

HOMework #3

Due date: 1st June, 2020

Submission file must be in a PDF format

Question 1. (10pts)

Fill in the “?” to clarify the operation modes of NPN transistors

a.

Mode	EB Junction (Forward or Reverse)	CB Junction (Forward or Reverse)
Cutoff	Reverse	?
Active	?	?
Saturation	?	?

b.

Case	V_E [volts]	V_B [volts]	V_C [volts]	Mode
1	0	0.7	2	?
2	0	1	0.2	?
3	-0.7	0	1	?
5	0	0	5	?

Question 2. (20pts)

Transistors Q1, Q2, Q3 are identical as shown in figure 1. Given that $\beta = 80$.

- Find I_{ref}
- Compute Q-point (V_{CEQ}, I_{CQ}). *Hint: $I_{ref} = I$ and $I \approx I_C$*

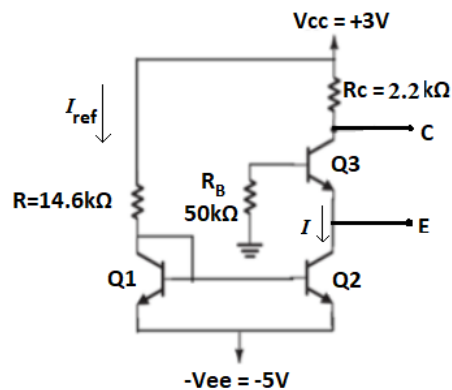


Figure 1

Question 3. (30pts)

- In figure 2a. Find R_C to obtain $V_C = 3\text{ V}$, given that $\beta = 50$.
- Now, if the β is changed from 50 to 100. Find the percentage of change of I_C and V_C .
- In figure 2b. Find the percentage of change change of I_C and V_C , if the β is changed from 50 to 100.

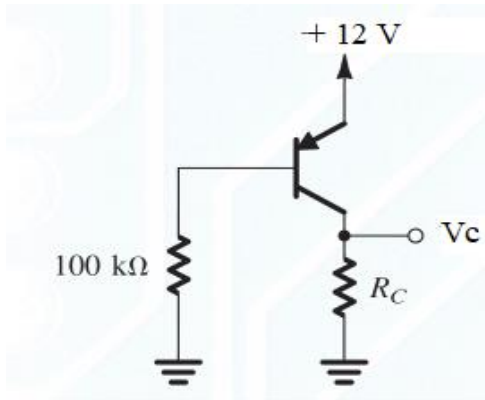


Figure 2a

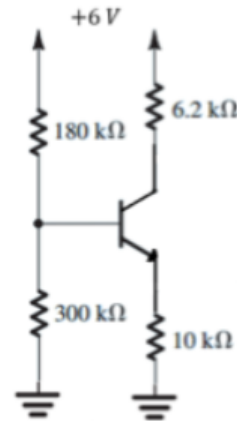


Figure 2b

Question 4. (40pts)

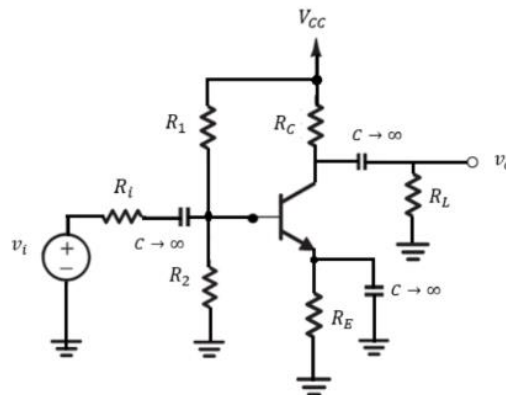


Figure 3

Given the following values: $V_{CC} = 12\text{ V}$, $R_i = 0.4\text{ k}\Omega$, $R_1 = 8.2\text{ k}\Omega$, $R_2 = 2\text{ k}\Omega$, $R_C = 3\text{ k}\Omega$, $R_E = 1\text{ k}\Omega$, $R_L = 1\text{ k}\Omega$ and $\beta = 100$. Use Figure 3 to calculate the followings:

- Give the circuit in DC analysis and sketch DC load line. (Hint: Plot the function I_C versus V_{CE}).
- Find Q-point (I_{CQ} , V_{CEQ})
- Plot the AC equivalent circuit.
- Find $A_v = \frac{v_o}{v_i}$