E84: Spring 2007 Midterm 1

You have 50 minutes to complete this closed book, open equation sheet exam. There are 5 problems. The point distribution and time estimates are listed below. The problems are in the approximate order that the material was covered. You will get the most credit for showing that you understand the concepts involved in the problem. This does not mean simply listing everything that you know about a particular type of device or relaying things that could be copied from an equation sheet – instead, I'm looking for careful analysis of the problem at hand. If there is a stumbling block between you and a final answer, explain what that stumbling block is, make an assumption and move on. Obviously, the scale of the assumption and its impact on the solution will determine how much partial credit is possible.

With the obvious time-constraints on this test, your best strategy is to attack each problem for a set period of time – allowing you enough time to attempt all 5 problems. I've provided time estimates to help you decide how much time to spend on each problem. I'd recommend not exceeding the suggested times until you've tried every problem, even if you don't have time to finish some problems. The time estimates add to 45 minutes, leaving you five extra minutes to use as you wish. This test is long and I don't necessarily expect you to finish. I want to test your knowledge on a variety of topics – so you should do your best to show me what you know about all five problems.

There are no purposeful ambiguities on this test. If you have any questions, ask.

Please show all work. State any assumptions where relevant. Show all units in your final answers. Make it clear where your final answer is.

Good luck!!!

Name:_____

Problem 1: _____/ 20 (5 minutes)

Problem 2: _____/ 25 (15 minutes)

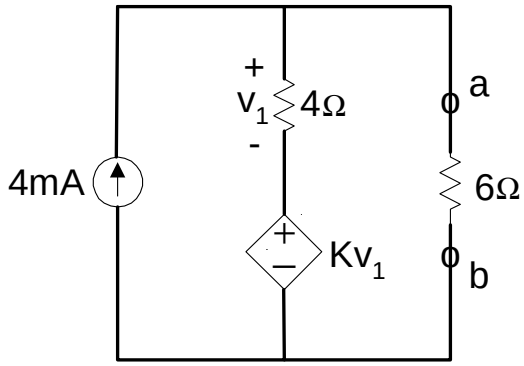
Problem 3: _____/ 15 (5 minutes)

Problem 4: _____/ 20 (10 minutes)

Problem 5: _____/ 20 (10 minutes)

Total: _____/ 100

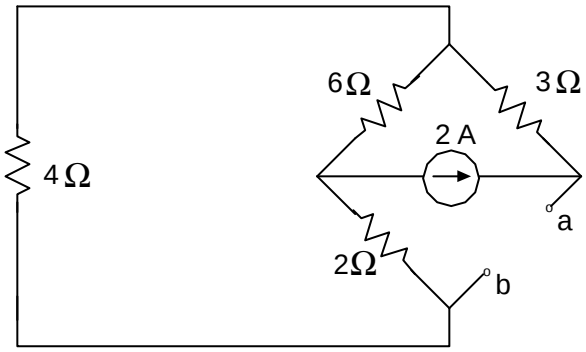
Problem 1 (20 points)



(1a) Assuming that 3mA is flowing through the 6Ω resistor from “a” to “b” - find K.

(1b) Using the value for K found in part 1a, what value resistor would you replace the 6Ω with to absorb the maximum amount of power? (Note that because this resistor will change, the current flowing from “a” to “b” will no longer 3mA.)

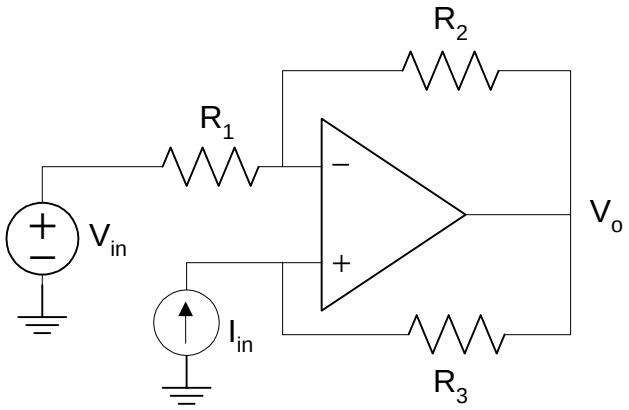
Problem 2 (25 points)



(2a) Find the equivalent resistance as seen by terminals a&b.

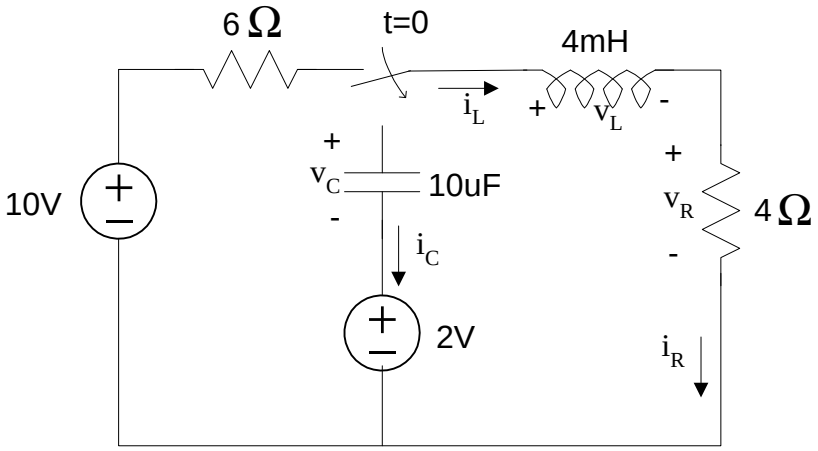
(2b) What is v_{oc} at terminals a&b?

Problem 3 (15 points)



(3) Find an expression for V_o in terms of V_{in}, I_{in}, R_1, R_2 and R_3.

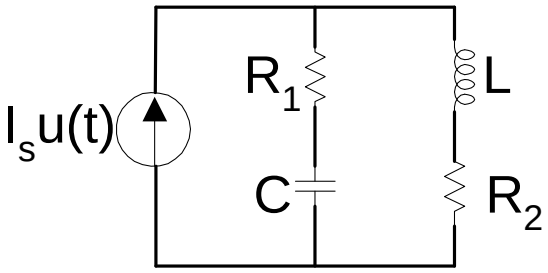
Problem 4 (20 points)



	$t=0^-$	$t=0^+$	$t=\infty$
i_L	**A**	**A**	**A**
i_R	**A**	**A**	**A**
i_C	**A**	**A**	**A**
v_L	**V**	**V**	**V**
v_R	**V**	**V**	**V**
v_C	**V**	**V**	**V**

(4) Fill in the table above for the circuit above. If it is not clear from the diagram, the switch connects the inductor to the other end of the 6Ω resistor until t=0, when the inductor is connected to the other end of the capacitor.

Problem 5 (20 points)



(5) Find the 2nd order differential equation that describes the voltage across the capacitor for t>0. Your answer should be in terms of I_s, C, L, R_1 and R_2.