Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (please print)

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ECE 3355 – Exam 1

October 10, 2015

Keep this exam closed until you are told to begin.

1. This exam is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent.

2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution that is not given in a reasonable order will lose credit. Clearly indicate your answer (for example by enclosing it in a box). If your answer is a plot, no box is needed.

3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**

4. Show all units in solutions, intermediate results, and figures. Units in the exam will be included between square brackets.

5. Do not use red ink. Do not use red pencil.

6. You will have 90 minutes to work on this exam.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/40

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/20

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/40

Total = 100

Room for extra work

1. {40 Points} A circuit with two identical transconductance amplifiers is shown in Figure 1. The equivalent circuit for the transconductance amplifiers in this circuit is shown in Figure 2. Note that the circuit is only grounded at one point, at the load. The terminal numbers show how to connect the amplifiers.

a) Find the voltage gain *vl/vs*.

b) Find the input resistance seen by the source.

c) Find the output resistance seen by the load.



# Room for extra work

2. {20 Points} Assume that the input of an oscilloscope can be modeled with a 400[k] resistance, and an equivalent parallel capacitance of 270[pF]. Design a one-hundred-times probe that could be used with this oscilloscope to give an accurate shape for the signals displayed on the screen. Give the numerical values you obtain to at least three significant figures.

Room for extra work

3. {40 Points} Given that a circuit has the transfer function,



Perform the following:

1. Plot the straight-line approximation to the magnitude Bode plot for this circuit. Use one of the pieces of semi-log graph paper on the following pages.
2. Plot the straight-line approximation to the phase Bode plot for this circuit. Use one of the pieces of semi-log graph paper on the following pages.
3. Use your plots to estimate the transfer function *Vo/Vi* at *f* = 100[kHz].

Room for extra work

Solution:

1. {40 Points} A circuit with two identical transconductance amplifiers is shown in Figure 1. The equivalent circuit for the transconductance amplifiers in this circuit is shown in Figure 2. Note that the circuit is only grounded at one point, at the load. The terminal numbers show how to connect the amplifiers.

a) Find the voltage gain *vl/vs*.

b) Find the input resistance seen by the source.

c) Find the output resistance seen by the load.



