EECE 2150 – Circuits and Signals, Biomedical Applications
Final Exam

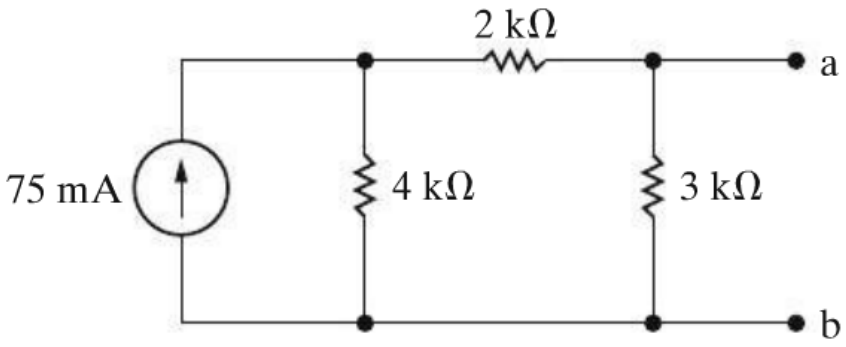
Name:_____

Instructions:

- Closed book, closed notes; Computers and cell phones are not allowed
- Equation sheet, 8.5x11 inches, both sides, permitted
- Scientific calculators are allowed
- **Complete all 6 problems**
- Show all work and **place a box around all your final answers**
- Include units with answers as appropriate
- Show your work for partial credit
- You may write on both sides of the pages

Question 1 (20 Points) **Name:**

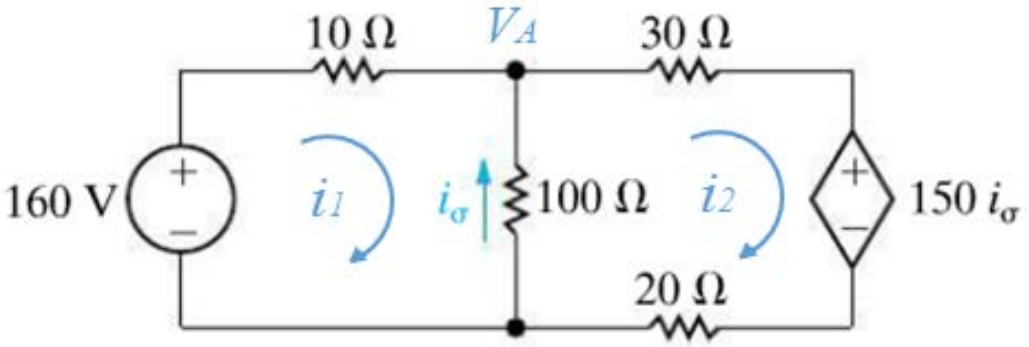
1) Find the Thevenin equivalent circuit across terminals a ,b for the circuit below:



Answers: V_{Th} =

R_{Th} =

Question 2 (20 Points) **Name:**



2A) Use either the node-voltage or the mesh-current technique to set up the matrix equations for either the currents i_1 and i_2 or for the voltage $V_{A.}$

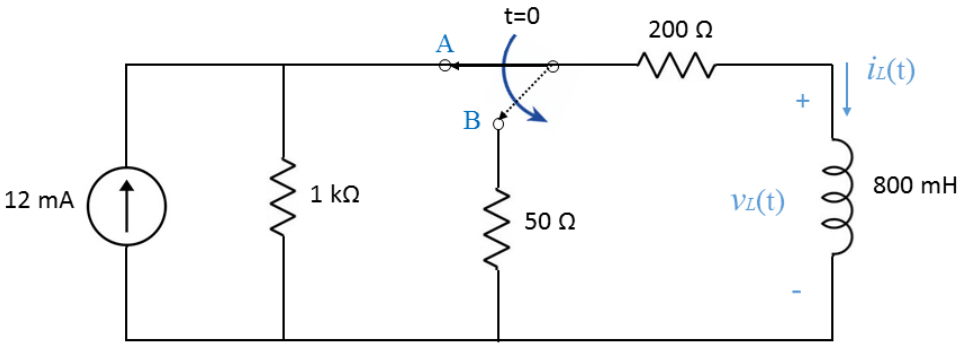
2B) Solve the resulting equations to find the power dissipated in the 100 ohm resistor.

(extra space on the next page)

Question 2 (extra space) **Name:**

Question 3 (20 Points) **Name:**

In the circuit below, the switch has been in position A for a long time. At $t = 0$, it is switched to positon B.



3A) Find the current through the inductor $i_L(0^-)$ and the voltage across the inductor $v_L(0^-)$ just before the switch is thrown.

3B) Find an expression for the current through the inductor as a function of time $i_L(t)$ for $t > 0$.

