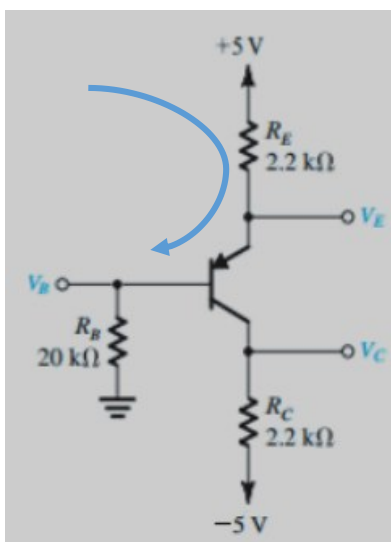


Pekerjaan Rumah #4

EL2040 Elektronika

1. Untuk rangkaian **Gambar 1**, apabila diketahui $\beta = 50$, tentukan nilai
 - a) V_B , V_C , dan V_E
 - b) Apabila nilai R_B naik menjadi $100 \text{ k}\Omega$, tentukan V_B , V_C , dan V_E
 - c) Untuk nilai $R_B = 100 \text{ k}\Omega$, tentukan nilai agar diperoleh nilai V_B , V_C , dan V_E sama dengan yang diperoleh pada soal 1 a).



Gambar 1

a) Karena BJT berada pada kondisi aktif, maka $V_{BE} = 0.7 \text{ V}$, $I_E = (\beta+1)I_B$, $I_C = \beta I_B$

$$5 - 2.2I_E - V_{BE} - 20I_B = 0$$

$$5 - 2.2(\beta + 1)I_B - 0.7 - 20I_B = 0$$

$$I_B = 0.0325 \text{ mA}$$

$$I_E = (\beta+1)I_B$$

$$= (51)(0.0325)$$

$$= 1.66 \text{ mA}$$

$$V_E = 5 - (2.2)(1.66)$$

$$= 1.35 \text{ V}$$

$$I_C = \beta I_B$$

$$= (50)(0.0325)$$

$$= 1.625 \text{ mA}$$

$$V_C = 2.2I_C - 5$$

$$= (2.2)(1.625) - 5$$

$$= -3.575 \text{ V}$$

b) Karena BJT berada pada kondisi aktif, maka $V_{BE} = 0.7 \text{ V}$, $I_E = (\beta+1)I_B$, $I_C = \beta I_B$

$$5 - 2.2I_E - V_{BE} - 100I_B = 0$$

$$5 - 2.2(\beta + 1)I_B - 0.7 - 100I_B = 0$$

$$I_B = 0.02 \text{ mA}$$

$$I_E = (\beta+1)I_B$$

$$= (51)(0.02)$$

$$= 1.03 \text{ mA}$$

$$V_E = 5 - (2.2)(1.03)$$

$$= 2.73 \text{ V}$$

$$I_C = \beta I_B$$

$$= (50)(0.02)$$

$$= 1 \text{ mA}$$

$$V_C = 2.2I_C - 5$$

$$= (2.2)(1) - 5$$

$$= -2.8 \text{ V}$$

c) Untuk $R_B = 100 \text{ k}\Omega$

$$I_E = 1.66 \text{ mA}$$

$$I_C = 1.625 \text{ mA}$$

Dicari nilai I_B ,

$$5 - 2.2I_E - V_{BE} - 100I_B = 0$$

$$5 - (2.2)(1.66) - 0.7 - (100)I_B = 0$$

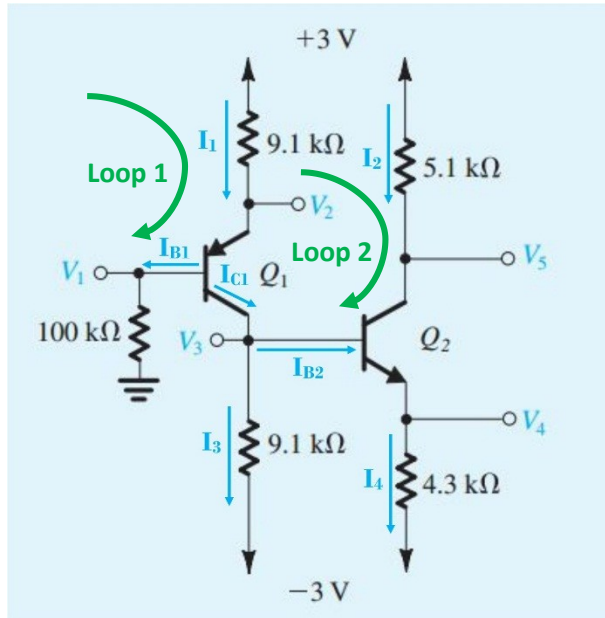
$$I_B = 6.5 \text{ }\mu\text{A}$$

$$\beta = I_C/I_B$$

$$= (1.625)(1000)/6.5$$

$$= 250$$

2. Untuk rangkaian **Gambar 2**, tentukan nilai V_1, V_2, V_3, V_4 , serta arus I_1, I_2, I_3 , dan I_4 untuk:
- $\beta = \infty$
 - $\beta = 100$



