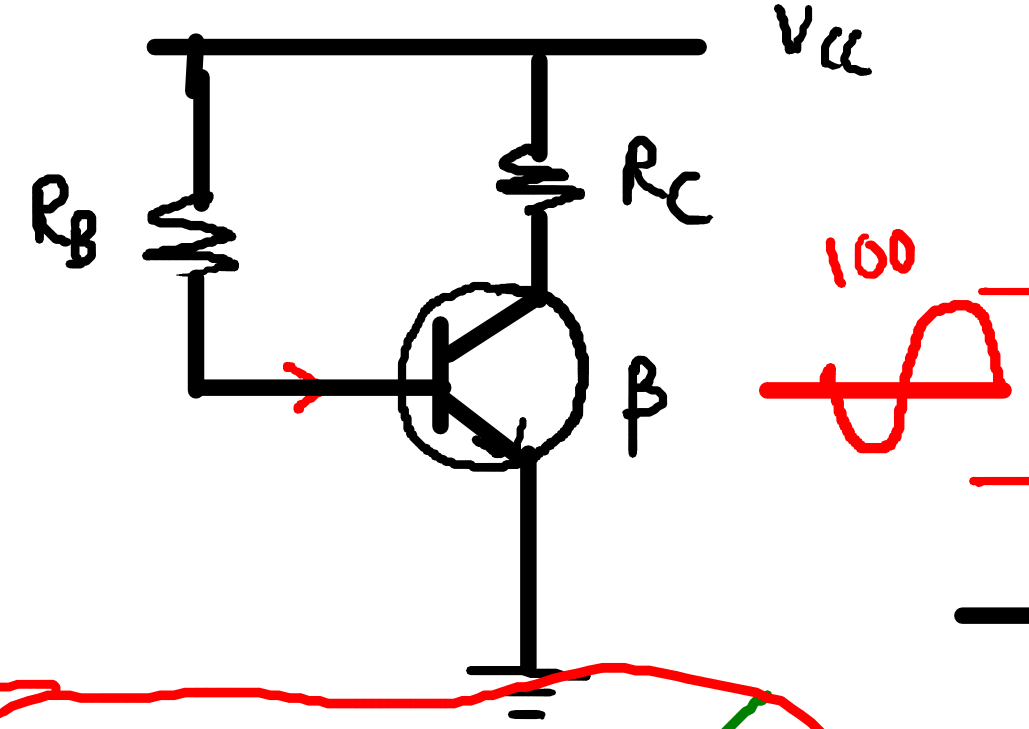
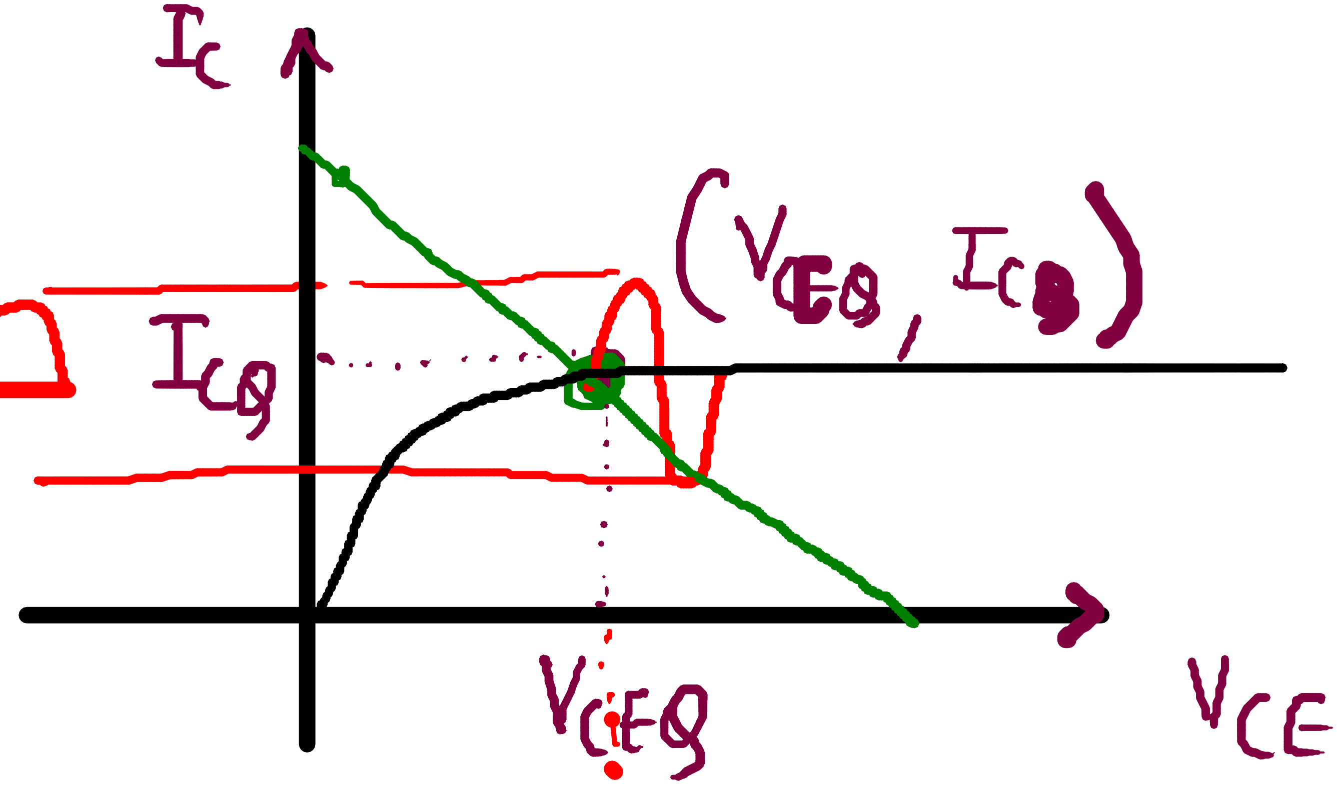
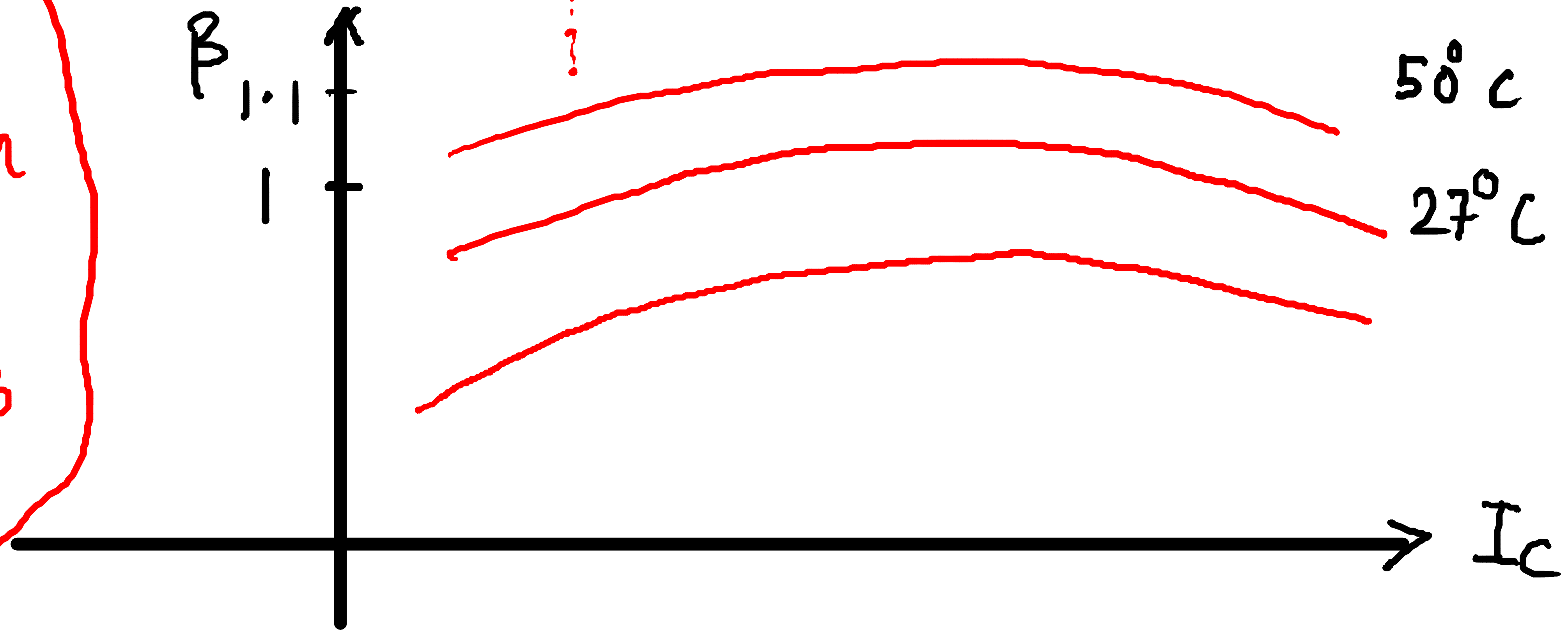




