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BME-029

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

01340

Term-End Examination

June, 2014

BME-029 : ROBOTICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks.*

1. (a) Write four laws of Robotics. 7

(b) What kind of robot is suitable for painting ? Why ? 7

2. (a) With the help of suitable block diagram briefly explain the components of an actuator. 7

(b) List any three advantages and disadvantages of a pneumatic actuator. 7

3. (a) What are the major capabilities of sensors required for robotic applications ? 7

(b) How can we reduce the processing time in a vision system ? Explain. 7

4. (a) With suitable sketch explain the kinematic structure of a robot. 7

(b) Assume that $[Q_A]_F$ and $[Q_B]_A$ are given by

$$[Q_A]_F = \begin{bmatrix} \cos 30° & -\sin 30° & 0 \\ \sin 30° & \cos 30° & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$[Q_B]_A = \begin{bmatrix} \cos 45° & -\sin 45° & 0 \\ \sin 45° & \cos 45° & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Find $[Q_B]_F$. 7

5. (a) Find the Jacobian matrix for a planar 2-link revolute-jointed arm. 9

(b) Write the Euler-Lagrange equations of motion. Explain all the terms used in the above equations. 5

6. What are the advantages and disadvantages of the following schemes in trajectory planning : 7+7

(a) Joint Space Scheme

(b) Cartesian Space Scheme

7. (a) Write the applications for point to point and continuous path planning. 7

(b) Write the steps involved to develop the program of a typical robot. 7