Name: _____ (please print)

Signature: _____

ECE 3455
Quiz #5
Summer 2010

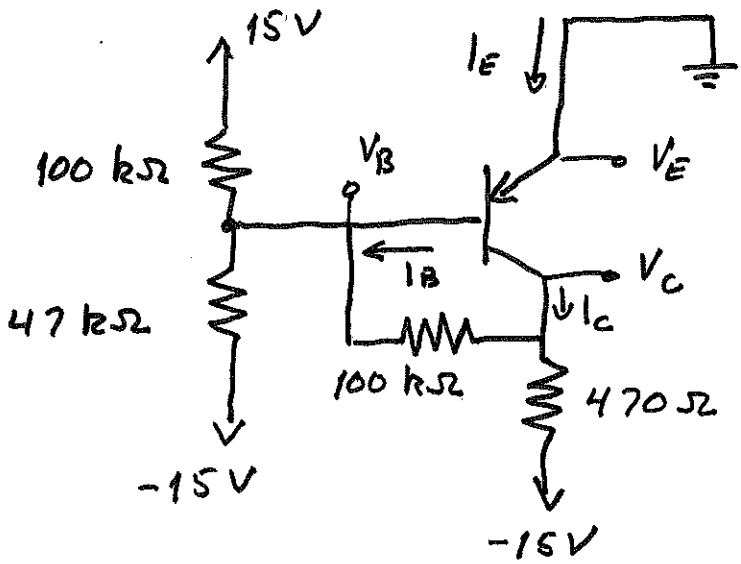
Quiz duration: 25 minutes

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.

SOLUTION

_____/20

For the BJT below, find VC, VB, VE, IC, IB, and IE and state the mode of operation. Credit will be given for an initial guess that is not correct, if you prove that it is not correct.



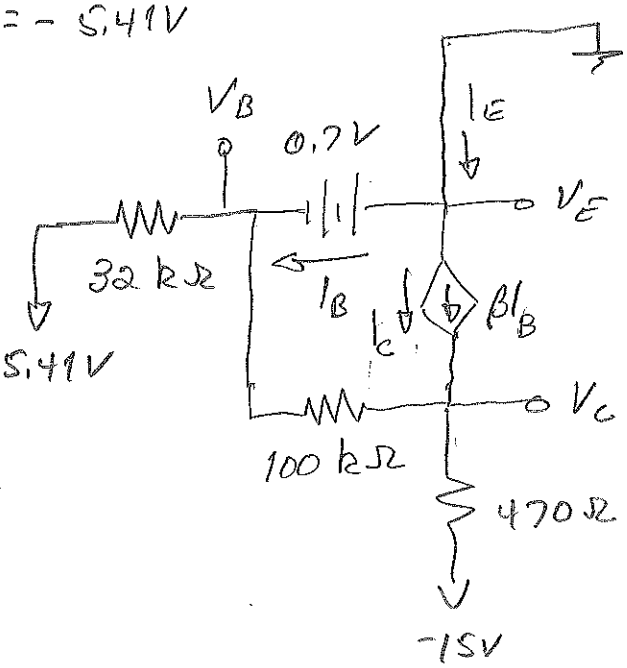
$\beta = 99$

$-V_{CE,sat} = 0.3\,V$

We Thevenize the base first:

$R_{Th} = 100\,k\Omega \,//\, 47\,k\Omega = 32\,k\Omega$

$V_{Th} = 30 \cdot \frac{47}{100+47} - 15 = -5.41\,V$



This V_{Th} looks like it will turn on the BE junction. Also, with -15 V at the collector, we will assume linear region.

Room for Extra Work

We have right away that $V_E = 0$ $V_B = -0.7\,V$

Node voltage for V_c:

$$\frac{V_c + 15}{470} + \frac{V_c + 0.7}{100 \times 10^3} - \beta I_B = 0$$

$$I_B = \frac{-0.7 + 5.41}{32 \times 10^3} - \frac{V_c + 0.7}{100 \times 10^3}$$

This gives $V_c = -5.77\,V$

So $I_B > 0$ and $V_{CE} < V_{CESAT}$ $\Rightarrow$ active region.

$I_B = 198\,\mu A$

$I_E = I_B + \beta I_B = 19.8\,mA$

$I_C = \beta I_B = 19.6\,mA$