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**COURSE HAND OUT**

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| **School:** | **School of Computing** | **Dept.:** | **AI & ML** |

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| **Course Code** | **:** | 22AI102002 | | | | |
| **Course Title** | **:** | Artificial Intelligence | | | | |
| **Course Credit Structure** | **:** | L | T | P | S | C |
| 3 | - | 2 | - | 4 |
| **Year & Semester** | **:** | II Year II Semester | | | | |
| **Contact Hours** | **:** | 45 | | | | |
| **Instructor** | **:** | C. SUDARSANA REDDY | | | | |
| **Instructor’s Email** | **:** | [sudarsanareddy.c@mbu.asia](mailto:sudarsanareddy.c@mbu.asia) | | | | |
| **Office Hours** | **:** | All working days with prior appointment | | | | |
| **Academic Year** | **:** | 2024-2025 | | | | |
| **Date of Issue** | **:** | 16 December 2024 | | | | |

**PROGRAM OUTCOMES**

On successful completion of the Program, the graduates of B. Tech. (CSE-AIML) Program will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

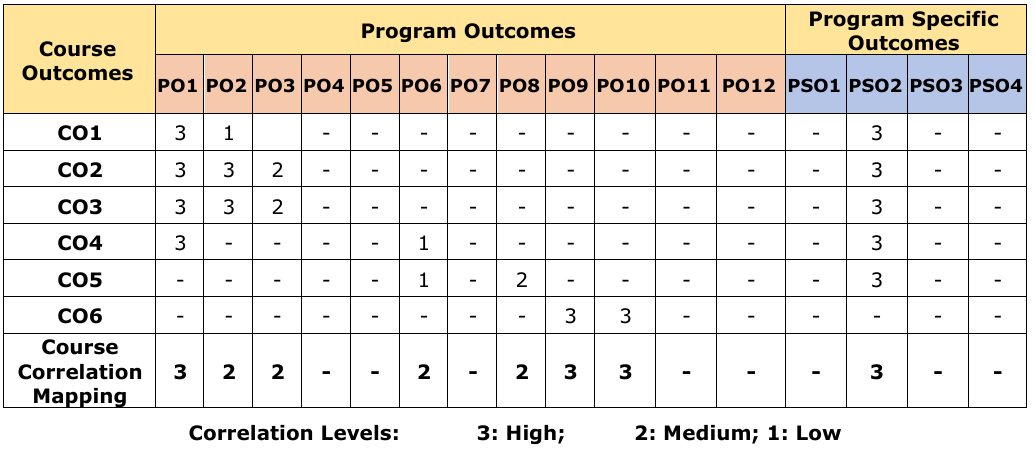
**PROGRAM SPECIFIC OUTCOMES**

On successful completion of the Program, the graduates of B.Tech.(CSE-AIML) program will be able to:

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| **PSO1:** | Use mathematical methodologies to model real-world problems, Employ modern tools and platforms for efficient design and development of computer-based systems. |
| **PSO2:** | Apply adaptive algorithms and methodologies to develop intelligent systems for solving problems from inter-disciplinary domains. |
| **PSO3:** | Apply suitable models, tools and techniques to perform data analytics for effective decision making. |
| **PSO4:** | Design and deploy networked systems using standards and principles, evaluate security measures for complex networks, apply procedures and tools to solve networking issues. |

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| **Pre-Requisite** | | - |
| **Anti-Requisite** | | - |
| **Co-Requisite** | | - |
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| **COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Introduction to Artificial Intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI. | | |
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| **COURSE OUTCOMES:** After successful completion of the course, students will be able to: | | |
|  | Architect intelligent agents using artificial intelligence techniques and principles. | |
|  | Analyze and interpret the problem, identify suitable solutions using heuristic  functions, optimization algorithms and search algorithms. | |
|  | Select and apply appropriate knowledge representation to build Bayesian network  models to reason under uncertainty. | |
|  | Investigate robot hardware and frameworks for intelligent robotic perception. | |
|  | Demonstrate knowledge on ethical implications of intelligent machines for  providing privacy, trust, security and safety | |
|  | Work Independently to solve problems with effective communication. | |

**CO-PO-PSO Mapping Table:**

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**Correlation Levels: 3: High; 2: Medium; 1: Low**

