EEE 109 HW on Amplifier and Frequency Response

1. The pnp transistor circuit shown in Fig. 1 below has the following paramters: R_E = 0.3 kΩ, R_C = 4 kΩ, R_1 = 14.4 kΩ, R_2 = 110 kΩ, R_L = 10 kΩ. The Transistor paramters are β = 100, V_{EB} (on) = 0.7 V, and $V_A = \infty$.
   1) Determine the quiescent values I_{CQ} and V_{ECQ} ?
   2) Find the small signal paramters g_m, r_π, and r_o ?
   3) Determine the small-signal voltage gain A_v ?

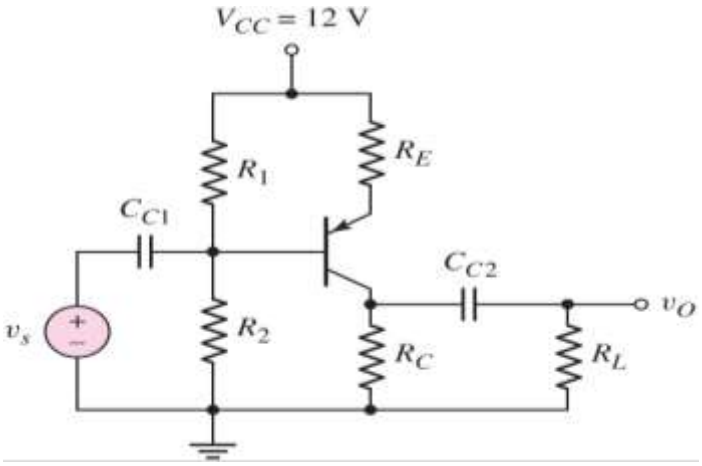

Fig. 1

2. Consider the circuit shown in Fig. 2. Transistors Q_1 and Q_2 are identical, both having $I_{ES} = 10^{-14}$ A and β = 100 where I_{ES} is the reverse-bias saturation current of the B-E junction. Calculate V_{BE} and I_{C2}. Assume that V_T = 26 mV for both transistors.

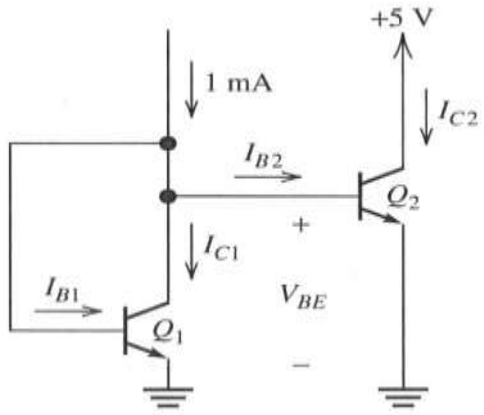

Fig. 2

3. Given $\beta = 100$, $V_{CC} = 12$ V in Fig. 3 below, use $V_{BE} = 0.7$ V, $R_C = 6$ kΩ, $R_B = 50$ kΩ, and $V_{BB} = 1.2$ V to calculate the voltage gain.

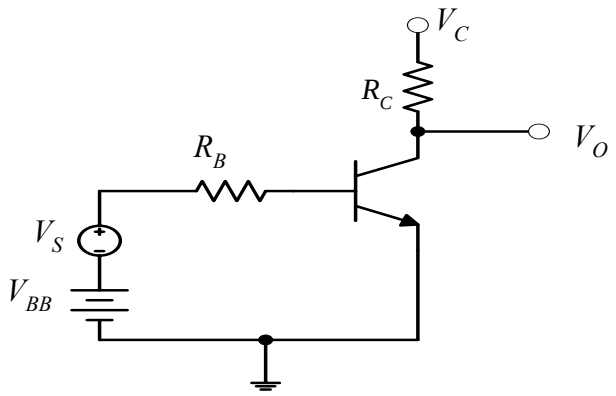

Fig. 3

4. Given Q-point values: $I_{CQ} = 1.6$ mA, $V_{CEQ} = 4.86$ V, $\beta = 100$ and $V_A = 70$ V
   1) Find r_π, g_m, and r_o.
   2) Determine the total low-frequency response of the amplifier.

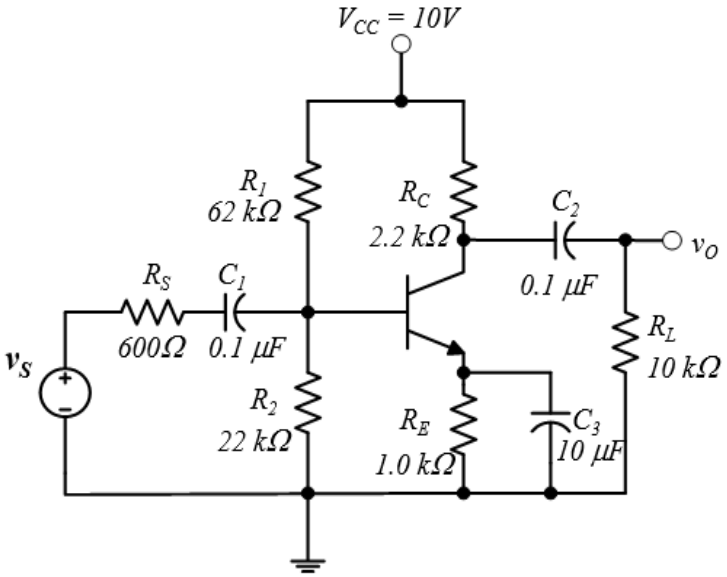

Fig. 4