

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

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

ECE 3355 – Quiz #5  
November 14, 2019

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

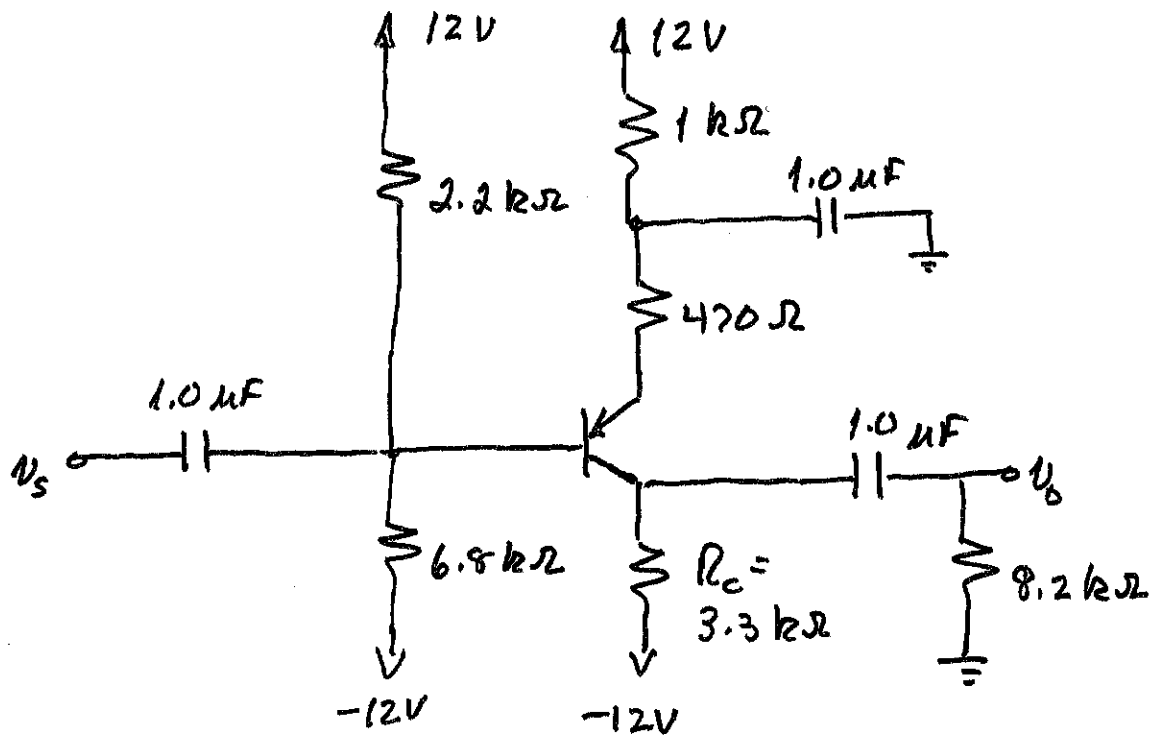
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order 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.

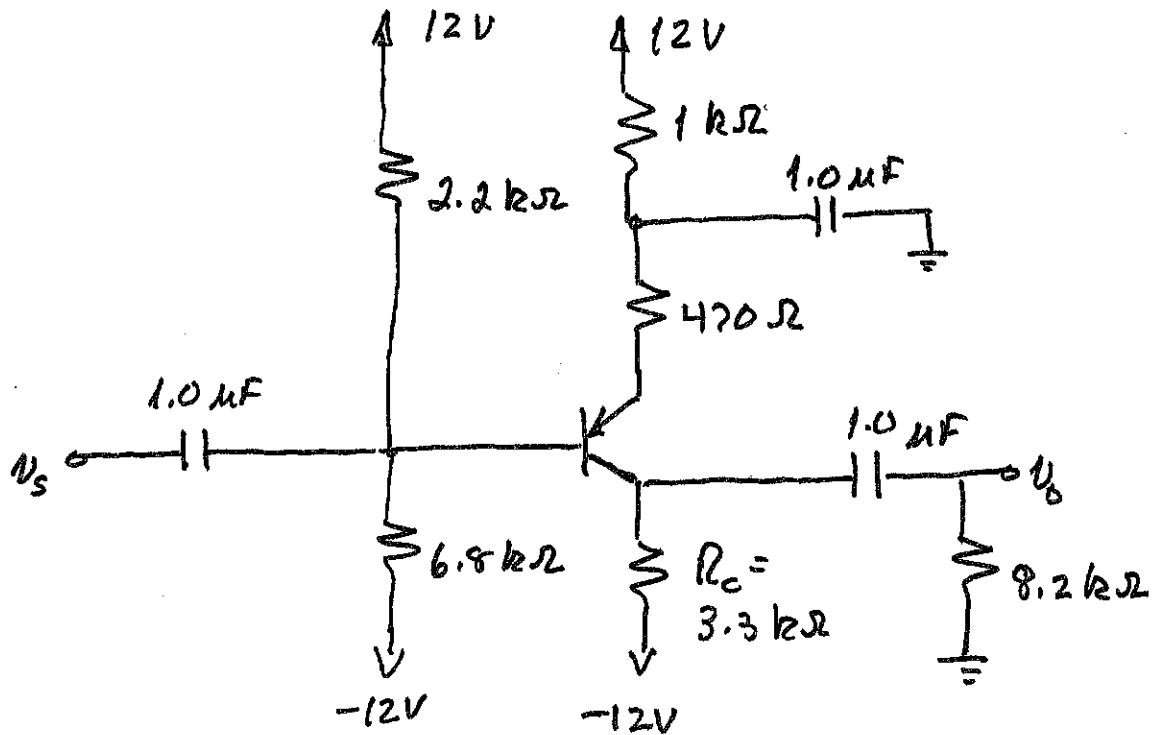
- Show that the BJT is biased in the linear (active) region. Be sure to conduct all necessary tests to show this. Assume  $\beta = 50$  and  $V_{CE,SAT} = -0.2 \text{ V}$ .
- Is there a value of  $R_C$  that will put the BJT in a region other than linear? If there is, find this value. If there is not, explain how you know this.



