

Register No.: ..... Name: .....

**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023****(2020 SCHEME)****Course Code : 20RBT392****Course Name: Advanced Control for Robotics****Max. Marks : 100****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Illustrate the block diagram of a closed-loop control architecture.
2. Examine the necessity of controllers in robot manipulators.
3. List the advantages of using non-linear controllers in robotic systems.
4. Describe the role of energy function in the Lyapunov second method.
5. Examine the natural constraints of turning a screwdriver.
6. What is the role of force control in assembly operations.
7. Compare at least three control approaches applied for wheeled mobile robots.
8. Explain the state space model of a mobile robot.
9. How vision system can be used to control the position of robots?
10. List the types of image segmentation techniques.

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

11. a) Differentiate between feedforward control and feedback control. (8)  
b) Examine the robot mathematical model used in a single-axis PID controller and examine the assumptions made for linearizing the model. (6)

**OR**

12. a) Differentiate between continuous and discrete control. (7)  
b) Explain the working principle of a PID Controller. (7)

**MODULE II**

13. a) Explain the computed torque control algorithm for a robot manipulator. (7)  
b) Explain the working of PD Gravity control and examine whether it is linear or nonlinear. (7)

**OR**

14. a) Explain the working of resolved motion rate control of 2R manipulator. (7)  
b) Describe the role of adaptive control in robotic arm operations. (7)

**MODULE III**

15. a) Differentiate between force control and position control in industrial robots. (8)  
b) Classify the constraints involved in applying force control algorithms. (6)

**OR**

16. a) Illustrate the constraints involved in inserting a round peg into round hole. (9)  
b) Explain the term “assembly strategy”. (5)

**MODULE IV**

17. a) Examine the stability criteria explained by Lyapunov with the help of an example. (8)  
b) Illustrate the working of a linear control scheme for position control of mobile robots. (6)

**OR**

18. a) Explain at least two non-linear control algorithms used for mobile robots. (7)  
b) With the help of block diagram, explain the working of computed torque control in mobile robots. (7)

**MODULE V**

19. a) Illustrate the techniques involved in position based visual servoing. (7)  
b) Illustrate the techniques involved in image based visual servoing. (7)

**OR**

20. a) Examine the applications of vision systems in industrial robot control algorithms. (6)  
b) Explain the term “image interpretation.” List the techniques involved in the method. (8)

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