No. of Printed Pages : 3

BME-029

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

00088

June, 2016

BME-029 : ROBOTICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) What are the 'Laws of Robotics' ?

(b) Name few Robot manufacturers and their robot programming languages. *5+5*

2. (a) What do you understand by 'actuators' ? What are its types ? Describe its advantages and disadvantages.

(b) What are the various types of transmission systems used in Robotics ? Explain. *5+5*

3. (a) Describe the kinematic structure of a robot with the help of a suitable diagram.

(b) What do you understand by degree of freedom ? Explain with examples. *5+5*

4. (a) Draw the block diagram of Robot feedback control system. Describe its features. Why is feedback control necessary ?

(b) The co-ordinates of a point q_{abc} are given by $(7, 5, 9)^T$ which is rotated about the OX-axis of the reference frame OXYZ by an angle of 30°. Determine the co-ordinates of the point q_{xyz}. *5+5*

5. (a) How many joints should a wrist have and why ?

(b) What is the order of a trajectory that has to satisfy the position, velocity and acceleration constraints at the initial and final points ? *5+5*

6. Differentiate between on-line and off-line programming methods for robots. Discuss the advantages and limitations of these methods. *10*

7. (a) Explain the construction of different end effectors for different types of applications. Describe a simple servo control system for a robot.

(b) Identify various types of sensors used in robots. *5+5*

8. (a) Differentiate between contact and non-contact sensors in robots with the help of examples.

(b) Describe the construction and working principle of one contact and one non-contact type of sensor. *5+5*

9. (a) Rotate the vector

$$V = 5i + 4j + 6k$$

by an angle of 90° about the x-axis.

(b) Explain in brief the forward and inverse kinematics. *5+5*

10. (a) Discuss the operation of rotation about an arbitrary axis represented by a vector and derive the rotation matrix and give geometric interpretation.

(b) What are the merits and demerits of electric drive system of a robot ? *5+5*
