

# CBCS SCHEME

17ME563

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## Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Automation and Robotics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Write neat sketches wherever required.

### Module-1

- 1 a. With a block diagram, explain briefly the basic elements of an automated system. (13 Marks)  
b. Briefly explain the general configuration of an adaptive control system. (07 Marks)

OR

- 2 a. With a schematic diagram, explain the components of a DDC system. (06 Marks)  
b. Compare hydraulic and pneumatic systems used as actuator for automation and process control (any eight). (08 Marks)  
c. Explain the steps involved in analog to digital conversion of continuous analog signals from process with a schematic diagram. (06 Marks)

### Module-2

- 3 a. With a schematic diagram, explain the operation of walking beam transfer system. (08 Marks)  
b. A 20 station transfer line to machine a certain component currently produced by conventional methods is under consideration. The manufacturing department estimated a production rate of 60 pieces per hour with 100% efficiency. The probability of station breakdown per cycle is equal for all stations and is 0.005 breakdown/cycle and average downtime per line stop is 6 minutes. The starting casting for the component costs Rs 100/-. The transfer line operates at a cost of Rs 500/hr and the 20 cutting tools lasts for 50 parts each. The average cost per tool is Rs 5/- part. Compute the following :  
i) Cycle time  
ii) Actual production rate  
iii) Number of hours required to meet a demand of 1500 units/week  
iv) Line efficiency  
v) Balance delay  
vi) Cost/unit produced. (12 Marks)

OR

- 4 a. Explain briefly the hardware elements of the parts delivery system at an assembly work station with a schematic diagram. (08 Marks)  
b. Enumerate the principle components of AIDC. List any five categories of AIDC technologies. (04 Marks)  
c. Write a brief note on bar code technology. (08 Marks)

**Module-3**

- 5 a. Define Robot. Enumerate the robot physical configurations. Explain jointed arm and polar robot configuration with a neat sketch. (10 Marks)  
 b. Explain the five major components of a basic control system. (05 Marks)  
 c. Write a brief note on end effectors. (05 Marks)

**OR**

- 6 a. Explain the tactile, proximity and range sensors with respect to robots. (12 Marks)  
 b. Explain robot accuracy and repeatability. (05 Marks)  
 c. Enumerate the Asimov's three laws of Robotics. (03 Marks)

**Module-4**

- 7 a. Obtain the relation between the body attached frame with base frame of reference by transformation matrix ( $4 \times 4$ ). (06 Marks)  
 b. A six joint robotic manipulator equipped with a digital TV camera is capable of continuously monitoring the position and orientation of an object. The position and orientation of the object with respect to camera is expressed by a matrix  $[T_1]$ , the origin of the robot's base co-ordinate with respect to camera is gives by  $[T_2]$  and the position and orientation of the gripper with respect to the base co-ordinate frame is given by  $[T_3]$ .

$$[T_1] = \begin{bmatrix} 0 & 1 & 0 & 5 \\ 1 & 0 & 0 & 6 \\ 0 & 0 & -1 & 10 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad [T_2] = \begin{bmatrix} 1 & 0 & 0 & -20 \\ 0 & -1 & 0 & 10 \\ 0 & 0 & -1 & 12 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad [T_3] = \begin{bmatrix} 1 & 0 & 0 & 8 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 1 & 6 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Determine :

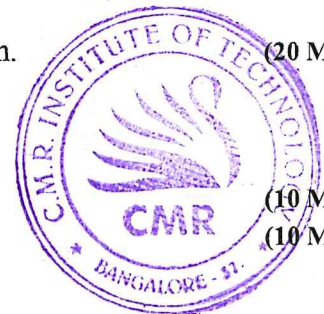
- i) The position and orientation of the object with respect to the base co-ordinate  
 ii) The position and orientation of the object with respect to gripper. (14 Marks)

**OR**

- 8 Explain the general D-H Algorithm with Schematic illustration. (20 Marks)

**Module-5**

- 9 a. Explain briefly the three levels of robot programming. (10 Marks)  
 b. Explain the requirements of a robot programming Language. (10 Marks)

**OR**

- 10 a. Explain the central issues of OLP systems. (10 Marks)  
 b. Explain briefly the different automating subtasks in OLP systems. (10 Marks)

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