EE 210   **Assignment #4**   **Assigned: 3.2.21**

1. For the transistor circuit shown in Fig.1, the emitter potential V_E is measured to be equal to -1 V. Determine I_E, V_B, I_B, I_C, V_C, V_{CE}, β, and α. What mode the transistor is operating in? Justify. *Note that a single measurement gives all the information about the transistor and its bias state.* Also, determine the total power drawn by the circuit from the two power supplies (± 5 V). Calculate the power dissipated in the transistor, and the various resistive elements in the circuit. Is the total power for the circuit a conserved quantity? Why or why not?

Fig.1
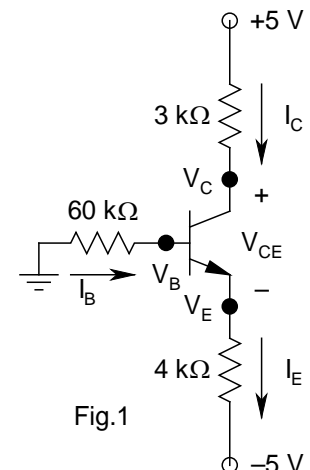
2. Consider the fixed resistor bias network for BJTs, as discussed in class, with $V_{CC} = 5$ V, $R_B = 100$ kΩ, and $R_C = 500$ Ω. The nominal value of β is 100, however, it may vary between 50 and 150. Determine the range of values of I_{CQ} and V_{CEQ}, and express these changes as a percent of the nominal values of I_{CQ} and V_{CEQ}.

3. The circuit shown in Fig.2 uses a transistor having $\beta = 100$.
   a) With $V_{BB} = 0$:
      i) Determine V_{01} and V_{02}.
      ii) What new value of R_C would make $V_{01} = 0$?
   b) Using the component values given in the figure, determine the value of V_{BB} which:
      i) Just barely saturates the transistor.
      ii) Makes the transistor operate with $\beta_{sat} = 10$.

Fig.2
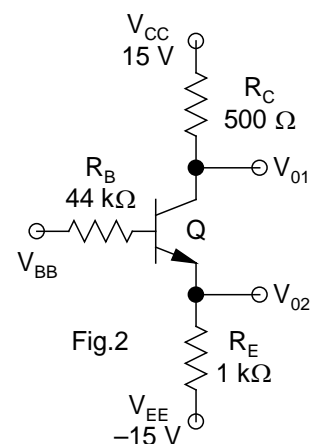
4. Consider the emitter feedback bias network for BJTs, as discussed in class, with $V_{CC} = 5$ V, $R_B = 100$ kΩ, $R_C = 500$ Ω, and $R_E = 1$ kΩ. The nominal value of β is 100, however, it may vary from 50 to 150. Determine the range of values of I_{CQ} and V_{CEQ}, and express these changes as a percent of the nominal values of I_{CQ} and V_{CEQ}. Compare these results with those obtained in Prob.2, and observe how robust this circuit is with respect to transistor β variation.

5. Repeat Prob.4 for the collector feedback bias circuit, as discussed in class. Use the same data as given in Prob.4.