Department of Electrical Engineering
Indian Institute of Technology, Kanpur

EE 210 **Assignment #4** **Assigned: 31.1.25**

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?

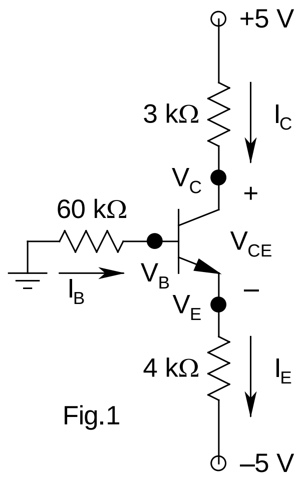

Fig.1

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 β = 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 β_{sat} = 10.

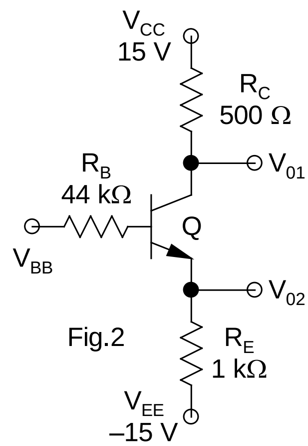

Fig.2

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.