R16

Code No: 136FC

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, March - 2024

FUNDAMENTALS OF ROBOTICS

(Common to CE, ECE, CSE)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Differentiate internal and external sensors.	[2]
b)	List out the Components of Industrial robotics-precession.	[3]
c)	List out the advantages of grippers.	[2]
d)	Explain the robot selections based on the application.	[3]
e)	Differentiate Direct and Inverse kinematics for industrial robots.	[2]
f)	Explain about manipulator kinematics.	[3]
g)	Draw the block diagram of trajectory planning.	[2]
h)	Differentiate between path planning and trajectory planning.	[3]
i)	List out the rules to be followed in robot programming.	[2]
j)	List out the various commands used in robot programming.	[3]

PART – B

(50 Marks)

2.a) Discuss the applications and working principle of the following sensors.
i) Range sensors ii) Acoustic sensors iii) Tactile sensors.
b) What are the different actuators used in the robots? Describe them briefly. [5+5]

OR

3.a) What are the basic components of a robotic system? Explain the functions of each of the components with a diagram.
b) Differentiate between Serial manipulator and Parallel Manipulator. [5+5]

4.a) Explain the working of magnet grippers used for robots.
b) Discuss some of the important considerations in the design of grippers. [5+5]

OR

5.a) Explain the types of gripper mechanisms and force analysis in grippers.
b) Explain the applications of robots in detail in a manufacturing industry. [5+5]

6.a) Derive the forward kinematics equation using the DH convention for the two-link manipulator with one revolute and one prismatic joint.
b) Using the above formula find the motion parameters for the point a(uvw)= (6,2,4) T rotate 30^0 about the y-axis followed by translation of 6 units along X-axis. [5+5]

OR

7.a) Explain the inverse kinematics for any manipulator based on D-H convention.

b) Compute the basic rotation matrix representing rotation about x-axis by an angle 60^0. [5+5]

8.a) A single cubic trajectory given by $q(t) = 30+t^2-6t^3$ is used for a period of 3 seconds. Determine starting and final position, velocity and acceleration of the end-effector.

b) With block diagram, explain adaptive control system. [5+5]

OR

9.a) Explain a 3-5-3 trajectory plan to represent a pick and place movement for an assembly operation.

b) Explain the adaptive control optimization with a neat sketch for turning operation. [5+5]

10.a) Discuss the textural robot language structure with the help of block diagram.

b) What is the need for robot programming? Explain any one programming language with its salient points. [5+5]

OR

11.a) Explain the safety considerations to be followed while programming robots.

b) Differentiate between VAL and RAIL robot programming language. [5+5]

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