EECE301 Problem Set #5

1. For the circuit in Figure 1, do the following:

a) Draw the high-frequency small-signal model.

b) Show that $v_{\pi 1} = v_{\pi 2}$ at midband, irrespective of whether $\beta_1 = \beta_2$ or not.

c) Find expressions for the 3 high-frequency poles.

d) Which of the 3 high-frequency poles do you think will be the dominant pole. Briefly explain your choice.

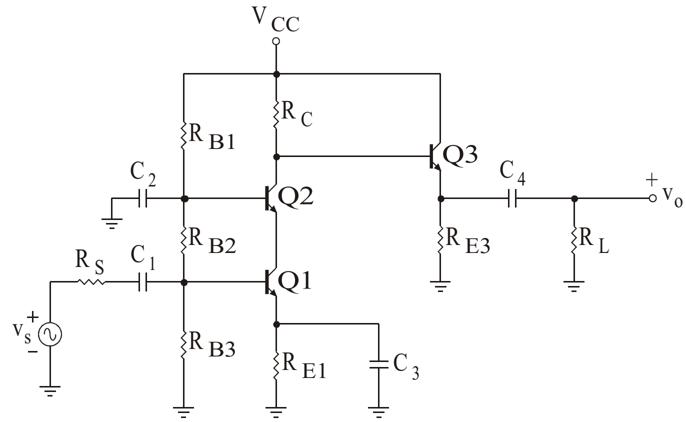

Figure 1.

2) Give the transfer function of the circuit shown in figure 2 with numerical values for the poles, zeros and mid band gain. You may assume that $V_{C1} = V_{B2} = 10V$ and that $V_{E1} = 5V$. You may also assume that the pole and zero associated with $c_{\pi 2}$ cancel one another.

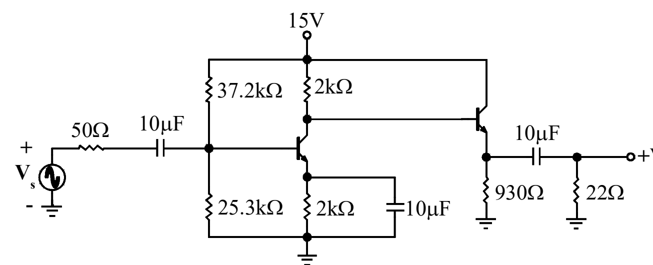

Figure 2.

3) The designers of the circuit shown in figure 3 have used a 1/3 rule to bias the amplifier shown. They have also used "pole-zero cancellation" to give the amplifier the low frequency amplitude response of a single time-constant circuit and have put ω_{L3dB} at 1500/s. Assume that $\beta_1 = 100$ and that $\beta_2 = 1000$. What are the values of C_E and C_{C1} ? ($C_E = 26.6\ \mu F$; $C_{C1} = 3.8\ \mu F$)

4) Assuming that the differential amplifier shown in figure 4 is attached to a load consisting of a 10 kΩ resistor in parallel with a 100 pF capacitor, find the value of the mid band gain and the high frequency 3 dB point. ($A_M = -196$ V/V ; $\omega_{3dB\_H} = 1.98 \times 10^6$/s)

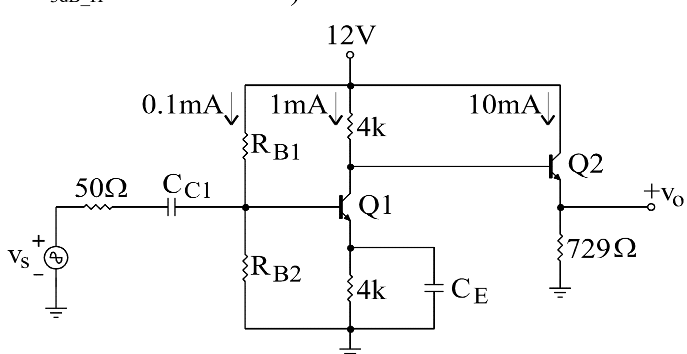

Figure 3.

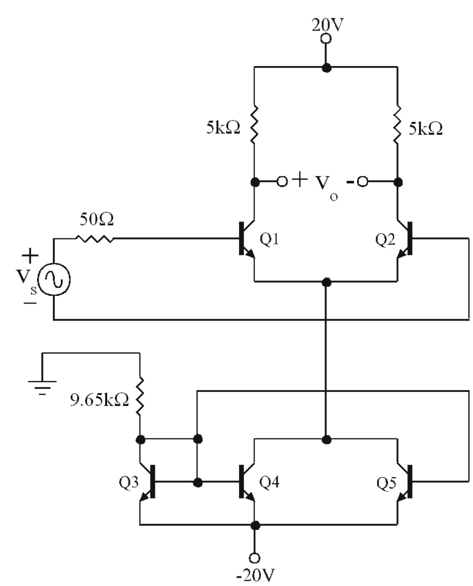

Figure 4.