

GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
ARTIFICIAL INTELLIGENCE & ROBOTICS
EC704A

TIME ALLOTTED: 3 HOURS

FULL MARKS:70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any **ten** from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No
1(i)	What is Artificial intelligence? a) Putting your intelligence into Computer b) Programming with your own intelligence c) Making a Machine intelligent d) Playing a Game	1	CO1
1(ii)	Match the following Robot part functions a. Manipulator arm 1. For holding a piece or tool b. Controllers 2. Move the manipulator arm and end effector c. Drives 3. Number of degrees of freedom of movement d. Gripper 4. Delivers commands to the actuators a) a-1, b-4, c-2, d-3 b) a-3, b-4, c-2, d-1 c) a-3, b-2, c-4, d-1 d) a-4, b-3, c-2, d-1	1	CO2
1(iii)	Which is used to compute the truth of any sentence? a)Semantics of propositional logic b) Alpha-beta pruning c) First-order logic d) Both Semantics of propositional logic & Alpha-beta pruning	1	CO2
1(iv)	A heuristic is a way of trying a) To discover something or an idea embedded in a program b) To search and measure how far a node in a search tree seems to be from a goal c) To compare two nodes in a search tree to see if one is better than the other is d) All of the mentioned	1	CO2
1(v)	Which is not Familiar Connectives in First Order Logic? a) and b) iff c) or d) not	1	CO3

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|---------|--|---|-----|
| 1(vi) | Error correction learning is
a) Unsupervised
b) Supervised
c) Reinforcement
d) Both (a) & (b) | 1 | CO3 |
| 1(vii) | Degrees of Freedom (DOF) of a PUMA robot is
a) 1
b) 5
c) 3
d) 6 | 1 | CO4 |
| 1(viii) | To orient and position, the wrist of a robot in space in a simplest position manner anywhere within its work envelope requires
a) 3DOF
b) 4DOF
c) 5DOF
d) 6DOF | 1 | CO5 |
| 1(ix) | The robot designed with polar coordinate systems has
a) Three linear movements
b) Three rotational movements
c) Two linear and one rotational movement
d) Two rotational and one linear movement | 1 | CO4 |
| 1(x) | What is the name for information sent from robot sensors to robot controllers?
a) Temperature
b) Pressure
c) Feedback
d) Signal | 1 | CO5 |
| 1(xi) | The Robot designed with cylindrical coordinate systems has
a) Three linear movements
b) Three rotational movements
c) Two linear and one rotational movement
d) Two rotational and one linear movement | 1 | CO4 |
| 1(xii) | How many DH parameters exist in robot kinematics?
a) 1
b) 2
c) 3
d) 4 | 1 | CO5 |

GROUP – B

(Short Answer Type Questions)
(Answer any *three* of the following)

3 x 5 = 15

2. Solve the 8 puzzle problem

Marks CO No
5 CO2

2	8	1
	4	3
7	6	5



1	2	3
8		4
7	6	5

Initial State

Goal State

3.a)	List the advantages of Decision Trees.	3	CO3
3.b)	List some of the practical uses of decision tree.	2	CO3
4.a)	What are the laws of robotics? What is DOF?	2	CO5
4.b)	Sketch a SCARA robot indicating the degrees of freedom.	3	CO5
5.a)	Classify the robots according to the coordinates of motion. with a sketch and example, explain the features of each type	3	CO4
5.b)	According to Denavit Hartenberg notation ,what is represented as link and joint parameters?	2	CO4
6.	Solve a forward and reverse kinematics problem for a 3DOF 2-D manipulator.	5	CO5

GROUP – C

(Long Answer Type Questions)

(Answer any *three* of the following)

3 x 15 = 45

		Marks	CO NO
7.a)	How are the piezoelectric transducers used for building micro-robot manipulators? Sketch the set-up for a 6 DOF micro-robot manipulator.	6	CO5
7.b)	What is robot vision? What are the types of vision sensor used to take the image of an object?	3	CO4
7.c)	Name two industrial applications where the intelligence of a robot is required	3	CO5
7.d)	What are the factors that affect the size and shape of work envelope?	3	CO5
8.a)	State some applications of neural network. Explain the role of activation function in neural network	5	CO4
8.b)	Explain a 3:4:2:2 multilayer feedforward neural network with diagram. Describe clustering with example.	5	CO4
8.c)	A two input ANN has inputs 3,4 having weights 4 and 3 respectively. Find the output for i) No bias and No activation function, ii) A bias $b=-12$ and Threshold (Unit step) activation function, iii) Sigmoid activation function	5	CO4
9.a)	Differentiate between a serial robot and a parallel robot with example.	3	CO4
9.b)	Explain D-H parameters with proper diagram	6	CO4
9.c)	Illustrate the working principle of a stepper motor.	6	CO4
10.a)	Given three predicates with obvious semantics: male(x), female(x) and spouse(x,y) Facts: male(Ram) spouse(Ram, Reena) What axiom is needed to infer the fact female(Reena)?	5	CO2
10.b)	Predicate glitters(x) is true if x glitters and predicate gold(x) is true if x is gold. Write the logical formulae that represents the statement: Not all that glitters is gold.	4	CO3

10.c)	Sketch and explain the following configuration of robot.	6	CO5
	(i) TRR		
	(ii) TRL:R		
	(iii) RR:R		
11.	Write short notes on (any three)		
11.a)	Tower of Hanoi Problem	5	CO4
11.b)	FOPL	5	CO1
11.c)	Proximity sensor	5	CO4
11.d)	Robot trajectory planning	5	CO4
11.e)	Use of PID control in robotics	5	CO5