10ME766

USN [| | | | | | | | |]

Seventh Semester B.E. Degree Examination, July/August 2022
Robotics

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. How the Robots were classified? **(08 Marks)**
   b. With schematic diagrams, explain any three types of Robot based on their geometric configuration. **(12 Marks)**

2 a. Explain with a block diagram Direct and Inverse kinematics. **(06 Marks)**
   b. Derive the direct kinematic equations for 3R manipulator shown in Fig. Q2 (b)

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	0	ℓ_1	0	θ_2
3	0	ℓ_2	0	θ_3

Fig. Q2 (b)   **(14 Marks)**
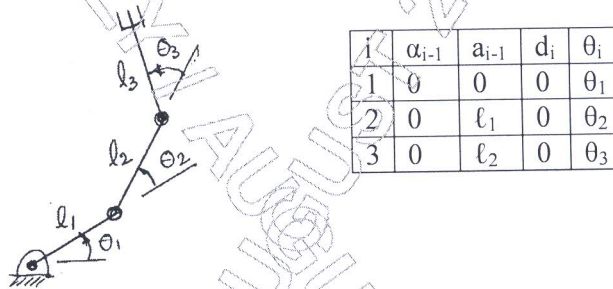
3 a. Explain in brief, the differential Translation and Rotations. **(08 Marks)**
   b. Explain Static forces on manipulators. **(12 Marks)**

4 a. Explain Dynamic model of a One-axis Robot or Inverted pendulum using Lagrange-Euler formulation? **(12 Marks)**
   b. Discuss Inertia of a link with the help of a rigid body. **(08 Marks)**

PART – B

5 a. What is Trajectory? What are the main issues of trajectory planning and generation? **(04 Marks)**
   b. Briefly explain Joint-space and Cartesian space schemes. **(04 Marks)**
   c. Describe the equation for velocity and acceleration between initial and final points in a cubic polynomial. **(12 Marks)**

6 a. Derive the equation of motion for a single link manipulator fitted with a motor and explain the feedback control with a block diagram. **(12 Marks)**
   b. With a neat diagram, explain the implementation of PID control of multilink manipulator. **(08 Marks)**

7 a. Write the important characteristics of Actuating system. Explain any three of them. **(12 Marks)**
   b. What is Stepper Motor? Explain the principle operation and its characteristics. **(08 Marks)**

8 a. What is Position Sensors? Explain with neat sketches LVDT and resolver. **(10 Marks)**
   b. Explain Touch and Tactile sensors with neat sketch and show how tactile sensors provide information about the object. **(10 Marks)**

*****