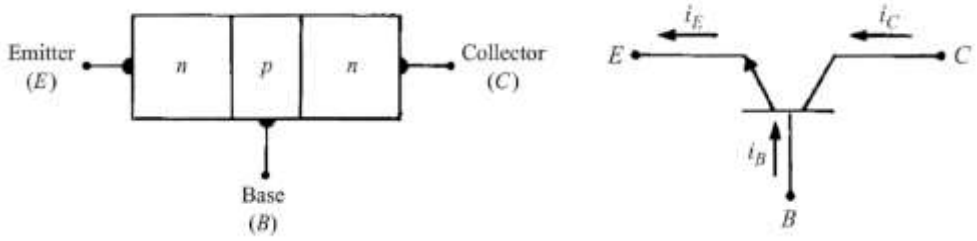
Tutorial Sheet

Bipolar Junction Transistor

1. In a npn transistor, 10^8 holes/μs move from the base to the emitter region while 10^{10} electrons/μs move from the emitter to the base region. An ammeter reads the base current as $I_B = 16\mu A$.

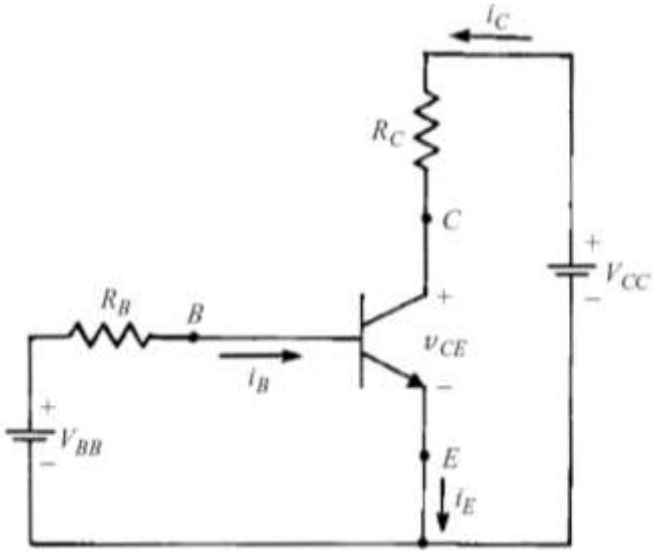
   a) Determine the emitter current I_E and the collector current I_C.



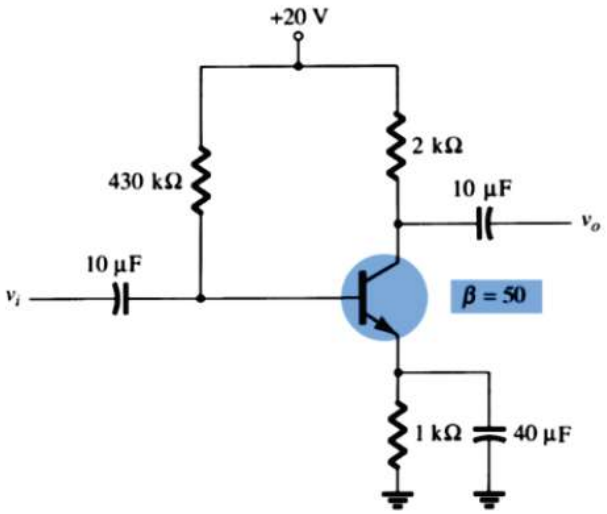
   b) For the previous example, find the α and β, if the leakage currents are considered negligible, and the described charge flow is constant.
   Given data: npn transistor, I_B = 16μA, I_E = 1.618mA, I_C=1.602m

2. A BJT has α=0.99, Base current, I_B=25μA, Leakage current, I_{CBO} = 200nA
   Find the following parameters:
   i. DC collector Current
   ii. DC emitter Current
   iii. % Error in the emitter current when the leakage current is neglected.

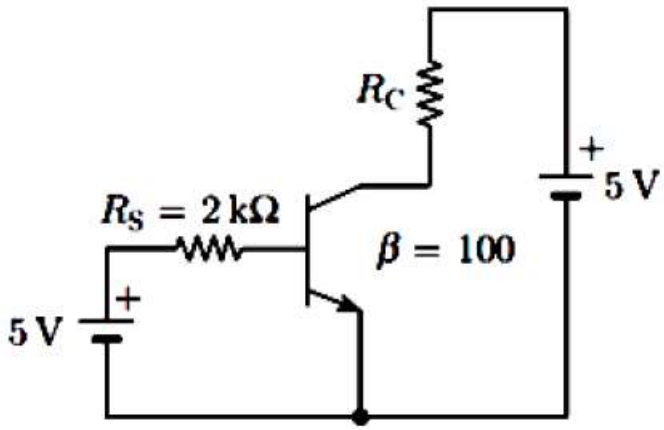
3. In the circuit of Figure, β = 100; I_{BQ} = 20μA, V_{CC}=15 V and R_C= 3k. If I_{CBO}= 0, find (a) I_{EQ} b) V_{CEQ}. (c) Find V_{CEQ} if R_C is changed to 6 KΩ and all else remains the same.



4. For the emitter bias circuit shown below, determine collector current *Ic (in mA)*.
   Assume V_{BE} = 0.7 V



5. The transistor in the given circuit should always be in the active region. Take $V_{CE(Sat)}$ = 0.2 V, V_{BE} = 0.7 V. What is the maximum value of R_c in Ω which can be used?



6. In the circuit of given figure Vcc = 12 V, Vs = 2V, Rc = 4 kΩ, and R = 100 kΩ. The Ge transistor is characterized by β= 50; I_{CEO} = 0, and V = 0.2V. Find the value of R (in kΩ) that just results in saturation if the capacitor is replaced with a short circuit. V_{BE} for germanium transistor = 0.3 V