

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), MAY 2023**ROBOTICS AND AUTOMATION****(2021 Scheme)****Course Code: 21RA203****Course Name: Control, Programming and Calibrations of Robots****Max. Marks: 60****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Describe how does an end effector compensate for the environmental constraints.
2. Model the kinematic bicycle representation of a four-wheel robot.
3. Illustrate in detail about Pose estimation.
4. Build a program to create a python dependent package 'Marshmallow' in a workspace 'Opensource' in a directory 'Android'.
5. Differentiate the terms localization and navigation.
6. Describe the importance of dead reckoning in robot localization.
7. Compare and contrast between manual calibration and bulls eye calibration.
8. Examine why the level 1 calibration is known as joint level calibration.

PART B***(Answer one full question from each module, each question carries 6 marks)*****MODULE I**

9. a) Demonstrate an alternative method to Lyapunov based control (3) schemes.
- b) Define how the step angle can be calculated in Stepper Motor (3) Control.

OR

10. Model a Hybrid Motion Control system to describe the manipulator (6) constraints in a rigid environment.

MODULE II

11. a) Illustrate the use of Carrot and Donkey Approach in mobile (3) Robotics.
- b) Describe the Posture Kinematic Model of robots with sketches. (3)

OR

12. Illustrate the trajectory planning of a mobile robot using cubic polynomial function. (6)

MODULE III

13. List the advantages of vision-based control of robot manipulators, and list the limitations. (6)

OR

14. a) Explain the concept of Region based segmentation. (3)
b) Illustrate in detail about Position based servoing. (3)

MODULE IV

15. Model a VAL program to move an RRR Robot with following steps (6)
- First three joints to be rotated by 200, 400, and -600 respectively.
 - The end effect moves to appoint 20mm apart from a point P, measured along z axis in negative direction.
 - The end effector reaches the point P in a straight line.
 - The speed limit of end effector is fixed at 50 in/sec.
 - The operation c is happening at 75% of the maximum permissible speed
 - Close the gripper.

OR

16. a) Examine the limitations of Lead through Programming in industrial applications. (3)
b) Differentiate between manual lead through and powered lead through programming techniques. (3)

MODULE V

17. a) Differentiate between the terms reactive navigation and map based navigation. (3)
b) Explain the reason behind keeping the linear velocity constant for a robot with unicycle model to follow a straight line. (3)

OR

18. Describe the steps in developing a unicycle model to a robot. Investigate how the initial conditions of the robots can be specified. (6)

MODULE VI

19. a) Compare and contrast kinematic calibration and non-kinematic calibration. (3)
b) Summarize the concept of homing process in calibration. (3)

OR

20. a) Describe how the process of robot calibration is different from (3)
adaptive control?
- b) Explain the role of correction step during the process of robot (3)
calibration