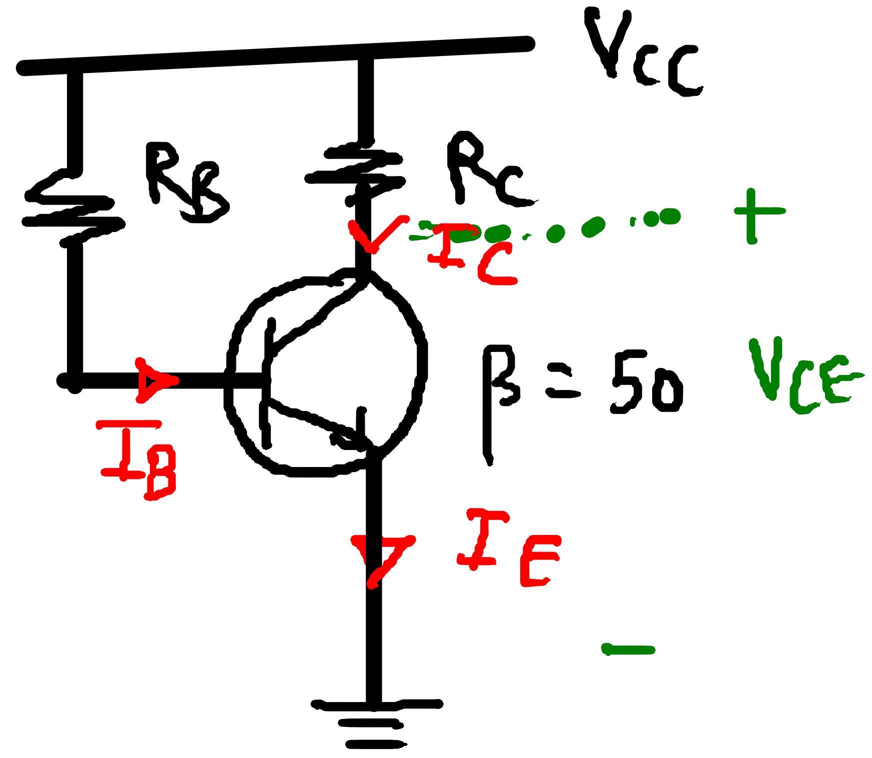
Aim : Fix biasing point (V_{CEQ}, I_{CQ})

