
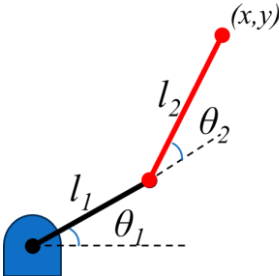


<b>Name:</b> <b>Enrolment No:</b>	
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<b>UPES</b> <b>End Semester Examination, December 2024</b>	<b>Semester: VII</b> <b>Time : 03 hrs.</b> <b>Max. Marks: 100</b>
<b>Course: Nano Electronics and Robotics</b> <b>Program: B. Tech (AMNT)</b> <b>Course Code: ECEG4049</b>	
<b>Instructions:</b> <ol style="list-style-type: none"> <li>1. Read the instructions carefully.</li> <li>2. You may assume any missing but relevant information and data.</li> </ol>	

<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
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S. No.		Marks	CO
Q 1	State the importance of a robot's workspace in industrial applications.	4	CO1
Q 2	What are the key differences between a BJT (Bipolar Junction Transistor) and a MOSFET?	4	CO2
Q 3	Discuss the relationship between Roll, Pitch, and Yaw and the overall functionality of a robotic system.	4	CO2
Q 4	Define forward kinematics in the context of robotics.	4	CO1
Q 5	Calculate the location of the end effector $(x,y)$ for the 2 degree of freedom robot having 2 revolute joints as shown in the figure. Consider the arm length $l_1$ and $l_2$ while joint angles $\theta_1$ and $\theta_2$ . <div style="text-align: center; margin-top: 10px;">  </div>	4	CO2

<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
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Q 6	Compare the non-permanent magnet DC motor and permanent magnet DC motor.	10	CO3
Q 7	Suggest a robot from its kinematic viewpoint to place electronic components on a fixed printed circuit board.	10	CO3
Q 8	Explain how a MOSFET operates as a switch in digital circuits.	10	CO3

Q 9	<p>A MOSFET is used in a circuit to drive an LED. If the gate voltage is reduced below the threshold voltage, predict the LED's behavior and explain why.</p> <p style="text-align: center;"><b>OR</b></p> <p>Analyze the effect of increasing the gate-to-source voltage (<math>V_{GS}</math>) on the drain current (<math>I_D</math>) in an enhancement-mode MOSFET.</p>	<b>10</b>	<b>CO3</b>
<p><b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b></p>			
Q 10	<p>Explain the working and usage of different types of robotic grippers. Suggest appropriate grippers to handle objects of non-uniform shape.</p> <p style="text-align: center;"><b>OR</b></p> <p>A stepper motor has a step angle of <b>1.8°</b>. It is connected to a controller that sends <b>4000</b> pulses per second. If the motor operates for <b>10</b> seconds, calculate:</p> <ol style="list-style-type: none"> <li>I. The total number of steps taken by the motor.</li> <li>II. The angular displacement of the motor shaft in degrees.</li> <li>III. The rotational speed of the motor in revolutions per minute (RPM).</li> </ol>	<b>20</b>	<b>CO4</b>
Q 11	<p>Analyze the factors influencing the speed of motion and load-carrying capacity of a robot, explaining their effects on overall performance.</p>	<b>20</b>	<b>CO4</b>