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BME-029

01447

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2013

BME-029 : ROBOTICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) What are the different types of internal sensors ? Explain their functional details. 5+5
   (b) Explain selection methodology of actuators and sensors for a robotic system.

2. (a) Explain and find out Jacobian matrix for a two link planar manipulator. 5+5
   (b) Discuss the desirable engineering features of sensors and transducers.

3. (a) Explain point to point and continuous path planning. 5+5
   (b) Discuss the purpose and importance of feedback control system ?

4. (a) Mention the types of actuators in robot and the characteristics of actuators. 5+5

(b) State the advantages and disadvantages of pneumatic actuators.

5. (a) Describe the salient features of a microprocessor based robot controller ? List a few popular brands of robotic controllers. 5+5

(b) A single cubic trajectory is given by

$\theta(t) = 10 + 90t - 60t^2$

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

6. (a) Discuss the anatomy of a robot. 5+5

(b) The Co-ordinates of point Q with respect to base reference frame is given by $[4, 2\sqrt{3}, 5]^T$. Determine the co-ordinates of Q with respect to mobile rotated frame of the robot if the angle of rotation with the OX is 60°.

7. (a) What is an encoder ? What are the types of encoder ? Explain in brief. 5+5

(b) Describe the functions of strain gauge and piezoelectric sensor. Are these devices, internal or external sensors ?

8. (a) What do you understand by position analysis ? Describe the method to solve a direct problem. 5+5

(b) What is 'Lagrangian' ? How is Lagrangian correlated with forces in the links of a kinematic chain ?

9. (a) With the help of suitable examples, explain the use of robots in the following : 5+5

(i) welding , and

(ii) spray painting

(b) Explain the features of Robot Oriented programming.

10. (a) Differentiate between a robot and CNC machine tools. 5+5

(b) Using block diagrams define forward and inverse kinematics of a robot. How are they useful for a robot ?