


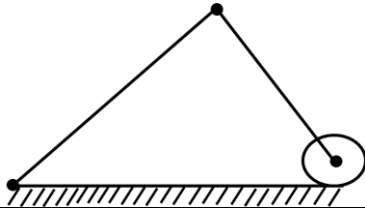
<b>Name:</b> <b>Enrolment No:</b>	
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**UPES**  
**End Semester Examination, December 2024**

**Course: Engineering System Components** **Semester: I**  
**Program: M. Tech. Robotics Engineering** **Time : 03 hrs.**  
**Course Code: ECEG7036** **Max. Marks: 100**

**Instructions: Attempt all the questions. Use of calculator is allowed.**

**SECTION A**  
**(5Qx4M=20Marks)**

S. No.		Marks	CO
Q1	A mechanism is shown below. What is the number of degrees of freedom? <div style="text-align: center;">  </div>	4	CO1
Q2	In the kinematics of machines, how does the concept of relative motion define constrained and unconstrained motion, and what are the main types of constraints applied to motion in machine components?	4	CO1
Q3	How does a MOSFET operate across different regions based on its gate voltage, and what insights can be drawn from its I-V characteristics in each region?	4	CO2
Q4	The single-phase half wave rectifier has a purely resistive load of $10\Omega$ and the delay angle is $\alpha = \pi/2$ . If the supply voltage is 220 V, determine the DC load voltage and current.	4	CO2
Q5	Determine the estimated range remaining if the battery SoC = 70%, SoH <sub>capacity</sub> = 80% and the total BOL range = 200km.	4	CO3

**SECTION B**  
**(4Qx10M= 40 Marks)**

Q6	Determine the degree of freedom of the mechanism given below.	10	CO1
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Q7	Explain the working principle of a step-down (buck) converter with the help of the switching modes, illustrate its waveforms, and discuss its common application areas.	<b>10</b>	<b>CO2</b>
Q8	Determine the size of battery pack to drive a 1000W (rated), 60V BLDC motor for 200kM range with a maximum speed of 50kmph.	<b>10</b>	<b>CO3</b>
Q9	Assume that RAM locations 40-44H have values 7DH, EBH, C5H, 5BH, 30H. Write a program to find the sum of all values. At the end of the program, register A should contain the lower byte and R7 the higher byte. OR Assume that ROM space starting at 250H contains 'AMERICA', write a program to transfer the bytes into RAM locations starting at 40H.	<b>10</b>	<b>CO4</b>
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
Q10	What is a Battery Management System (BMS), and can you provide a detailed explanation of its functionalities and role in managing battery performance?	<b>20</b>	<b>CO3</b>
Q11	What are the different addressing modes of the 8051 microcontroller and illustrate each mode with an example. OR What are the flag bits in the PSW register of the 8051 microcontroller, and how can each flag bit be set with the help of an example?	<b>20</b>	<b>CO4</b>