

Aim:

The aim of this experiment is learn more about β . We understood how the change of β in a transistor circuit can change the Q-point of the circuit. Our aim is find the best circuit for all Beta's are equal.

Experimental Work:

1) $1\text{ k} = 0,981\text{ k}$ $100 = 0,100\text{ k}$ $2,2\text{ k} = 2,184\text{ k}$
 $470\text{ k} = 469\text{ k}$

2)

	V_{CC}	$V_{C_{measured}}$	$V_{B_{measured}}$	$\beta_{calculated}$
2N3903	15 V	12,951 V	0,669 V	68,33
2N3904	15 V	10,29 V	0,715 V	157
BC238B	15 V	4,2 V	0,695 V	360

This part we built the circuit in Fig.1 with $R_B = 470\text{ k}$. We measured V_C and V_B and then we calculated the β for all transistors.

When we look at the table, we can see that our medium β value is belongs to 2N3904.

3) a.

$$R_B = (V_{CC} - V_{CE}) / I_B = (15 - 0,65) / (6\text{mA} / 157) \\ = 375,49\text{ k}$$

b.

$$R_B = (V_{CC} - V_{BE} - I_C R_E) / I_B = (15 - 0,65 - 0,6\text{mA} * 100) / (6\text{mA} / 157) \\ = 359,79\text{ k}$$

c.

$$R_F = (V_{CE} - V_{BE}) / I_B = (15 - 6 - 0,65) / (6 / 157) = \\ = 218,49\text{ k}$$

d.

$$R_2 = (V_{CC} - V_{BE} - I_C R_E) / (I_{R1} + I_B) = (15 - 0,65 - 0,6) / (0,568\text{mA} + 6\text{mA} / 157) \\ = 22,68\text{ k}$$

4)

		$V_{Cmeasured}$	$I_{CQcalculated}$
Circuit in Fig.1	Low β	12,060 V	2,94 mA
	Medium β	9,148 V	5,852 mA
	High β	2,146 V	12,854 mA
Circuit in Fig.2	Low β	11,922 V	3,078 mA
	Medium β	9,126 V	5,874 mA
	High β	2,806 V	12,194 mA
Circuit in Fig.3	Low β	12,312 V	2,688 mA
	Medium β	9,35 V	5,65 mA
	High β	6,140 V	8,86 mA
Circuit in Fig.4	Low β	9,96 V	5,14 mA
	Medium β	9,074 V	5,926 mA
	High β	9,09 V	6,03 mA

5) a.

For Fig.1;

$$\text{Range} = 100 * (12,854 - 2,94) / 5,852 = 169,41$$

For Fig.2;

$$\text{Range} = 100 * (12,194 - 3,078) / 5,874 = 155,19$$

For Fig.3;

$$\text{Range} = 100 * (8,86 - 2,688) / 5,65 = 109,23$$

For Fig.4;

$$\text{Range} = 100 * (6,03 - 5,14) / 5,926 = 15,01$$

b. Most stable circuit is Fig.4, then Fig.3, then Fig.2.
Least stable circuit is Fig.1

$$4 > 3 > 2 > 1$$