3C) Find the current through the inductor at $t = 1$ ms.

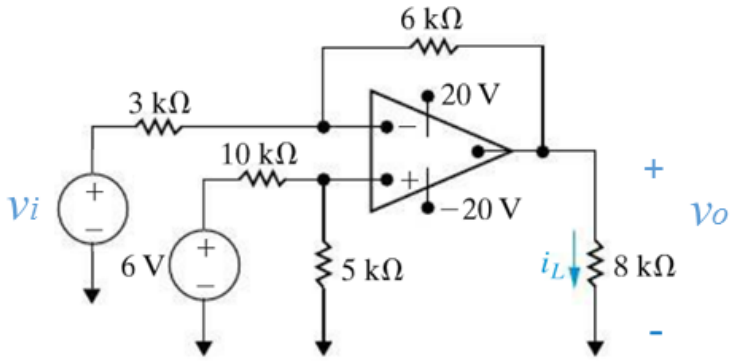
3D) Find the voltage across the inductor at $t = 1$ ms.

(extra space on the next page)

Question 3 (extra space) **Name:**

Question 4 (20 Points) **Name:**

Assuming the op amp is ideal, find i_L in the circuit below.

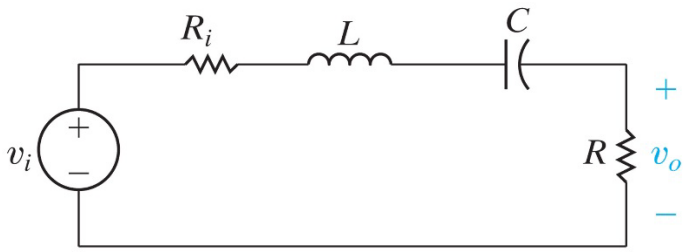


(extra space on the next page)

Question 4 (extra space) **Name:**

Question 5 (20 Points) **Name:**

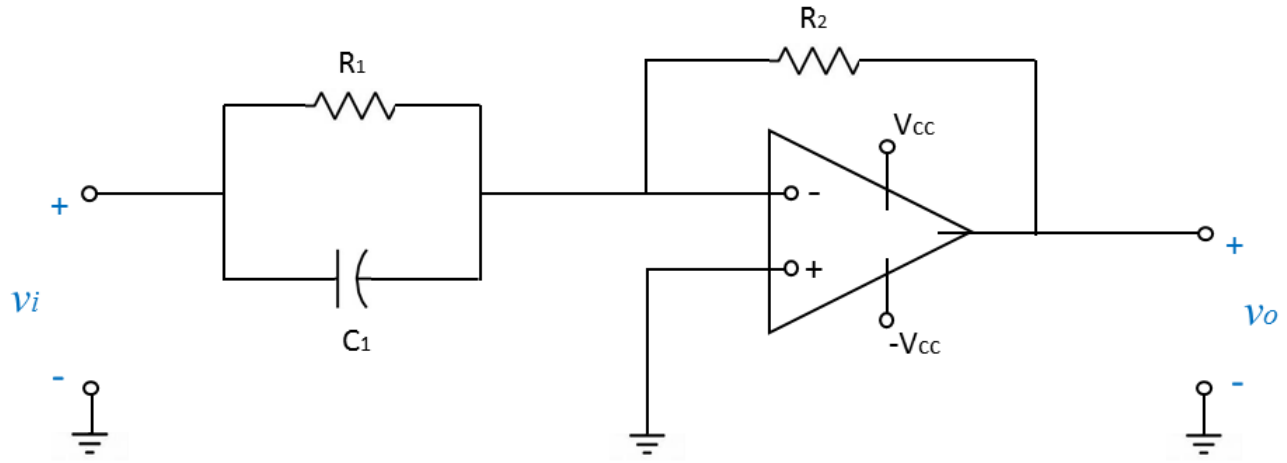
For the following circuit:



5A) Assuming that R_i=100Ω, L=100mH, C=1μF, and R=1kΩ, find the transfer function (v_o/v_i) at ω=1000 rad/s.

5B) If vi=5cos(1000t), what is the output voltage?

Question 6 (20 Points) **Name:**



6A) If the op amp in the circuit above is ideal, find an expression for the transfer function $H(\omega) = {}^{v_o}/_{v_i}$

6B) If R1=5kΩ, R2=15kΩ, and C=1μF and the input voltage is given by $v_i(t) = 0.5\cos(200t)$, find the output voltage $v_o(t)$.

6C) If R1=5kΩ, R2=15kΩ, and C=1μF, sketch the magnitude of $H(\omega)$ *vs.* frequency on the axes shown. Label two values on each axis.

Question 6 (extra space) **Name:**