

**Massachusetts institute of Technology**  
**Department of Nuclear Science and Engineering**  
**Department of Electrical Engineering and Computer Science**

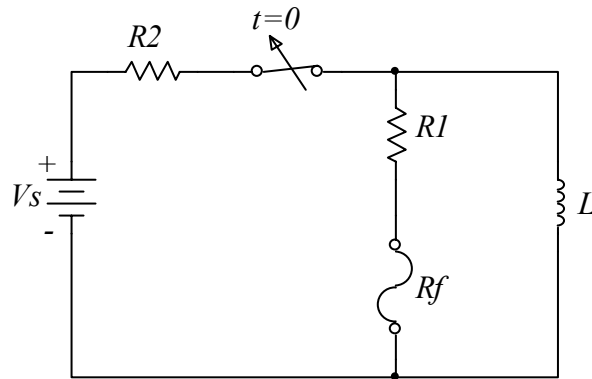
**22.071/6.071 - Introduction to Electronics, Signals and Measurement**  
**Spring 2006**

Homework 7  
 Due 4/12/06

Problem 1.

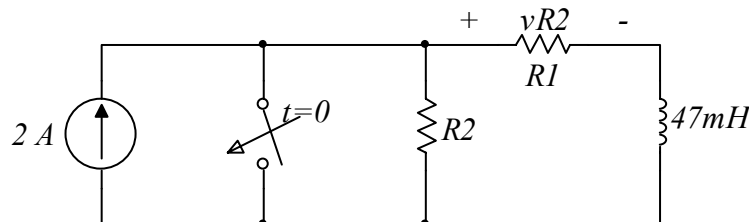
The fuse element is a resistor of resistance  $R_f$  which is destroyed when the current through it exceeds a certain value.

The circuit below has such a fuse in it. The switch in the circuit has been in the closed position for a long time. At time  $t=0$  the switch is opened. If the maximum current that can flow through the fuse is  $I_m$ , calculate the minimum resistance of the fuse ( $R_f$ ) as a function of  $I_m$  and the other circuit parameters.



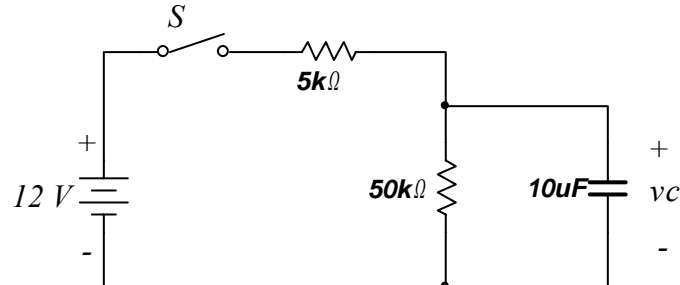
Problem 2.

For the circuit below determine the values for resistors  $R_1$  and  $R_2$  so that  $v_{R2}(t=0^+) = 12V$  and  $v_{R2}(t=2ms) = 6V$



Problem 3.

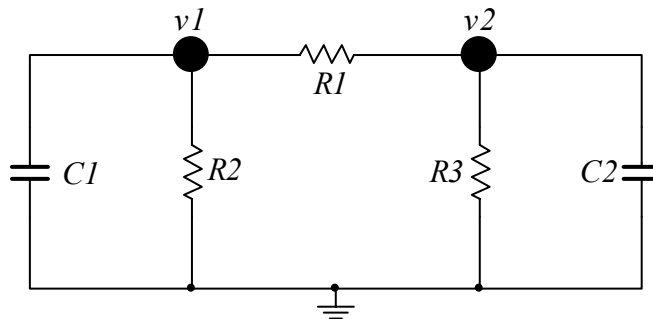
For the following circuit the switch  $S$  has been opened for a long time. At time  $t=0$  the switch is closed and it is opened again at time  $t=1$  sec. Sketch  $v_c(t)$  for all  $t$ . Indicate all relevant values in your sketch.



Problem 4.

The capacitors in the following circuit are independent. They can not be combined into an equivalent capacitance.

- A. Derive the equations for the node voltages  $v_1$  and  $v_2$ .
- B. Assume a solution of the form  $Ae^{st}$  and show that this circuit **can not** exhibit undamped (oscillatory) behavior. (Note that you are not given any initial conditions since you do not need them to solve this problem)



Problem 5.

The switch  $S1$  has been in position  $A$  for a very long time. At  $t=0$  the switch is moved from position  $A$  to position  $B$ . Sketch the voltage  $v_c(t)$  and the current  $i(t)$ . Use  $V_S=10V$ ,  $R=100\Omega$ ,  $L=2H$ ,  $C=0.1F$ . Label all relevant values.

