# American University of Beirut

Department of Electrical and Computer Engineering

**EECE 210 – Electric Circuits**
**Quiz 2 – May 7, 2010**
**Closed Book – No Programmable Calculators**
**90 minutes**

**Name: ________________________________ ID number: ________________**

**Circle your instructor's name:**

**Ernst Huijer Rabih Jabr Danielle Nasrallah**

## Penalty is 5 to 1

(1 to 4 wrong answers do not result in a penalty; 5 to 9 wrong answers cancel one correct answer; 10 to 14 wrong answers cancel two correct answers; and so on)

- Mark your last name on the computer card with a pencil
- Mark your ID number on the computer card with a pencil
- When using an eraser, make sure you erased well
- Make sure to write your name and ID number on the question sheet and the scratch booklet
- You are required to return the computer card and the question sheet within the scratch booklet

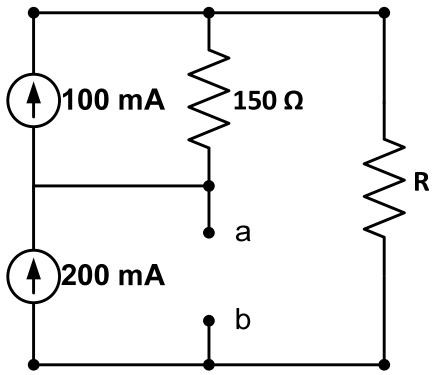
*** OP-AMPS ARE IDEAL AND OPERATING IN THEIR LINEAR REGION.**

*** NOTATION:**

| | | |
|---|---|---|
| $V_{TH}$ | : | **THEVENIN VOLTAGE** |
| $I_N$ | : | **NORTON CURRENT** |
| $R_{TH}$ | : | **THEVENIN RESISTANCE** |

*** NOTE THAT QUESTIONS ARE ARRANGED BY TOPIC AND FOR EACH TOPIC THE DEGREE OF DIFFICULTY VARIES**

In the circuit shown below, R = 100 Ω. Refer to this circuit for questions 1 and 2.




1. Determine $V_{Th}$ (in V) with respect to the terminals a-b.
a) 115 b) 35 c) 75 d) 55 e) 95

2. Determine the Norton current $I_N$ (in mA) with respect to the terminals a-b.
a) 172.7 b) 166.7 c) 140.0 d) 176.9 e) 157.1

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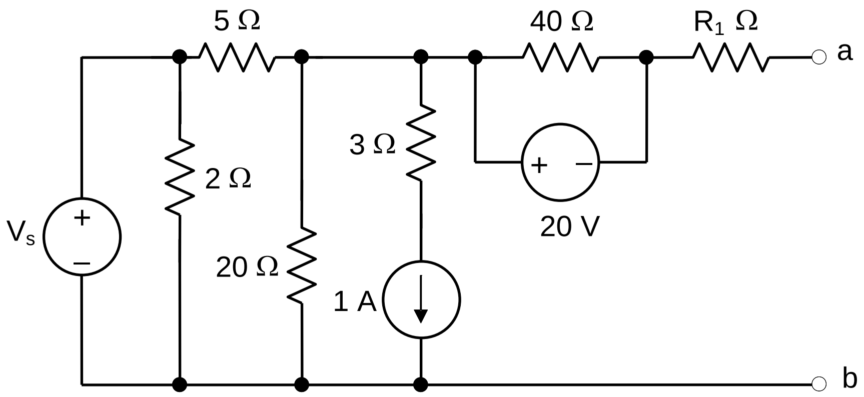
Refer to the circuit shown below for questions 3 and 4.




3. Find $V_{Th}$ (in V) with respect to the terminals a-b when $R_1$ = 1Ω and $V_s$ = 5 V.
a) -16 b) -8 c) -4 d) -12 e) -20

