Name: _____ (please print)

Signature: _____

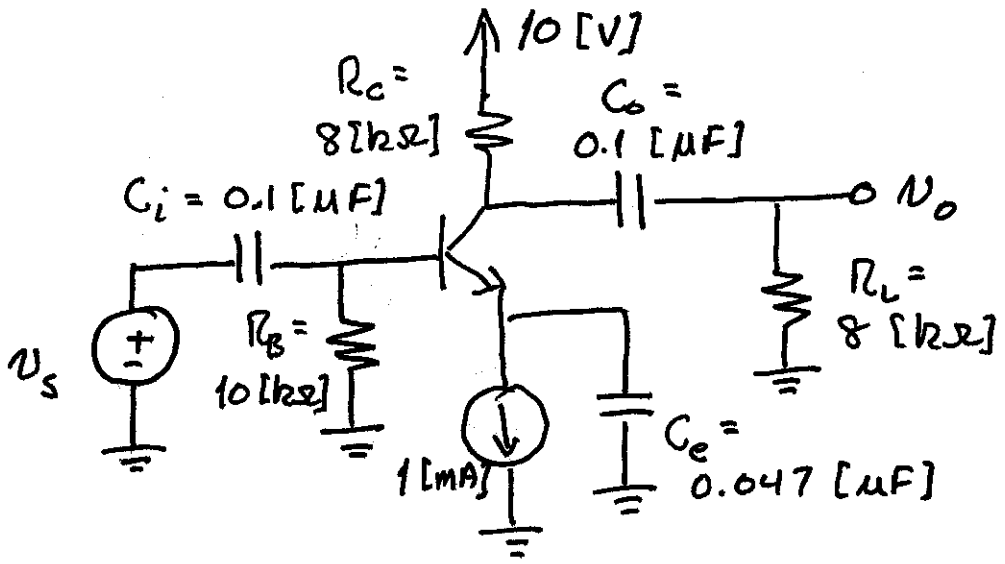
ECE 3455
Quiz #6
April 27, 2007

Quiz duration: 25 minutes

1. You may have one 8 ½ x 11 in. "crib" sheet, written on both sides, during the quiz. You may have any calculator you choose, but no computers. No other notes or materials will be allowed.
2. Show all work necessary to complete the problem on these pages. A solution without the work shown will receive no credit.
3. Show units in intermediate and final results, and in figures.
4. If your work is sloppy or difficult to follow, points will be subtracted.

_____/20

The BJT in the circuit below has $\beta = 100$ and $V_{CE,SAT} = 0.03$ V. It is biased in the linear region; you may assume this without proof. Find the gain v_o/v_s in the passband.



In the passband, all capacitors are shorted. If they are open-circuit, then either the input would be cut off (C_i), the output would be cut off (C_o), or the emitter would be open-circuit to ac (C_e).

We do not need to solve the dc case but we need I_C:

$$I_E = 1\,\text{mA} \Rightarrow I_C = \frac{\beta}{\beta+1} I_E = 0.99\,\text{mA}.$$

Let's look at biasing anyway:

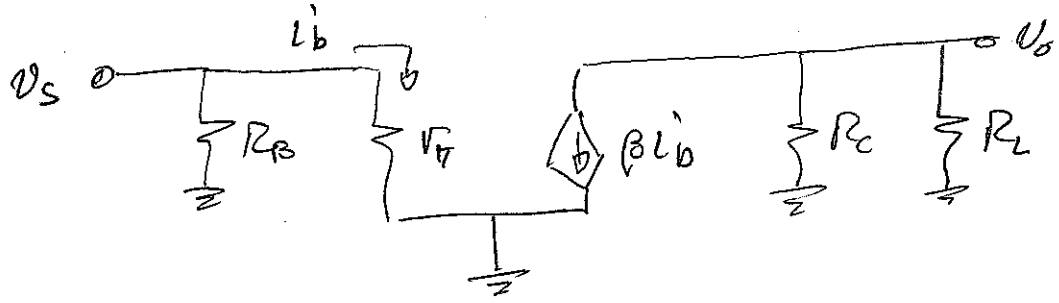
$$V_C - V_E = (10 - I_C R_C) - \underbrace{\left(-\frac{I_C}{\beta} R_B - 0.7\right)}_{V_B} = 3.77\,\text{V}.$$

OK

Room for Extra Work

$r_\pi = \frac{\beta V_T}{I_C} = \beta \frac{0.025}{0.99 \times 10^{-3}} = 2525\ \Omega$

ac model:



So $\frac{v_o}{v_s} = \frac{-\beta i_b (R_C \| R_L)}{i_b r_\pi} = -\beta \frac{R_C \| R_L}{r_\pi}$

$= -100 \cdot \frac{4000}{2525}$

$\frac{v_o}{v_s} = -158.$