

ECE 3050 Analog Electronics Quiz 10

July 22, 2009

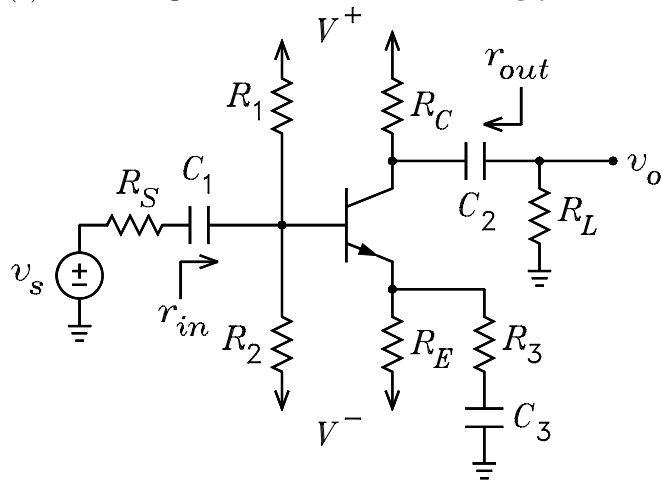
Professor Leach Last Name: _____ First Name: _____

Instructions. Print your name in the spaces above. Place a box around any answer. Credit will not be given for any answer without full supporting work. **Honor Code Statement:** *I have neither given nor received help on this quiz.* Initials _____

$$r_{ib} = r_x + r_\pi + (1 + \beta) R_{te} \quad r_\pi = \frac{V_T}{I_B} \quad r_{ie} = r'_e = \frac{R_{ib} + r_x}{1 + \beta} + r_e \quad r_e = \frac{V_T}{I_E} \quad r_{ic} = \frac{r_0 + r'_e \parallel R_{te}}{1 - \frac{\alpha R_{te}}{r'_e + R_{te}}} \quad r_0 = \frac{V_A + V_{CE}}{I_C}$$

A CE amplifier is shown. It is given that $R_1 = 100 \text{ k}\Omega$, $R_2 = 120 \text{ k}\Omega$, $R_C = 5.1 \text{ k}\Omega$, $R_E = 6.8 \text{ k}\Omega$, $R_S = 3 \text{ k}\Omega$, $R_L = 15 \text{ k}\Omega$, $V^+ = 15 \text{ V}$, $V^- = -15 \text{ V}$, $V_{BE} = 0.65 \text{ V}$, $V_T = 25 \text{ mV}$, $\beta = 99$, $\alpha = 0.99$, $r_x = 50 \Omega$, $V_A = \infty$, $R_3 = 120 \Omega$, $C_1 = 0.15 \mu\text{F}$, $C_2 = 2.2 \mu\text{F}$, $C_3 = 120 \mu\text{F}$, and $I_C = 2.53 \text{ mA}$.

- Solve for the worst case pole frequency set by C_1 .
- Solve for the worst case pole frequency set by C_2 .
- Solve for the worst case pole and zero frequencies set by C_3 .
- Solve for the worst case lower cutoff frequency in Hz using the equation $f_L = \sqrt{\Sigma p_{pole}^2 - 2\Sigma f_{zero}^2}$
- Which capacitor dominates in setting f_L ?



$$r_{ib} := r_x + r_\pi + (1 + \beta) \cdot R_{te} \quad r_{ib} = 1.301 \cdot 10^4$$

$$r_{in} := R_{p2}(r_{ib}, R_{p2}(R_1, R_2)) \quad r_{in} = 1.05 \cdot 10^4$$

$$\tau_1 := (R_S + r_{in}) \cdot C_1 \quad \tau_1 = 2.026 \cdot 10^{-3} \quad f_1 := \frac{1}{2 \cdot \pi \cdot \tau_1} \quad f_1 = 78.567$$

$$\tau_2 := (R_C + R_L) \cdot C_2 \quad \tau_2 = 0.044 \quad f_2 := \frac{1}{2 \cdot \pi \cdot \tau_2} \quad f_2 = 3.599$$

$$\tau_{3p} := (R_{p2}(R_E, r'_e) + R_3) \cdot C_3 \quad \tau_{3p} = 0.019 \quad f_{3p} := \frac{1}{2 \cdot \pi \cdot \tau_{3p}} \quad f_{3p} = 8.27$$

$$\tau_{3z} := (R_E + R_3) \cdot C_3 \quad \tau_{3z} = 0.83 \quad f_{3z} := \frac{1}{2 \cdot \pi \cdot \tau_{3z}} \quad f_{3z} = 0.192$$

$$f_L := \sqrt{f_1^2 + f_2^2 + f_{3p}^2 - 2 \cdot f_{3z}^2} \quad f_L = 79.082$$