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R09

Code No: 57026

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, December - 2014

ROBOTICS

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks

- 1.a) Write the homogeneous transformation matrix for a rotation of 90° about the z-axis, followed by a rotation of 90° about the x-axis, followed by a translation of (3, 7, 9).
- b) Suppose that instead of a frame, a point $P = (3; 5; 7)^T$ in space was translated a distance of $d = (2; 3; 4)^T$. Find the new location of the point relative to the reference frame.
- 2.a) Define the term Robot as per RIA.
- b) What is work envelope? Draw configurations and work space of cylindrical and Spherical robots.
- c) Differentiate between Forward and Inverse kinematics.
- 3.a) Discuss the various methods of Robot Programming.
- b) Discuss the structure, elements and functions of any one Robot Language.
- c) Discuss the types of various Robot Cell layouts.
4. Obtain the Forward Kinematic Equations for determining the Position and orientation of a two link RR Planar Robotic manipulator by (i) Direct Method (ii) Denavit and Hartenberg approach.
- 5.a) Distinguish between proximity and tactile sensors used in robotic applications.
- b) Differentiate between Newton-Euler and Lagrangian formulations in finding the dynamic equations of motion.
- c) What are the singular configurations of a spherical robot?
6. For a planar RR manipulator, derive the Jacobean matrix and find the linear velocity and angular velocity of the end effector. Explain the determination of Jacobean with respect to frames attached to different links, when the Jacobean with respect to base frame is given.
7. Derive the dynamic equations of motion (EOM) of a RR type planar robot and find the expressions of torque at the first joint and the second joint.
- 8.a) Write short notes on:
i) Range Sensors ii) Position sensors iii) Velocity sensors.
- b) Explain Reach and Stroke of a robot.
- c) Discuss the types of drives used in robotics.

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