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Question Paper Code : 40823

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh/Eighth Semester

Mechanical Engineering

ME 8099 — ROBOTICS

(Common to Automobile Engineering/Manufacturing Engineering/ Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Production Engineering

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the applications industrial robots?

2. Define pay load of a robot.

3. List the advantages of pneumatic actuators over hydraulic actuators.

4. What is the difference between internal grippers and external grippers?

5. Write the working properties of touch sensors.

6. Mention any two examples for contract and non-contract sensors.

7. What is trajectory planning?

8. Differentiate between forward kinematics and inverse kinematics.

9. Mention various types of AGV vehicles.

10. What are the general characteristics that make potential robot application technically practical and economically feasible?

PART B — (5 × 13 = 65 marks)

11. (a) What are the various configurations of robot? Explain any three of them in detail with aid of sketches. (13)

Or

(b) Explain the following :

(i) Types of robot controls. (8)

(ii) Important specifications of an industrial robot. (5)

12. (a) Discuss about the different types of grippers. Also list out the gripper design considerations. (13)

Or

(b) Discuss about the salient features of servo motor and stepper motor. Based on the discussion, brief the drive system selection criteria tar an industrial robot. (13)

13. (a) Draw and explain the construction and working property of LVDT and give its advantages and disadvantages and applications.

Or

(b) What are areas of application of image processing in the field of robots? What do you mean by robot vision? Also discuss about various lighting techniques used in machine vision. (13)

14. (a) Determine the forward and inverse kinematic equations of a 2 DOF RR configuration robot. Also determine the values to which the angles of a manipulator must be set in order to achieve the point (40, 32) in space, if the length of links 1 and 2 are 30 cm and 25 cm respectively. (13)

Or

(b) A point $P(7, 3, 1)^T$ is attached to a frame F_{noa} and is subjected to the following transformations Find the coordinates of the point relative to the reference frame at the conclusion of transformations.

(i) Rotation of g0° about the z -axis,

(ii) Followed by a rotation of 90° about the y -axis,

(iii) Followed by a translation of [4, 3, 7].

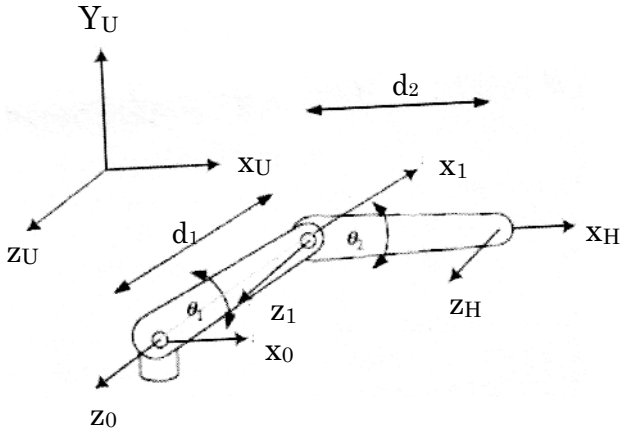
15. (a) Discuss the various steps to be taken for implementing robots in industry considering safety issues. (13)

Or

(b) With suitable example, discuss about the pay back and rate of return method of economic analysis while implementing robots in industry. (13)

PART C — (1 × 15 = 15 marks)

16. (a) For the 2-axis planar robot shown In figure below, assign the necessary coordinate systems based on the D-H representation, fill out the parameters table, and derive the forward kinematic equations of the robot. (15)



A simple 2-axis articulated robot arm.

Or

(b) (i) List the commands used in VAL programming and describe its functions. (5)

(ii) Develop a program in VAL II to command a PUMA robot to unload a cylindrical part of 10 mm diameter from machine 1 positioned at point P_1 and load the part on machine 2 positioned at P_2. The speed of robot motion is 40 in/s. However, because of safety precautions the speed is reduced to 10 in/s while moving to a machine for an unloading or loading operation. (10)

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