KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

SECOND SEMESTER 2007/2008

EE 201 MAJOR EXAM   II

DATE: SATURDAY 3-5-2008

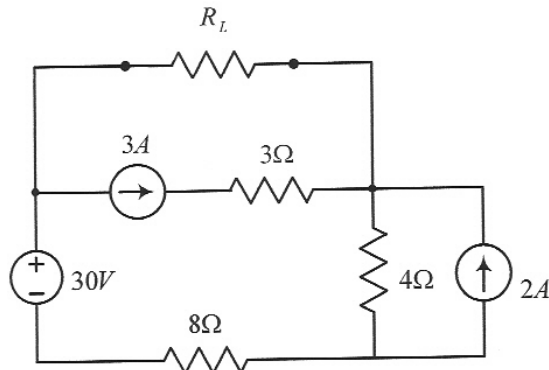TIME: 10:00-10:55 AM

LOCATION: IN CLASS

Student's Name:.................... KEY ....

Student's I.D. Number:.......................

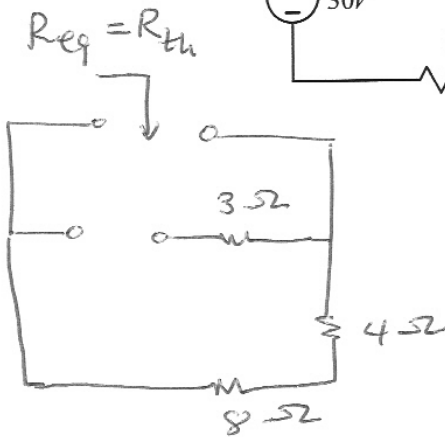|	Maximum Score	Score
Problem 1	40	
Problem 2	20	
Problem 3	40	
Total	100	

Problem 1 [40 pts]

In the circuit shown below, find:

a) R_L for maximum power transfer.
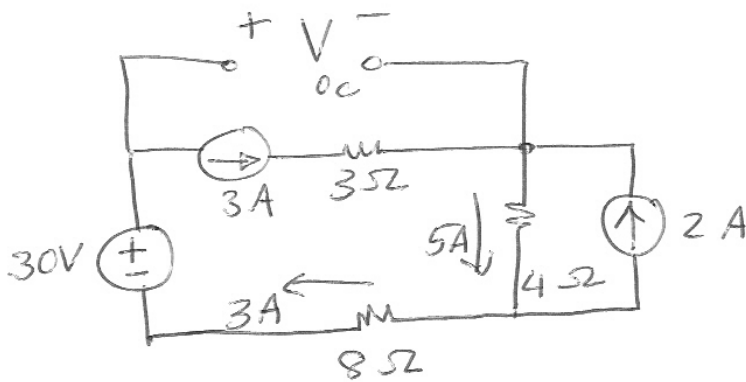b) The maximum power transferred to R_L.

R_L

3A   3Ω

$+$ 30V   4Ω $\uparrow$ 2A

$Req = R_{th}$ 8Ω

a)

3 Ω

4 Ω

8 Ω

$\Rightarrow Req = 4 + 8$
$= 12\,\Omega$

b)

$+ V_{oc} -$

3A   3Ω

30V $\pm$

5A $\uparrow$ 2A

3A   4 Ω

8 Ω
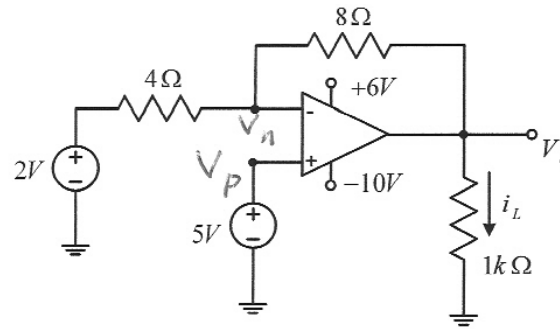
$V_{oc} = V_{th} = 30 - 3 \times 8 - 5 \times 4 = -14 V$

$P_{max} = \dfrac{V_{th}^2}{4 R_{th}} = \dfrac{(196)}{4 \times 12} = 4.08\,W$

Problem 2 [20 pts]

In the ideal Op Amp circuit shown below, calculate the current i_L through the $1k\,\Omega$ load resistor.

