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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; June - 2017

**Industrial Robotics**

Time: 3 hrs

Max. Marks: 100

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

## UNIT - I

- 1 a. Discuss advantages and applications of robots in industry. 10
- b. Define the terms as applicable to robots, 10
- (i) Accuracy (ii) Precision (iii) Repeatability
- (iv) Spatial resolution (v) Compliance.
- 2 a. Explain the various configurations of robots. 10
- b. What is trajectory design consideration? Explain briefly. 10

## UNIT - II

- 3 a. Explain the types of drive systems generally used in robot system. 10
- b. Explain the principle of operation of stepper motors used in robot. 10
- 4 a. Discuss the control loop using voltage amplifier method. 10
- b. List the types of controllers used in a robot joint and explain any two. 10

## UNIT - III

- 5 a. Using D.H. convention, obtain the displacement matrices for a typical cylindrical arm robot. 10
- b. Explain the role of homogeneous transformation matrix in robot kinematic problems. 10
- 6 a. Define direct and indirect kinematics and explain how DH convention representation method is useful in this area? 10
- b. Using relative transformations obtain the composite transformations matrix for 3D relation about any arbitrary line. Indicate the transformation with neat sketch. 10

## UNIT - IV

- 7 a. Discuss the key issues of locomotion. 10
- b. Determine the gait of a biped and illustrate them. 10
- 8 a. With a neat sketch, explain two types of leg configuration. 10
- b. Briefly discuss robot kinematic constraints with examples. 10

## UNIT - V

- 9 a. Discuss the degree of mobility and steerability with respect to mobile robot. 10
- b. Explain path and trajectory consideration with an example. 10
10. Short notes on : i) Obstacle avoidance ii) Navigation architectures. 20