SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Fall 2016
ENSC 220: ELECTRIC CIRCUITS I

Midterm Examination No. 1
Wednesday, October 12, 2016

Duration: 50 minutes. Attempt all problems. Questions are not equally weighted. Closed book and closed notes. Calculators, PDAs, laptops, and wireless phones are not permitted. Please write legibly. Illegible text will not be graded.

1. **(10 points)**

   A voltage bridge circuit is shown in Figure 1. Resistor R_x is variable. The goal is to "balance" the bridge by making $V_x = 0$V. Derive an expression for R_x in terms of the other resistors when the bridge is balanced.

2. **(20 points)**

   Find the equivalent resistance R_{eq} "seen" by the current source I_s in the circuit shown in Figure 2.

3. **(30 points)**

   The circuit shown in Figure 3 models an operational amplifier circuit.

   - Write two nodal equations that will enable you to find voltages V_1 and V_2.
   - Write the equations in a matrix form.

4. **(40 points)**

   Consider the circuit shown in Figure 4, $V_{s1} = 250$V and $I_{s2} = 0.75$A:

   - Write two mesh equations.
   - Write the equations in a matrix form.
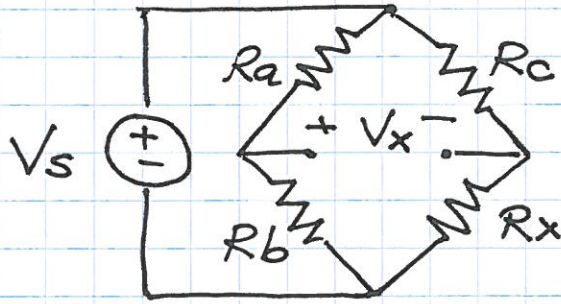   - Solve the mesh equations.
   - Determine V_B.

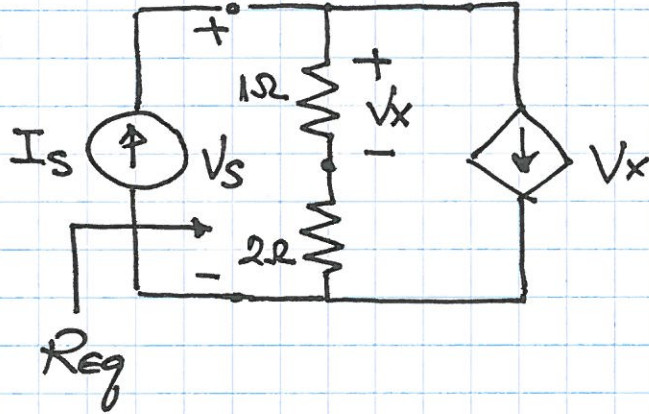**Figure 1:**

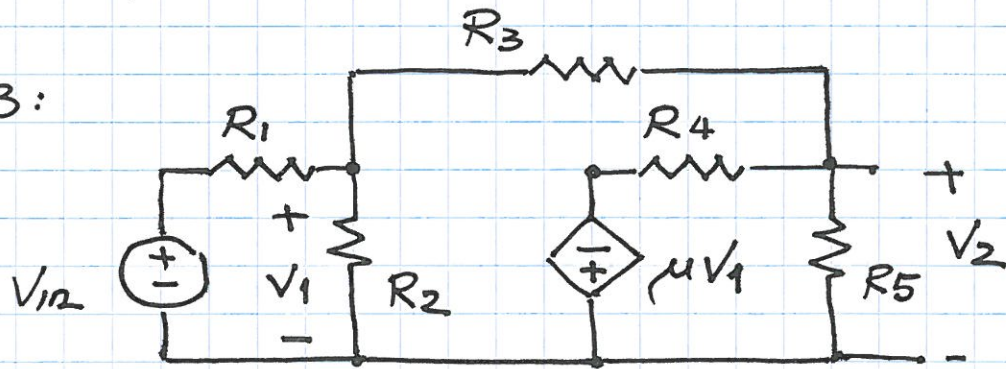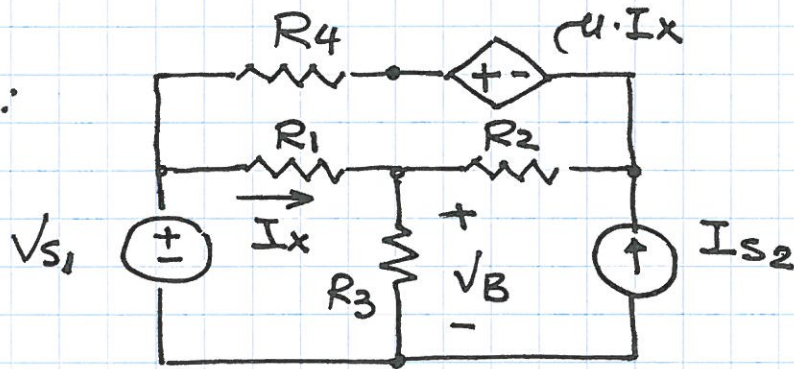

Figure 2:

Figure 3:

Figure 4:

$R_1 = 200\,\Omega$; $R_2 = 200\,\Omega$; $R_3 = 200\,\Omega$

$R_4 = 100\,\Omega$; $\mu = 300$