BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER : II**
BRANCH: MECHANICAL **SESSION : SP/2025**

SUBJECT: ME525R1 ROBOTICS MANIPULATOR DESIGN

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Derive the D-H Parameter of 3R manipulator shown in Fig. Q.1 (a) and find the homogeneous transformation matrix ${}^{S}_{3}T$.	[5]	1	2

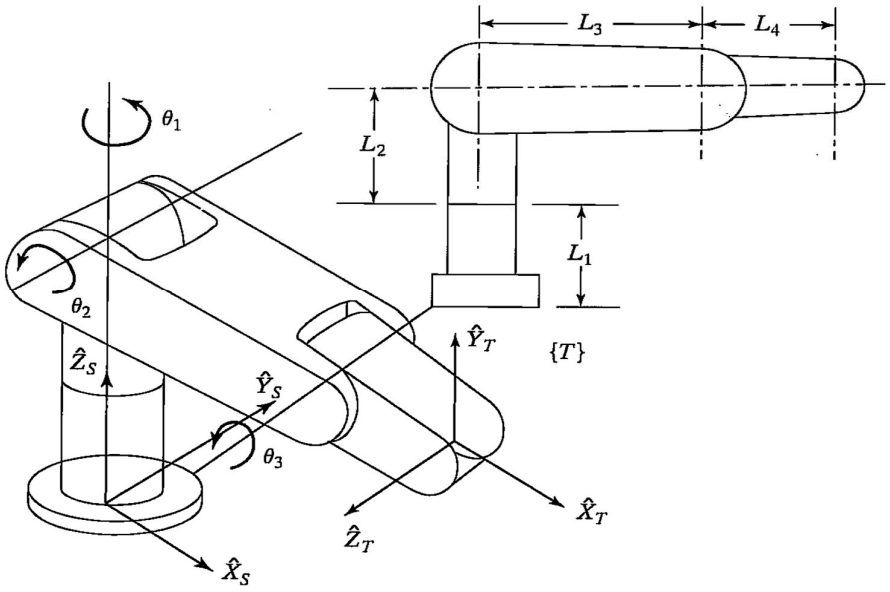

Fig. Q.1 (a)

Q.1(b)	Find the Jacobian of the RPP manipulator shown in Fig. Q.1 (b).	[5]	1	3

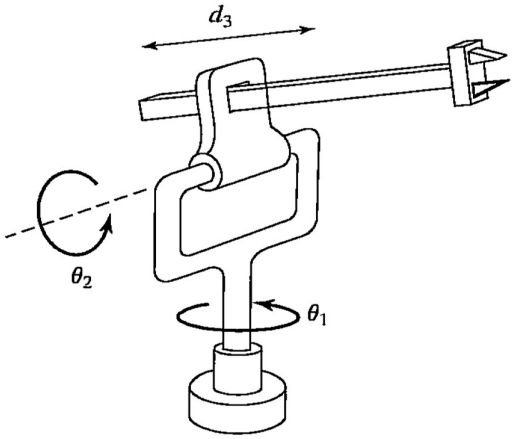

Fig. Q.1 (b)

Q.2 Derive the equations of motion for the RRR spatial manipulator shown in Fig. Q.2. Assume all mass exists as a point mass at the distal end of each link. [10] 2 3

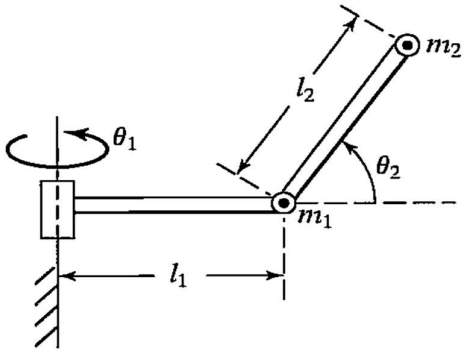

Fig. Q.2

Q.3 Derive forward and inverse kinematics of the planar manipulator shown in Fig. Q.3 [10] 3 3

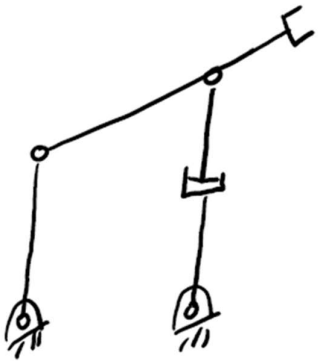

Fig. Q.3

Q.4(a) Sketch the fingertip workspace of the two-link manipulator Shown in Fig. Q.4(a), for the case L_1= *15.0*, and L_2 = *10.0*. [5] 4 2

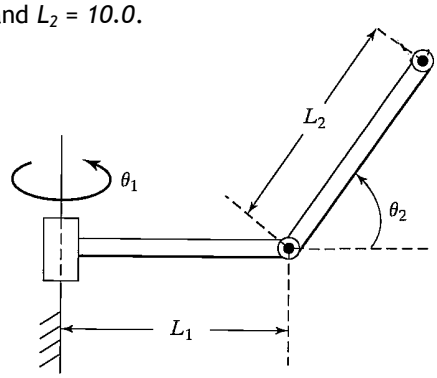

Fig. Q.4 (a)

Q.4(b) Write a short notes on repeatability and accuracy of a robot. [5] 4 1

Q.5(a) Determine the motion of the system in Fig. Q. 5(b) if parameter values are m= 1, b = 5, and k = 6 and the block (initially at rest) is released from the position x = −1. [5] 5 3

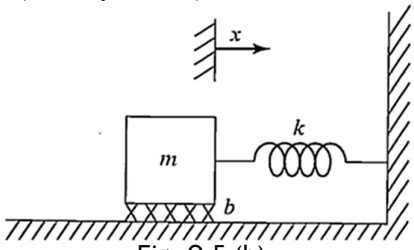

Fig. Q.5 (b)

Q.5(b) Write short notes on PD, and PID controller. [5] 5 2