4. Find $R_{Th}$ (in Ω) with respect to the terminals a-b when $R_1$ = 2 Ω and $V_s$ = 30 V.
a) 6 b) 10 c) 9 d) 7 e) 8

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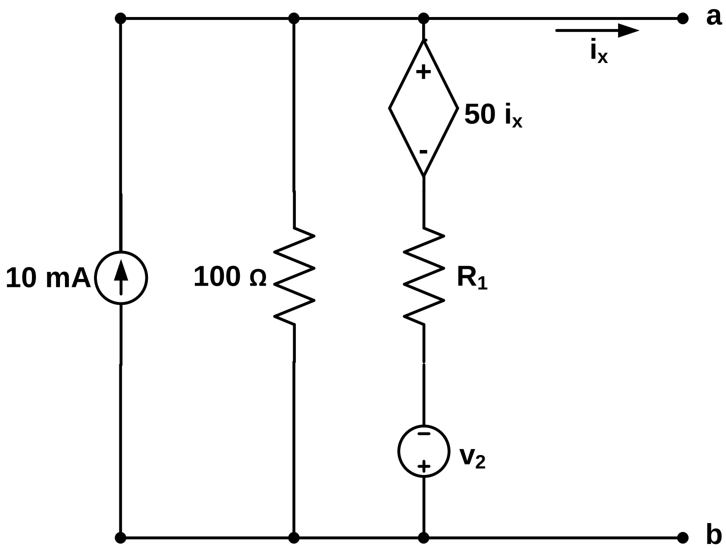
In the circuit shown below, $R_1$ = 100 Ω. Refer to this circuit for questions 5, 6, and 7.




5. To find $V_{Th}$ with respect to the terminals a-b we apply superposition. What is the contribution of just the current source to $V_{Th}$ (in V)?
a) 0.60 b) 0.71 c) 0.50 d) 0.75 e) 0.67

6. Now we consider the contribution of both sources. For what value of $v_2$ (in V) do we obtain $V_{Th}$ = 0 V?
a) 2.0 b) 2.5 c) 3.0 d) 1.0 e) 1.5

7. What is the value of $R_{Th}$ (in Ω) with respect to the terminals a-b?
a) 25.0 b) 57.1 c) 40.0 d) 62.5 e) 50.0

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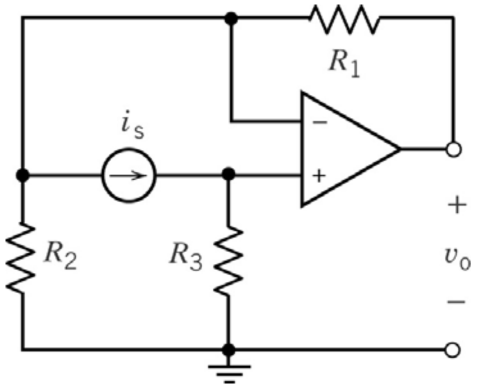
8. In the circuit shown below, $R_1$ = 5 kΩ, $R_2$ = $R_3$ = 10 kΩ, and $v_o$ = 1 V. Determine the value of $i_S$ (in mA).
a) 0.10 b) 0.25 c) 0.15 d) 0.05 e) 0.20

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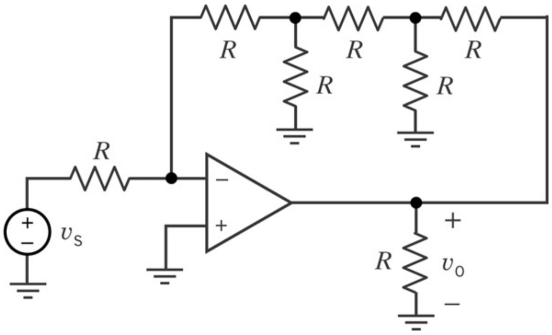
9. In the circuit shown below, $R = 0.5$ kΩ and the output voltage $v_o = -8$ V. Determine the power (in mw) supplied by the input voltage source $v_S$.

a) 0.125 b) 2 c) 0.5 d) 1 e) 0.25

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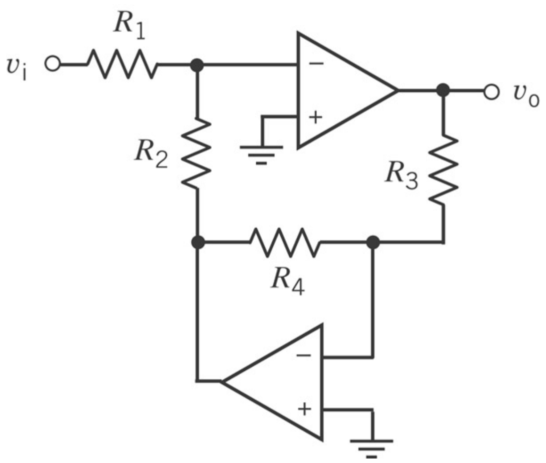
10. In the circuit shown below, $R_1 = R_4 = 10$ kΩ, $R_2 = 40$ kΩ, $R_3 = 50$ kΩ, and $v_i = 0.1$ V. Determine the value of $v_O$ (in V).

