Artificial Intelligence

Code	Credit Hours
CS - 860	3-0

Course Description:

What do web search, speech recognition, face recognition, machine translation, autonomous driving, and automatic scheduling have in common? These are all complex real-world problems, and the goal of artificial intelligence (AI) is to tackle these with rigorous mathematical tools. In this course, you will learn the foundational principles that drive these applications and practice implementing some of these systems. Specific topics include problem formulation, search, game playing, Markov decision processes, logic, and application of AI in robotics. The main goal of the course is to equip you with the tools to tackle new AI problems you might encounter in life.

Text Book:

1. Stuart Russel, Peter Norvig. Artificial Intelligence: A Modern Approach, 4th Edition. Prentice Hall, 2021 edition.

Reference Book:

2. Any material (papers, notes, slides, video) on the web from credible sources.

Prerequisites

NA

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10 %
Assignments	10 %
Mid Terms	30 %
ESE	50 %

Teaching Plan

Week No	Topics	Learning Outcomes

1-8	Introduction to AI, Intelligent Agents, Search Algorithms, Game Theory in AI, Constraint Satisfaction Problems	Students will gain a comprehensive understanding of artificial intelligence principles, ethical considerations, and biases. They will be able to design and evaluate intelligent agents, understand various types of agents and their rational behaviors, and formulate problems for AI solutions. Students will master uninformed and informed search algorithms, including BFS, DFS, Dijkstra, UCS, IDS, Hill Climbing, Beam Search, Greedy BFS, A* Search, and memory-bounded searches like IDA*, RBFS, and SMA*. They will also learn game theory concepts such as optimal decision making, Minimax, Alpha-beta Pruning, cut-off search, evaluation functions, forward pruning, stochastic games, and Expectiminimax.
9	**MID-TERM EXAM**	
10-17	Linear Programming / Optimization, Propositional Logic, Shortest Path Algorithms, Markov Decision Processes, Reinforcement Learning	Students will become proficient in formulating and solving linear programming problems using optimization techniques like the Simplex algorithm. They will understand propositional and first order predicate logic for logical reasoning in AI. Students will master shortest path algorithms such as Dijkstra, Bellman-Ford, Floyd-Warshall, and Johnson's for network optimization. They will gain a solid understanding of Markov Decision Processes, including policy evaluation and value iteration. In reinforcement learning, students will learn model-based and model-free Monte Carlo methods, bootstrapping techniques, and algorithms like SARSA and Q-Learning, enabling them to develop advanced AI solutions.
18	**END-TERM EXAM**	