EECS 40, Fall 2006
Prof. Chang-Hasnain
Midterm #1

September 27, 2006
Total Time Allotted: 50 minutes
Total Points: 100

1. This is a closed book exam. However, you are allowed to bring one page (8.5" x 11"), single-sided notes
2. No electronic devices, i.e. calculators, cell phones, computers, etc.
3. SHOW all the steps on the exam. Answers without steps will be given only a small percentage of credits. Partial credits will be given if you have proper steps but no final answers.
4. Draw BOXES around your final answers.
5. **Remember to put down units.** Points will be taken off for answers without units.

Last (Family) Name:_____

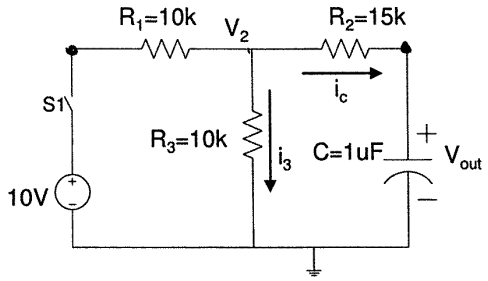
First Name: _____

Student ID: _____Discussion Session: _____

Signature: _____

Score:	
Problem 1 (50 pts)	
Problem 2 (50 pts):	
Total	

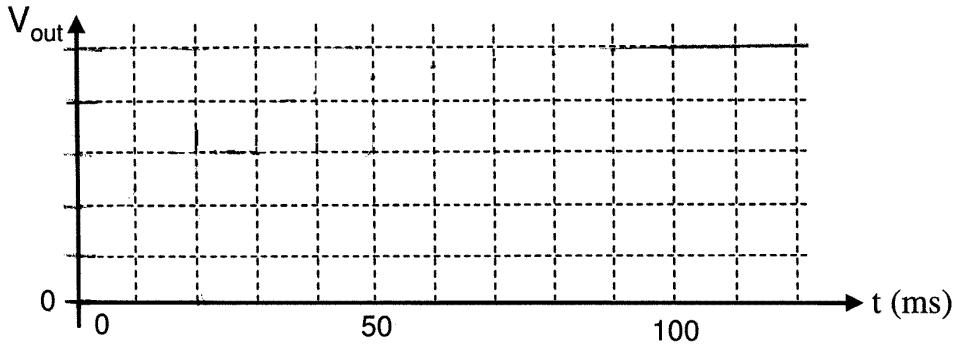
2. For t<0, the switch was open and V_{out}=0. At t = 0s, S1 closes. NOTE: □=10^{-6}; k=10^{3}; e^{-1}=0.37; e^{-2}=0.14 Remember to put down units.



(a) (12 pts) Construct the differential equation of V_{out} in terms of all the given quantities. *Hint:you may solve this use Mesh or Nodal analysis, or, even simpler, Thevnin equivalent circuit. Write all your steps.*

(b) (5 pts) Write a closed-form expression for $V_{out}(t)$ for t>0

(c) (8 pts) Plot V_{out} as a function of time t = 0 to t = 100ms. **Label the y-axis and all key points:** starting value, 1 time constant value, value at infinity.



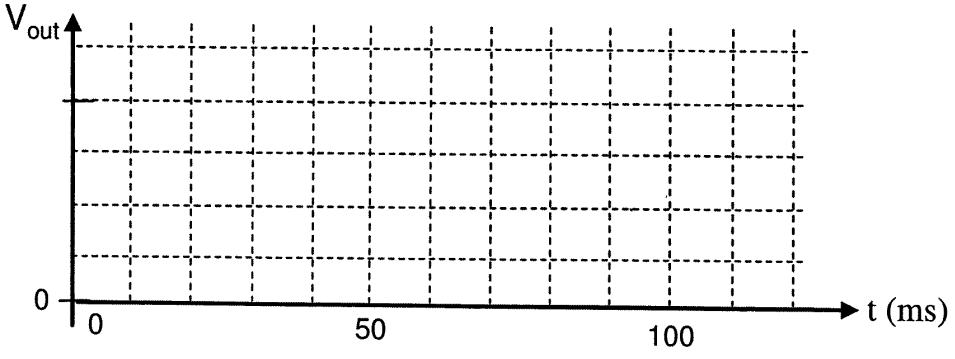
(d) (5 pts) As t approaches infinity, what value will i_3 approach?

(e) (5 pts) Now, suppose someone disturbed the circuit and S1 is re-opened at 40 ms again! Construct the new differential equation.

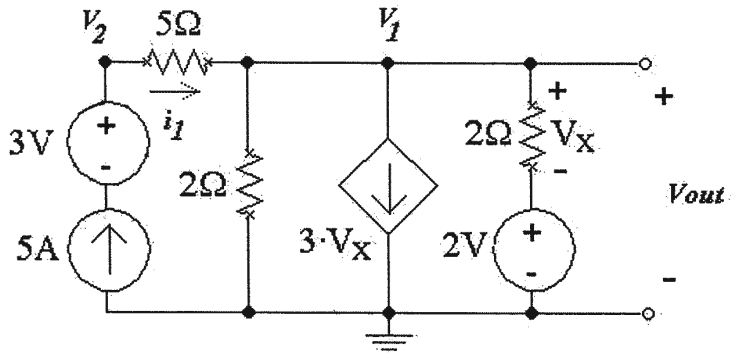
(f) (6 pts) What is the new time constant? What is the new expression for $V_{out}(t)$ for t>40 ms.

(g) (5 pts) In this case, as t approaches infinity, what value will i_3 approach?

(h) (5 pts) Plot the new V_{out} from t=0ms to 100 ms to include the re-opening of the switch at 40 ms. **Label the y-axis and all key points:** starting value, value at switching point, 1 time constant values, value at infinity.



1. (50 pts) Equivalent circuit.



(a) (5 pts) What is the current i_1 through the 5 Ohm resistor?

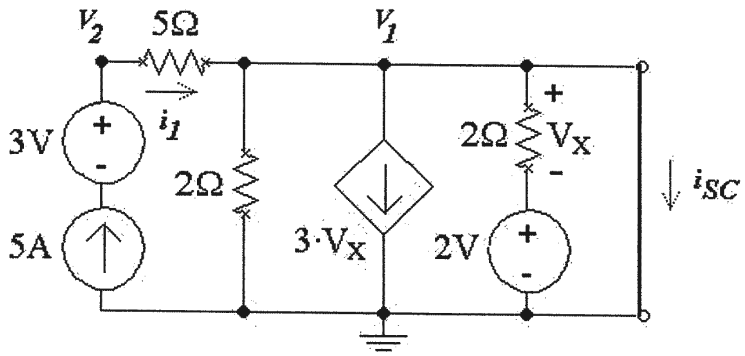
(b) (5 pts) Use KVL, write down the equation for V_x in terms of V_1 and/or V_2

(c) (5 pts) Use KCL, write down the equation for V_1 and solve for V_1

(d) (5 pts) Use KCL, write down the equation for V_2 and solve for V_2

(e) (5 pts) Solve for V_{out} (this is simply the Thevenin Voltage)

(f) Now we short the two end terminals.



(5 pts) What is V_1 ?

(g) (5 pts) What is V_x ?

(h) (5 pts) What is I_{sc}?

(i) (5 pts) what is the Thevenin Resistance?

(j) (5 pts) Draw the Thevenin Equivalent Circuit.