Ultimate aim:

Make the transistor operation (output) as independent of β as possible.



Example :



$R_B = 240\,k$; $R_C = 2.2\,K$

$V_{CC} = 12\,V$; $\beta = 50 \longrightarrow 100$

Task ① : Calculate I_B, I_C, V_{CE} for $\beta = 50$

$I_B = 47.08\,\mu$	$I_C = 2.354\,m$	$V_{CE} = 6.8\,V$

0% 100% 76.5%

Task ② : Calculate I_B, I_C, V_{CE} for $\beta = 100$

$I_B = 47.08\,\mu$	$I_C = 4.708\,m$	$V_{CE} = 1.6\,V$

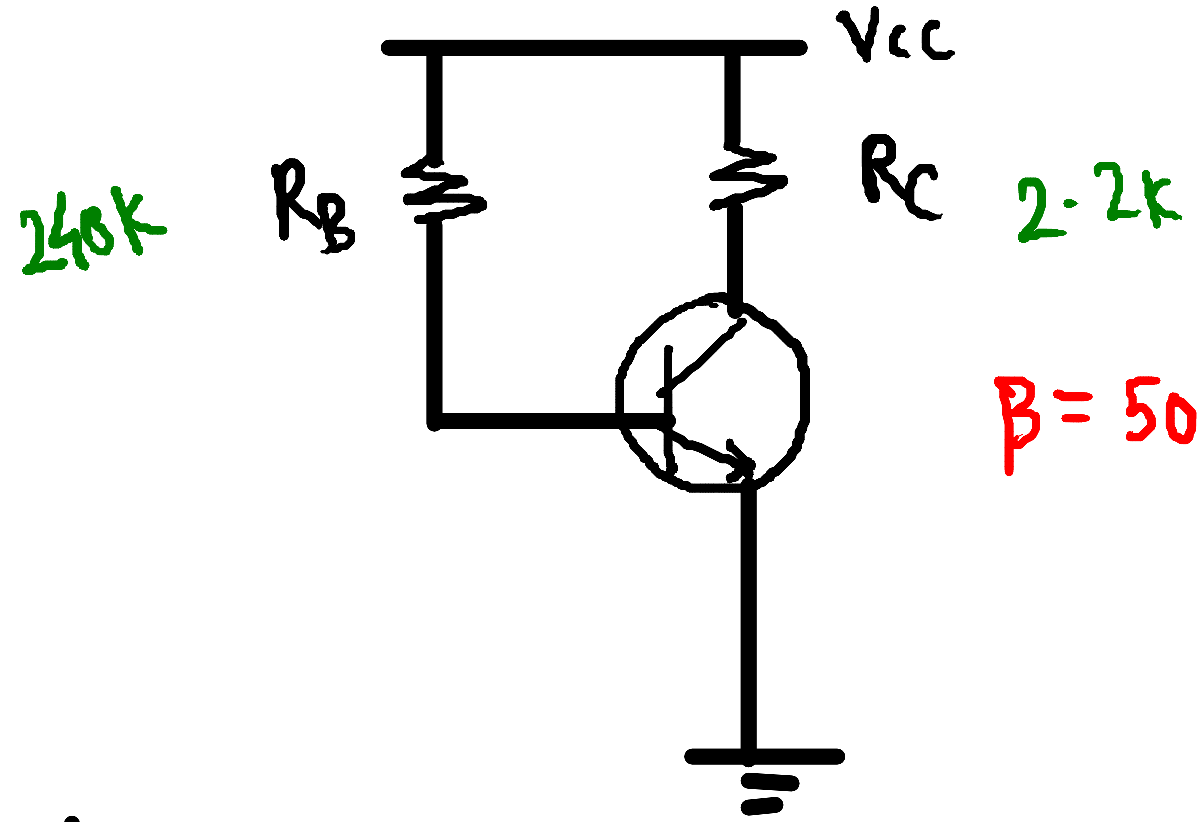
$$\left| \frac{\text{Initial} - \text{Final}}{\text{Initial}} \times 100\% \right|$$

