

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

Term-End Examination

June, 2017

00659

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 criteria for deciding the robot for a flexible manufacturing system ?
(b) What are lead through programming and walk through programming of a robot ? 5+5
2. (a) Describe the permanent magnet stepper motor.
(b) Do robots prevent safety problems to humans ? Justify your answer with suitable example. 5+5
3. (a) What is control law ? Express the force to be applied by an actuator in the form of an equation. Express closed loop dynamics in equations. What conclusions are drawn from these equations ?

- (b) A single cubic trajectory is given by

$$\theta(t) = 10 + 90t - 60t^3$$

and is used over the time interval from $t = 0$ to $t = 1$. What are the starting and final positions, velocities and accelerations? 5+5

4. (a) What are the ways of classifying a robot? Name two robot manufacturers and their robot programming languages.
- (b) Describe the salient features of a microprocessor based robot controller. List a few popular brands of robotic controllers. 5+5
5. (a) Explain the Jacobian matrix for a two-link planar manipulator.
- (b) Discuss the desirable engineering features of sensors and transducers. 5+5
6. (a) What is an encoder? What are the types of encoders?
- (b) Describe the functions of strain gauge and piezoelectric sensor. Are these devices internal or external sensors? 5+5
7. (a) Explain the advantages of the following controllers:
- (i) PD controller
 - (ii) PID controller
- (b) What are the various types of transmission systems used in Robotics? Explain with the help of examples. 5+5

8. (a) What do you understand by degree of freedom ? Explain with examples.
- (b) How can robots be used in medical surgery ? Explain with suitable examples. 5+5
9. (a) Discuss the purpose and importance of a feedback control system.
- (b) State the advantages and disadvantages of pneumatic actuators. 5+5
10. (a) With the help of suitable examples, explain the use of robots in the following :
- (i) Welding
- (ii) Spray painting
- (b) The coordinates of a point P_{abc} in the mobile frame OABC are given by $[4, 3, 2\sqrt{3}]^T$. If the frame OABC is rotated 60° with respect to OY of the OXYZ frame, find the coordinates of P_{xyz} with respect to the base frame. 5+5
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