

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

CLASS: MCA  
BRANCH: MCA

SEMESTER: II  
SESSION: SP/2023

SUBJECT: CA435 MODERN ARTIFICIAL INTELLIGENCE

TIME: 3 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

**Q.1(a) (I) Differentiate the following terms (any two):** Marks [3+2=5]    CO    BL  
CO1    BL1  
BL4

- Rational agent vs Autonomous agent
- Bounded rationality vs Perfect rationality.
- Turing Test vs The Chinese room argument.
- Is AI a science, or is it engineering? Or neither or both? Explain.

(II) For the following activity, describe a PEAS description of the task environment and characterize it in terms of the properties: **“Shopping for AI books on the Internet.”** CO1    BL1  
BL2

**Q.1(b) (I) Interpret the task environment of the followings:** [2+3=5]    CO1    BL2  
CO5    BL3

Task Environment	Fully / Partially observable env.	Single/ Multiagent Env.	Deterministic/ Stochastic/ Strategic	Episodic / Sequential	Discrete/ Continuous
Chess with a clock					

(II) Apply any of the agent designs (listed below) and describe its evolution from simple reflex agent to model-based agent to goal-based agent to utility-based agent in a partially observable environment. **“Vacuum agent” OR “Automated taxi driving as an example”.** CO1    BL2  
BL3

**Q.2(a) (I) Describe the following terms (any two):** [3+3=6]    CO2    BL2  
CO5    BL3

- 8-puzzle solution using any heuristic search technique (Apply Hill Climbing/Best first search / A\* algo.).
- Simulated Annealing with example.
- Genetic Algorithm with example.
- Describe A\* search strategy with the help of applying the following characteristics: Admissible heuristic, consistency, monotonicity, triangular inequality, and optimality.

(II) In CSP problem, solve the following cryptarithmic problem:

$$\begin{array}{r}
 \text{SOME} \\
 + \text{TIME} \\
 \hline
 \text{SPENT}
 \end{array}$$
CO5    BL3

**Q.2(b)** A game tree for the game of tic-tac-toe. The top node is the initial state, and MAX moves first, placing an X in an empty square. We show part of the tree, giving alternating moves by MIN (O) and MAX (X), until we eventually reach terminal states, which can be assigned utilities according to the rules of the game. How minmax algorithm solves the tic-tac-toe problem by calculating backed up utility for winning X's or O's. And how Alpha-Beta pruning algorithm reduce the number of steps by pruning branches for this problem and how to measure the performance in terms of time complexity of alpha beta pruning. [4]    CO2    BL2  
CO5    BL3

Q.3(a)	<p>(I) Formulate the following facts to <u>predicate logic form and clausal form</u>. <b>[5]</b></p> <p><u>And also proof the conclusion using resolution:</u></p> <p>-Everyone who loves all animals is loved by someone.          -Anyone who kills an animal is loved by no one.          - Jack loves all animals.          -Either Jack or Curiosity killed the cat, who is named Tuna.</p> <p><b>Conclusion:</b> Did Curiosity kill the cat?</p> <p>(I) Convert these statements in <b>predicate logic</b>.          (II) Convert these predicates to <b>Clausal form</b>.          (III) proof the question using <b>resolution</b>.</p>	CO3	BL4 BL5 BL6
Q.3(b)	<p><b>Explain the following terms with example (any two):</b></p> <p>(I) <b>Matching:</b> Quantitative and qualitative measures for matching <b>OR</b> String and Graph Matching with one example. <b>[2.5x2=5]</b></p> <p>(II) <b>Approaches to knowledge representation:</b> Frame, Conceptual Graph and Conceptual dependencies with one example of each.</p> <p>(III) <b>Forward vs Backward Reasonings:</b> with one example of each.</p>	CO3	BL2 BL4 BL5
Q.4(a)	<p><b>Differentiate the following terms with examples:</b></p> <p>(I) Monotonic Reasoning, Non-monotonic Reasoning and Default Reasoning with examples. <b>[2x2.5=5]</b></p> <p>(II) Open world and Close world assumption with examples.</p>	CO3	BL5 BL3 BL4
Q.4(b)	<p><b>Make brief notes on the following themes, providing examples as evidence (any two):</b> <b>[2x2.5=5]</b></p> <p>I. An illustration of the Dempster-Shafer Theory.</p> <p>II. Goal-stack planning using a block world as an example.</p> <p>III. Example-Based Induction Learning.</p>	CO4	BL3 BL4 BL5
Q.5(a)	<p>Describe the terms <b>NLP, NLU and NLG</b>. Explain briefly - Morphology analysis, syntactic processing, Semantic analysis, and Pragmatic analysis of NLP with examples. <b>[5]</b></p>	CO4	BL2 BL3
Q.5(b)	<p>Define the term robotics. Explain the hardware component of robot and evaluate its path planning algorithms in certain and uncertain domains. <b>[5]</b></p>	CO4 CO5	BL1 BL2 BL5

:01/05/2023: