# Birla Institute of Technology & Science, Pilani

Hyderabad Campus

**Computer Science and Information Systems Department**

Second Semester 2022-2023 Course Handout (Part II)

**Date**: July 9, 2024

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
Instructors : **Jabez Christopher**
Attarde Pranjali Devidas, Chavali Lalitha, Nida Fatima

## 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.

## Text Book

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

## 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**- Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 2nd Ed., 2002.
**R5**- Han, J., Pei, J., & Kamber, M. Data mining: concepts and techniques, Elsevier Publishers 2011.

**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 heuristics, blind adversarial search etc will be covered. | **Problem Solving using Search Strategies:** State Space search: Problem Spaces, Graph Theory, and Strategies for State Space Search.<br>Heuristic Search: Generate & Test, Hill Climbing, Best First, Problem Reduction, Properties of Heuristics like Admissibility, Monotonicity, and Informedness.<br>Adversarial Search (Game Playing): Minimax, | T1(3), R1(3)<br>T1(5), R1(4)<br>T1(6), R1(5) | 2<br>2<br>2 |

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|---|---|---|---|---|
| | | Alpha-Beta Cutoffs.<br>Search & Optimization: Genetic Algorithms & Particle swarm optimization. | T1 (4)<br>Lecture Notes. | 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.<br>Understand 'Planning' as a search problem & solving real world problems using state space search.<br>Handle real world data that is vague/uncertain. | **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.<br>Classical Planning, Planning Graphs<br>**Reasoning under Uncertainties**: Bayes' Theorem, Bayesian Networks, Decision Theory.<br>Fuzzy Logic & Representation of uncertainty<br>Fuzzy Inference Systems | T1(8,9), R1(2)<br>T1(10)<br>T1(13, 14,16)<br>R3(1, 2, 4)<br>Lecture Notes. | 2<br>2<br>4<br>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.<br>Learn Neural networks design and working with applications.<br>Understand different machine learning algorithms with applications. | Machine Learning: General Concepts in Knowledge Acquisition & Learning; Decision Tree, Ensemble learning Methods.<br>Explanation based learning. Inductive logic programming.<br>Connectionist Models: Introduction to Neural Networks, Backpropagation Learning.<br>Applications of ML: Speech, Vision, Handwritten digit recognition. | T1(18), R1(9), R5<br>T1(19)<br>T1(20), R1(10)<br>Lecture Notes. | 2<br>2<br>2<br>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.<br>Fuzzy Expert Systems | R1(13)<br>Lecture Notes. | 2<br>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 |

**EVALUATION SCHEME**:

| S. No. | Component & Nature | Duration | Weightage | Date and Time |
|---|---|---|---|---|
| 1 | Mid semester Test (Closed Book) | 1.5 hrs. | 30% | 13/03 9.30 - 11.00AM |
| 2. | 1 Project (2 evaluations) (Open Book) | -- | 25% | TBA |
| 3. | Comprehensive Exam (Closed Book) | 3 hrs | 45% | 08/05 FN |

**Note:** All notices related to the course will be posted in CMS.
Genuine cases with a request for makeup reaching I/C before the day of the test may be considered.
**Chamber Consultation Hour**: Will be announced in the class.
**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**