**COURSE CONTENT**

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| **Module 1:** | **INTRODUCTION TO ARTIFICIAL INTELLIGENCE** | ***(09 Periods)*** |
| Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents. | | |
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| **Module 2:** | **PROBLEM SOLVING BY SEARCHING** | ***(09 Periods)*** |
| Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A\* search; Heuristic functions. | | |  |
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| **Module 3:** | **SEARCH IN COMPLEX ENVIRONMENTS** | ***(09 Periods)*** |
| Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search, Kalman Filter. | | |
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| **Module 4:** | **PROBABILISTIC REASONING** | ***(09 Periods)*** |
| Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter. | | |
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| **Module 5:** | **ROBOTICS, ETHICS AND SAFETY IN AI** | ***(09 Periods)*** |
| Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application  domains. Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety. | | |
| ***Total Periods: 45*** | | |

**EXPERIENTIAL LEARNING**

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| 1. | Design and implement agent programs for Table-driven agents using the agent function of vacuum-cleaner world. The agent cleans the current square if it is dirty, otherwise it  moves to the other square. |
| 2. | Implement agent programs for Simple reflex agents and Model-based reflex agents using  the agent function of vacuum-cleaner world. |
| 3 | Solve the travelling sales man problem using Hill Climbing search algorithm |
| 4 | Design and implement solution for 8-puzzle problem using Greedy Best First Search. |
| 5 | Find the shortest path between a starting location and destination location in a graph  using A\* search algorithm. |
| 6 | Implement MiniMax algorithm for finding an optimal decision in a tic-toc game. |
| 7 | Implement Monte-Carlo Tree search intended to run on small game trees. |
| 8 | Solve the monty hall problem using Bayesian Network. |
| 9 | The game involves three doors, given that behind one of these doors is a car and  the remaining two have goats behind them. So you start by picking a random door, say #2. On the other hand, the host knows where the car is hidden and he opens  another door, say #1 (behind which there is a goat). Here’s the catch, you’re now  given a choice, the host will ask you if you want to pick door #3 instead of your first  choice i.e. #2.  Implement Kalman Filter to track the aircraft by determining the position and  velocity of aircraft. |
| 10 | Design and implement a stock prices forecasting model using Hidden Markov Model. |

**RESOURCES**

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| TEXT BOOKS: | |
|  | Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4th Edition, 2020. |
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| **REFERENCE BOOKS:** | |
|  | Stephen Lucci, Danny Kopec, Artificial Intelligence in the 21st Century, Mercury  Learning and Information, 3rd Edition,2018 |
|  | Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009. |
|  | Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill  Education, 2017. |
|  | Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011. |
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| **SOFTWARE / TOOLS** | |
| 1. Python | |
| 2**.** pandas, matplotlib | |
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| **VIDEO LECTURES:** | |
|  | https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence |
|  | http://aima.cs.berkeley.edu/ |
|  | https://ai.google/education/ |
|  | https://www.coursera.org/courses?query=artificial%20intelligence |
|  | https://www.edureka.co/blog/artificial-intelligence-with-python/ |
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| **WEB RESOURCES:** | |
|  | http://www.airesources.org/ |
|  | https://allthingsai.com/ |
|  | https://designmodo.com/ai-tools-designers/ |
|  | https://www.ulethbridge.ca/teachingcentre/chatgpt-ai-resources |

**PEDAGOGY:**

The following pedagogy methods will be used to deliver the course.

