SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Fall 2016
ENSC 220: ELECTRIC CIRCUITS I

Midterm Examination No. 2
Monday, November 14, 2016

Duration: 110 minutes. Attempt all problems. Questions are* not *equally weighted. Closed book and closed notes. Simple calculators (with no graphing/programming functions) are permitted. PDAs, laptops, and wireless phones are not permitted. Please write legibly. Illegible text will not be graded.

1. **(15 points)** For the circuit shown in Figure 1, find the voltage ratio V_{out}/V_s.

2. **(20 points)** For the circuit shown in Figure 2, find:

   (a) Thévenin equivalent circuit.

   (b) Norton equivalent circuit.

   (c) If a load resistor R_L is attached across the output terminals, find the value of R_L for which the load absorbs maximum power.

   (d) Calculate the maximum power transferred to the load.

3. **(25 points)** In the circuit shown in Figure 3, suppose $i_s(t) = 4sin(4t)$ A.

   (a) Find and sketch $v_L(t)$.

   (b) Find and sketch $i_C(t)$.

   (c) For $t \geq 0$, compute the energy stored in:

   - the inductor.
   - the capacitor.

4. **(40 points)** The circuit shown in Figure 4 has an ideal op-amp.

   (a) Write nodal analysis equations.

   (b) Obtain the differential equations for $v_o(t)$.

   (c) Let $R_1 = 4\Omega$, $R_2 = 10\Omega$, $C = 0.5$ F. If $v_i(t) = 6u(t)$ and $v_C(0\_) = 4$ V, find and sketch $v_o(t)$ for $t > 0$.

   (d) Find and sketch $i_C(t)$.

Figure 1:

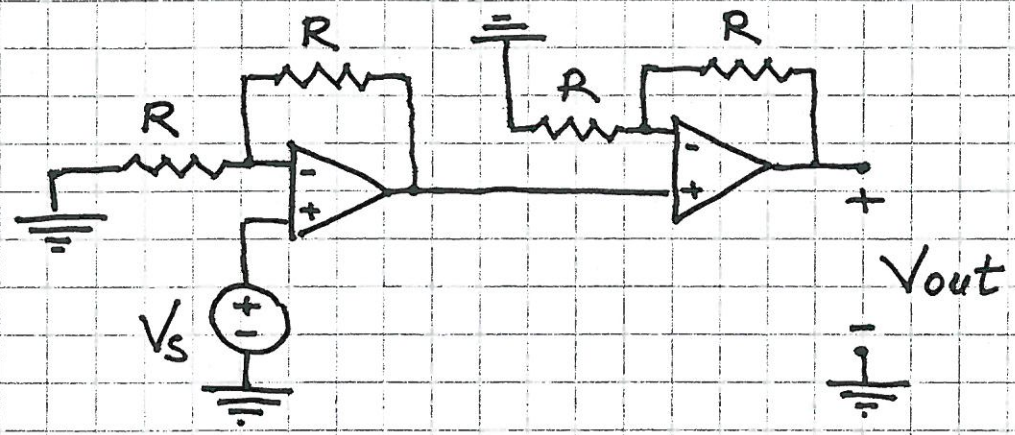

Figure 2:

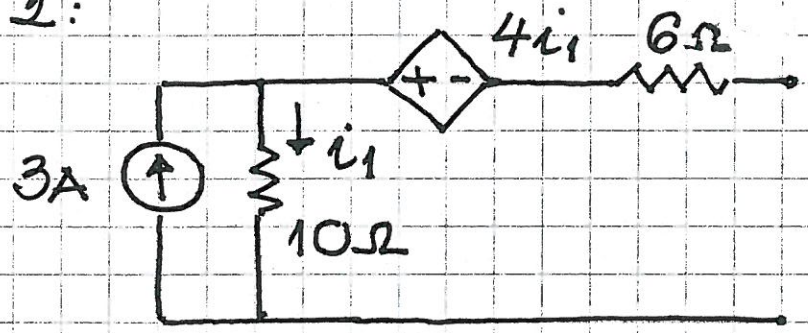

Figure 3:

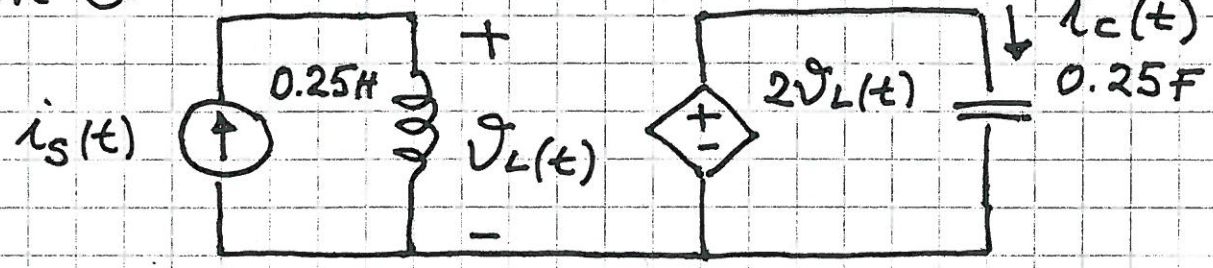

Figure 4: