**BITS PILANI, DUBAI CAMPUS**

**ACADEMIC – UNDERGRADUATE STUDIES DIVISION**

**SECOND SEMESTER 2023 ‑ 2024**

**Course Handout (Part II)**

Date: 5.2.2024

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 (3 0 3)**

**Course Title : Artificial Intelligence**

**Instructor-in-charge : Dr. Sujala D. Shetty**

**Instructors : Dr. Sujala D. Shetty**

**Scope and objective of the course**:

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 development of intelligent programs. AI not only strives to build intelligent entities, but also allows understanding them. This course will empower the students to know how to program computers, using classical symbolic methods, to behave in ways normally attributed to "intelligence" when observed in humans. AI currently encompasses a huge variety of sub fields, like perception, logical reasoning, proving mathematical theorems, and diagnosing diseases etc. AI empowers the computer engineers to systematize and automate the intellectual tasks, with the help of a set of tools, and methodologies. The methods studied in this course can be applied in any area of human intellectual endeavor.

The assignments / laboratory components will emphasize the use of C, C++,Java but predominantly Python or any other language of student’s interest. The students will be asked 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 using models like TMS or Bayes’ Networks, Natural Language understanding programs, and Programs in the area of Machine learning using connectionist models like neural networks or using symbolic models.

**Course Pre/Co- requisite** (if any) **& Catalogue / Bulletin Description:** *Given in the Bulletin 2023 – 2024*

**Study Material:**

**Text Books:**

T1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach Prentice Hall, Third Edition 2015 (Indian reprint: Pearson Education).

**Reference books:**

(i) George F.Luger,, Artificial Intelligence, Pearson Education

(ii) Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, Second Edition

(iii) Tom M Mitchell, “Machine Learning”, McGraw-Hill

**Course plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lec. No.** | **Learning objectives** | **Contents** | **References@ (Chapters)** |
| 1 | Introduction | Introduction to AI, background, Overview of course | Class Notes |
| 2-4 | Problem Solving | Problem Solving Agents, Example Problems, Uninformed Search Strategies, Avoiding Repeated States in search | Pg. 66-93 |
| 5-7 | Informed Search | Heuristic Search Strategies (Greedy Best First Search, A\* Search, Memory Bounded Heuristic Search) | Pg. 94-104 |
| 8 | Heuristic Functions | Designing Heuristic Functions | Pg. 104-109 |
| 9-10 | Planning and acting in the real world | Local Search Algorithms (Hill-Climbing Search, Simulated Annealing Search, Local Beam Search) | Pg. 123-132 |
| 11-13 | Game Playing | Game Playing, Minimax & Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions, Constraint Satisfaction Problems | Pg. 164-173 |
| 14-16 | Student Presentations | Student presentations on current research areas of search strategies from Journals of AI |  |
| 17-21 | Uncertainty | Acting under uncertainty, Basic Probability Notation, Inference Using Full Joint Distribution, Independence, Bayes Rule and it’s Use, Bayesian Networks | Pg. 488-539 |
| 22-25 | Planning | Planning problem, Planning with state space search , Partial order planning, planning graphs, planning with propositional logic | Pg. 373-394 |
| 26-29 | Machine Learning | Connectionist Models: Introduction to Neural Networks, Hopfield Networks, Perceptron Learning, Backpropagation & Competitive Learning, Applications of Neural Net: Speech, Vision, Traveling Salesman, Handwritten digit recognition. | T3 Ch 2 + Class Notes |
| 30-36 | Introduction to Deep Learning with Introduction to Computer Vision, Natural Language Processing and most recent topics in AI like Conversational AI and Explainable AI | Introduction to CNN and RNN and concepts relevant to learning Vision and Language. | Class Notes |
| 37-40 | Generative AI | Explore common generative AI models and tools for text, code, image, audio, and video generation, LLM, Prompt engineering |  |
| 41-42 | Student Presentations | Current Research on Machine learning from Transactions on Neural networks, Pattern Recognition, etc. Students pick up a topic and work on the implementation of the same in groups |  |

The lectures may slightly diverge from aforesaid plan based on students ‘background & interest in the topic, which may perhaps include special lectures and discussions that would be planned and schedule notified accordingly. Most topics will be accompanied with corresponding lab sessions.

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students should be able to:

* **CLO1** Differentiate different search algorithms and understand their working
* **CLO2** Apply how AI techniques can be used in Game playing applications
* **CLO3** Solve numerical problems related to uncertainty in AI reasoning systems
* **CLO4** Evaluate different neural network architectures for different applications
* **CLO5** Identify real world problems, apply state-of-the-art AI algorithms, compare different approaches, discuss the findings and prepare a report

**Evaluation Scheme**:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EC No** | **Components** | **Nature of Component** | **Duration** | **Weightage%** | | **Date & Time** | **Venue** |
| 1 | Mid-Sem Test | Open Book | 90 minutes | 30 | 03.04.24 (FN) | | To be announced later |
| 2 | Application Development1 + Presentation\* | Take home |  | 12 | 19.04.24 | |
| 3 | Application Development2 + Presentation\* | Take home |  | 18 | 17.05.24 | |
| 4 | Compre Exam | Closed Book | 3 hours | 40 | 04.06.24 (AN) | |

\*Detailed information will be shared with the students about this component

**Mapping of CLOs, PLOs, and CECs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CLOs** | **PLOs** | **Evaluation Components (ECs)** | | | |
| **EC1** | **EC2** | **EC3** | **EC4** |
| CLO1 | 1, 4 | **✓** |  |  | **✓** |
| CLO2 | 1, 3, 4 | **✓** |  |  | **✓** |
| CLO3 | 1, 3, 4 |  |  |  | **✓** |
| CLO4 | 1, 3, 4 |  |  |  | **✓** |
| CLO5 | 1, 3, 4, 8 |  | **✓** | **✓** |  |

**Mid-sem Grading**:

Mid-sem grading will be displayed after Mid-Sem Test-1 and application development1 and presentation (42% weightage) are completed.

**Note:** **A student will be likely to get “NC”, if he / she**

* Doesn’t appear / appear for the sake of appearing for the evaluation components / scoring zero in pre-compre total.

**Makeup and Attendance policies**:

**Make-ups** are not given as a routine. It is solely dependent upon the genuineness of the circumstances under which a student fails to appear in a scheduled evaluation component. In such circumstances, **prior permission should be obtained** from the Instructor-in-Charge (I/C).The decision of the I/C in the above **matter will be final.**

**Attendance:** Every student is expected to be responsible for regularity of his/her attendance in class rooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course. A student should have a minimum of 60% of attendance in a course to be eligible to appear for the Comprehensive Examination in that course. For the students under the purview of Academic Counseling Board (ACB), the Board shall prescribe the minimum attendance requirement on a case-to-case basis. Attendance in the course will be a deciding factor in judging the seriousness of a student which may be directly / indirectly related to grading.

**General timings for consultation**:

The students can contact the instructor between 9:20AM and 10:10AM on Tuesday.

**General instructions**:

Students should come prepared for classes and carry the text book(s) or material(s) as prescribed by the Course Faculty to the class.

**Notices**:

All notices concerning the course will be displayed on the CS Notice Boards.

Dr. Sujala D. Shetty

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**Instructor-in-Charge CS F407**