19ELC101 Electrical & Electronic Circuits

Assignment #6 **SOLUTION** **Due Date: 15th April 2022**

Q1. A transistor has a current gain of 175. If the base current is 0.1 mA, what is the collector current?

[Ans: I_C = 17.5 mA]

Q2. A transistor has a collector current of 10 mA and a base current of 40 µA. What is the current gain of the transistor?

[Ans: β = 250]

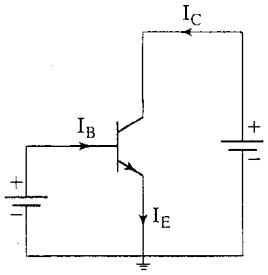
Q3. Consider an npn transistor with v_{BE} = 0.7 V at i_C = 1 mA. Find v_{BE} at i_C = 0.1 mA and 10 mA.

[Ans. 0.64 V; 0.76 V]

Q4. Transistors of a certain type are specified to have β values in the range 50 to 150. Find the range of their α values.

[Ans: 0.980 to 0.993]

Q5. A transistor is connected as shown in figure and has a base current of 16µA and a beta of 80. What is the collector current and emitter current of the transistor?

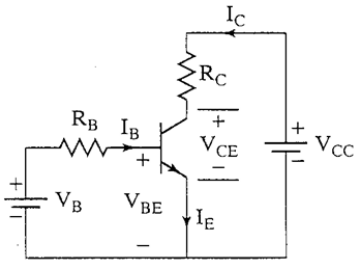


[Ans: Ic = 1.28 mA, I_E = 1.296 mA]

Q6. Measurement of an *npn* BJT in a particular circuit shows the base current to be 14.46µA, emitter current to be 1.460 mA, and the base-emitter voltage to be 0.7 V. Calculate α, β, and I_S.

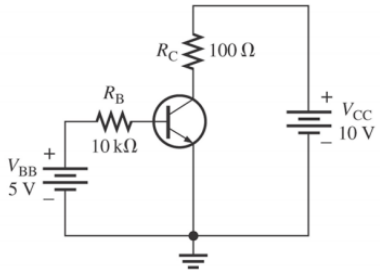
[Ans: α = 0.99, β = 100, $I_S = 10^{-15}$ A]

Q7. For the circuit shown below with R_B = 100kΩ, R_C = 2kΩ, V_B = 3V, V_{CC} = 9V and β=120, determine the collector current and V_{CE}.



[Ans: I_B = 23µA, I_C = 2.76 mA, V_{CE} = 3.48 V]

Q8. Determine I_B, I_C, I_E, V_{BE}, V_{CE}, and V_{CB} in the circuit. Assume β_{DC} = 150.



Solution:

$$V_{BE} = 0.7\ \text{V}$$

$$I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{5 - 0.7}{10\ \text{k}\Omega} = 430\ \mu\text{A}$$

$$I_C = \beta_{DC} I_B = 150 * 430\ \mu A = 64.5 mA$$

$$I_E = I_C + I_B = 64.5 mA + 430\ \mu A = 64.9 mA$$

$$V_{CE} = V_{CC} - I_C R_C = 10 - (64.5 mA * 100\Omega) = 3.55 V$$

$$V_{CB} = V_{CE} - V_{BE} = 3.55 V - 0.7 V = 2.85 V$$

$$\left.\begin{array}{l} *V_{BE} = 0.7 V, \text{forward bias} \\ V_{CB} = V_C - V_B = 2.85 V, \text{reverse bias} \end{array}\right\} \text{Mode active}$$