**KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY**
**(DEEMED TO BE UNIVERSITY)**
**SCHOOL OF COMPUTER ENGINEERING**
**B.Tech. in C.S.E/IT**

| | | | | | |
|---|---|---|---|---|---|
| **Sub.Code** | : | **CS 3011 (L-T-P: 3-0-0)** | **Year / Sem** | : | III / V |
| **Sub.Name** | : | **Artificial Intelligence** | **Batch** | : | 2021-2025 |
| **Course Coordinator** | | **Dr. Rajdeep Chatterjee** | **Academic Year** | : | 2023-2024 |
| **Faculty Name** | : | Dr. Debajyoty Banik, Mr. Sovan Kumar Sahoo, Dr. Santwana Sagnika, Mr. N. Biraja Isac, Dr. Mainak Bandyopadhyay, Mr. Debanjan Pathak, Dr. Rina Kumari, Ms. Archana Balmik, Dr. Madhabananda Das, Mr. Ajay Anand, Mr. Subhadip Pramanik, Dr. Pampa Sinha, Dr. Banhi Sanyal, Dr. Pratyusa Mukherjee, Mr. Anirban Bhattacharjee, Mrs. Subhashree Darshana, Dr. Padarabinda Samal, Dr. Nibedan Panda, Dr. Jaydeep Das, and Ms. Susmita Das | | | |

**Course Objectives:** The objective of the course is to learn, understand, and practice of Artificial Intelligence

**Course Outcomes:** The students learning outcomes are designed to specify what the students will be able to perform after completion of the course:

CO1. Ability to gain the basic idea of Artificial Intelligence (AI) by broadly understanding its definitions, foundations, history of its developments and current state of the art real world applications.
CO2. Ability to gain the knowledge of AI from a rational agent approach by understanding the PEAS specifications of the task environments, types of environments and types of agent structures.
CO3. Ability to apply various search strategies, either uninformed or informed, for solving different search-based problems.
CO4. Ability to apply local search algorithms for solving some of the special type of search and optimization problems.
CO5. Ability to make use of algorithms of Adversarial Search and Constraint Satisfaction Problems (CSP) for solving some game problems and constraint-based problems respectively.
CO6. Ability to explain and develop some Knowledge-based agents by using either Propositional Logic or First-Order Logic through some inference techniques and planning ideas.

**Text Books:**

1. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, Pearson Education

**Reference Books:**

1. Artificial Intelligence, Rich, Knight and Nair, Tata McGraw Hill.
2. Principles of Artificial Intelligence, Nils J. Nilsson, Elsevier, 1980.

## LESSON PLAN

| Module No. & Name | Topic/Coverage | No. of Hours Required | Lectures Required | Books of Reference | Teaching Methodology |
|---|---|---|---|---|---|
| 1. Introduction | 1. What is AI?<br>2. The foundations of AI<br>3. The history of AI<br>4. The State of the Art | 3 | 1-3 | Text Book | Online, PPT and Handouts |
| 2. Intelligent Agents | 1. Agents & Environments<br>2.The good behavior: The concept of rationality<br>3.The nature of Environments | 6 | 4-9 | Text Book | Online, PPT and Handouts |

