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Seventh Semester B.E. Degree Examination, June/July 2016

Robotics

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Define a robot. With neat sketches, explain any two basic configurations of robots. (10 Marks)
- b. With a neat sketch, explain the DH representation of robot link parameters. (10 Marks)
- 2 a. Explain the direct and inverse kinematic analysis of robot. (08 Marks)
- b. Explain with neat sketch, direct kinematics of PUMA 560 manipulator by using link transformation matrix. (12 Marks)
- 3 a. Derive the expression for the differential operator $[\Delta]$ for a frame with differential translations and rotations. (08 Marks)
- b. Find the effect of differential rotation of 0.1 radian about Y-axis followed by differential translation $[0.1, 0, 0.2]$ on the frame given below:

$$\begin{bmatrix} 0 & 0 & 1 & 10 \\ 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
 (08 Marks)
- c. Explain the statics of serial manipulator. (04 Marks)
- 4 a. Illustrate the equation of motion of a planar 2R manipulator using Lagrangian formulation. (10 Marks)
- b. Discuss the inertia of a link by using a rigid body. (10 Marks)

PART – B

- 5 a. Explain the parameters to be considered in planning a joint-interpolated trajectory. (10 Marks)
- b. Compare joint-space normalized movements and Cartesian-space movement for a two degree freedom robot. (10 Marks)
- 6 a. With sketch explain briefly feedback control of a single link manipulator for a first order system. (10 Marks)
- b. Explain the PID control of a multilink manipulator. (10 Marks)
- 7 a. List the important characteristics of actuating system. Explain briefly any four of them. (10 Marks)
- b. What is a stepper motor? Explain its principle of operation and characteristics. (10 Marks)
- 8 Write short notes on any four of the following:
 - a. Proximity sensor.
 - b. Force sensor.
 - c. Touch and tactile sensor.
 - d. Optical sensor.
 - e. LVDT
 (20 Marks)