Step ①: Mark the currents

Step ②: KVL in J_E junction
find I_B, I_E

Step ③: KVL in J_C junction

Fixed Bias



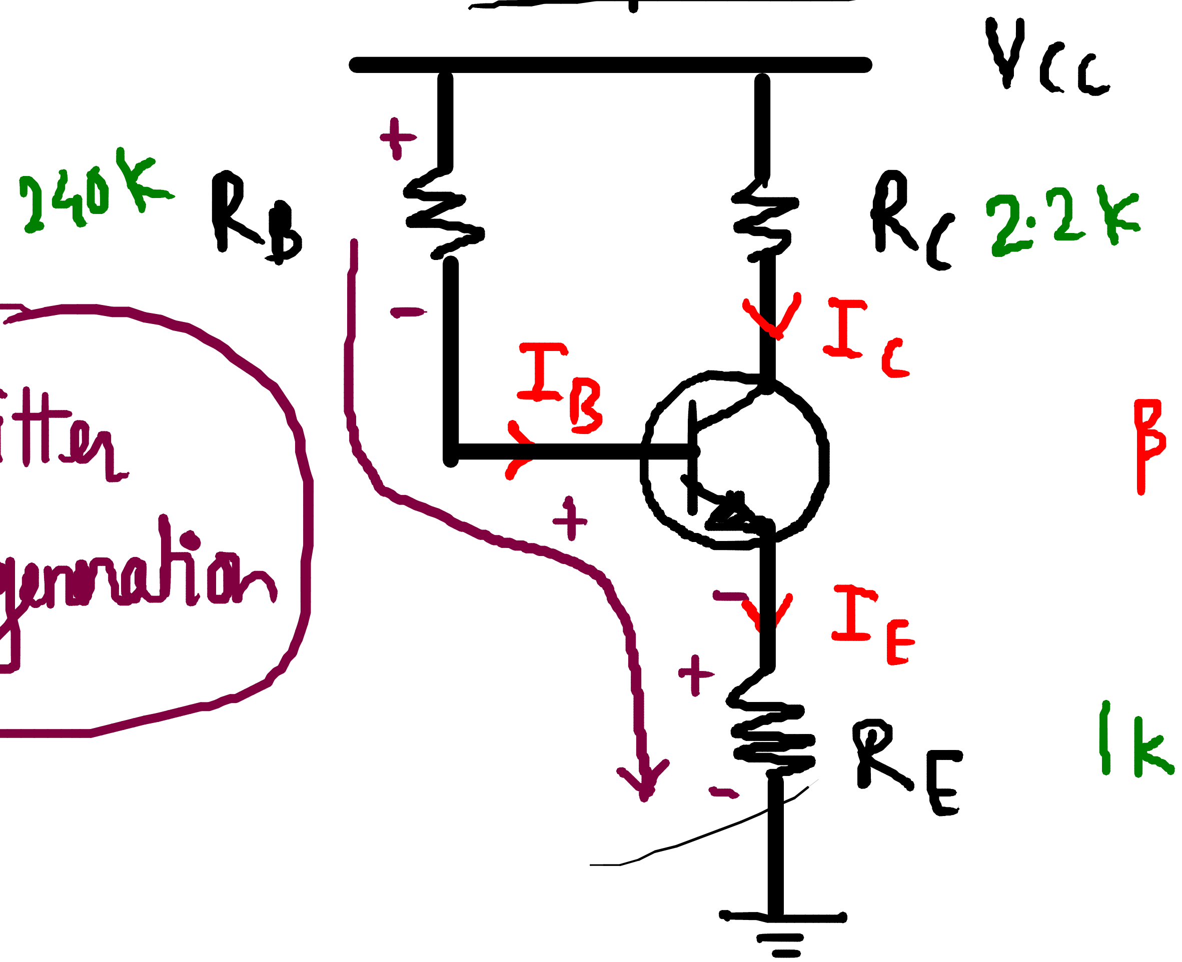
$\beta = 50$ to 100

$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$I_C = \beta I_B$$

$$V_{CE} = V_{CC} - (\beta I_B) R_{CC}$$

CE with R_E — Improved



Emitter degeneration

$\beta = 50$ to 100

$$V_{CC} - I_B R_B - V_{BE} - (1+\beta) I_B R_E = 0$$

$$\boxed{\begin{gathered} I_B = \frac{V_{CC} - V_{BE}}{R_B + (1+\beta) R_E} \\ V_{CE} = V_{CC} - (\beta I_B) R_C - (1+\beta) I_B R_E \end{gathered}}$$

$\Delta I_B = 0\ \%$

$\Delta I_C = 100\ \%\ \uparrow$

$\Delta V_{CE} = 76.5\ \%\ \downarrow$

$\Delta I_B = 14.6\ \%\ \downarrow$

$\Delta I_C = 70.6\ \%\ \uparrow$

$\Delta V_{CE} = 76.24\ \downarrow$

Student Queries :

