



PAPER ID-310473

Printed Page: 1 of 2
Subject Code: NME044

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B. TECH.
(SEM VII) THEORY EXAMINATION 2020-21
AUTOMATION AND ROBOTICS

Time: 03 Hours

M.M.: 100

SECTION-A

1. Attempt all the parts.

(10x2 =20)

- (a) Distinguish between hard automation and soft automation.
- (b) What is Automatic Transfer Machine?
- (c) What is robot work space?
- (d) Define robot anatomy.
- (e) What are the methods of transmission used for converting motion?
- (f) Differentiate between active gripper and passive gripper.
- (g) What is end effector?
- (h) How does a vacuum gripper works?
- (i) What are the different types of robot cell layout?
- (j) Differentiate between CNC and DNC.

SECTION-B

2. Attempt any 5 parts.

(5x10 = 50)

- (a) What do you mean by industrial automation? Give its advantages and disadvantages. Explain hierarchy of an industrial automation system with the help of a neat sketch.
- (b) What do you mean by robot arm kinematics? Differentiate between direct kinematics and Inverse kinematics.
- (c) Explain the parameters used in Robot selection of specific purpose.
- (d) What are the various level of robot programming? Explain all of them in detail.
- (e) Calculate the forward and reverse kinematics for 2 DOF planner manipulator arm.
- (f) Define the working of the drive system given below and compare their relative advantages and disadvantages:
 - (i) Hydraulic system
 - (ii) Pneumatic system
 - (iii) Electric motor
- (g) Write homogeneous transform matrix for a rotation of 90^0 about the z-axis, followed by a rotation of -90^0 about the x-axis, followed by a translation of (3, 7, 9).
- (h) Define the robot application in manufacturing in the following section:
 - (i) Material transfer
 - (ii) Spray painting
 - (iii) Assembly operation
 - (iv) Inspection



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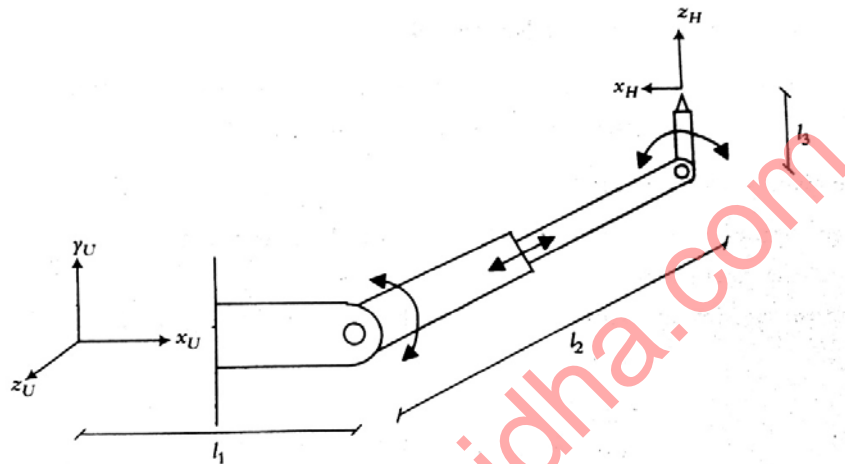
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SECTION-C

3. Attempt any 2 parts.

(2x15 = 30)

- (a) A special 3-DOF spraying robot has been designed as shown in the figure below
- (i) Assign the coordinate frames based on the D-H representation.
 - (ii) Fill out the D/H parameters table.
 - (iii) Write the ${}^U T_H$ matrix.



- (b) Explain any three of the following with the help of suitable illustration:
- (i) Collision free motion planning
 - (ii) Robot Programming Synthesis
 - (iii) Assembly Sequence Planning
 - (iv) Dynamics of Mechanical systems
 - (v) Servo system for robot Control
- (c) What are the various methods of robot programming? Explain the term Robot simulation and compare it with online programming method with the suitable example.