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12MAR13

First Semester M.Tech. Degree Examination, June/July 2014

Robotics for Industrial Automation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define an industrial robot as per RIA and give the complete classification of robots. **(06 Marks)**

b. Explain with simple sketches the four basic robotic configurations with their relative merits and demerits. **(10 Marks)**

c. Explain the following robot performance characteristics:
i) Repeatability ii) Resolution **(04 Marks)**

2 a. Explain the concept of direct and indirect kinematics in robotics. **(06 Marks)**

b. Derive the composite matrix for rotation about an arbitrary axis. **(08 Marks)**

c. The position and restored orientation of a cylindrical robot are given. Find the matrix representing the original position and orientation of the robot before it was restored.

$$T = \begin{bmatrix} 1 & 0 & 0 & -2.394 \\ 0 & 1 & 0 & 6.578 \\ 0 & 0 & 1 & 9 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$ **(06 Marks)**

3 a. Find the position of the end effector in cylindrical coordinates which has the following translations/rotations:
i) translation of r units along x-axis
ii) rotation of α about z-axis
iii) translation of l units along z-axis. **(10 Marks)**

b. Using D-H method, explain how direct kinematic problems are solved. **(10 Marks)**

4 a. Explain with an example third order polynomial trajectory planning. **(10 Marks)**

b. Explain absolute and incremental interpolators used in trajectory interpolation. **(10 Marks)**

5 a. Explain dynamic modeling of a robot for a general six axis manipulator. **(10 Marks)**

b. Discuss Lagrange-Euler dynamic modeling of robotic arms. **(10 Marks)**

6 a. Explain the following terms in robot programming:
i) Branching ii) Signal and delay commands **(10 Marks)**

b. Discuss the various programming methods used in robot teaching with their merits and demerits. **(10 Marks)**

7 a. Explain with a block diagram the components and their functions in a robotic vision system. **(10 Marks)**

b. Explain the use of sensors in robotics with examples. **(10 Marks)**

8 Write short notes on the following:
a. Industrial applications of robots b. Bond graph modeling in robotics
c. Future automation d. AI and expert systems in robotics **(20 Marks)**

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