a) 8 b) 10 c) 4 d) 6 e) 2

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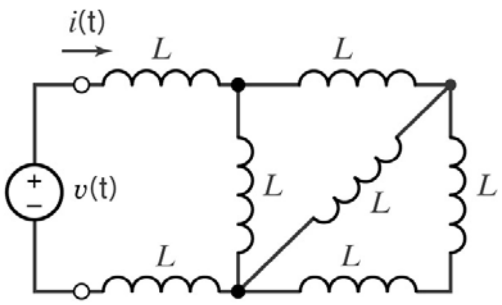
11. The circuit shown below has seven inductors, each having inductance $L = 1$ H. The source voltage is given by $v(t) = 4\cos(3t)$ V for $t \geq 0$. Find the current $i(t)$ for $t \geq 0$ (in mA) given that $i(0) = 0$.

a) 254.0 sin(3$t$) b) 101.6 sin(3$t$) c) 169.3 sin(3$t$) d) 127.0 sin(3$t$) e) 507.9 sin(3$t$)

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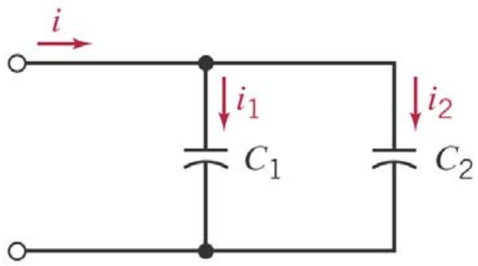
12. In the circuit shown below, $C_1$ = 1 pF, $C_2$ = 3 pF, and $i(t) = 4te^{-t}$ mA for $t > 0$. Find $i_1(t)$ for $t > 0$ (in mA).

a) $0.5te^{-t}$  b) $te^{-t}$  c) $0.4te^{-t}$  d) $0.25te^{-t}$  e) $0.8te^{-t}$

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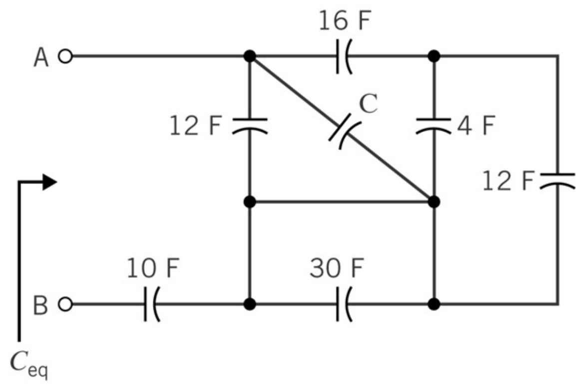
13. Determine the value of the capacitance $C$ (in F) in the circuit shown below, given that $C_{eq}$ = 7.5 F.

a) 10  b) 70  c) 95  d) 20  e) 170

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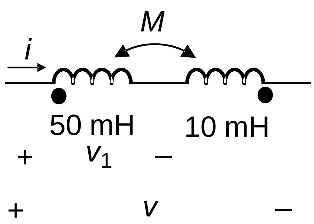
14. In the circuit shown below, determine the ratio $v_1/v$ if $M$ = 5 mH.

a) 1.75  b) 1.125  c) 0.9  d) 1  e) 1.5

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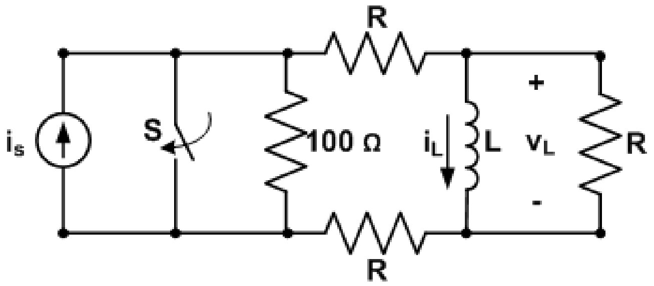
In the circuit shown below, the switch S has been open for a long time before it closes at t=0. $i_s$= 1.5 A, R = 50 Ω, L = 200 mH. Refer to this circuit for questions 15 and 16.