Gambar 2

a) Untuk $\beta = \infty$

$$I_3 = I_{C1} - I_{B2}$$

$$I_{B2} = 0 \text{ (karena } \beta = \infty \text{)}$$

$$I_3 = I_{C1} = I_{E1} = 0.253 \text{ mA}$$

Karena $\beta = \infty$, maka

$$I_{B1} = 0 \text{ A dan } I_{C1} = I_{E1}$$

$$V_{B1} = V_1 = 0 \text{ V}$$

Q_1 diasumsikan berada pada kondisi aktif, sehingga $V_{EB1} = 0.7 \text{ V}$

$$V_{EB1} = V_{E1} - V_{B1} = 0.7 \text{ V}$$

$$V_{E1} = V_2 = 0.7 \text{ V}$$

$$I_{E1} = \frac{3 - V_E}{9.1} = \frac{3 - 0.7}{9.1} = 0.253 \text{ mA}$$

$$I_{E1} = I_1 = 0.253 \text{ mA}$$

$$V_3 = -3 + 9.1 \times I_3$$

$$= -3 + 2.3$$

$$V_3 = -0.7 \text{ V}$$

Q2 juga diasumsikan berada pada kondisi aktif, sehingga $V_{EB2} = 0.7 \text{ V}$

$$V_B - V_E = V_3 - V_4 = 0.7$$

$$-0.7 - V_4 = 0.7$$

$$V_4 = -1.4 \text{ V}$$

$$I_4 = \frac{V_4 - (-3)}{4.3} = \frac{1.4 + 3}{4.3} = 0.372 \text{ mA}$$

$$I_4 \cong I_2 = 0.372 \text{ mA}$$

Karena $\beta = \infty$, maka

$$I_{C2} = I_{E2} \quad I_{C2} = I_2 \quad I_{E4} = I_4$$

$$V_5 = 3 - I_2 \times 5.1$$

$$= 3 - 0.372 \times 5.1$$

$$V_5 = 1.1028 \text{ V}$$

b) Untuk $\beta = 100$

Loop 1

$$3 - 9.1I_{E1} - V_{BE} - 100I_{B1} = 0$$

$$V_{B1} = 100I_{B1} = (0.0023)(100)$$

$$V_{B1} = V_1 = 0.23 \text{ V}$$

$$I_C = \beta I_B \quad V_C = \alpha I_E$$

$$\alpha = \beta / (\beta + 1) \quad V_E = I_B(\beta + 1)$$

$$I_{E1} = (\beta + 1)I_{B1} = (101)(0.0023)$$

$$I_{E1} = I_1 = 0.232 \text{ mA}$$

karenanya,

$$3 - 9.1(\beta + 1)I_{B1} - 0.7 - 100I_{B1} = 0$$

$$V_{E1} = 3 - 9.1I_{E1} = 3 - (9.1)(0.232)$$

$$2.3 - 919.1I_{B1} - 100I_{B1} = 0$$

$$V_{E1} = V_2 = 0.889 \text{ V}$$

$$I_{B1} = 0.0023 \text{ mA}$$

$$I_3 = I_{C1} - I_{B2}$$

$$I_{C1} = \beta I_{B1} = (100)(0.0023)$$

$$= 0.23 \text{ mA}$$

Loop 2

$$9.1I_3 - V_{BE} - 4.3I_{E2} = 0$$

$$(0.23 - I_{B2})9.1 - 0.7 - 4.3(\beta+1)I_{B2} = 0$$

$$I_{B2} = 0.00257 \text{ mA}$$

$$I_{E2} = (\beta+1)I_{B2} = 0.259 \text{ mA}$$

$$I_{E2} = I_4 = 0.259 \text{ mA}$$

$$V_4 = (4.3)(0.259) + (-3)$$

$$V_4 = -1.89 \text{ V}$$

$$I_2 = I_{C2} = \beta I_{B2} = (100)(0.00257)$$

$$I_2 = 0.257 \text{ mA}$$

$$V_5 = 3 - 5.1I_2 = 3 - (0.257)(5.1)$$

$$V_5 = 1.69 \text{ V}$$