# COURSE BASICS

|  |  |
| --- | --- |
| Course Title**:** | **Artificial Intelligence** |
| Course Code**:** | **CSC-411** |
| Credit Hours**:** | **2 + 1** |
| Prerequisite**:** | **None** |
| Class & Section: | **BSE – 5 A/ BSE – 5B** |

**COURSE OBJECTIVES AND DESCRIPTION:**

The objective of this course is to provide students with fundamental concepts on Artificial Intelligence and problem-solving search algorithms by exploring the filed by its breadth. The course would cover an introduction to artificial intelligence, logical agents, informed/uninformed searching algorithms, local search algorithms, adversarial search, knowledge-based agents and an introduction to few machine learning techniques, deep learning, neural networks, AI planning.

**COURSE LEARNING OUTCOMES (CLO):**

Upon completion of this course, students will be able to:

|  |  |  |
| --- | --- | --- |
| **CLO #** | **CLO Statement** | **Bloom’s Taxonomy** |
| **CLO 1** | Describe and recall the fundamental concepts behind the approaches in artificial intelligence. | Knowledge (C1) |
| **CLO 2** | Explain the concepts of AI | Comprehension (C2) |
| **CLO 3** | Apply the various AI techniques to solve Problems. | Application (C3) |

**WEEKLY BREAKDOWN:**

|  |  |
| --- | --- |
| **Week** | **Tentative Course Plan** |
| 1 | Introduction to Artificial Intelligence   * AI foundations and history  Artificial general intelligence. State-of-the-art in AI   Intelligent Agents   * Agents and environments * Rational agent * Generative AI |
| **Lab#01: Advanced Python Programming** |
| 2 | * K line theory of memory, * Nature of environments * Structure of agents (Simple reflex, Model-based reflex, Goal-based, Utility-based) * Multiagent systems and Distributed AI. |

|  |  |
| --- | --- |
|  | **Lab#02: Python packages** |
| 3 | Solving Problems by Searching Uniformed and informed search  Formulating problem  BFS, DFS, Uniform cost search. |
| **Lab#03: Uninformed search algorithms** |
| 4 | * Greedy best first search A\* admissible heuristics Hill climbing Search in complex environment |
| Lab#4: Informed search algorithm |
| 5 | Adversarial search Minimax, alpha beta pruning |
| **Lab#05: Tic Tac Toe search** |
| 6 | * Logic * Proposition logic revision * First order logic and inference * Godelincompleteness theorems and its implication on AI |
| **Lab#06: inference engine of propositional logic** |
| 7 | * AI planning * Forward and backward state space search , plan and state space search. Partial order planning. Graphplan , Prodigy |
| **Lab#07: LISP and Planning in Graphplan and prodigy** |
| 8 | Knowledge based management system  Ontologies, Semantic net, Ontolingua, Protégé.  Circumscription. |
| **Lab#08: Introduction to building ontologies in Protégé** |
| **9** | **MIND TERM EXAMINATIONS** |
| 10 | * Genetic algorithm and genetic programming. * Selection.Cross over mutation. Applications like antenna Beowulf cluster for genetic programming |
| **Lab#09: Some examples of genetic algorithm** |
| 11 | * Uncertain knowledge and reasoning Bayes theorem. Naïve Bayes models Bayesian network Hidden Markov model. DBN. |
| Lab 10: Text classification using Naïve Bayes |
| 12 | * Making simple and complex decisions Decision network MDP POMDP |
| **Lab#11: Decision making using MDP** |

|  |  |
| --- | --- |
| 13 | * Learning in AI. PAC learning Types of machine learning. Gradient descent. Hyper parameter tuning Linear regression and classification |
| **Lab#12: linear regression** |
| 14 | Decision trees. Non parametric model. Ensemble learning. |
| **Lab#13: Decision Trees** |
| 15 | * Neural networks, perceptron Backpropagation, Recurrent neural networks BP through time |
| **Lab#14: Artificial Neural Networks** |
| 16 | **Deep learning**  • Neural Networks CNN, Deep RNN GAN, GPT, BERT Gemini |
| Lab #14 CNN for vision |
| 17 | Robotics , Robotic perception, planning and control Strong AI, Weak AI, Chinese room experiment  Generative AI and its tools. |
| **18** | **Final Term Exam** |

***NOTE:***

1. *This schedule is subject to revisions as conditions may warrant.*
2. *Topics will be covered in sequence no matter if city observes any planned or unplanned holidays.*
3. *The information in this course outline is subject to revision as conditions may warrant.*

