

SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Fall 2017
ENSC 220: ELECTRIC CIRCUITS I

Midterm Examination No. 1
Wednesday, October 11, 2017

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. (20 points)

Determine the value of the voltage V_x for the circuit of Figure 1.

2. (20 points)

A voltage bridge circuit is shown in Figure 2. Resistor R_x is variable. The goal is to "balance" the bridge by making $V_x = 0V$. Derive an expression for R_x in terms of the other resistors when the bridge is balanced.

3. (30 points)

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

- Write two nodal equations in terms of voltages V_1 and V_2 .
- Write the equations in a matrix form.
- Write the conductance matrix if the voltage controlled voltage source was "removed".
- List three properties of this conductance matrix.

4. (30 points)

For the circuit shown in Figure 4, $V_{s1} = 225V$, $V_{s2} = 15V$, $R_1 = 30\Omega$, $R_2 = 270\Omega$, $R_3 = 20\Omega$, $R_4 = 80\Omega$, and $\alpha = -0.5$.

- Write the mesh equations.
- Write the equations in a matrix form.
- Write the resistance matrix if the current controlled current source was "removed".
- List three properties of this resistance matrix.
- Solve the mesh equations.

