Roll No. | | | | | | | | | | |

# B.E (FULL TIME) DEGREE END SEMESTER EXAMINATION, NOV/DEC 2024

## ELECTRONICS AND COMMUNICATION ENGINEERING

## EC5078 – ROBOTICS

## SEMESTER V & VII

## REGULATION 2019

Time:3 Hours | Answer all Questions | Max.Marks: 100

| | |
|---|---|
| CO1 | Ability to comprehend and appreciate the significance and role of this course in the present contemporary world |
| CO2 | Ability to design and develop robotic based systems |
| CO3 | Ability to develop system for industrial automation and medical applications. |
| CO4 | Ability to provide automatic solution for replacing humans in life threatening area. |

BL-Bloom's Taxonomy Levels
(L1- Remembering, L2- Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

| Sl.No | Questions | Marks | CO | BL |
|---|---|---|---|---|
| | **PART A (10 x 2 = 20 Marks)** | | | |
| 1. | Name the important specifications of an industrial robot. | 2 | 1 | 1 |
| 2. | Differentiate flexible automation and fixed automation. | 2 | 1 | 2 |
| 3. | What are the degrees of freedom associated with the arm and body motion? | 2 | 1 | 2 |
| 4. | Robot with one degree of freedom it has one sliding joint with a full range of 5.0m the robot control memory has 32 bit storage capacity. Determine the control resolution for the axis of motion. | 2 | 2 | 2 |
| 5. | Define interlocks. Mention its types. | 2 | 2 | 1 |
| 6. | List out different robot programming languages. | 2 | 2 | 1 |
| 7. | A frame F has been moved 10 units along y-axis and 5 units along z-axis of reference frame. Find new location of frame. $F = \begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ | 2 | 3 | 2 |
| 8. | Why is safety important in robotics? | 2 | 3 | 2 |
| 9. | What is the purpose of a mobile robot? | 2 | 4 | 1 |
| 10. | What are the benefits of solar robots? | 2 | 4 | 1 |
| | **PART B (5 x 13 = 65 Marks)** | | | |
| 11.a) | Sketch and explain the four basic robot configurations classified according to the coordinate system. | 13 | 1 | 2 |
| | (OR) | | | |
| 11.b) | i) Explain the application of robot in continuous arc welding. | 7 | 1 | 2 |
| | ii) Explain the importance of Robot in Spot Welding. | 6 | 1 | 2 |

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|---|---|---|---|---|
| 12.a) | Explain the types of gripper mechanism in detail | 13 | 2 | 2 |
| | (OR) | | | |
| 12. b) | Explain the various drive system used with an industrial robot and compare their features, merits and demerits. | 13 | 2 | 2 |
| | | | | |
| 13.a) | i) Define the following commands: (I) WAIT (II) SIGNAL (III) DELAY | 7 | 3 | 3 |
| | ii) Write short notes on characteristics of task level languages | 6 | 3 | 3 |
| | (OR) | | | |
| 13 b) | Write a program for pick and-place operation on the conveyor system. it consists of two conveyors running parallel with center distance of 800 mm at same level. An industrial robot is fixed centrally between the conveyors. The robot is used to transfer work pieces from conveyor 1 to 2 at a constant speed. Draw a schematic view of the system. Assume all necessary dimensions. | 13 | 3 | 3 |
| | | | | |
| 14.a) | i) Write short notes on Robot cell layout. | 7 | 3 | 2 |
| | ii) Discuss about Compliance and Remote Center Compliance device in detail. | 6 | 3 | 2 |
| | (OR) | | | |
| 14. b) | i) List few safety precautions necessary for robotic application | 7 | 3 | 2 |
| | ii) Explain the three levels of safety sensor systems in robotics defined by National Bureau of Standards? | 6 | 3 | 2 |
| | | | | |
| 15. a) | Discuss and explain the various applications of robots in space exploration. | 13 | 4 | 3 |
| | (OR) | | | |
| 15. b) | Discuss the various applications of underwater robots in scientific research, industrial use, and environmental monitoring. Highlight the advantages they offer over traditional methods and the challenges they face in deep-sea exploration | 13 | 4 | 3 |
| | **PART C (1 x 15 = 15 Marks) (Compulsory)** | | | |
| 16. | i) A robot is to be programmed to unload parts from one pallet and load them onto another pallet. The parts are located on the unload pallet (pallet 1) in 3 by 4 pattern in known fixed positions, 40 mm apart in both directions. The two directions of the pallet are assumed to be parallel to the x and y world coordinates axes of the robot. The parts are to be placed on the load pallet (pallet 2) in a 2 by 6 pattern, 40 mm apart in both directions. The directions of the pallet are again assumed to be parallel to the x and y world coordinates axes of the robot. Make sketch of the work station setup. | 10 | 3 | 4 |
| | ii) A point P (3,7,5) is attached to frame and subjected to following transformations. Find coordinate of point relative to reference frame. 1.Rotation of 30° about x-axis 2.Followed by translation of 6 units along y axis .3.Followed by rotation of 90° about y-axis 3.Followed by rotation of 45° along Z axis. | 5 | 3 | 4 |