UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

TERM TEST 1

February 8th, 2018

90 minutes

First Year – Engineering Science

ECE 159S - ELECTRIC CIRCUIT FUNDAMENTALS

Exam Type: A

Examiners: K. Phang and N.P. Kherani

NAME: _____

Last **First**

STUDENT NO: Please write your student number on the top of Page 2

SECTION (circle one):

LEC101 (Phang) LEC102 (Kherani)

INSTRUCTIONS:

- This is a Type A examination; no aids are allowed.
- Only non-programmable calculators are allowed.
- Place your final answers in the boxes provided. Proper units must be provided.
- All work is to be done on the pages of this booklet.
- When answering the questions include all the steps of your work on these pages. For additional space, you may use the back of the preceding page and the blank page provided at the end.
- Do not unstaple this exam booklet.

Q1	/10
Q2	/4
Q3	/5
Q4	/7
Q5	/6
Q6	/8
Total	**/40**

Name: _____ Student No.: _____

QUESTION 1 [10 marks]
Circle TRUE or FALSE, or answer the question as appropriate. Comment if you must. Each part is worth 1 mark unless stated otherwise.

a) The fine filament wire in an incandescent light bulb is a practical example of a resistor.

TRUE / FALSE

b) Sketch the electric field lines between two point charges of +Q and -Q.

c) Kirchhoff's Voltage Law states: _____

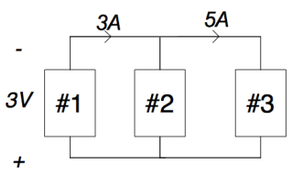
_____

d) How much work is done by a charge Q that experiences a potential drop of V: _____

e) Draw below the I-V characteristics of a 5V independent voltage source; that is, a plot of current (y-axis) versus voltage (x-axis). Clearly label the axes.

f) What is the current through a resistor, R, if its terminals are connected together through an ideal wire?

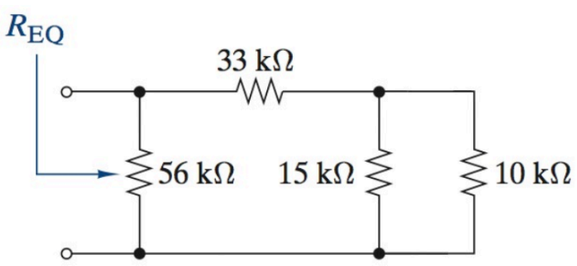
g) Circle the element(s) that are supplying power in the circuit below: **#1** **#2** **#3**



h) The resistivities of stainless steel and aluminum are $\rho_{SS} = 74\ \mu\Omega$ cm and $\rho_{Al} = 2.7\ \mu\Omega$ cm, respectively. Which metal would you use as a conductor to minimize the potential drop between circuit components? _____

i) (2 marks) Find the equivalent resistance R_{EQ}.

R_{EQ} =



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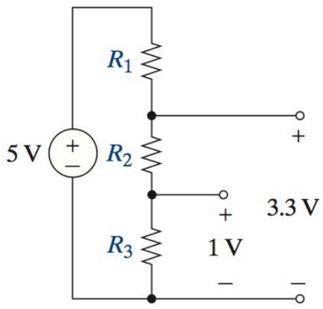
QUESTION 2 [4 marks]
Select values for resistors R_1, R_2, and R_3 such that the resulting voltage divider draws 100μA from the voltage source and produces the two output voltages shown. Assume there is no current flowing out of the open terminals.

R_1 =

R_2 =

R_3 =



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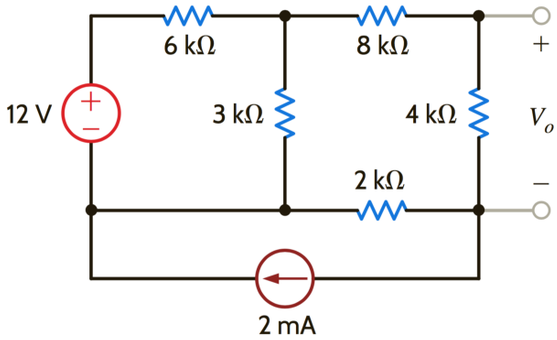
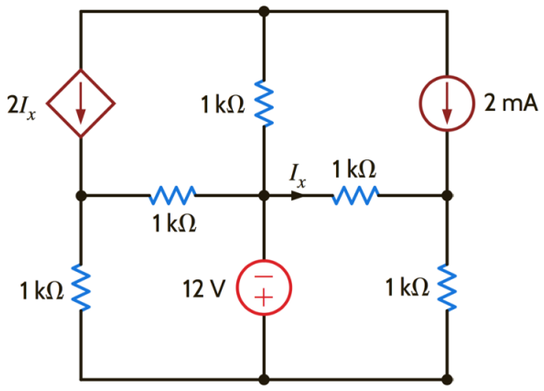
QUESTION 3 [5 marks]
Use source transformation to find V_o in the circuit below.



V_o =

Name: _____ Student No.: _____

QUESTION 4 [7 marks]
Use nodal analysis to find the power, P_{2mA}, *supplied* by the 2mA current source in the circuit below.



$P_{2mA} =$

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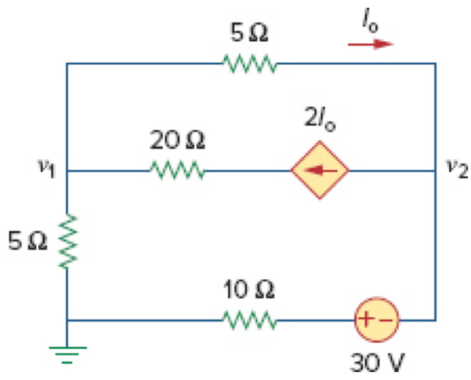
QUESTION 5 [6 marks]
Use mesh analysis to find the power, $P_{20\Omega}$, dissipated by the 20Ω resistor.



$P_{20\Omega}$ =

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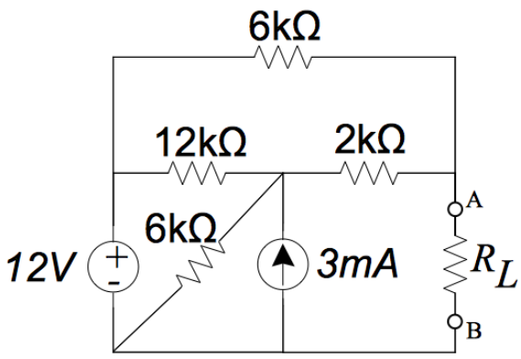
QUESTION 6 [8 marks]

a) [6 marks] Find the Thevenin equivalent circuit at terminals A and B.

b) [2 marks] Calculate the maximum power, P_{Lmax}, that can be delivered to load R_L.



a)

V_{Th} =

R_{Th} =

b)

P_{Lmax} =

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