Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: B.Tech. Mechatronics Engineering **Semester : VI**
Course Name : Advanced Robotics **Time : 03 hrs**
Course Code : MEPD3009 **Max. Marks : 100**
No. of page(s) : 1

Instructions: Assume any missing data. All questions are compulsory. Write in your own handwriting and mention your Roll No., Date of examination and Subject on the top of your answer script.

SECTION A (30 marks)

S. No.		Marks	CO
Q 1	Explain why homogeneous coordinates are required in modeling of robotic manipulators.	5	CO1
Q 2	Discuss the parameters for a link for kinematic modeling? Which of these parameters are variable and which are constant for (a) a revolute joint, and (b) a prismatic joint?	5	CO1
Q 3	Discuss the procedure of assignment of X-axis in DH representation.	5	CO1
Q 4	Explain why DH convention does not give unique frame assignment for a given manipulator.	5	CO1
Q 5	Discuss the significance of studying the manipulator differential motion.	5	CO1
Q 6	Discuss the singularities of a manipulator. Explain briefly.		
	SECTION B (50 marks)		
Q 7	Describe the procedure of computing the Jacobian for a prismatic joint.	10	CO2
Q 8	Find out the DH parameters for a 3 DoF articulated robot.	10	CO2
Q 9	Derive the relationship between transformation matrix and angular velocity for serial manipulators.	10	CO2
Q 10	Show that the overall differential transformation due to three differential rotations of $\delta x, \delta y, and\ \delta z$ about $x-, y-, and\ z-$ axes, respectively, is independent of the order in which rotations are made.	10	CO2
Q 11	Explain the significance of Jacobian in static analysis of serial manipulators. Derive the necessary results.	10	CO1
	SECTION-C (20 marks)		
Q 12	Derive the Jacobian matrix for a 3 DoF articulated robot.	20	CO2