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

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

ECE 3355 – Final Exam

December 3, 2024

Keep this quiz closed until you are told to begin.

1. Print your name, and sign your name, at the top of this page.
2. This exam is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent. You may use a calculator. You should **not** use a cell phone, tablet computer, or laptop computer, as you work on this exam.
3. Show all work on these pages. You may use both sides of each page. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
5. Do not use red ink. Do not use red pencil.
6. You will have 100 minutes to work on this exam.
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30
8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30
9. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30
10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30

Room for extra work

1. {30 Points} Assume an ideal op amp. Assume the diode can be modeled using a piecewise linear diode model, where *Vf* = 1[V], *rd* = 1[kW], and   
   *Is* = 1[mA]. Use the circuit diagram below to solve.
2. Assume *vA* = 3.5[V]. Find *vB*.
3. Assume *vA* = -3.6[V]. Find *vB*.
4. Assume *vA* = -7.6[V]. Find *vB*.



Room for extra work

1. {30 Points} A device called an Ampulator has the schematic symbol shown in Figure 1. This device has the relationship between the current and the voltage given in Figure 2.
2. Find a model for the device when it is in region D. Draw the model, labeling all components with numerical values, and labeling terminals F and G.
3. Find the test or tests that can be used to determine whether the device is in region D.
4. Find the signal model for the device in Region D.

 

Room for extra work

1. {30 Points} Assume that the transistor has *b* = 100, and operates at room temperature. Find the transconductance *if / va* in the passband.



Room for extra work

1. {30 Points} Assume that the transistor in Figure 1 has *b* = 50, and operates at room temperature. .
   1. Find the voltage gain *vo / vs* in the passband.
   2. Find the input resistance seen by the *vs* source, in the passband.
   3. Find *CX* if the straight-line approximation to the magnitude Bode plot in Figure 2 holds for this circuit. (Hint: Use the result you found in part b. for this part. The value X can be determined from part a.)

 



















