

Registration No :

--	--	--	--	--	--	--	--	--	--

Total Number of Pages : 02

B.Tech
PME7J003

7th Semester Regular Examination 2018-19

ROBOTICS

Branch : MECH

Time : 3 Hours

Max Marks : 100

Q.CODE : E186

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Short Answer Type Questions (Answer All-10) (2 x 10)

- Differentiate the dexterous workspace and reachable workspace.
- What is meant by pitch, yaw and roll?
- Explain about robot anatomy.
- Define base and tool coordinate system.
- Newton-Euler formulation based on which two basic principles?
- What is tactile sensor?
- Distinguish between path and trajectory.
- What are various stages in selecting robot for individual application?
- State type manipulator is best suitable for machine loading and unloading application?
- What do you mean by path update rate?

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any EIGHT out of TWELVE) (8 x 6)

- Describe in detail the types of joints used in robots.
- Discuss about the four types of robot controls.
- Consider two frames {A}&{B}. The frame {B} is rotated with respect to frame{A} by 30 degree around z-axis and the origin of{B} is shifted with respect to the origin of{A} by[5,10,5].the Z_a and Z_b axes are parallel point 'p' is described in {B} by (1,2,3).describe the same point with respect to {A} using the transform matrix.
- State and explain the laws of robotics.
- Derive the forward kinematics equation of a 3- degree of freedom robot arm.
- Illustrate the economics of robot implementation with help of pay back method
- Explain in detail about the internal and external sensors.
- A single cubic trajectory given by $q(t)=30+t^2 -6t^2$ is used for a period of 3 seconds. Determine starting and goal position, velocity and acceleration of the end effector.
- How a robot can be specified? Distinguish between the accuracy and repeatability of a robot.
- Describe about the micro actuators and its specialty over other actuators.
- Explain about functions of the basic components of a robotic system.
- Describe the role of Robot for inspection operation giving any industrial example

Part-III

Long Answer Type Questions (Answer Any TWO out of FOUR)

Q3 Classify robots according to the coordinates of motion. With a sketch and an example, Explain the features of each type. **(16)**

Q4 Determine the joint variables θ_1, d_2, d_3 and θ_4 for a 4-DOF RPPR manipulator, if the joint-link transformation matrices and tip configuration matrix at a given instant is given as :

$${}^0_1T(\theta_1) = \begin{bmatrix} C_1 & -S_1 & 0 & 0 \\ S_1 & C_1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad {}^1_2T(\theta_2) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & d_2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^2_3T(\theta_3) = \begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad {}^3_4T(\theta_4) = \begin{bmatrix} C_4 & -S_4 & 0 & 0 \\ S_4 & C_4 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_E = \begin{bmatrix} -0.250 & 0.433 & -0.866 & -89.10 \\ 0.433 & -0.750 & -0.500 & -45.67 \\ -0.866 & -0.500 & 0.000 & 50.00 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Q5 Describe the function of actuator in robots also explain various actuators used in robotics **(16)**

Q6 Define Jacobian and singularity. Derive the dynamic equation of motion for the planner 2-DOF manipulator with one prismatic joint and one revolute joint using Lagrangian mechanics. **(16)**