

SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Fall 2001
ENSC 220
ELECTRIC CIRCUITS I

Final Examination
December 15, 2001

*Attempt all five problems.
Problems are not equally weighted.*

1. (10 points) For the circuit shown in Figure 1, determine the gain V_o/V_i . Assume that the op-amp is ideal.
2. (20 points) In the circuit shown in Figure 2:
 - Write a set of node equations.
 - Solve the node equations for v_2 .
 - Find the Thévenin equivalent resistance at the output.(Note: Keep your numerical results in terms of fractions.)
3. (30 points) At $t = 0$, a 10-ma current pulse (rectangular) is applied to the initially relaxed circuit shown in Figure 3.
 - Find $i(t)$ for $t > 0$.
 - Sketch the results to scale on the graph of the pulse. (Note: $e^{-3} \approx 0.05$.)
4. (20 points) The capacitors in the circuit shown in Figure 4 are initially not charged when the circuit is excited by a step voltage. The given values are normalized.
 - Find the state equations.
 - Form these, find the characteristic equation and the natural frequencies.
 - Find the complete response of the state variables, leaving no unspecified constants.
 - Determine $v_o(t)$ for $t > 0$.
5. (20 points) The circuit shown in Figure 5 is to act as a *phase shifter*, that is, to produce an output-voltage phasor V_3 that has the same magnitude as that of V_1 and an angle that leads the angle of V_1 by 90° . Find V_3 and determine how closely the circuit meets these objectives.