# COURSE ASSESSMENT METHOD

**METHOD OF EVALUATION AND STRUCTURE:**

A student’s grade will be based on multiple measures of performance as mentioned below: -

|  |  |
| --- | --- |
| **EVALUATION INSTRUMENTS (EI)** | **MARKS** |
| Quizzes (4 Quizzes of 10 Marks) | 10 |
| Assignments (4 Assignments) | 20 |
| Mid Term Examination | 20 |
| Final Examination | 50 |
| **Total** | **100** |

*NOTE: Any change in this scheme/format will be communicated well in time.*

**MAPPING OF CLOS TO PLOS (PROGRAM LEARNING OUTCOMES)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PLO’S** |  | | **CLO’S** | |  |  |
| **CLO 1** | **CLO 2** |  |  | **CLO 3** | **CLO 4** |
| PLO:1 (Engineering Knowledge) | ✓ | ✓ |  |  |  |  |
| PLO:2 (Problem Analysis) |  |  |  |  | ✓ | ✓ |
| PLO:3 (Designing and Development of Solutions) |  |  |  |  |  |  |
| PLO:4 (Investigation) |  |  |  |  |  |  |
| PLO:5 (Modern Tool Usage) |  |  |  |  |  |  |
| PLO:6 (The Engineer and Society) |  |  |  |  |  |  |
| PLO:7 (Environment and  Sustainability) |  |  |  |  |  |  |
| PLO:8 (Ethics) |  |  |  |  |  |  |
| PLO:9 (Individual and Team Work) |  |  |  |  |  |  |
| PLO:10 (Communication) |  |  |  |  |  |  |
| PLO:11 (Project Management) |  |  |  |  |  |  |
| PLO:12 (Lifelong Learning) |  |  |  |  |  |  |

**GRADING SYSTEM:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter Grade** | **Grade Point** | **Percentage** | |
| **A** | 4.0 | ≥ 85 | - |
| **A-** | 3.67 | ≥ 80 | < 85 |
| **B+** | 3.33 | ≥ 75 | < 80 |
| **B** | 3.00 | ≥ 71 | < 75 |
| **B-** | 2.67 | ≥ 68 | < 71 |
| **C+** | 2.33 | ≥ 64 | < 68 |
| **C** | 2.00 | ≥ 60 | < 64 |
| **C-** | 1.67 | ≥ 57 | < 60 |
| **D+** | 1.33 | ≥ 54 | < 57 |
| **D** | 1.00 | ≥ 50 | < 53 |
| **F** | 0.00 | - | < 50 |

COURSE RESOURCES

**INSTRUCTOR:**

|  |  |
| --- | --- |
| NAME: | Engr. Faiz ul haque Zeya |
| DESIGNATION: OFFICE: | Senior Associate professor Liaqat block Faculty 2 1st floor |
| EMAIL: | [Faiz.bukc@bahria.edu.pk](mailto:Faiz.bukc@bahria.edu.pk) |

**TEXT BOOK:**

Artificial Intelligence: A modern Approach (3rd Edition), Stuart Russell and Peter Norvig, Pearson.

**REFERENCE BOOKS:**

1. Gerhard Weiss . Multiagent systems.
2. Marvin Minky. Society of Mind.
3. Ian Goodfellow, Yousha Bengio. Deep learning. <https://www.deeplearningbook.org/>
4. Tom Mitchell. Machine Learning.

<https://www.cs.cmu.edu/~tom/files/MachineLearningTomMitchell.pdf>

**ONLINE REFERENCES:**

1.<http://aima.cs.berkeley.edu/>2.<http://norvig.com/>

1. [https://www.pearson.com/us/higher-education/program/Russell-Artificial-Intelligence-A-ModernApproach-3rd-](https://www.pearson.com/us/higher-education/program/Russell-Artificial-Intelligence-A-ModernApproach-3rd-Edition/PGM156683.html)  [Edition/PGM156683.html](https://www.pearson.com/us/higher-education/program/Russell-Artificial-Intelligence-A-ModernApproach-3rd-Edition/PGM156683.html)
2. <https://www.singularityweblog.com/stuart-russell/>

## Appendix I

Blooms Taxonomy Levels Codes

|  |  |
| --- | --- |
| **C**ognitive | Knowledge (C1) |
| Comprehension (C2) |
| Application (C3) |
| Analysis (C4) |
| Synthesis (C5) |
| Evaluation (C6) |
| **A**ffective | Receiving (A1) |
| Responding (A2) |
| Valuing (A3) |
| Organization (A4) |
| Characterization (A5) |
| **P**sychomotor | Perception (P1) |
| Set (P2) |
| Guided Response (P3) |
| Mechanism (P4) |
| Complete Overt Response (P5) |
| Adaption (P6) |
| Organization (P7) |