ECE 3040 Quiz 8 – July 13, 2005

Professor Leach Name_____

Instructions. Print your name in the space above. The quiz is closed-book and closed-notes. The quiz consists of one problem. **Honor Code Statement:** *I have neither given nor received help on this quiz.* Initials _____

1. The figure shows two common-emitter stages in cascade. It is given that $R_B = 1\,\text{k}\Omega$, $R_C = 10\,\text{k}\Omega$, $I_C = 1\,\text{mA}$, $V_{CE} = 10\,\text{V}$, $V_A = 40\,\text{V}$, $V_T = 25\,\text{mV}$, $\beta = 99$, $g_m = I_C/V_T$, $r_\pi = V_T/I_B$, $r_e = V_T/I_E$, and $r_0 = (V_A + V_{CE})/I_C$.
   (a) What are the values of g_m, r_π, r_0, and r_e?

$$g_m = \frac{0.001}{0.025} = 0.04\,\text{S} \quad r_\pi = \frac{0.025}{0.001/99} = 2475\,\Omega$$
$$r_e = 25.25\,\Omega \quad r_0 = 50\,\text{k}\Omega$$

   (b) Draw the π model for the two transistor circuit. You must use this circuit model to solve for the following three parts. Credit will not be given if any answers are written from memory without their derivation from the circuit.
   (c) What is the value of v_{b2}/v_i?

$$\frac{v_{b2}}{v_i} = \frac{1}{R_B + r_\pi} \times (-\beta) \times r_0 \| R_C \| r_\pi = -54.37$$

   (d) What is the value of v_o/v_{b2}?

$$\frac{v_0}{v_{b2}} = \frac{1}{r_\pi} \times (-\beta) \times r_0 \| R_C = -333.33$$

   (e) What is the value of v_o/v_i?

$$\frac{v_o}{v_i} = \frac{v_{b2}}{v_i} \times \frac{v_0}{v_{b2}} = 1.812 \times 10^4$$