R16

Code No: 137GR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, December-2023/January-2024
ROBOTICS
(Mechanical Engineering)

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)	Define the term industrial robot.	[2]
b)	Define automation.	[3]
c)	Explain about manipulator kinematics.	[2]
d)	Explain about Euler angles.	[3]
e)	What is dynamic modeling?	[2]
f)	What it means by differential transformation?	[3]
g)	What is path planning?	[2]
h)	What is Trajectory Planning?	[3]
i)	Describe robot applications in manufacturing.	[2]
j)	What are the considerations in robot material handling?	[3]

PART – B

(50 Marks)

2.a) Classification of robot by control system.
b) Write a note on overview of robotics with applications. [5+5]

OR

3.a) Name any three types of end effectors of robots. State the advantages of each.
b) How many DOF is required to position an end effector at any point in 3D space? Justify. [5+5]

4.a) Compute the basic rotation matrix representing rotation about x-axis by an angle 60^0.
b) For the point $a_{uvw} = (6, 2, 4)^T$ rotate 30^0 about the x-axis followed by translation of 6 units along y-axis. [5+5]

OR

5.a) Derive rotation in z-x plane using the geometric approach.
b) Explain the inverse kinematics for any manipulator based on D-H convention. [5+5]

6.a) Derive the expression for joint torques for a planar R-P robotic manipulator using Lagrangian-Euler formulation.

b) What is Jacobain of a robot system, how does the study of singularity help in robot analysis. [5+5]

OR

7.a) Differentiate clearly with reference to 2-jointed manipulator of RR type.

b) Establish the dynamic model of a one-axis robot with Lagrangian-Euler formulation. [5+5]

8.a) Differentiate between path planning and trajectory planning.

b) Explain a 3-5-3 trajectory plan to represent a pick and place movement for an assembly operation. [5+5]

OR

9.a) A manipulator with a single link is to rotate from 30^0 to 100^0 in 2 seconds. The joint velocity and acceleration are both zero at the initial and final positions. Determine the coefficient of a cubic polynomial that accomplishes the motion.

b) List out the advantages and disadvantages of hydraulic actuators. [5+5]

10.a) Explain the loading and unloading of material handling in plastic molding process.

b) Explain the robot role in machining operations. [5+5]

OR

11.a) Describe the pelletizing operation of material transfer application of a robot.

b) Explain loading and unloading of material handling in die casting process. [5+5]

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