| | | | | | |
|---|---|---|---|---|---|
| | 4.The Structure of Agents<br>5. The Learning Agent<br><br>**ACTIVITY- 1 [5 marks]**<br>**(Must be conducted by 01.08.23 (TUE) covering Module nos. 1 & 2)** | | | | |
| 3. Solving Problems by Searching | 1. Problem Solving Agents<br>2. Example Problems<br>3. Searching for Solutions<br>4. Uninformed Search Strategies<br>5. Avoiding repeated states<br>6. Informed Search Strategies<br>7. Heuristic functions<br><br>**ACTIVITY-2 [5 marks]**<br>**(Must be conducted by 25.08.23 (FRI) covering part of Module no. 3)**<br><br>**ACTIVITY-5 [6 marks]**<br>**(Must be conducted by 01.09.23 (FRI) covering remaining part of Module no. 3 prior to Mid Semester Exam)**<br>***NOTE: 50% of Activities marks i.e. 18 marks to be announced to students before AI mid semester exam*** | 12 | 10-21 | Text Book | Online, PPT and Handouts |
| **MID SEMESTER EXAM<br>(11.09.2023 – 16.08.2023)** | | | | | |
| 4. Beyond Classical Search | Local search algorithms & optimization problems<br>(Hill Climbing, Simulated Annealing, Local Beam Search and Genetic Algorithm) | 6 | 22-27 | Text Book | Online, PPT and Handouts |
| 5. Constraint Satisfaction Problems | Constraint Satisfaction Problems (Definitions, Australian color mapping, Job shop scheduling, Sudoku game, Cryptarithmetic, types of variables, types of constraints, types of consistencies, constraint propagation, backtracking search for CSPs and local search for CSPs etc.) | 4 | 28-31 | Text Book | Online, PPT and Handouts |
| 6. Adversarial Search | Adversarial Search (Games, Optimal decision in games, Minimax values, Minimax algorithm, Alpha-Beta pruning etc.)<br><br>**ACTIVITY-4 [5 marks]**<br>**(Must be conducted by 13.10.23 (FRI) covering Module no. 4, and 5)** | 5 | 32-36 | Text Book | Online, PPT and Handouts |
| 7. Logical Agents | Logical Agents (Knowledge-based agents, the Wumpus World, entailment, inference, sound and complete inference algorithms, propositional logic, various inference procedures such as model checking and theorem proving, forward and backward chaining etc.) | 4 | 37-40 | Text Book | Online, PPT and Handouts |
| 8. First-Order Logic and its Inference | First-order Logic and its inference (Syntax and semantics of First-Order Logic, Propositional vs First-Order Inference etc.)<br><br>**ACTIVITY-5 [5 marks]**<br>**(Must be conducted by 10.11.23 (FRI) covering Module no. 6 and 7)** | 3 | 41-43 | Text Book | Online, PPT and Handouts |
| 9. Planning | Definition of classical planning, PDDL (Planning Domain Definition Language), application of PDDL in some example problems, Algorithms for classical planning etc. | 2 | 44-45 | Text Book | Online, PPT and Handouts |

| | | | | | |
|---|---|---|---|---|---|
| | **ACTIVITY-6 [5 marks]**<br>**(Must be conducted by 15.11.23 (WED) covering Module nos. 8 and 9)** | | | | |
| **END SEMESTER EXAM**<br>**(25.11.2023 – 02.12.2023)**<br><br>***NOTE: Inform total internal marks (50) to students prior to their End Sem Exam.*** | | | | | |

## AI Activity Chart

### 1. Activity based Teaching and Learning:

Considering the guidelines circulated and after discussing with the faculty members, following component wise description of each activity list is proposed:

### Activity List

Component wise distributions of the activities are listed

below. i). Problem Solving : 15 Marks

ii). Quiz : 10

Marks iii). Critical Thinking

: 05

Marks

### i). Problem solving (15 marks): Activity/Assignment

Assignments have to be solved in a group/individual and mentioned below for reference only. Faculties are free to give their own assignments and evaluation is to be done by the respective assigned subject teacher. Subject teachers have to decide the number of groups and students for each group. Students are expected to write the solution in the writing pad and submit the soft copy to the subject teacher.

### ii). Quiz (10 marks):

Minimum of two quizzes with easy, moderate and difficulty level will be conducted one before the mid sem and another after mid-semester examination. Faculties are free to give their own questions in the quiz. Evaluation is to be done by the respective assigned subject teacher.

### iii). Critical thinking (05 marks):

The critical thinking process is related to demonstrating the individual student's capability for grasping the subject. Evaluation is to be done by the respective assigned subject teacher.

### 2. Unit wise Activity List:

Protocol:

- Students have to participate and submit the activities in time to the concerned subject teacher as stipulated.
- Students have to appear in all in-class activities in physical mode.

- Students have to appear on at least 2 quizzes in Moodle (online) preferably.

**3. Course Materials:** Course Material will be provided for all topics which can be used as reference. The material consists of –

- Lecture Notes/PPTs
- Class Work
- Home Work
- Supplementary Reading

| Module No. | Focus Area | CO Mapping |
|---|---|---|
| **1** | Problem Solving | CO1 |
| | Quiz | |
| **2 and 3** | Problem Solving | CO2 |
| | Critical Thinking | |
| | Quiz | |
| **3 and 4** | Problem Solving | CO3 |
| | Critical Thinking | |
| | Quiz | |
| **5 and 6** | Problem Solving | CO4 |
| | Critical Thinking | |
| | Quiz | |
| **7 and 8** | Problem Solving | CO5 |
| | Critical Thinking | |
| | Quiz | |
| **8 and 9** | Problem Solving | CO6 |
| | Critical Thinking | |