PAPER ID-310473

Subject Code: NME044

Roll No: | | | | | | | | | | | | | |

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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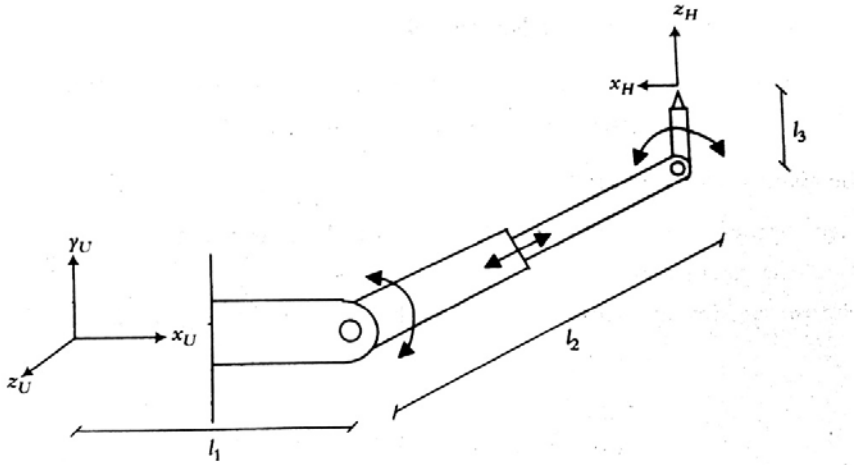
SECTION-C

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.