CBCS SCHEME

USN | | | | | | | | | | 18ME732

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Automation and Robotics

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Explain the basic elements of an automated system with the help of a block diagram.   **(10 Marks)**

    b.   What are the reasons for automation? List them and explain.   **(10 Marks)**

OR

2   a.   What are different types of sensors used in industrial automation? List them.   **(05 Marks)**

    b.   Describe input/output devices for discrete data.   **(10 Marks)**

    c.   What are hardware components for automation and process control?   **(05 Marks)**

Module-2

3   a.   Explain Transfer lines. Sketch and explain rotary transfer machine.   **(08 Marks)**

    b.   A ten station in-line assembly machine has an ideal cycle time of 6 sec. The base part is automatically loaded prior to the first station and components are added to each of the stations. The fraction defect rate at each of the ten stations is $q = 0.01$ and the probability that a defect will Jam is $m = 0.5$. When a jam occurs, the average down time is 2 minutes. Cost to operate the assembly machine is Rs.2940/hour. Other costs are ignored.

     Determine:

     i)   Average production rate of all assemblies.

     ii)   Yield of good assemblies.

     iii)   Average production rate of good product.

     iv)   Efficiency of the assembly machines.

     v)   Cost per unit produced.   **(12 Marks)**

OR

4   a.   What is AIDC? Explain.   **(10 Marks)**

    b.   Write a brief note on bar-code technology.   **(10 Marks)**

Module-3

5   a.   Define a Robot Enumerate the robot physical configurations. Explain any two configurations with neat sketch.   **(10 Marks)**

    b.   With a neat sketch, explain roll, pitch and yaw motions.   **(05 Marks)**

    c.   List applications of industrial robots.   **(05 Marks)**

OR

6   a.   Define the terms accuracy and repeatability.   **(08 Marks)**

    b.   What do you mean by dynamic stabilization of robots? Give an example.   **(06 Marks)**

    c.   State the laws of Asimov's.   **(06 Marks)**

Module-4

7 a. What is a servomotor? Explain its characteristics and advantages. (06 Marks)

b. Differentiate between tactile and proximate sensors. (04 Marks)

c. Explain potentiometer with neat sketch. (10 Marks)

OR

8 a. Obtain the relation between the body attached frame with base frame of reference by transformation matrix (4×4). (06 Marks)

b. For a 6 joint robotic manipulator, equipped with a digital TV camera and it is capable of monitoring the position and orientation of an object. The position and orientation of the object with respect to the camera is expressed by a matrix $[T_1]$, the origin of the robot base coordinate with respect to the camera is given by $[T_2]$ and the position and orientation of the gripper with respect to the base coordinate frame is given by $[T_3]$.

$$[T_1] = \begin{bmatrix} 0 & 1 & 0 & 5 \\ 1 & 0 & 0 & 6 \\ 0 & 0 & -1 & 10 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad [T_2] = \begin{bmatrix} 1 & 0 & 0 & -25 \\ 0 & -1 & 0 & 10 \\ 0 & 0 & -1 & 12 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad [T_3] = \begin{bmatrix} 1 & 0 & 0 & 8 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 1 & 6 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Determine:

i) The position and orientation of the object with respect to the base coordinate.

ii) The position and orientation of the object with respect to gripper. (14 Marks)

Module-5

9 a. Explain the following:

i) Object level programming

ii) Lead through programming. (10 Marks)

b. Explain the requirements of a robot programming language. (10 Marks)

OR

10 a. Write the robot programming using AL for the following palletizing operation. Working; Pick a part from a pallet with r_1 – rows and c_1 columns and put into a pallet of r_2 rows and c_2 columns; signal or wait for representation and removal of full or empty pallets. (15 Marks)

b. Discuss the central issues in OLP system. (05 Marks)

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