ECE 3050 Analog Electronics Quiz 1

May 26, 2010

Professor Leach Last Name:_____ First Name:_____

Instructions. Print and sign your name in the spaces above. Place a box around answers when appropriate.

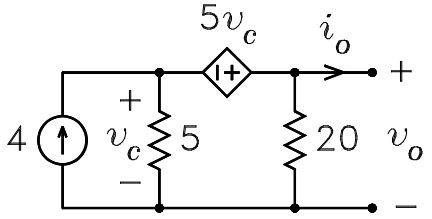
Honor Code Statement: *I have neither given nor received help on this quiz.* Initials _____

1 of 2. (a) Solve for v_o with $i_o = 0$.

(b) Solve for i_o with $v_o = 0$.

(c) What is the output resistance r_{out}?

(d) Draw the Thévenin and Norton equivalents at the circuit output.



$$v_c = 4 \times 5 \| 20 - 5v_c \frac{5}{5+20} = 16 - v_c \Longrightarrow v_c = 8\,\text{V}$$

$$v_{o(oc)} = 4 \times 5 \| 20 + 5v_c \frac{20}{5+20} = 16 + 4v_c = 48\,\text{V}$$

$$v_c = 4 \times 0 + \frac{5v_c}{5} \Longrightarrow v_c = 0$$

$$i_{(sc)} = 4 + \frac{5v_c}{5} = 4\,\text{A}$$

$$r_{out} = \frac{v_{o(oc)}}{i_{o(sc)}} = \frac{48}{4} = 12\,\Omega$$

2 of 2. (a) Draw and label the hybrid-π model of the BJT. On the drawings, include labels for the currents i_b, i_e, i'_e, i_c, and i'_c and labels for the resistors r_π and r_0. Answer: See class notes.

(b) How is the hybrid-π model converted into the T model? Explain any condition that must hold for the models to be equivalent and and draw the T model. Answer: Replace r_π in the i_b branch with r_e in the i'_e branch such that $i_b r_\pi = i'_e r_e$.