7th Semester Regular/Back Examination 2019-20
ROBOTICS
BRANCH : MECH
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB134
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	**Only Short Answer Type Questions (Answer All-10)**	**(2 x 10)**
a)	What are the types of End effectors?	
b)	Define base and tool coordinate systems.	
c)	Give the classification of robot by control system.	
d)	What are the four basic robot configurations available commercially?	
e)	Define DH parameters.	
f)	What are the properties of stepper motor?	
g)	State the working principle of the touch sensor?	
h)	List out the few robot applications area in manufacturing.	
i)	What is LVDT?	
j)	What features are required for robot in spray painting?	

Part- II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**
a)	Discuss the performance characteristics of actuators.	
b)	Briefly explain in the following terms: (i) Payload (ii) compliance (iii) Precision (iv) Accuracy	
c)	Explain the various parts of a robot with neat sketch.	
d)	Determine the transformation matrix T that represents a translation of 'a' units along x-axis, followed by a rotation of β about x-axis and followed by a rotation of Θ about z-axis.	
e)	Explain use of robot in assembly operation	
f)	How a robot can be specified? Distinguish between the accuracy and repeatability of a robot.	
g)	What is homogenous transformation matrix? Explain four sub matrices	
h)	Explain the steps involved in Trajectory planning.	
i)	Discuss about the Characteristics of the various sensors.	
j)	Describe the advantages and disadvantages of Newton-Euler formulation.	
k)	Determine the jacobian, singularity and joint velocities for a 3-DOF planar manipulator with three revolute joints.	
l)	Explain the importance of Robot in Spot Welding.	

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Describe the classification of sensors and the factors to be considered for its selection. **(16)**

Q4 Derive the dynamic model for a 2-DOF planar (RR) manipulator using Lagrangian mechanics. **(16)**

Q5 Find out the position and orientation of the end-effector of a 3-DOF manipulator with three revolute joints, that is an RRR arm configuration with respect to the base. The axis of joint 2 and joint 3 are parallel and axis of joint 1 is perpendicular to these two. Explain in detail step by step, how to get DH parameters and transformation matrices. **(16)**

Q6 Describe the function of actuator in robots also explain various actuators used in robotics **(16)**