# Birla Institute of Technology & Science, Pilani

## Hyderabad Campus

**Computer Science and Information Systems Department**

First Semester 2023-2024 Course Handout (Part II)

**Date**: August 11, 2023

In addition to Part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:

Course No.          : CS F407
Course Title        : Artificial Intelligence
Instructor (I/C)    : **Jabez Christopher**

### 1. Scope

This course introduces students to basic concepts and methods of artificial intelligence from a computer science perspective. AI concerns itself with a certain set of problems and develops a particular body of techniques for approaching these problems. The focus of the course will be on the study of methods of knowledge representation, reasoning, and algorithms required for the developing intelligent systems and programs.

### Course Objectives

● Empower students to know how to program computers, using classical symbolic methods, to behave in ways normally attributed to "intelligence" when observed in humans.

● To have an understanding of the core topics in AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

● To have a basic proficiency in a traditional AI language and logic, including the ability to write simple to intermediate programs and understand code.

● Emphasize the use of MATLAB, Java, Python and R to implement the use of Search strategies in real world problem solving, Game playing programs like chess or tic-tac-toe, Planners, Small Expert system shell with only inference engine, Programs for reasoning under uncertainties etc.

● Cultivate an interest in the field, sufficient to handle more advanced projects.

### 2.Text Book

**T1**: Stuart Russell, and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson education, 3$^{rd}$ Ed, 2009.

### 3. Reference Books

**R1**- George F. Luger "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson, 2002.
**R2**- D. W. Patterson, "Introduction to Artificial Intelligence & Expert Systems", PHI, 2002.
**R3**- Ross, T. J. (2005). Fuzzy logic with engineering applications. John Wiley & Sons.
**R4**- Deepak Khemani, A first course in Artificial Intelligence, Tata McGraw Hill, 1$^{st}$ Ed., 2013.
**R5**- Han, J., Pei, J., & Kamber, M. Data mining: concepts and techniques, Elsevier Publishers 2011.

### 4.PLAN OF STUDY:

| S. No. | Learning Objectives | TOPIC | CHA. REF. | Hrs |
|---|---|---|---|---|
| 1. | To understand need of AI and what can be called as an AI technique. | **Fundamental Issues in Intelligent Systems:** Definitions, Attitude towards intelligence & knowledge; Agents, Percepts, Environments; Example of an AI Technique. | T1(1), R1(1) Lecture Notes. | 2 |
| 2. | Learn state space search for problem solving; Different approaches to search a space like | **Problem Solving using Search Strategies:** State Space search: Problem Spaces, Graph Theory, and Strategies for State Space Search. | T1(3), R1(3) | 2 |

| | | heuristics, blind adversarial search etc will be covered. | Heuristic Search: Generate & Test, Hill Climbing, Best First, Problem Reduction, Properties of Heuristics like Admissibility, Monotonicity, and Informedness. | T1(5), R1(4) | 2 |
| | | | | T1(6), R1(5) | |
| | | | Adversarial Search (Game Playing): Minimax, Alpha-Beta Cutoffs. | T1 (4) Lecture Notes. | 4 |
| | | | Local Search & Optimization: Genetic Algorithms & Particle swarm optimization. | | 4 |
| 3. | To develop systems/models that can infer new information & knowledge from existing ones. Also, what would be few right approaches to represent (store) the knowledge to be processed or used in the reasoning. | **Knowledge Representation and Reasoning**: Approaches and Issues, Predicate Logic: Syntax, and Semantics of Propositional and First Order Predicate Logic, Conversion to Clause Form, Deduction, Unification, Resolution based Theorem Proving. | T1(8,9), R1(2) | 4 |
| | Handle real world data that is vague/uncertain. | **Reasoning under Uncertainties**: Bayes' Theorem, Bayesian Networks, Decision Theory. Fuzzy Logic & Representation of uncertainty Fuzzy Inference Systems | T1(13, 14,16) R3(1, 2, 4) Lecture Notes. | 4 4 |
| 4. | To understand the state of art research in reasoning systems. | Current Research on Knowledge representation and Reasoning from International Journal of Approximate reasoning or Knowledge-based Systems. | Elsevier publications | 1 |
| 5. | To build models/programs that can learn from the past. | Machine Learning: General Concepts in Knowledge Acquisition & Learning; Decision Tree, Ensemble learning Methods. | T1(18), R1(9), R5 | 2 |
| | | Explanation based learning. Inductive logic programming. | T1(19) T1(20), R1(10) | 2 |
| | Understand different machine learning algorithms with applications. | Applications of ML: Speech, Vision, Handwritten digit recognition. | Lecture Notes. | 2 |
| **6.** | To learn how to write programs that can make a computer interpret images. | Perception: Introduction, Formation, Image Processing Operations, Object Recognition. | **T1(24)** | **2** |
| 7. | To learn architecture / framework for an expert system. | Expert Systems: Rule based Expert System Architecture. | R1(13) Lecture Notes. | 2 |
| | | Fuzzy Expert Systems | | 2 |
| 8 | To understand the state of art research and applications in Exp. Sys & Decision-Support Sys. | Current Research on Knowledge representation and Reasoning from Exp. Sys. with App; CMPB, CBM etc. | Elsevier publications | 1 |
| | | | Total Lecture hours | 40 |

## 5. EVALUATION SCHEME:

| S. No. | Component & Nature | Duration | Weightage | Date and Time |
|--------|--------------------|----------|-----------|----------------|
| 1 | Mid semester Test (Closed Book) | 1.5 hrs. | 30% | 11/10 - 11.30 - 1.00PM |
| 2. | 1 Project (2 evaluations) (Open Book) | -- | 20% | TBA |
| 3. | Classroom Interaction (Open Book) | -- | 5% | TBA |
| 4. | Comprehensive Exam (Closed Book) | 3 hrs | 45% | 12/12 AN |

**Note:** All notices related to the course will be posted in CMS.

6. Makeup Policy: Genuine cases with a request for makeup reaching I/C before the day of the test may be considered.

No makeup for components 2 and 3.

**7. Chamber Consultation Hour**: Will be announced in the class.

**8. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Jabez Christopher**
**Instructor-in-charge**