EECS 40, Spring 2005
Prof. Chang-Hasnain
Midterm #1
March 3, 2005
Total Time Allotted: 80 minutes

1. This is a closed book exam. However, you are allowed to bring one page (8.5" x 11"), double-sided notes
2. No electronic devices, i.e. calculators, cell phones, computers, etc.
3. Numerical answers within a factor of 1.5 will not get points deducted, provided the steps are all correct and the errors are due to the lack of a calculator. (e.g. if the correct answer is 1, the acceptable range will be 0.67~1.5).
4. 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.
5. Write your answers in the spaces (lines, boxes or plots) provided.
6. Remember to put down units. Points will be taken off for answers without units.
7. **NOTE: nH=10^{-9} H; pF=10^{-12} F; GHz=10^{9} Hz; MHz=10^{6} Hz**

Last (Family) Name:____

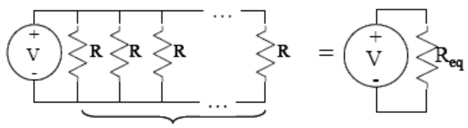
First Name:
____

Student ID:
____

Signature:
____

Score:
Problem 1 (20 pts)
Problem 2 (20 pts):
Problem 3 (30 pts):
Problem 4 (30 pts):
Total 100 pts

1: A voltage source with voltage V is connected to N identical resistors with resistance R.



(a) All of the resistors are connected in parallel, as in Figure 1a. What is the equivalent resistance R_{eq}? What is the total power consumed in the resistors?

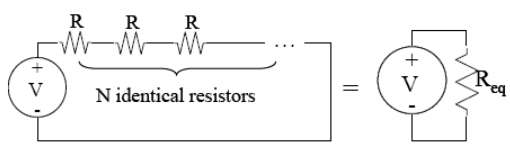
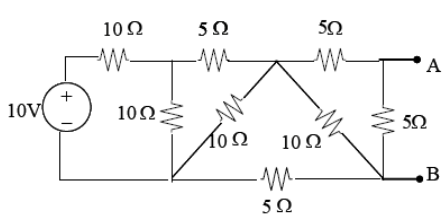


Fig. 1b

(b) All the resistors are all connected in series, as in Figure 1b. What is the equivalent resistance R_{eq}? What is the total power consumed in the resistors?

2. Equivalent circuit



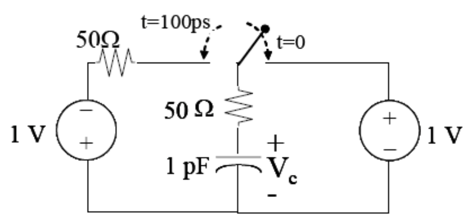
(a) What is equivalent resistance R_{eq} for points A-B?

(b) What is the open circuit voltage across points A-B?

(c) What is the short circuit current through points A-B?

(d) Draw both Thevenin equivalent circuits.

3. Transient Analysis: 1^{st} order circuit



(a) At t<0, the switch is open and $V_c = 0$. At t=0, the switch is closed towards the right.

What is $V_c(t)$? (*Hint: You can leave terms of the form* e^{-x} *as they are*)

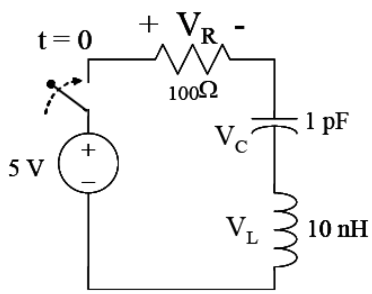
(b) At t=100 ps, the switch is closed towards the left and shall stay closed towards the left.

What is $V_c(t)$ when t>100 ps?

(c) Qualitatively draw $V_c(t)$ when t>0.

4. Transient Analysis: 2^{nd} order circuit

At t=0, the switch is closed.



(a) What is the KVL equation of the circuit in terms of $V_c(t)$?

(b) Calculate ζ α ω and , , 0. Is the circuit underdamped, critically damped or overdamped?

(c) What is the solution of $V_c(t)$?

(*Hint:* $\omega_n = \sqrt{\omega_0^2 - \alpha^2} = \frac{\sqrt{3}}{2} \times 10^{10}$ rad/s)