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Question Paper Code:AME553



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech VI Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R16

INTRODUCTION TO ROBOTICS

Time: 3 Hours

(AE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. (a) What is industrial automation? Outline the types of industrial automation with examples. [7M]
(b) Discuss the classification of robots based on coordinate system with their applications. [7M]
2. (a) Point out the importance of automation in industries and justify the necessity of robots to achieve the automation. [7M]
(b) What are the various factors in gripper's selection and design? Explain. [7M]

UNIT – II

3. (a) Explain about assigning the frame for end effector a neat sketch. [7M]
(b) Define world coordinates of a robot. Deduce rotation matrix for fixed angle representation. [7M]
4. (a) Deduce the forward and inverse kinematics expressions for a 3 link system. [7M]
(b) Define and illustrate the link and joint parameters. Explain their uses. Point out the role of D-H notations in the analysis of robots. [7M]

UNIT – III

5. (a) Explain the Lagrange Euler's formulation for robot arm. [7M]
(b) Derive the torque at joints for the following robot arm as shown in Figure 1 using LE Formulation. [7M]

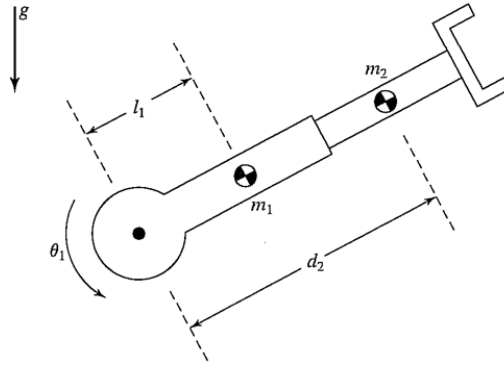


Figure 1

6. (a) Explain the static force analysis of robot manipulator with the help of jacobian matrix. [7M]
- (b) Deduce the equation of motion for a single link manipulator given the mass and length of the link. [7M]

UNIT – IV

7. (a) Differentiate straight line motion and joint interpolated motion of a robot. [7M]
- (b) A robot is designed to perform loading and unloading work parts from a CNC machine. List out the necessary actuators and explain the working principle. [7M]
8. (a) Write a short note on slew motion and joint interpolated motion. [7M]
- (b) Determine the time required for each joint of a three-axis RRR manipulator to travel the following distances using slew motion; joint 1, 100° ; joint 2, 30° ; and joint 3, 60° . All joints travel at a rotation velocity of $15^\circ/\text{s}$. [7M]

UNIT – V

9. (a) Explain with a neat diagram about Hydraulic Actuator. [7M]
- (b) Explain function of robots in assembly and inspection. Explain pick-and-place robots for machining operation of plastic moulding. [7M]
10. (a) Compare benefits and drawbacks of Pneumatic, hydraulic and electric actuators. [7M]
- (b) Describe sensors used in robotic arc welding. Explain various assembly systems configuration. [7M]

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