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**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**THIRD SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 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. What are the future applications of robot?
2. Differentiate between open and closed kinematic chain.
3. List any three characteristics that should be considered for the selection of a sensor.
4. Differentiate servo controlled robots and non-servo controlled robots.
5. What is the difference between SCARA and Gantry Robots?
6. Explain the principle of vacuum grippers.
7. Differentiate between forward and inverse kinematics.
8. Explain the difference between tool coordinate frame and world coordinate frame.
9. Differentiate between feedback control system and non feedback control system.
10. Examine the importance of dynamic modeling for a robotic system.

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

11. a) Explain the following aspects for robotic selection. i)number of axes ii)stroke and reach iii)capacity and load. (9)
- b) Describe the application of robot in spot welding operation. (5)

**OR**

12. a) With neat diagram, explain the anatomy of robotic manipulator. (8)
- b) Discuss the salient features and applications of i)wheeled robots (6)
- ii)aerial robots.

**MODULE II**

13. a) What are the basic characteristics, a sensor should possess? (6)

- b) Explain the working of a hydraulic actuator. (8)

**OR**

14. a) Suggest a sensor for measuring position of rotational joint of a robotic manipulator. Justify your suggestion. (7)
- b) Explain the principle of operation of an acceleration sensor. (7)

**MODULE III**

15. Explain the robotic configurations – PPP, RPP, RRP and RRR with neat sketches. (14)

**OR**

16. Explain the working of mechanical grippers and describe any 4 actuation mechanisms used in mechanical grippers. (14)

**MODULE IV**

17. a) A point  $P(4,3,1)^T$  is subjected to i) rotation of 90 degree about the z-axis ii) followed by a rotation of 90 degree about the y-axis iii) followed by a translation of  $[2 \ 3 \ -5]$ . Find the coordinates of the point relative to the reference frame at the end of all transformation. (6)
- b) Explain the implementation of D H notation for a link coordinate system and joint parameters. (8)

**OR**

18. a) Write the fundamental transformation matrices for rotation in 3D space. (6)
- b) A single cubic trajectory given by  $a(x)=30+x^2-6x^3$  is used for 5 seconds. Determine the starting point, final point, velocity and acceleration of the end effector. (8)

**MODULE V**

19. Explain the closed loop system for robotic manipulator using PID controller with a neat diagram. (14)

**OR**

20. Derive the Lagrange equation for the dynamic modeling of a robotic manipulator with single degree of freedom. (14)

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