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B

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

SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH. DEGREE EXAMINATION (R), MARCH 2021

(ROBOTICS)

Course Code: 20ECRAT103

Course Name: ROBOTIC SYSTEM CONFIGURATION

Max. Marks: 60 **Duration:** 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Classify robot manipulators based on the configuration of major axes.
2. Examine the role of homogeneous transformation matrix in robot kinematics.
3. Differentiate between point to point and continuous operations of a robotic motion.
4. Illustrate the concept of inverse dynamics of a robotic arm.
5. Differentiate between PID Controller and PD gravity controller of robotic joint.
6. Explain the feedback parameters used for a robotic joint control.
7. Differentiate between status sensors and environmental sensors.
8. List the industrial applications of robotics.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

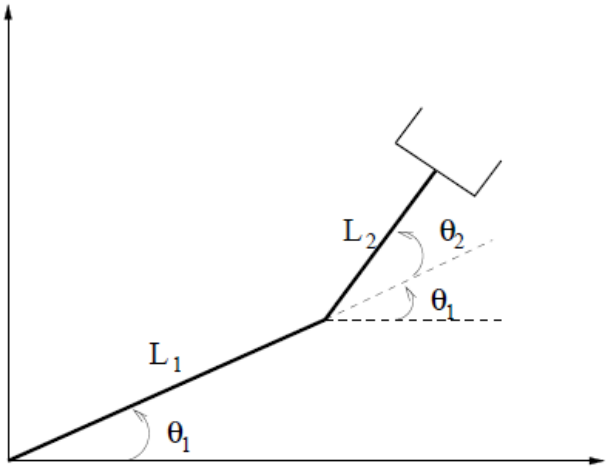
9. The coordinates of point P with respect to a mobile frame are P= $[1.0\ 1.6\ 2.6\ 1]^T$. Identify the coordinates of P with respect to fixed frame, if the mobile frame is rotated by an angle 60^O about the z axis. (6)

OR

10. Identify the rotation matrix for a rotation of 90^O about the z axis, followed by 120^O about the x axis and finally 45^O degree about the y axis. All rotations are carried out with respect to fixed frame. (6)

MODULE II

11. Find the singularity of the 2 – link manipulator. The singularity should be calculated by equating determinant J to zero. (6)



OR

12. Explain the steps involved in developing the arm equation for robot manipulators. (6)

MODULE III

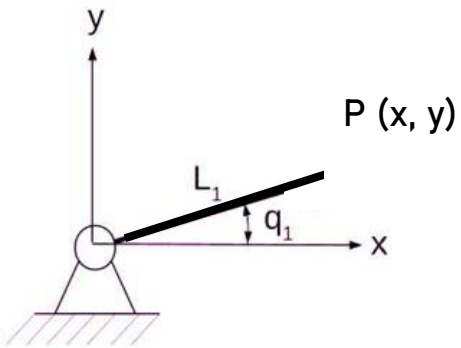
13. Differentiate between joint space trajectory planning and cartesian space trajectory planning. (6)

OR

14. The second joint of a SCARA Robot is moved from 110 to 210 degree in 7 seconds. Find the cubic polynomial trajectory equations for position, velocity and acceleration. (6)

MODULE IV

15. (6)



Calculated the torque of a 1 degree of freedom serial manipulator using Lagrange's Equation $T = \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_i}\right) - \frac{\partial L}{\partial q_i}$, where L is the lagrangian. Take mass of the link as m and Inertia as that of a rectangular section. Take appropriate notations for any missing parameters.

OR

16. Evaluate Lagrange Equations of a single link robot. Develop the dynamic model. (6)

MODULE V

17. With the help of a block diagram illustrate the concept of linear control schemes of a robotic arm. (6)

OR

18. Illustrate the variable structure technique in detail. (6)

MODULE VI

19. Explain the different types of sensors used in robotics with an industrial example. (6)

OR

20. Differentiate between perspective and inverse perspective transformation. (6)

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