Capital University of Science and Technology

Department of Computer Science

CS4813 - Artificial Intelligence

Course Title:	Artificial Intelligence (CS4813)
Pre-requisite(s):	Data Structures (CS2143)
Credit Hours:	3
Instructor(s):	
Text Book(s):	George F. Luger: Artificial Intelligence - Structures and Strategies for Complex Problem Solving, 6thEdition, Addison-Wesley Publishing Company, 2008, ISBN 978-0321545893.
Reference Book(s):	• Stuart J. Russell and Peter Norvig: Artificial Intelligence – A Modern Approach, 3rdEdition, Prentice-Hall Publishing Co., 2009, ISBN 978-0136042594.
Web Reference:	• https://www.tutorialspoint.com/artificial_intelligence/index.htm

Course Introduction:

This course will introduce to the students the application areas of artificial intelligence (AI), the techniques and tools used in writing AI applications. In particular, the students will learn to structure a real-world problem as an AI problem, apply the appropriate techniques and tools to solve the problem. The students will be taught Prolog language and its use in representing and solving a logical system. Application of AI techniques such as state space search, heuristic search, optimization techniques, game programming, expert system development, natural language processing, and machine learning will be covered in detail. The students will be given extensive programming exercises to provide them opportunity to practice their classroom skills.

Course Objectives:

By the end of this course, the students will have an understanding of the various application areas of artificial intelligence, such as general problem solving, game playing, expert systems, natural language processing and machine learning. The students will be able to model a variety of real-world problems as state space problems and solve such problems using AI techniques and

algorithms. The students will also learn the techniques used to select optimal moves in two-player or multi-player games. The course will also cover techniques for knowledge representation and building knowledge-based systems.

Course Learning Outcomes (CLOs):

At the end of this course, the students should be able to:

- **CLO:1.** Explain artificial intelligence, its characteristics and its application areas. [C2-Comprehension]
- **CLO:2.** Formulate real-world problems as state space problems, optimization problems or constraint satisfaction problems. (C4-Analysis)
- **CLO:3.** Select and apply appropriate algorithms and AI techniques to solve complex problems. (C3-Application)
- **CLO:4.** Design and develop an expert system by using appropriate tools and techniques. [C5-Synthesis]

CLOs – PLOs Mapping:

	CLO:1	**CLO:2**	**CLO:3**	**CLO:4**
PLO:1 (Academic Education)				
PLO:2 (Knowledge for Solving Computing Problems)	√			
PLO:3 (Problem Analysis)		√		
PLO:4 (Design/Development of Solutions)			√	√
PLO:5 (Modern Tool Usage)				

Course Contents:

Week	Contents
1	• Introduction to the course • Defining AI • Turing's Test • Chinese Room Experiment • Application Areas of AI
2	• Agent Based Approach to AI • Types of Agents and their Environments
3	• Problem Solving by State Space Search • Identifying Initial State, Goal State and Operators • Examples of Formulating a Real World Problems as a State Space Search Problems • Data-driven and Goal-driven Search Strategies
4	• Breadth-first Search Algorithm • Finding Solution Path • Depth-first Search Algorithm • Finding Solution Path • DLS and IDS Search Algorithm • Comparison of Search Algorithm
5	• Informed Search Algorithms • Greedy Best-First Search • Uniform Cost Search
6	• A* Search • Design a Heuristic Function • Optimality and Completeness of A* Search • Admissibility, Monotonicity and Informedness
7	• Optimization Problems • Hill Climbing and Other Local Search Algorithms • Local Maxima
8	• Genetic Algorithms(Mutation, Crossover) • Selection Algorithm in Genetic Algorithm • Examples using Genetic Algorithms • Midterm discussion
Mid-Term Exam	
9	• Revise concepts of Genetic Algorithm • Game Programming • Minimax Algorithm

	• Applying Minimax to a Fixed Ply Depth
10	• Revision of Game Programming • Utility Function • Alpha Beta Pruning Algorithm
11	• Constraint Satisfaction Problems • Simple Backtracking Search using CSF • Heuristics for Constraint Satisfaction Problems
12	• First Order Logic • Introduction to Prolog (Atomic Sentences, Complex Sentences, Universal and existential quantifier, assertion and queries) • Introduction to Prolog • Predicate, Clauses, Queries, Built-In Predicates
13	• Introduction to Expert Systems • Design of rule-based Expert Systems • Knowledge Engineering and Knowledge Representation • Expert System Shells
14	• Machine Learning for classification • Bayesian theorem • Naïve Bayes
15	• Decision Trees
16	• Advanced Topics • Revision or Final Discussion

Grading Policy:

S.No	Grading	% of Total Marks
1	Assignments	15
2	Quizzes	15
3	Project	10
4	Mid-term Exam	20
5	Final Exam	40
	Total	**100**