Tab 1

### COURSE DESCRIPTION FORM: AI-2002 Artificial Intelligence (AI)

### INSTITUTION: FAST School of Computing, National University of Computer and Emerging Sciences, Karachi

### PROGRAM TO BE EVALUATED: BS CS Spring 2025

## COURSE DESCRIPTION

**Course Code** AI2002 / AL2002

**Course Title** Artificial Intelligence

**Credit hours** 3 + 1

**Prerequisites** None

**Grading Policy** Absolute Grading (might have additive factor)

**Missed Assessments Policy** Retake of missed assessments will not be held except for final and sessional exams. For a missed sessional or final exam, an exam retake/pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.

**Plagiarism Policy** Plagiarism in any assessment will result in F grade in the course. Zero plagiarism tolerance policy.

**Assessment Weightage**

Theory

| **Assessment** | **% weightage** |
| --- | --- |
| Final Exam | 50 |
| Sessional (1 and 2) | 30 |
| Quizzes | 8 |
| Assignments | 8 |
| Project | 4 |

Lab Work

| **Assessment** | **% weightage** |
| --- | --- |
| Final Exam | 50 |
| Mid Term | 26 |
| Lab Tasks | 14 |
| Project | 10 |

**Course Instructors** Dr. [Fahad Sherwani](mailto:fahad.sherwani@nu.edu.pk), [Anaum Hamid](mailto:anaum.hamid@nu.edu.pk), Fizza Aqeel, Yusra Kaleem, Nauraiz Subhan, Alina Arshad, Saeeda Kanwal, Saif-Ur-Rehman, Syed [Farooq Zaidi](mailto:farooq.zaidi@nu.edu.pk)

**Lab Instructors** Sarah, Shafique-Ur-Rehman, [Abdullah Yaqoob](mailto:abdullah.yaqoob@nu.edu.pk), Ravia Ijaz, Talha Shahid, Muhammad Khalid, [Sohail Ahmed](mailto:sohailahmed@nu.edu.pk), Alishba Subbani, Almas Ayesha, Mehak Mazhar, Ramsha Jatt

**Course Coordinator** Syed [Farooq Zaidi](mailto:farooq.zaidi@nu.edu.pk)

**Lab Coordinator** Alishba Subbani

**Current Catalog Description** This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence. Upon completion, students should be able to develop intelligent systems by assembling solutions to concrete computational problems; understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering; and appreciate the role of problem solving, vision, and language in understanding human intelligence from a computational perspective.

**Text Book** Stuart Russell and Peter Norvig, Artificial Intelligence. A Modern Approach, 4th Global Edition, Prentice Hall, Inc.

**Reference Material**

## TOPICS TO BE COVERED

| List of Topics | Week | Contact  Hours | CLO(s) |
| --- | --- | --- | --- |
| Introduction to AI, 4 dimensions of Ai, basic components of AI, Identifying AI systems. (1 Lecture)  Branches of AI (State of the Art), History of Ai (1 Lecture)  Intelligent Agents: Agents and Environments, sensors, actuators. The Concept of Rationality, Performance measures, Rationality, Rationality V/S Omniscience (1 Lecture) | 1 | 3 | 1 |
| The Nature of Environment, Performance, Environment, Actuators and Sensors (PEAS), Agent Types, Properties of environments, The structure of Agents (1 Lecture)  Problem Representation: Introduction to Trees and Graphs. Problem Solving by Searching: Problem Solving agents, Components of Problem. (1 Lecture)  Formulating problems, Searching for Solutions. (1 Lecture) | 2 | 3 | 1,2,3 |
| Uninformed Search (1 Lecture)  Informed Search: Using heuristics to improve tree search. Admissible Heuristics (1 Lecture)  Local Search: Hill Climbing + Genetic Algorithm (1 Lecture) | 3 | 3 | 1,2,3 |
| Constraint Satisfaction Problems: Intro and defining **CSPs**. How is it different from other search problems? **Map-Coloring** and Job-shop scheduling as examples of CSP, mapping other problems to CSPs and making **Constraint Graphs** (1 Lecture)  Backtracking Search: Recursive pseudo-code of backtracking-search algorithm. Dry running a problem (N-Queen) with backtracking-search. (1 Lecture)  Improving Backtracking Search: Variable and Value Ordering  (1 Lecture) | 4 | 3 |  |
| Further Improving Backtracking Search: Forward propagation and Maintaining Arc Consistency (MAC). (1 Lecture)  Adversarial Search: Min-Max Algorithm and Alpha Beta Pruning  Using heuristics instead of solving Min-max to leaf nodes.  (1 Lecture)  Revision before Sessional 1. (1 Lecture) | 5 | 3 | 2,3 |
| **Sessional 1 Exam** | 6 |  |  |
| Basic Probability, Inference using full joint distributions, Independence  Conditional independence, and conditional dependency. **Bayes Rule**  **Probabilistic Reasoning:** **Bayesian Networks**. Inference using Bayesian Networks and **Markov Blankets** | 7 | 3 | 2,3 |
| **Supervised Learning:** Learning from data, classification vs regression,  Model Selection: Training-Validation-Test split, **K-Fold**, LOOCV and **Confusion Matrix**, Ockham's Razor overfitting and underfitting  Naive Bayes Model and Laplace Smoothing  **Linear Regression** | 8 | 3 | 2,3 |
| **Logistic Regression:** Gradient descent and loss function  Learning rate, complexity and L1, L2 Regularization  Brief discussion of SVM, Perceptron and Kernel Trick  Nearest Neighbors | 9 | 3 | 2,3 |
| Decision Trees: Entropy, Information gain and **ID3** Algorithm  **Unsupervised Learning:** Clustering using **K-Means** algorithms  Revision before Sessional 2 | 10 |  |  |
| **Sessional 2 Exam** | 11 |  |  |
| Sequential Decision Problems: **Markov Decision Process** and  optimal policies in stochastic environments.  Bellman Equation  Solving MDPs using value iteration | 12 | 3 | 2,3 |
| Reinforcement Learning: Types of RL, Applications of RL  NLP an introduction  NLP: Grammar and Parsing | 13 | 3 | 2,3 |
| Miscellaneous Topics: Latest Trends in Ai | 14 | 3 | 3 |
| Revision for final exam | 15 |  |  |
| **Final Exam** | 16 |  |  |