

Name _____ Section _____

ES205
Examination I
April 2, 1997

Problem	Score
1	/30
2	/30
3	/40
Total	/100

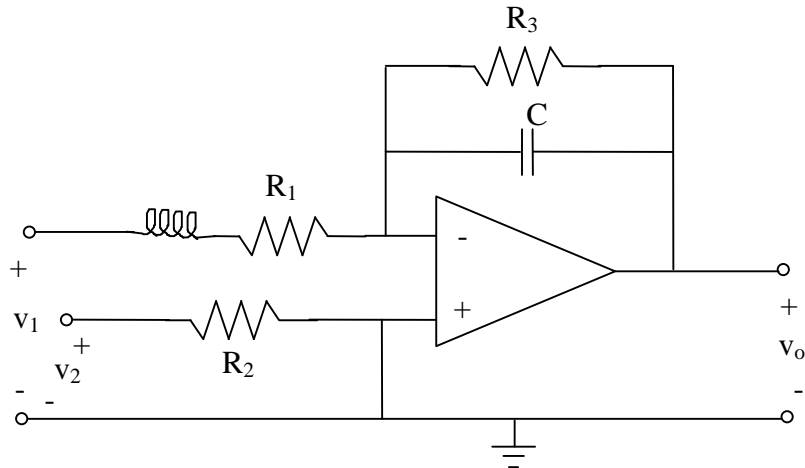
Show all work for credit
AND
Turn in your signed help sheet

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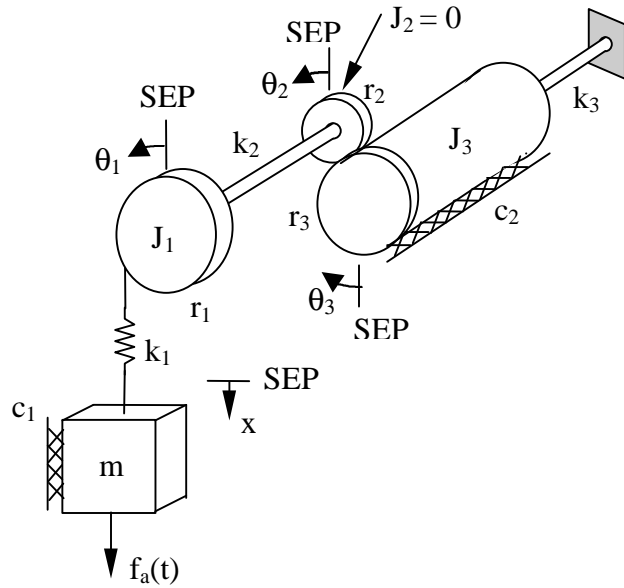
Problem 1

30 pts
April 2, 1997

For the operational amplifier circuit shown, find the transfer function relating the output voltage to the input voltage, the undamped natural frequency for the output voltage, and the damping ratio ζ for the output voltage. The natural frequency and the damping ratio are to be in symbolic form.



For the system shown below, the input is $f_a(t)$ and the output variables are x , θ_1 , and θ_3 . Write the three differential equations of motion for the system in second order matrix form.

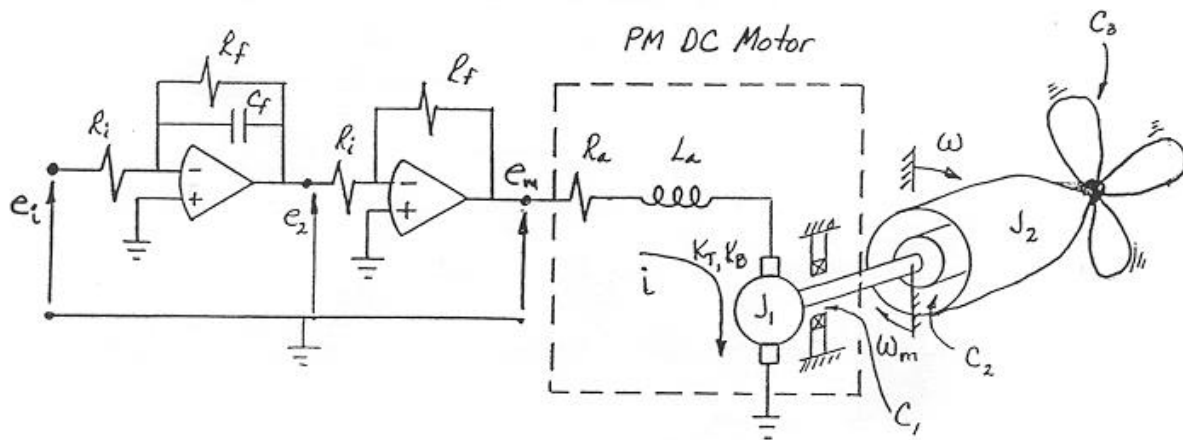


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Problem 3

40 pts
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An electro-mechanical system, shown below, is used to assist the removal of heat from a car's cooling system. Determine, in the **Laplace domain**, the necessary equations to find the differential equation of motion (EOM) that relates the known input op-amp voltage, e_i , to the unknown output speed, ω . **Do not find the EOM** but number the equations that you would use and generate a list of the unknown variables and known parameters.



List unknown variables:

List known parameters: