|  |  |  |
| --- | --- | --- |
| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| AIC211- L | ARTIFICIAL INTELLIGENCE | 3+1 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1. Basic Information | | | |
| Instructor | Hafiza Maliha | Designation | Lab Instructor |
| Prerequisite(s) | CMC112 | Semester | Fall 2024 |
| Email | Hafiza.m@iqra.edu.pk | Phone | NA |
| Consulting Hours | Friday(12:00 – 14:00) | Office Location | -- |

|  |
| --- |
| 1. **Course Objective(s)** |
| Artificial Intelligence has emerged as one of the most significant and promising areas of computing. This course focuses on the foundations of AI and its basic techniques like Symbolic manipulations, Pattern Matching, Knowledge Representation, Decision Making and Appreciating the differences between Knowledge, Data and Code. Python has been proposed for the practical work of this course. |

|  |
| --- |
| 1. **Course Contents** |
| Introduction to AI, Intelligence and Artificial Intelligence, branches and applications. Agent based Systems: Introduction, applications, rationality, environment types, and agent types. Problem Solving, formulating problems. Uninformed search strategies, Breadth-first search, uniform search, depth first search, iterative depending search. Performance parameters. Informed (Heuristic) Search Strategies, Heuristic functions, greedy search, A\* Search, Genetic algorithm. Game Playing, minmax algorithm, Alpha Beta Pruning. Knowledge and reasoning, Introduction to Fuzzy Logic, operator, inference procedure. Advanced Topics, Machine Learning, Types of machine learning, artificial neural network, Naïve Bayes etc. Natural Language Processing; Recent trends in AI and applications of AI algorithms. Any programming language will be used to explore and illustrate various issues and techniques in Artificial Intelligence. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Apply** fundamental concepts of Artificial Intelligence, including rational agents, search algorithms, and fuzzy logic, to solve real-world problems. | C3 | GA2 | #9  IS | 9 | 60% |
| CLO2 | Leverage modern AI tools and frameworks to **design** and implement basic algorithms, including search strategies and machine learning models. | P2 | GA5 | 40% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Artificial Intelligence: A Modern Approach | Stuart Russell and Peter Norvig | 4th Edition (latest edition- 2022) |
|  | Artificial Intelligence: Foundations of Computational Agents | David L. Poole and Alan K. Mackworth | 3rd Edition (2023) |
|  | Fuzzy Logic with Engineering Applications | Timothy J. Ross, | 4th Edition, John Wiley & Sons, Ltd, 2016 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. **CLO Outcome Based Assessment (OBA) (Tentative)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Lab Manual**  **10** |  | ***CLO 1, 2*** | 10 | 100% | 10 | TBD |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments/ Lab Task**  **15** | Assignment #1 | *CLO1* | 10 | 25% | 5 |  |
| Assignment #2 | *CLO2* | 10 | 25% | 5 |  |
| Assignment #3 | *CLO1* | 10 | 50% | 10 |  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q1 | *CLO1* | 15 | **60%** | **15** |  |
| Midterm Q2 | *CLO2* | **10** | **40%** | **10** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **10** | OEL | *CLO2* | 10 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q1 | *CLO1* | 20 | **50%** |  |  |
| Final Exam Q2 | *CLO2* | 20 | **50%** |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Understand the scope of AI, types of agents, and environments.  Activities: Explore real-world AI applications (image recognition, chatbots, etc.). Implement a basic reflex agent in Python for a simple environment (e.g., vacuum cleaner problem). | 3 |  |
| 2 | 2 | Learn problem formulation and solve puzzles using search strategies.  Activities: Implement the 8-puzzle problem.  Measure problem-solving performance by tracking node expansion. | 3 |  |
| 3 | 3 | Explore BFS, DFS, and Uniform Cost Search.  Activities: Write Python implementations for BFS and DFS.  Compare their performance on a graph-based maze. | 3 |  |
| 4 | 4 | Dive deeper into search optimizations.  Activities: Implement depth-limited search and iterative deepening algorithms.  Visualize their search patterns using graphical tools. | 3 |  |
| 5 | 5 | Introduce heuristic-based search techniques like Greedy and A\* Search.  Activities: Implement the A\* algorithm for the 8-puzzle problem using Manhattan distance.  Compare Greedy Search and A\* on the same problem. | 3 |  |
| 6 | 6 | Explore optimization techniques like Hill Climbing and Genetic Algorithms.  Activities: Implement Hill Climbing for the 8-queens problem.  Simulate a Genetic Algorithm to optimize a fitness function. | 3 |  |
| 7 |  | **Open Ended Lab/Project Assigned** |  |  |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Understand game-playing agents with Minimax and Alpha-Beta pruning.  Activities: Implement Minimax for a simple game like Tic-Tac-Toe.  Enhance performance with Alpha-Beta pruning. | 3 |  |
| 10 | 8 | Explore Fuzzy Sets and Operations.  Activities: Write Python code to represent crisp and fuzzy sets.  Perform union, intersection, and complement operations on fuzzy sets. | 3 |  |
| 11 | 9 | Design a fuzzy logic-based expert system.  Activities: Develop a fuzzy system for temperature control (e.g., an air conditioner).  Implement fuzzification, rule evaluation, and defuzzification. | 3 |  |
| 12 | 10 | Explore supervised and unsupervised learning.  Activities: Implement Naïve Bayes for text classification.  Apply K-Means clustering on a dataset (e.g., Iris dataset). | 3 |  |
| 13 | 11 | Build a foundational understanding of ANN.  Activities: Create a simple perceptron for binary classification.  Train the perceptron on a linearly separable dataset. | 3 |  |
| 14 | 12 | Deep dive into multi-layer perceptrons and backpropagation.  Activities: Implement a multi-layer perceptron using libraries like TensorFlow or PyTorch.  Train it on a dataset (e.g., MNIST for digit classification). | 3 |  |
| 15 |  | **Revision / Open Ended Lab/Project Assessment** |  |  |
| 16 |  | **Open Ended Lab/Project Assessment** |  |  |
| 17 | **Final Exam** | | | |

|  |  |
| --- | --- |
| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Lab Manual 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |