

Register

No.:

Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2023**(2020 SCHEME)****Course Code : 20RBT281****Course Name: Basics of Robotics****Max. Marks : 100****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Draw and explain the work volume of the polar robot configuration.
2. Explain wrist configurations in robotic manipulator.
3. The acceleration of an object of mass 3 kg, is measured using a strain gauge of gauge factor 2 and resistance of the unreformed wire 100 Ω is used to measure. If the strain is 10^{-6} , cross sectional area = 10 mm² and Young's modulus = 6.9×10^{10} N/m², compute the acceleration of the object.
4. Explain the terms (i) Spatial resolution (ii) Accuracy (iii) Repeatability.
5. Consider a pick and place robot is used to operate a drinking glass manufacturing plant. Which type of gripper is suitable for the above operation? Why?
6. A part weighing 8lb is to be held by a gripper using friction against two opposing fingers. The coefficient of friction between the surfaces is 0.3. The orientation is such that the g factor for calculation should be 3. Compute the required gripper force for the system.
7. Differentiate between forward kinematics and Inverse kinematics of a robotic arm.
8. Differentiate between path and trajectory planning.
9. Differentiate between linear and non-linear control.
10. Explain the dynamic modelling of robots.

PART B***(Answer one full question from each module, each question carries 14 marks)*****MODULE I**

11. Explain the various characteristics or specifications required in the selection of a robot for any application. (14)

OR

12. a) Explain the anatomy of a Robot with a neat diagram. (7)
b) Explain the material handling application of a robot in the industry. (7)

MODULE II

13. a) How do you select an appropriate sensor for a robotic application? Explain with three applications. (6)
b) Explain the elements of vision sensors used in robotics. (8)

OR

14. a) Demonstrate the working of hydraulic drive system & its various components with a neat diagram. (8)
b) Describe the advantages and disadvantages of the various actuators or drive systems. (6)

MODULE III

15. Explain with necessary diagrams the various types of grippers. (14)

OR

16. a) Illustrate different robot arm configurations with neat diagrams. (10)
b) What are tools? List some applications of tool as end effectors in robotics. (4)

MODULE IV

17. a) Determine the forward kinematic model of a two link RR planar robot with intersecting joint axes. (7)
b) Suppose the mobile coordinate frame M is rotated about the fixed coordinate frame F by an angle 180° about the y (f^2) axis, followed by a rotation by an angle 90° about the x (f^1) axis, followed by a rotation of -90° about the y (f^2) axis. If p is a point whose coordinates in the mobile M frame are $[1, 1, 0]^T$. Obtain the composite rotation matrix R and the coordinates of p with respect to the fixed frame F. (7)

OR

18. a) Explain the trajectory planning for robot manipulator. (6)
b) Elaborate Task Space and Joint Space with advantages and disadvantages. (8)

MODULE V

19. a) Explain the performance and stability of feedback control of robots. (7)
b) Derive the equations of motion for a 2-DOF 2R planar manipulator robot arm. (7)

OR

20. Explain with necessary diagrams a PID controlled robotic manipulator by deriving the closed loop transfer function and examine its stability. (14)
