



U.S.N

--	--	--	--	--	--	--	--	--	--

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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, M. Tech – Mechanical Engineering (MCIM)

Semester End Examination; June - 2016

Industrial Robotics

Time: 3 hrs

Max. Marks: 100

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

ii) Missing data may suitably assume.

### UNIT - I

- |      |  |    |
|------|--|----|
| 1 a. | Define the term Robot. Enlist the various advantages and applications of Robots.                                 | 12 |
| b.   | Describe the salient features of PTP and CP Robotic system.  | 8  |
| 2 a. | With illustration, explain resolution, accuracy and repeatability of a Robot arm.                                | 10 |
| b.   | Explain various types of control systems. Sketch the structure for an articulated 6 axis open loop robot system. | 10 |

### UNIT - II

- |      |  |    |
|------|--|----|
| 3 a. | Briefly explain the principle of operation of a direct current servomotor.                           | 10 |
| b.   | With a neat block diagram explain hydraulic system for a robot arm.                                  | 10 |
| 4 a. | Discuss the control loop using voltage amplifier method.   | 10 |
| b.   | State the types of torques that are loaded by the D.C. servomotors which drive the manipulator axes. | 10 |

### UNIT - III

- |      |  |    |
|------|--|----|
| 5 a. | Discuss Homogeneous representations of two dimensional transformation matrices.                      | 10 |
| b.   | Explain the uses of orientation and displacement matrices.   | 10 |
| 6 a. | Explain the steps to be implemented in DH convention.  | 10 |
| b.   | Write homogeneous matrix for the following sequence of operation between $O_i$ and $O_{i-1}$ frames, | 10 |
|      | (i) Rotation of $O_i$ with respect to $O_{i-1}$ by an angle $\theta_i$                               |    |
|      | (ii) Translation of $O_i$ by an amount parallel to $O_{i-1}$ .                                       |    |

### UNIT - IV

- |      |   |    |
|------|---|----|
| 7 a. | Discuss the key issues involved in locomotion.                            | 8  |
| b.   | Discuss various types of wheels used in mobile robots with neat sketches. | 12 |
| 8 a. | Explain with a neat sketch, two types of leg configuration.               | 10 |
| b.   | Explain the kinematic constraints for wheeled locomotion.                 | 10 |

**UNIT - V**

- 9 a. Define;
  - (i) Degree of mobility 10
  - (ii) Degree of steerability
- b. Discuss the various competences for Navigation. 10
- 10 a. Discuss the various path and trajectory considerations for typical mobile robot. 10
- b. Explain the techniques for decomposition. 10

\* \* \* \*