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## Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025 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. Illustrate different levels of automation with neat block diagram. (10 Marks)
- b. Explain advanced automation functions. (10 Marks)

**OR**

- 2 a. Illustrate the configuration of an adaptive control system in continuous process control. (10 Marks)
- b. Compare Hydraulic and Pneumatic systems and explain the principles of hydraulic actuators. (10 Marks)

### Module-2

- 3 a. What do you understand by an automated flow line? Explain it with the help of a neat sketch and also list the objectives of automated flow line. (10 Marks)
- b. With examples, explain upper bound and lower bound approaches to analyze automated flow line without storage buffer. (10 Marks)

**OR**

- 4 a. A 20 station transfer line is divided into two stages of 10 stations each. The ideal cycle time of each stage is  $T_C = 1.2$  min. All of the stations in the line have the same probability of stopping  $P = 0.005$ . Assume that downtime is constant when a breakdown occurs,  $T_d = 8.0$  min. Compute the line efficiency for the following buffer capacities: i)  $b = 0$  ii)  $b = \infty$  iii)  $b = 10$ . (10 Marks)
- b. There are two forms of linear bar codes. Name them, and explain with the sketches. Also compare bar codes and RFID. (10 Marks)

### Module-3

- 5 a. Illustrate the Cartesian and cylindrical robotic configurations. (10 Marks)
- b. Explain robot control systems i.e. i) Limited sequence ii) Playback with point-to-point iii) Play back with continuous path control iv) Intelligent control. (10 Marks)

**OR**

- 6 a. Define robot end effector. Explain robot accuracy and repeatability. (10 Marks)
- b. Illustrate pitch, yaw and roll to explain degrees of freedom and also state Asimov's laws of robotics. (10 Marks)

### Module-4

- 7 a. Describe how you would use sensors to control the position of a robotic arm. (10 Marks)
- b. Illustrate the characteristics of DC motors and stepper motors in robotics applications. (10 Marks)

OR

- 8 a. A point  $P_{abc} = (2, 3, 4)^T$  has to be translated through distance of +4 units along OX-axis and -2 units along OZ – axis. Determine the co-ordinates of the new point  $P_{xyz}$  by homogeneous transformation. (10 Marks)
- b. Explain : i) Direct and inverse kinematics ii) DH convention. (10 Marks)

Module-5

- 9 a. Explain the levels of robotic programming. (10 Marks)
- b. Explain the requirements of robot programming language. (10 Marks)

OR

- 10 a. Explain the following VAL commands with descriptions for:  
 i) Motion control  
 ii) Speed control  
 iii) Position control  
 iv) End effector operation  
 v) Operation of the sensor. (10 Marks)
- b. Write a program in VAL for palletization of parts in a pallet having 4 rows that are 50 mm apart and 6 columns 40 mm apart. The robot must pick parts from an incoming chute and are 25 mm tall. Use in the program the following names for variables ROW, COLUMN, X and Y and use names for location constants PICK-UP, CORNER and DROP. (10 Marks)

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