Code No: 5215AR

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech II Semester Examinations, February - 2017
INDUSTRIAL ROBOTICS
(Machine Design)

Time: 3hrs **Max.Marks:75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

5 × 5 Marks = 25

1.a) What are the different classifications of robot, explain any two? [5]
b) Define the forward and inverse kinematics with block diagram. [5]
c) Briefly explain the term Wrench in robot kinematics. [5]
d) Differentiate between path planning and trajectory planning. [5]
e) What are the assumptions in Euler-Bernoulli Beam model by considering free bending vibration equation? [5]

PART - B

5 × 10 Marks = 50

2. Using Dinavit Hartenberg notation for frame assignment it is possible to have a link with zero link length where as physical link on the manipulator will have a finite link length. Explain. [10]

OR

3. Explain why homogeneous transformations are required in modeling of robotic manipulator. [10]

4. Prove that $\tau=J^T F$ where τ is the joint torque vector and F is the end point force vector and J is the Jacobean matrix of the manipulator. [10]

OR

5. For a two degrees of freedom robot of your own configuration, explain the procedure to solve an inverse kinematics problem. [10]

6. Formulate and solve the direct kinematics problem for a 3-3 Stewart Platform manipulator. [10]

OR

7. Derive the direct kinematics of 3RRR Parallel manipulator. [10]

8. Using the Lagrange Euler formulation, derive the expressions for the joint torques of a planner R-R manipulator. [10]

OR

9. Develop the expressions for the motion parameters in a joint space scheme by considering a cubic polynomial fit. [10]

10. For a planar 2R manipulator, with both links flexible, derive the symbolic dynamic equations of motion using the finite element method. Take two elements in each flexible link and assume that there is no gravity. [10]

OR

11. Derive the D-H parameters for a kinematic modelling of multi-link flexible manipulator. [10]

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