Name: _____ (please print)

Signature: _____

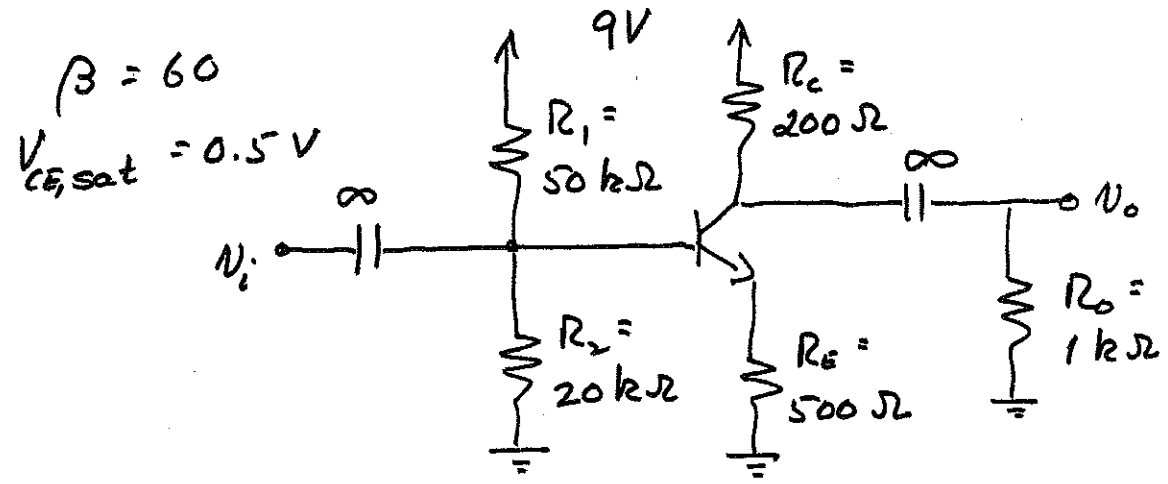
ECE 3455
Quiz 6
December 2, 2010

Quiz duration: 30 minutes

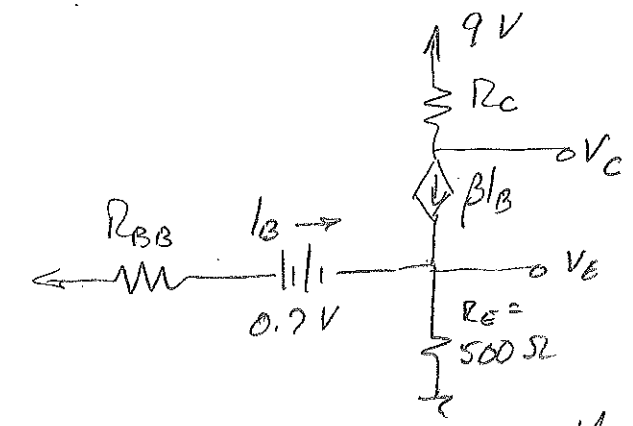
1. You may have one 8 ½ x 11 in. "crib" sheet, written on both sides, during the quiz. You may have any calculator you choose, but no computers. No other notes or materials will be allowed.
2. Show all work necessary to complete the problem on these pages. A solution without the work shown will receive 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 circuit below is biased in active mode. You may assume that without showing it. Draw the ac model for this BJT, and find the gain v_o/v_i.



DC Analysis:



$V_{BB} = 9 \cdot \frac{20}{20+50} = 2.57\,V$

$R_{BB} = 50k \| 120k = 14.3\,k\Omega$

+2

$I_B = \frac{V_{BB} - 0.7}{R_{BB} + (\beta+1)\,500} = 41.7\,\mu A \Rightarrow r_\pi = \frac{V_T}{I_B} = 600\,\Omega$

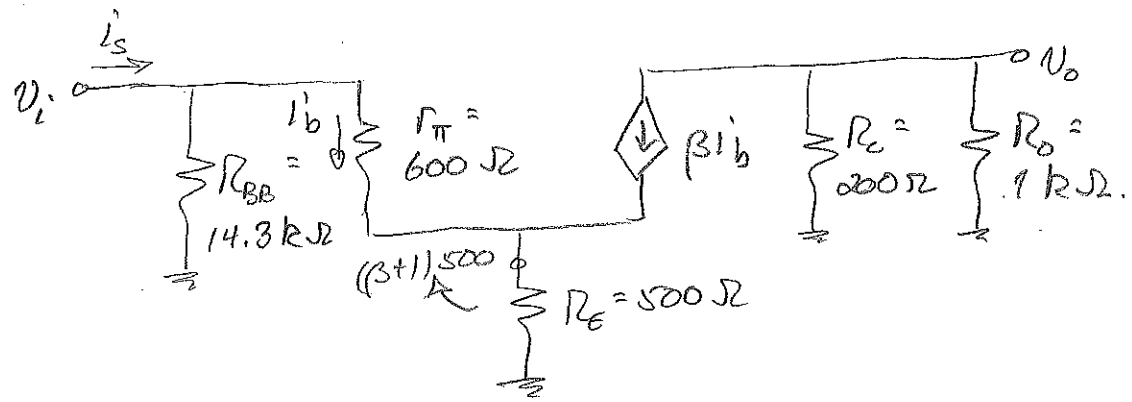
We weren't asked to show active region, but...

$V_{CE} = (9 - R_C \cdot \beta I_B) - (R_E(\beta+1)I_B) = 8.5 - 1.27 = 7.23\,V$ ✓

Room for Extra Work

+12

AC Analysis: C → short



$$v_o = -\beta i_b \cdot R_c \,//\, R_o$$

$$i_b = \frac{v_i}{r_\pi + (\beta+1)R_E}$$

+6

$$\frac{v_o}{v_i} = \frac{-\beta R_c \,//\, R_o}{r_\pi + (\beta+1)R_E}$$

$$= \frac{-60 \cdot 200 \,//\, 1000}{600 + 61(500)}$$

$$= -0.322 \ \text{V/V}$$