DEPARTMENT OF
COMPUTER SCIENCE

FACULTY OF COMPUTING & ARTIFICAL INTELLIGENCE

Course Guide

Artificial Intelligence
2024-2025

Air University Islamabad

Course Description:

This course provides a comprehensive coverage of topics related to Artificial Intelligence. The main focus is to learn techniques and theory developed in major areas of Artificial Intelligence and to learn about the state of the art in Artificial Intelligence.

1. To have an appreciation for and understanding of both the achievements of AI and the theory underlying those achievements.
2. To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
3. To study and discuss various techniques and algorithms of AI used in general problem solving, optimization problems, constraint satisfaction problems, and game programming.
4. To have a basic understanding of some of the more advanced topics of AI such as Knowledge based systems, fuzzy systems and learning using Hidden Markov model, Bayesian networks, Regression model and neural networks.

Pre-requisites

1. Data Structure and Algorithms

Schedule:

Week #	Topics Covered (16 Lectures Plan)
1	**Chapter 1: Introduction to Artificial Intelligence (AI)** • Introduction to AI • The Foundations of AI • History of AI • Approaches to AI • State of the Art

2	**Chapter 2: Intelligent Agents**
	• Agents and Environments
	• Structure of Intelligent Agents
	• Agent Types
	    o Simple reflex agent
	    o Model-based reflex agent
	    o Goal-based agent
	    o Utility-based agent
	    o Learning agent

3	**Chapter 3: Problem Solving (Goal Based) Agents**
	1. Problem Solving by Searching
	2. Problem Formulation
	3. Search Strategies
	    1. Unformed Search Strategies
	        1. DFS
	        2. BFS
	        3. Depth Limited Depth First Search Iterative
	        4. Deepening Depth First Search

4	**Search Strategies**
	    o Unformed Search Strategies
	    o Uniform Cost Search, Bidirectional Search and Comparative Analysis

5	**Search Strategies**
	    o Informed Search Strategies (Heuristically Searches)
	    o First Search
	    o Greedy Best First Search
	    o A* Procedure

6	**Local Search Strategies**
	   o Introduction to Error Surface, Optimization and Optimization as a Searching Problem, Gradient Descent
	   o Hill Climbing, Random Restart, Multiple Restarts
	   o Simulated Annealing
	   o Beam Search

7	**Introduction to Adversarial Searches and Game Playing Agents**
	   o Minimax Algorithm
	   o Alpha-Beta Pruning
	   o **GAN's/Actor Critic Problem**

8	**Constraint Satisfaction Problems**
	   o Crossword Problem
	   o 8 Queens Problem
	   o **Timetable Allocation problem**

9	**Genetic Algorithm**
	   o Basic Genetic Algorithm
	   o Solution to a Few Problems using GA
	   o Eight Queens Problem

10	**Chapter 4: Knowledge Based Agents**
	   o Logical Agents
	   o Propositional Logic
	   o Inference in Propositional Logic
	   o Predicate (First-Order) Logic
	   o Inference in First-Order Logic

11	**Chapter 4: Knowledge Based Agents**
	   o Knowledge Representation
	   o Knowledge-based Systems
	   o **Chatbot/Recommendation System**

12	**Chapter no 6**
	Handling uncertainty with fuzzy systems
	   o Introduction
	   o Classical sets
	   o Fuzzy sets
	   o Fuzzy Logic
	   o Fuzzy inference system
	   o **Fuzzy C-Mean Problem**

13	**Markov Models**
	   o Markov Chain
	   o Hidden Markov
	   o Markov Decision Process
	   o **Action/Activity Recognition Problem**

14	**Introduction to Machine Learning**
	   o Types of Machine Learning and Examples
	   o Tasks of Machine Learning (Supervised/Unsupervised/Reinforcement Learning etc.)
	   o Bayesian Networks

15	**Introduction to Machine Learning**
	   o Linear Regression
	   o Multiple Linear Regression

General Grading Policy:

Exam Type	Weightage
Quizzes	15 %
Assignments	15 %
Mid-Term	25 %
Final	45 %
Total	100 %

Grading and General Course Policies:

- Assignments and/or grade percentages are subject to change. The breakdown is as follows:
- No makeup quizzes / assignments
- No late assignments will be accepted.
- All assignments should be the outcome of individual work only. Group work is explicitly prohibited (severe penalties for violation).
- **An 'F' grade will be allotted if Projects/Assignments are found copied from internet or any other sources**

Reference Materials:

Text Book:

1. Hart, P.E., Stork, D.G. and Duda, R.O., 2001. Pattern classification. John Willey & Sons.
2. Luger, G.F. and Stubblefield, W.A., 2009. AI algorithms, data structures, and idioms in Prolog, Lisp, and Java. Pearson Addison-Wesley.

Reference Book:

1. Stuart Russell and Peter Norvig, **Artificial Intelligence. A Modern Approach**, 4ed edition, Prentice Hall, Inc., 2018.

Course Learning Objectives (CLOs):

CLO	Description	Domain	GA	BT Level
	CLO's Theory			
CLO 1	Understand key components in the field of artificial intelligence	C2 (Understand)	2	2
CLO 2	Implement classical artificial intelligence techniques	C3 (Implement)	4	3
CLO 3	Analyze artificial intelligence techniques for practical problem solving	C4 (Analyze)	4	4