No. of Printed Pages : 3

BME-029

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

December, 2018

00993

BME-029 : ROBOTICS

Time : 3 hours *Maximum Marks : 70*

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

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1. What are the basic elements of a robotic system ? Discuss the function of each element in the manufacturing environment. 7

2. Discuss the advantages and disadvantages of using robots in industry. Also discuss the non-industrial applications of robots. 7

3. When are hydraulic actuators preferred in robots ? What are the differences between stepper motor and DC servo motor ? 7

4. Explain the algebraic solution of a three-link planar manipulator for inverse kinematics problem. 7

5. If 3 revolute joints of a three-link planar robot arm have moved by 30°, 60° and 0°, find out the position and orientation of the end-effector. Take link lengths as $a_1 = 2$ units, $a_2 = 1$ unit, $a_3 = 0{\cdot}5$ units. 7

6. With the help of a block diagram, explain the functions of a robotic vision system and the devices used in the same system. 7

7. Explain the relationship of robotics with industrial automation and illustrate the same with a suitable example. 7

8. Differentiate between online and offline robot programming, with the help of suitable examples. 7

9. Write how robots can be used in medical surgery. 7

10. Discuss the Lagrange-Euler formulation for a robot arm. 7

11. A mobile body reference frame OABC is rotated 60° about OY-axis of the fixed base reference frame OXYZ. If $p_{xyz} = (2, 4, 6)^T$ and $q_{xyz} = [3, 5, 7]^T$ are the coordinates with respect to OXYZ plane, what are the corresponding coordinates of p and q with respect to OABC frame ? 7

12. Write short notes on any ***two*** of the following : $2 \times 3\frac{1}{2} = 7$

(a) Joint Space vs Cartesian Space

(b) Forward Kinematics vs Inverse Kinematics

(c) DH Parameters

(d) Accuracy and Sensitivity