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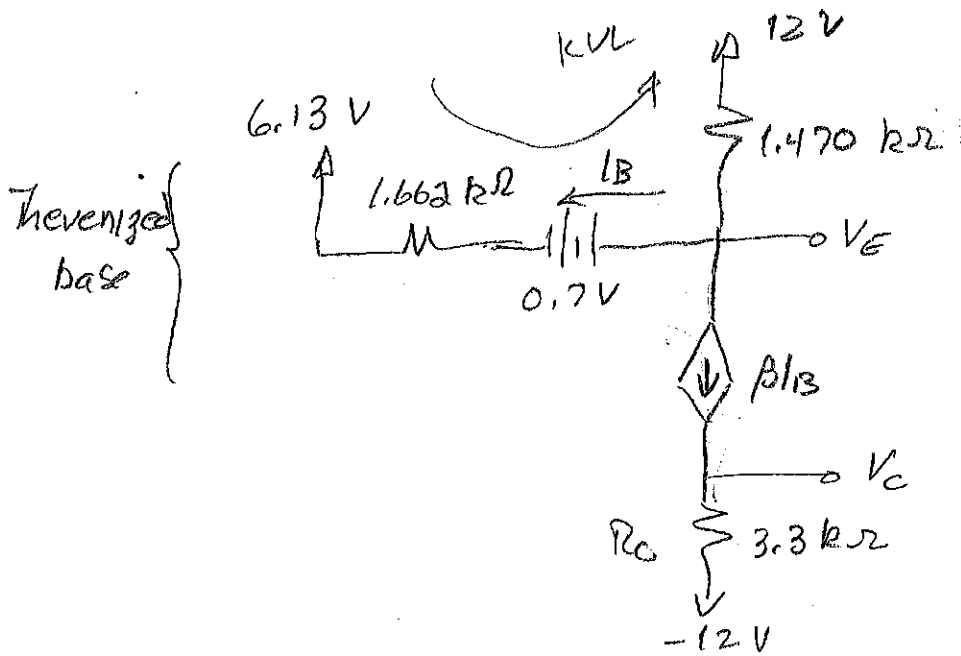
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We are interested in a dc analysis, so  $C \rightarrow$  open ckt.  
 The model for active region for pnp is on the next page.  
 we need to show that

$$I_B > 0 \quad V_{CE} < -0.2 \text{ V} \quad \rightarrow$$

Room for Extra Work



BASE:

$$V_{Th} = 24 \cdot \frac{6.8}{6.8 + 2.2} - 12$$

$$= 6.13 \text{ V}$$

$$R_{Th} = 6.8 \parallel 2.2 = 1.662 \text{ k}\Omega$$

B-E KVL:  $-6.13 - 1.662 I_B - 0.7 - 51(1.470) I_B + 12 = 0$

$$I_B = 67 \mu\text{A} \checkmark$$

KVL:

$$-12 + (\beta + 1) I_B (1.470) + V_E = 0 \Rightarrow V_E = 6.97 \text{ V}$$

KVL

$$V_C = \beta I_B \cdot 3.3 - 12 = -0.945 \text{ V}$$

$$V_{CE} = V_C - V_E = -7.92 \text{ V} \checkmark$$

So tests are satisfied and BJT is in linear (active) region.

If  $V_{CE} > -0.2 \text{ V}$ , say  $V_{CE} = 0 \text{ V}$ , the BJT is not in the linear region. Setting  $V_C = 6.97 \text{ V}$  will accomplish this.

$$V_C = \beta I_B \cdot R_C - 12 = 6.97 \Rightarrow R_C = \frac{6.97 + 12}{\beta I_B} = 5.663 \text{ k}\Omega$$