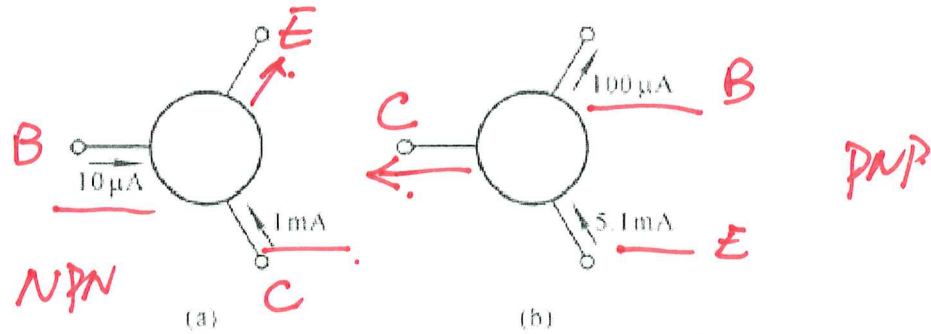


EE3122 Analogue Circuit Fundamentals Tutorial 1

Q1. Given a BJT transistor with current information available at two terminals, please determine the current value and direction at the remaining terminal.



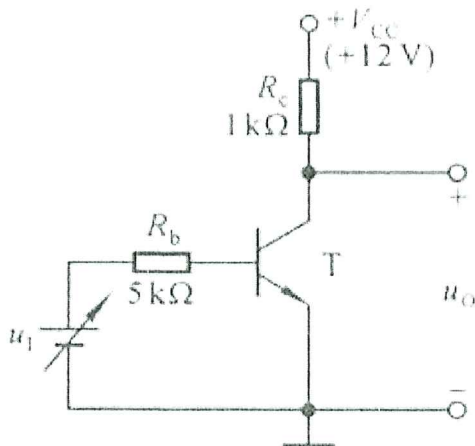
$$(a) \quad \beta = \frac{I_C}{I_B} = 100$$

$$I_E = 1.01 \text{ mA}$$

$$(b) \quad 1 + \beta = \frac{I_E}{I_B} = 51$$

$$\beta = 50 \quad I_C = 5 \text{ mA}$$

Q2. Given circuit below, please determine the operation region of transistor and the output voltage u_o given $u_i = 0 \text{ V}$, 1 V , and 3 V (suppose $V_{BE} = 0.7 \text{ V}$ and $\beta = 50$).



$$(1) \quad u_i = 0 : \text{cut-off}$$

$$(2) \quad u_i = 1 \text{ V. Assume T in Active Region}$$

$$I_B = \frac{u_i - V_{BE}}{R_b} = 60 \mu\text{A}$$

$$I_C = \beta I_B = 3 \text{ mA}$$

$$u_o = V_{cc} - I_C R_c = 9 \text{ V}$$

Assumption holds

$$(3) \quad u_i = 3 \text{ V Assume T in Active Region}$$

$$I_B = \frac{u_i - V_{BE}}{R_b} = 0.46 \text{ mA} \quad I_C = \beta I_B = 23 \text{ mA}$$

$$u_o = V_{cc} - I_C R_c = -11 \text{ V} < V_{BE} = 0.7 \text{ V}$$

in Saturation Region. $u_o \approx 0.7 \text{ V}$