Name: Enrolment No:	

UPES
End Semester Examination, May 2025

Course: Artificial Intelligence and Machine Learning	Semester: II
Program: M. Tech. (Robotics Engineering)	Time: 03 hrs.
Course Code: CSAI7026	Max. Marks: 100

Instructions: Attempt all the Questions

<table>
<tr><td colspan="4" align="center">SECTION A
(5Qx4M=20Marks)</td></tr>
<tr><td>S. No.</td><td></td><td>Marks</td><td>CO</td></tr>
<tr>
<td>Q 1</td>
<td>What is the significance of artificial intelligence in autonomous robots? Elucidate with real world examples.</td>
<td>4</td>
<td>CO1</td>
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<td>Q 2</td>
<td>(a) Which heuristic algorithm solves the AND-OR problem.
(i) Best first search (ii) Depth first search (iii) A* algorithm (iv) AO* algorithm
(b) The term _____ is used for a depth-first search that chooses values for one variable at a time and returns when a variable has no legal values left to assign.
(i) Forward search   (ii) Backtrack search
(iii) Hill algorithm   (iv) Reverse-Down-Hill search
(c) Which search is equal to minimax search but eliminates the branches that can't influence the final decision?
 (i) Depth-first search (ii) Breadth-first search (iii) Alpha-beta pruning (iv) None of these
(d) A* algorithm is based on _____
(i) Breadth-First-Search (ii) Depth First Search (iii) Best-First-Search (iv) Hill climbing</td>
<td>4</td>
<td>CO2</td>
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<td>Q 3</td>
<td>(a) Which of the following represents the first order logic form of the following statement?
"Ram lives in red house"
(i) lives (Ram, house) ∧ color (house, red)
(ii) lives (Ram, house) V color (house, red)
(iii) lives (house, Ram) V color (house, red)
(iv) lives (house, Ram) ∧ color (house, red)
(b) Which of the following is the example of PTRANS?
(i) Listen (ii) Tell (iii) Go (iv) Decide
(c) Which of the following primitive defines the statement "Building of new Information from old".
(i) ATRANS (ii) MTRANS (iii) PROPEL (iv) MBUILD</td>
<td>4</td>
<td>CO3</td>
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	(d) Which knowledge representation describes sequence of events? (i) Frames (ii) Scripts (iii) Semantic Network (iv) First order logic		
Q 4	(a) Which of the following are the supervised classification algorithms? (i) Decision Trees (ii) Random Forest (iii) SVM (iv) All of these (b) In SVM, _____ functions take low-dimensional input space and transform it to a higher dimensional space. (i) Kernel (ii) Vector (iii) Support Vector (iv) Hyper Plane (c) Which algorithm is also known as ensemble classifier? (i) Decision Tree (ii) Random Forest (iii) SVM (iv) kNN (d) Which clustering technique may filter out outliers (i) Hierarchical (ii) k-means (iii) Density-based (iv) None of these	**4**	**CO4**
Q 5	(a) The cell body of neuron can be analogous to what mathematical operation? (i) Summing (ii) Differentiator (iii) Integrator (iv) None of these (b) Why do we need biological neural networks? (i) to solve tasks like machine vision & natural language processing (ii) to apply heuristic search methods to find solutions of problem (iii) to make smart human interactive & user-friendly system (iv) None of these (c) Neural network is also referred to as: (i) Neurocomputer (ii) Connectionist network (iii) Parallel distributed processor (iv) All of these (d) What is the name of the neural network model which can perform weighted sum of inputs followed by threshold logic operation? (i) McCulloch-Pitts neuron model (ii) Marvin Minsky neuron model (iii) Hopfield model of neuron (iv) None of these	**4**	**CO5**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Differentiate the term heuristic and metaheuristic. Explain the following heuristic search algorithms with suitable example: (i) Generate and Test (ii) Hill Climbing (iii) Best First Search (iv) Mean End Analysis Algorithm	**10**	**CO2**
Q 7	Why knowledge representation is required in artificial intelligence. Briefly explain all categories of knowledge representation with a suitable example.	**10**	**CO3**
Q 8	How is unsupervised learning different from supervised learning? Explain with a suitable example. What is clustering in unsupervised learning? Briefly explain any two clustering techniques.	**10**	**CO4**
Q 9	What is the significance of weights, bias and activation function in neural network? Explain the following activation function with neat diagrams. (i) Threshold function (ii) Sigmoid function (iii) ReLU function	**10**	**CO5**

	(iv)　　Softmax function **OR** Differentiate the following: (i) Error Correction learning and Competitive learning (ii) Newton and Gauss Newton method (iii) Single layer and Multi-layer neural network (iv) Shallow neural network and deep neural network		
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	(a) Consider the tree shown in figure 1. The numbers on the arcs are the arc length; the heuristic estimates of B = 4, C = 3 and D = 2; all other states have a heuristic estimate of 0. Assume that the children of a node are explained in alphabetical order when no other order is specified by the search and that the goal is state J. No visited or expanded lists are used. In what order would the states be expanded by each type of search (DFS, BFS, best-first search and A*). Write only the sequence of states expanded by each search. **Figure. 1** (b) What do you understand by production system and state space search? Differentiate the following heuristic search and game playing techniques (i) A* and AO* algorithm (ii) MIN-MAX and Alpha-Beta Pruning Algorithm	20	CO2
Q 11	(a) Describe the structure of an artificial neuron. Derive the expression of weight change in a multi-layer neural network using back-propagation algorithm. (b) What is a perceptron? Which type of problems can be solved using perceptron. Explain how perceptron can be utilized to implement AND, OR gates. **OR** (a) Explain how multi-layer neural network can be used to solve XOR problem. (b) What are the significant parameters which affect the operation of artificial neural networks? Differentiate Hebbian learning and memory-based learning with suitable diagrams.	20	CO5