15. Find the value of the time constant τ, that governs the behavior of the circuit for t>0, in ms.
a) 2.4 b) 6.0 c) 2.0 d) 3.0 e) 4.0

16. Find the value of $v_L(0^+)$ in V.
a) -37.5 b) -30.0 c) -25.0 d) -35.7 e) -33.3

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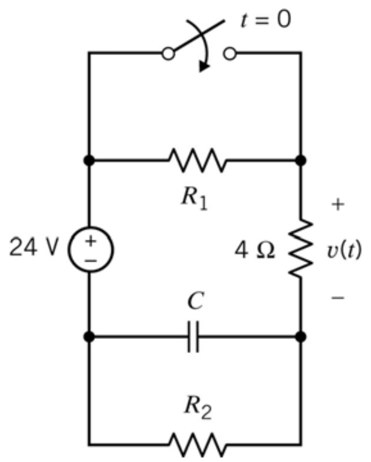
17. The circuit shown below is at steady state before the switch closes at time $t$ = 0. Determine the energy stored in the capacitor (in J) at time $t$ = 0.5 s. The following values are given: $R_1 = R_2 = 4\ \Omega$, and $C$ = 1 F.
a) 51.11 b) 69.63 c) 45.83 d) 61.69 e) 39.47

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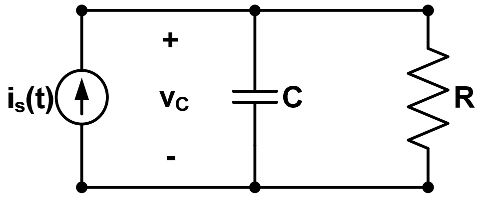
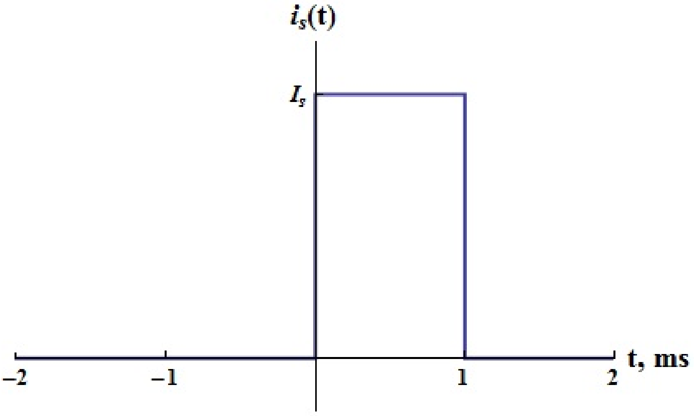
In the circuit shown below, the maximum value of the pulse is $I_s$ = 1 mA, C =1 μF, R =2 kΩ. The energy stored in the capacitor is zero for t < 0. Refer to this circuit for questions 18 and 19.




18. Determine the maximum value of $v_c(t)$ in V that will occur over time as a response to the current pulse $i_s(t)$, which as a function of time is indicated in the graph shown above.

a) 3.93 b) 1.57 c) 0.79 d) 3.15 e) 2.36

19. What is the total energy delivered by the current source in μJ?

a) 1.70 b) 0.43 c) 10.65 d) 3.83 e) 6.82

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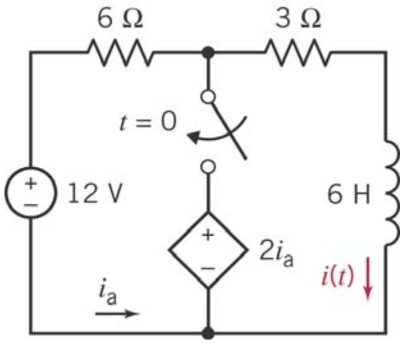
20. The circuit shown below is at steady state before the switch closes at time $t = 0$. Determine the inductor current $i(t)$ in A at time $t = 0.2$ s.

a) -1.549 b) 0.596 c) -0.774 d) 1.016 e) -1.834

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