a) Chalk and Board

b) PPTs

c) Videos

**COURSE DELIVERY SCHEDULE:**

| **S.No** | **Topic** | **Contact Hours** | **CO Mapping** | **Pedagogy** | **Resources** |
| --- | --- | --- | --- | --- | --- |
| **MODULE 1:** **INTRODUCTION TO ARTIFICIAL INTELLIGENCE** | | | | | |
| 1 | Foundations of artificial intelligence | 1 | CO1 | PPT | TB1, RB1 |
| 2 | History of artificial intelligence | 1 | CO1 | PPT | TB1, RB1 |
| 3 | State of the art | 2 | CO1 | PPT | TB1, RB1 |
| 4 | Risks and benefits of AI | 1 | CO1 | PPT | TB1, RB1 |
| 5 | Intelligent agents | 1 | CO1 | PPT | TB1, RB1 |
| 6 | Agents and environments | 1 | CO1 | PPT | TB1, RB1 |
| 7 | The concept of rationality | 1 | CO1 | PPT | TB1, RB1 |
| 8 | Structure of agents | 1 | CO1 | PPT | TB1, RB1 |
| **MODULE 2: PROBLEM SOLVING BY SEARCHING** | | | | | |
| 8 | Problem solving agents | 2 | CO2 | Blackboard | TB1, RB1 |
| 9 | Search algorithms | 1 | CO2 | PPT | TB1, RB1 |
| 10 | Uninformed search strategies | 2 | CO2 | Blackboard | TB1, RB1 |
| 11 | Informed search strategies | 1 | CO2 | PPT | TB1, RB1 |
| 12 | Greedy best-first search | 1 | CO2 | Blackboard | TB1, RB1 |
| 13 | A\* search | 1 | CO2 | PPT | TB1, RB1 |
| 14 | Heuristic functions | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| **MODULE 3: SEARCH IN COMPLEX ENVIRONMENTS** | | | | | |
| 15 | Local search algorithms and optimization problems | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 16 | Hill-climbing search | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 17 | Simulated annealing, Local beam search | 2 | CO2 | PPT /Blackboard | TB1, RB1 |
| 18 | Evolutionary algorithms | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 19 | Optimal decisions in games – The minimax search algorithm | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 20 | Optimal decisions in multiplayer games | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 21 | Alpha-Beta pruning, Move ordering | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| 22 | Monte Carlo tree search, Kalman Filter | 1 | CO2 | PPT /Blackboard | TB1, RB1 |
| **MODULE 4: PROBABILISTIC REASONING** | | | | | |
| 23 | Representing Knowledge in an uncertain domain | 2 | CO3 | PPT /Blackboard | TB1, RB1 |
| 24 | Semantics of Bayesian networks | 2 | CO3 | PPT /Blackboard | TB1, RB1 |
| 25 | Probabilistic reasoning over time – Time and uncertainty | 1 | CO3 | PPT /Blackboard | TB1, RB1 |
| 26 | Inference in temporal models | 2 | CO3 | PPT /Blackboard | TB1, RB1 |
| 27 | Hidden Markov models | 1 | CO3 | PPT /Blackboard | TB1, RB1 |
| 28 | Kalman Filter | 1 | CO3 | PPT /Blackboard | TB1, RB1 |
| **MODULE 5: ROBOTICS, ETHICS AND SAFETY IN AI** | | | | | |
| 29 | Robots, Robot hardware | 2 | CO4 | PPT | TB1, RB1 |
| 30 | Robotic perception | 1 | CO4 | PPT | TB1, RB1 |
| 31 | Alternative robotic frameworks | 1 | CO4 | PPT | TB1, RB1 |
| 32 | Application domains | 1 | CO4 | PPT | TB1, RB1 |
| 33 | Limits of AI, Ethics of AI – Surveillance | 1 | CO5 | PPT | TB1, RB1 |
| 34 | security and privacy | 1 | CO5 | PPT | TB1, RB1 |
| 35 | Fairness and bias, | 1 | CO5 | PPT | TB1, RB1 |
| 36 | Trust and transparency, AI safety | 1 | CO5 | PPT | TB1, RB1 |

**COURSE EVALUATION:**

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| **Evaluation Type** | **Syllabus** | **Duration**  **in Minutes** | **Marks for Evaluation** | **Marks to be Scaled to** | **Max. Marks** |
| Mid Term Exam -1 | Module - I & II | 90 Minutes | 50 | 30 | 30\* |
| Mid Term Exam -2 | Module – III, IV & V | 90 Minutes | 50 | 30 |
| End Term Exam | All Modules | 180 Minutes | 100 | 50 | 50 |
| Experiential Learning | Content specified above | - | 20 | -NA- | 20 |
| **Total Marks** | | | | | **100** |

\* For a total of 30 marks, 80% of better one of the two CIAT and 20% of the other one are added and finalized, any fraction shall be rounded off to the higher integer number.

c. Sudarsana reddy

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| **Signature of the course Instructor** | **Signature of the Chairperson D.A** |