
  2.2.1. Water jug problem
  2.2.2. N-Queen problem
  2.2.3. Cryptarithmetic problem
2.3. Problem solving by searching
2.4. Types of searching
2.5. Measuring problem solving performance
2.6. General State Space Search
2.7. Uninformed:
  2.7.1. Breadth-First Search

2.7.2. Depth-First Search
2.7.3. Depth-Limited Search
2.7.4. Iterative Deepening depth first Search.

2.8. Informed search:
2.8.1. Greedy Best-First Search
2.8.2. A* Search, Optimality of A*
2.8.3. Local search: Hill Climbing

2.9. Game Playing, Optimal Decisions in Games, Alpha – Beta Pruning, Minimax Algorithm, Tic-Tac –Toe Problem, Stochastic Games

Unit 3. Knowledge Representation and Reasoning [10 Hrs.]

3.1. Definition and importance of Knowledge
3.2. Issues in Knowledge Representation
3.3. Knowledge Representation Systems
3.4. Properties of Knowledge Representation Systems
3.5. Types of Knowledge
3.6. The Role of Knowledge
3.7. Knowledge representation techniques:
3.7.1. Rule Based
3.7.2. Logic based
3.8. Propositional Logic
3.8.1. Syntax and Semantic of propositional logic
3.8.2. Proof by Resolution
3.9. Predicate Logic:
3.9.1. FOPL, Syntax, Semantics, Quantification, horn clauses
3.9.2. Inference with FOPL: By converting into PL (Existential and universal instantiation)

Unit 4. Learning [5 Hrs.]

4.1. Concepts of machine learning
4.2. Rote learning
4.3. Learning by analogy
4.4. Inductive learning
4.5. Explanation based learning,
4.6. Supervised and unsupervised learning
4.7. Learning by evolution (genetic algorithm)

Unit 5. Neural Networks and Natural Language Processing [7 Hrs.]

5.1. Introduction to artificial neural network
5.2. Mathematical model of neural network
5.3. Types of neural network: feed-forward, feed-back, Gate realization using neural network
5.4. Learning in neural networks: Back propagation algorithm, Hopfield network
5.5. Concepts of natural language understanding and natural language generation
5.6. Steps in natural language processing:
5.6.1. Syntax analysis
5.6.2. Semantic analysis
5.6.3. Pragmatic analysis

Unit 6. Expert System and Machine Vision [5 Hrs.]

6.1. Expert System
6.2. Architecture of an expert system
6.3. Stages of expert systems development.
6.4. Concept of Machine Vision
6.5. Steps of machine vision
6.6. Application of machine vision

Practical **[45 Hrs.]**

Laboratory exercises can be conducted in PROLOG or any other high-level programming languages. Laboratory exercise must cover the concepts of:

1. Rule based intelligent agents
2. Inference and reasoning
3. Implementing DFS
4. Implementing BFS
5. Implementing A* search
6. Implementing Tic-Tac Toe
7. Implementing water jug problem
8. Implementing N-queen problem
9. Neural networks, etc. for solving practical problems.

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	6	12
2	**Problem Solving Methods**	12	21
3	Knowledge Representation and Reasoning	12	21
4	Learning	4	7
5	Neural Networks and Natural Language Processing	7	12
6	Expert System and Machine Vision	4	7
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. R. Stuart and N. Peter, Artificial Intelligence A Modern Approach, Pearson
2. E. Rich, K. Knight, Shivashankar B. Nair, Artificial Intelligence, Tata McGraw Hill.
3. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall