CBCS SCHEME

15MA82

Eighth Semester B.E. Degree Examination, July/August 2021
Industrial Robotics

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 a. Define robot. **(01 Marks)**
   b. Explain work volume. Show the work volume of the cylindrical and spherical robot. **(05 Marks)**
   c. List 8 advantages of industrial robot. **(04 Marks)**
   d. List and explain various social and economic aspects related to robots. **(06 Marks**

2 a. With neat sketches, explain different configuration used in robotics. **(06 Marks)**
   b. Explain types of joints used in industrial robots. **(04 Marks)**
   c. With a neat sketch, explain robot anatomy. **(06 Marks)**

3 a. With a neat block diagram, explain closed loop control system also give an example. **(04 Marks)**
   b. Derive an expression for transfer function used in P – I – D controllers. **(06 Marks)**
   c. Explain the following terms : i) Plant ii) Disturbance iii) Feedback. **(06 Marks**

4 a. Explain manual teaching and lead through teaching for robot programming. **(06 Marks)**
   b. List and explain advantages and disadvantages of online programming. **(06 Marks)**
   c. Give a list of programming language and its features used in programming robots. **(04 Marks)**

5 a. Define robot kinematics. Using example, explain the types of robot kinematics. **(04 Marks)**
   b. Mention the components that makes up a transformation matrix. **(02 Marks)**
   c. Derive an expression for finding out the position of end effector, if these are two links in the robot manipulator. **(10 Marks**

6 a. Explain composite matrix. **(02 Marks)**
   b. Derive an expression for a rotation matrix in 3D. **(10 Marks)**
   c. A vector $\vec{V} = 3\hat{i} + 2\hat{j} + 7\hat{k}$ is rotated at 60° about z–axis, then 30° about x–axis. Find the homogeneous transformation with reference to reference frame. **(04 Marks)**

7 a. State six reasons of studying dynamics of industrial robot. Given an example to illustrate the concept. **(06 Marks)**
   b. Derive an expression for finding out motion equations of an industrial robot. **(10 Marks)**

8 a. Explain various considerations that are taken during trajectory planning. **(06 Marks)**
   b. Using mathematical equations, explain 4 – 3 – 4 trajectory planning. **(04 Marks)**
   c. One of the joints of an industrial robot moves from initial angle of 20° to a final angle of 84° in 4 seconds. Using the concept of 3rd degree polynomial functions, find out the joint angle at t = 1 second, t = 2 seconds, and t = 3 seconds. **(06 Marks)**

9 a. Classify sensor. **(04 Marks)**
   b. List down and explain at least 4 desirable properties of sensors. **(04 Marks)**
   c. With a neat sketch, explain the working of vidicon camera. **(08 Marks)**

10 a. Explain the three basic steps that happens in A/D signal conversions. **(04 Marks)**
   b. Draw a flowchart of image processing technique. **(04 Marks)**
   c. Explain the steps involved in the operation of machine vision system. **(08 Marks)**

* * * * *