Name: _____ (please print)

Signature: _____

ECE 3355 – Quiz #6
November 26, 2019

Keep this quiz closed and face up until you are told to begin.

1. This quiz 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 which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____/25

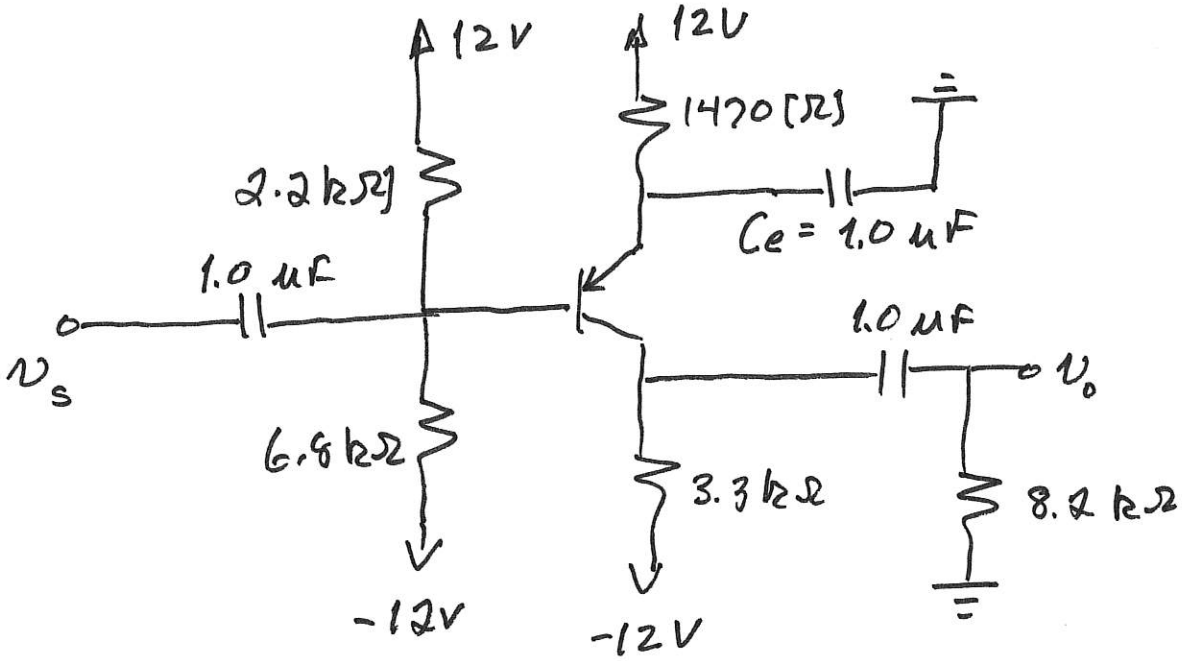
Room for Extra Work

In the circuit below, v_s is a small-signal input, and v_o is the output. The BJT is characterized by $\beta = 50$ and $V_{CE,SAT} = -0.2$ V. It is biased in the linear region, and it is known that $I_B = 67\ \mu A$.

a) Draw the small-signal model (ac model) for this BJT circuit. For this you may use any of the small-signal models discussed in class.

b) Find the input resistance (the resistance seen by the input v_s) in the passband. Assume that in the passband, C_e is a short.

c) Find the output resistance (the resistance seen by the output v_o) in the passband. Assume that in the passband, C_e is a short.



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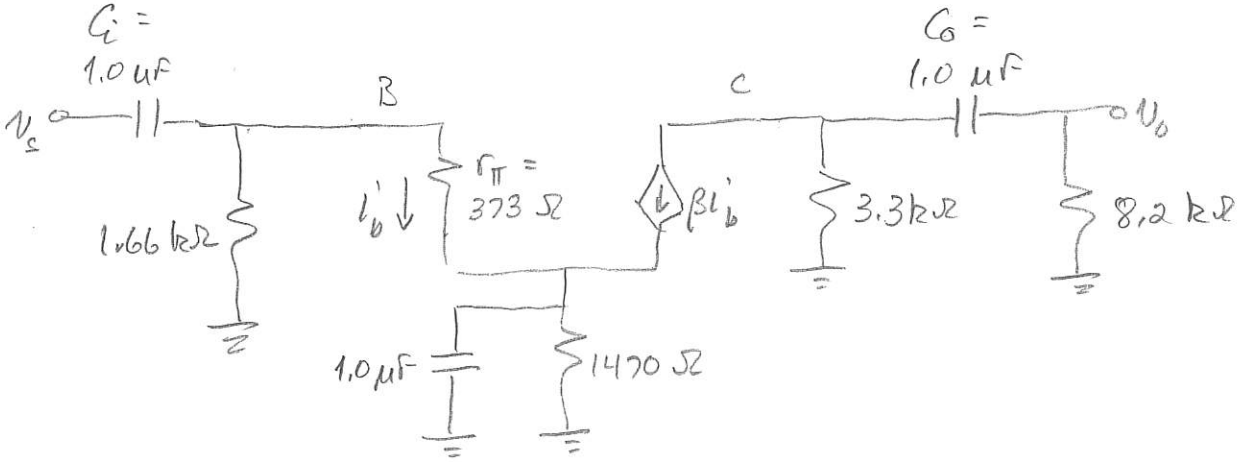
a) We will use hybrid-pi, with $r_\pi = V_T/I_B = \frac{25\ mV}{0.067\ mA} = 373\ \Omega$

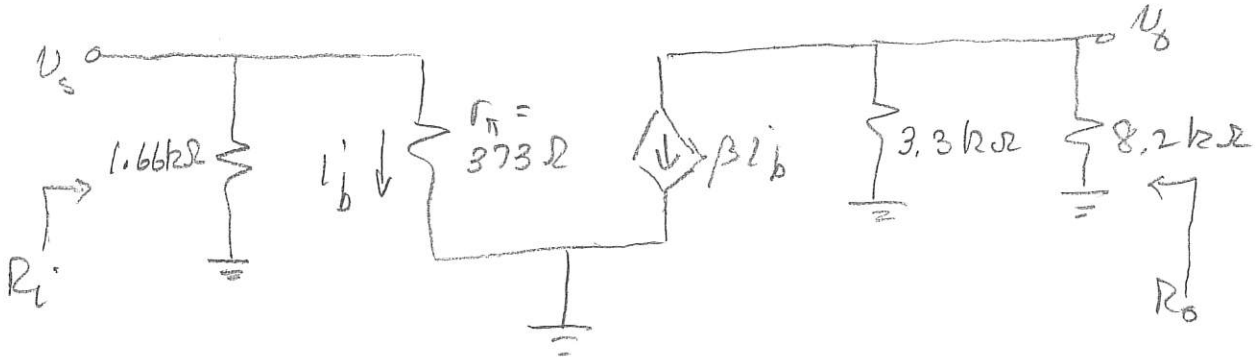
We could also use $g_m = \beta/r_\pi = 0.134$ [S].

For the T-model, we would need $r_e = r_\pi/(\beta+1) = 7.31\ \Omega$



b) In the pass band, $C_i \rightarrow$ short (otherwise we have no input), $C_o \rightarrow$ short (otherwise we have no output), and $C_e \rightarrow$ short (we are given this info). So...

Room for Extra Work



$R_i = 1.66\,k\Omega \,//\, 373\,\Omega = 305\,\Omega$

c) $R_o = 3.3k \,//\, 8.2k = 2.35\,k\Omega$