

**R16**

Code No: 136FC

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year II Semester Examinations, May - 2019****FUNDAMENTALS OF ROBOTICS****(Common to CE, EEE, ECE, CSE, AE)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) What controlled systems are involved in a robotic industry. [2]
- b) What are the different notation scheme in designing the robot configurations. [3]
- c) How tools can be used as end effectors. [2]
- d) How the linkage actuation determines the finger opening and closing activity. [3]
- e) What is homogeneous transformation matrix? [2]
- f) The x and y position of the end of the arm in world space by defining a for link 1 and another for link 2 of a 2 DOF arm in inverse transformation. [3]
- g) How the interaction control is used to control the robot motions. [2]
- h) Briefly explain the blending scheme in trajectory planning. [3]
- i) What is the function of VAL in robot textual language? [2]
- j) What is the meant by training the vision system. [3]

**PART - B****(50 Marks)**

- 2.a) Differentiate serial and parallel manipulator.
  - b) Explain the constructional features and range of any two proximity sensors. [5+5]
- OR**
- 3.a) How the correct accuracy, repeatability and resolution enhance the properties performed by a robot.
  - b) Explain the principle for potentiometer and encoder as position sensors. [5+5]
- 4.a) What is physical constriction method of finger design.
  - b) State the principle adopted in vacuum cup gripper and its applications. [5+5]
- OR**
- 5.a) Analyze the gripper force to be used in various linkage mechanisms.
  - b) How the grippers are selected based on the applications. [5+5]
- 6.a) What are the three basic rules on the basis of which DH matrix is established.
  - b) Determine the rotation matrix that represents a rotation of  $60^0$  about OZ axis, followed by rotation of  $30^0$  about OY axis, followed by rotation of  $45^0$  about OX axis. [5+5]
- OR**
7. Express the inverse transform technique for Euler angles solution upto inconsistent solution. [10]

8. Formulate joint trajectories in 5 cubic trajectory segments with time varying from 0 to 1 units with appropriate cubic spline functions. [10]
- OR**
- 9.a) Explain the cubic polynomial fit via point for a smooth trajectory.  
b) How the servo system is established for robotic control. [5+5]
- 10.a) Describe the various parameters considered in image data reduction and feature extraction in machine vision.  
b) Explain how the end effector and sensor commands are executed? [5+5]
- OR**
- 11.a) How the robot language is structured?  
b) What are the various motion commands used for robot's movement? [5+5]

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