

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**THIRD SEMESTER B.TECH DEGREE EXAMINATION (Regular), FEBRUARY 2022
(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. Define work volume and reach of a robotic manipulator.
2. Enumerate the features of an aerial robot.
3. Distinguish between internal sensors and external sensors.
4. Discuss the advantages of electric actuators.
5. List out any three features of SCARA robot.
6. List any six selection criteria of a gripper for specific applications.
7. Define any three D H parameters for a robotic manipulator.
8. Classify the trajectory planning techniques in robotics.
9. Explain the closed loop controller block diagram of a feedback system.
10. Distinguish between forward dynamics and inverse dynamics.

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

11. a) Illustrate the physical components of a robotic arm. Classify the types of robotic joints. (10)
- b) List the characteristics of a space robot. (4)

OR

12. a) Inspect the factors that need to be considered while selecting a robot for a particular application. (10)
- b) Compare point to point control and continuous path control. (4)

MODULE II

13. a) Explain the principal of sensing. Describe force sensing with strain gauge. (8)
- b) Explain the principle of working of hydraulic actuator with neat sketch. (6)

OR

14. a) Illustrate the working of a DC servo motor with the help of a block diagram. (7)
- b) Investigate the process of measuring position of a robot joint using any position sensor. (7)

MODULE III

15. Classify robots based on configuration. Assess the advantages and disadvantages of each configuration. (14)

OR

16. a) List out the different types of magnetic grippers and describe it's working. (10)
b) Explain the working of vacuum type gripper. (4)

MODULE IV

17. a) Explain the steps involved in developing a composite homogeneous transformation matrix (HTM). (8)
b) Discuss the fundamental rotation matrix about Z-axis of a coordinate frame. The coordinates of a point $P = (5,4,3)^T$ in the mobile coordinate frame is rotated 30° about z axis. Determine the coordinates of the vector P with respect to base reference coordinate frame. (6)

OR

18. a) Assess the equation for cubic polynomial trajectory of a robotic joint. Investigate how the polynomial coefficients are computed, if the velocities at the beginning and at the end of the motion segment are zero. (8)
b) Investigate the reason behind implementing parabolic blends to linear joint trajectories. (6)

MODULE V

19. Explain the concept closed loop system of a robotic joint with PID controller and a DC motor. Discuss the equations of PID controller and DC motor. (14)

OR

20. a) Investigate the importance of dynamic modelling of robotic arm. (5)
b) Illustrate the Euler Lagrange formulation for the dynamic analysis of robotic arm with an example. (9)
