



## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

**Eighth Semester, B.E. - Mechanical Engineering**

**Semester End Examination; July/ Aug. - 2022**

**Industrial Robotics**

Time: 3 hrs

Max. Marks: 100

*Note: Answer FIVE full questions, selecting ONE full question from each unit.*

### UNIT - I

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|--|----|
| 1 a. Explain three different types of automation by plotting the graph between product variety and product volume. | 10 |
| b. List different classification of Robots. Explain any two with neat diagram.                                     | 10 |
| 2 a. With neat sketches, explain resolution, accuracy and repeatability with respect to robot.                     | 10 |
| b. Explain different types of joints used in industrial robots, with a neat diagram for their motions.             | 10 |

### UNIT - II

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|---|----|
| 3 a. Explain the principle and working of tactile sensors with neat diagram.  | 10 |
| b. With a neat block diagram, explain hydraulic drive system of industrial robot mentioning its advantages and limitations. | 10 |
| 4 a. Explain with neat diagram, explain the principle and working of force and torque sensor.                               | 10 |
| b. With neat diagram, explain the principle and working of range sensor.  | 10 |

### UNIT - III

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|--|----|
| 5 a. Describe the Euler angle representation of system-II and system-III, also derive the Eulerian rotation matrix for system-I. | 10 |
| b. Explain the steps involved in implementing D-H representation with a neat sketch.   | 10 |
| 6 a. Derive an expression for kinetic energy of a robot.   | 10 |
| b. Explain the application of D-H method for 3-axis robot arm articulated robot and obtain transformation matrices.              | 10 |

### UNIT - IV

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|---|----|
| 7 a. Explain manual lead through and power lead through teaching of robot in detail.                | 10 |
| b. Explain the features and capabilities of first generation and second generation robot languages. | 10 |
| 8 a. Discuss the program control and subroutines in robot programming.                              | 10 |
| b. Discuss the end effort and sensor, commands in robots programming languages.                     | 10 |

Contd... 2

**UNIT - V**

- 9 a. List and explain the general consideration in Robot material handling in manufacturing industry. 10
- b. With a neat diagram, explain a die casting operation performed by an industrial robot. 10
- 10 a. Explain the application of industrial robot in spray coating in automobile industry. 10
- b. Explain the application of industrial robot in palletizing and related operations. 10

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