[*Show your work clearly*]

$$V_p = V_n = 5V$$

KCL at node n $\Rightarrow$

$$\frac{5-2}{4} + \frac{5-V_o}{8} = 0$$

$\therefore\ V_o = 11\,V > 6V = V_{cc}^{+} \quad \Rightarrow$

$$V_o = 6\,V$$

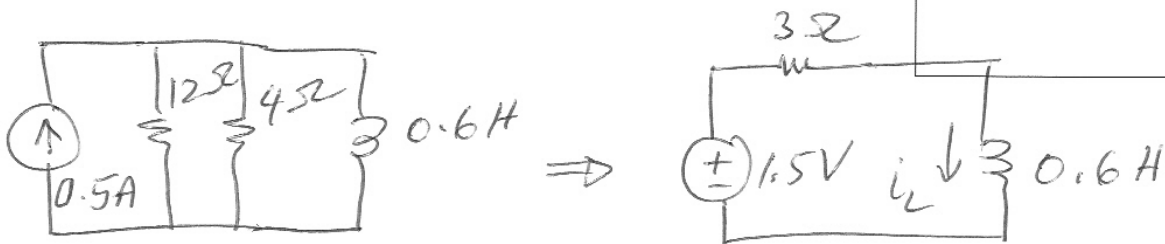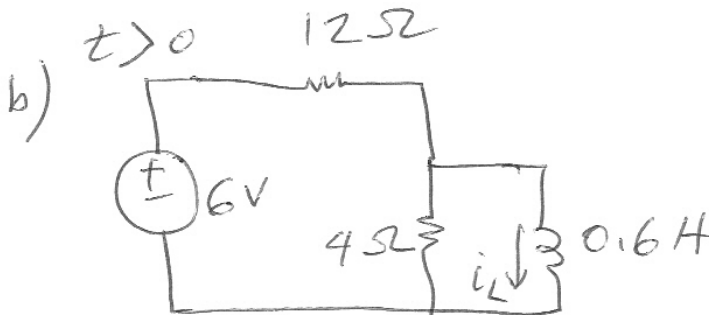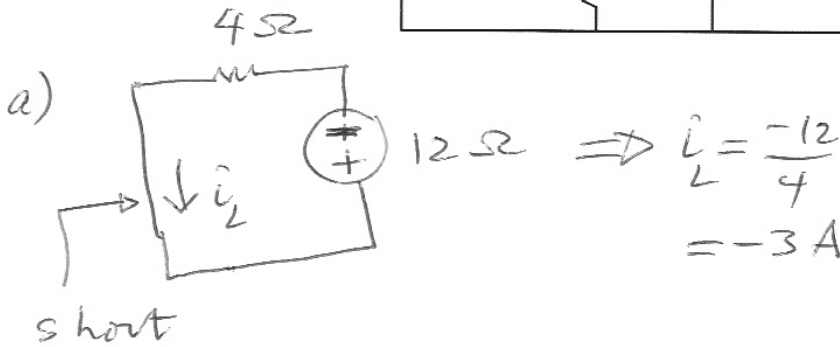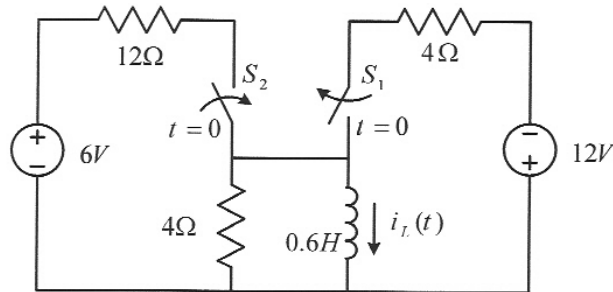$\therefore\ i_L = \dfrac{V_o}{1K} = \dfrac{6}{1000} = 6m\,A$

Answer:

$i_L = 6\,m\,A$

Problem 3 [40 pts]

In the circuit shown below, switch S_1 has been closed and switch S_2 has been open for a long time. At $t = 0$, switch S_1 is opened and switch S_2 is closed suddenly. Find:

a) $i_L(t)$ for $t < 0$.

b) $i_L(t)$ for $t \geq 0$.

a)

$12\,\Omega \Rightarrow i_L = \dfrac{-12}{4}$

$= -3\,A$

short

b) $t > 0$

$-1.5 + 3i_L + 0.6\dfrac{di_L}{dt} = 0 \Rightarrow \dfrac{di_L}{dt} + 5i_L = 2.5$

$\therefore i_L(t) = \dfrac{b}{a} + Ae^{-at} = 0.5 + Ae^{-5t}$

$i_L(0) = -3 = 0.5 + A \Rightarrow A = -3.5$

$\therefore i_L(t) = 0.5 - 3.5e^{-5t}$

Answers:

a) For $t < 0$,

$i_L(t) = -3A$

b) For $t \geq 0$,

$i_L(t) = $

$0.5 - 3.5e^{-5t}$