1. $I_C \uparrow$

$$V_{CE} = V_{CC} - \underbrace{I_C R_C}$$

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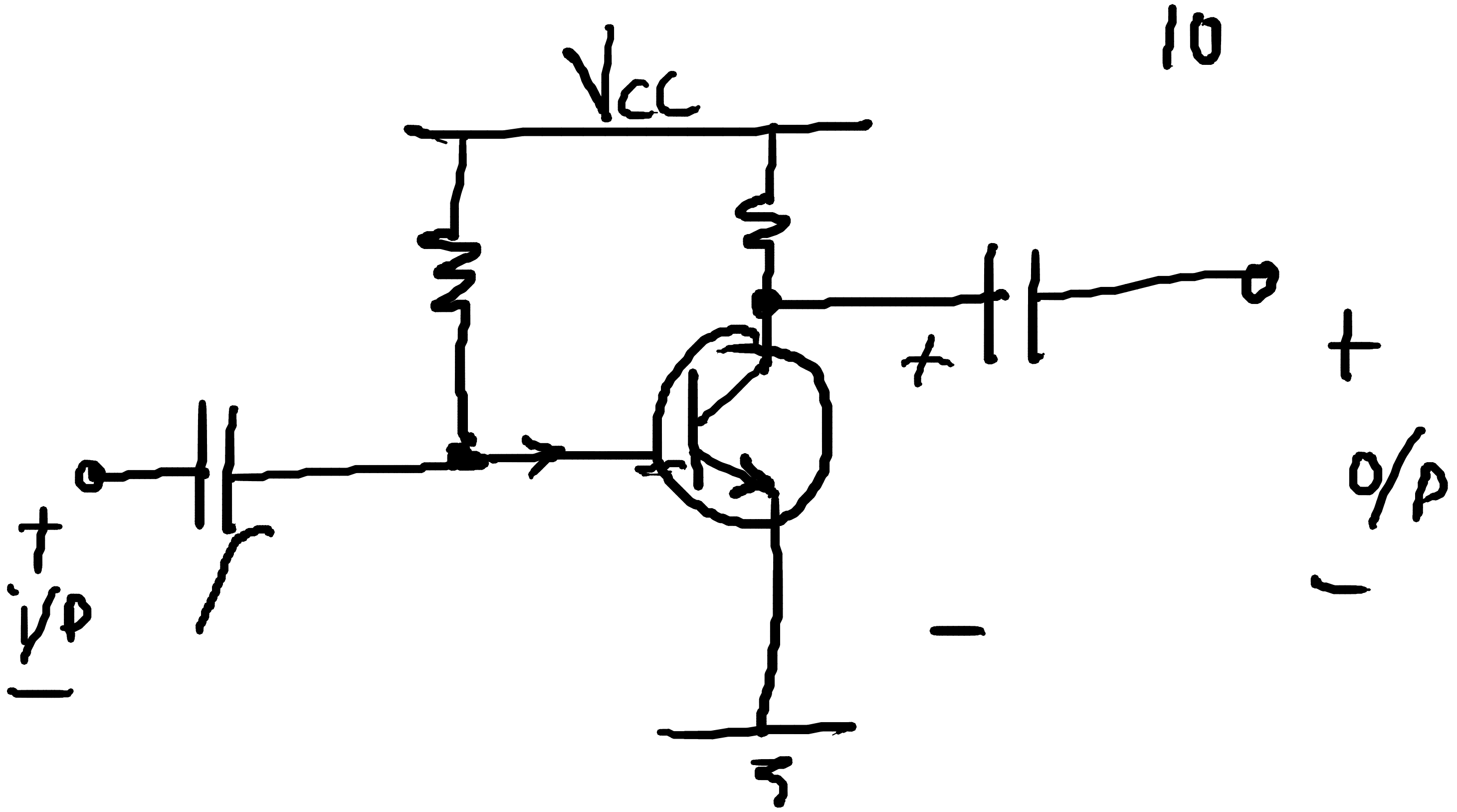
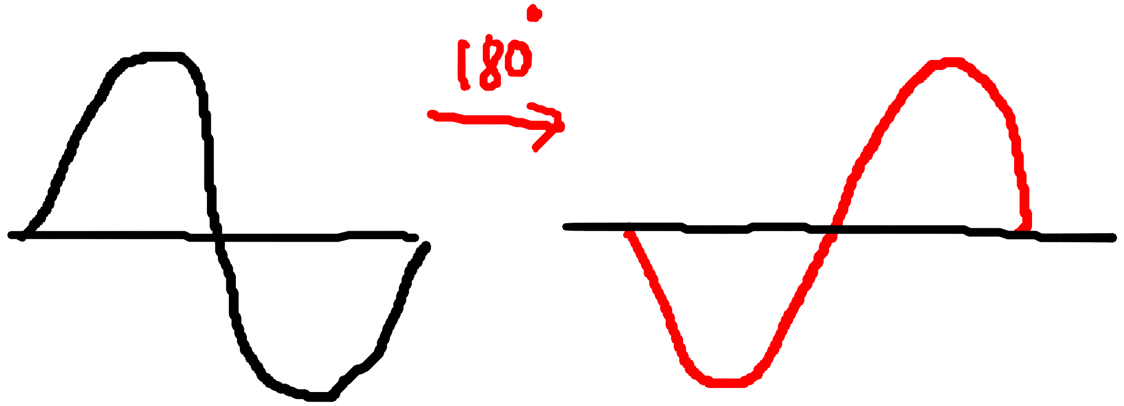
2.

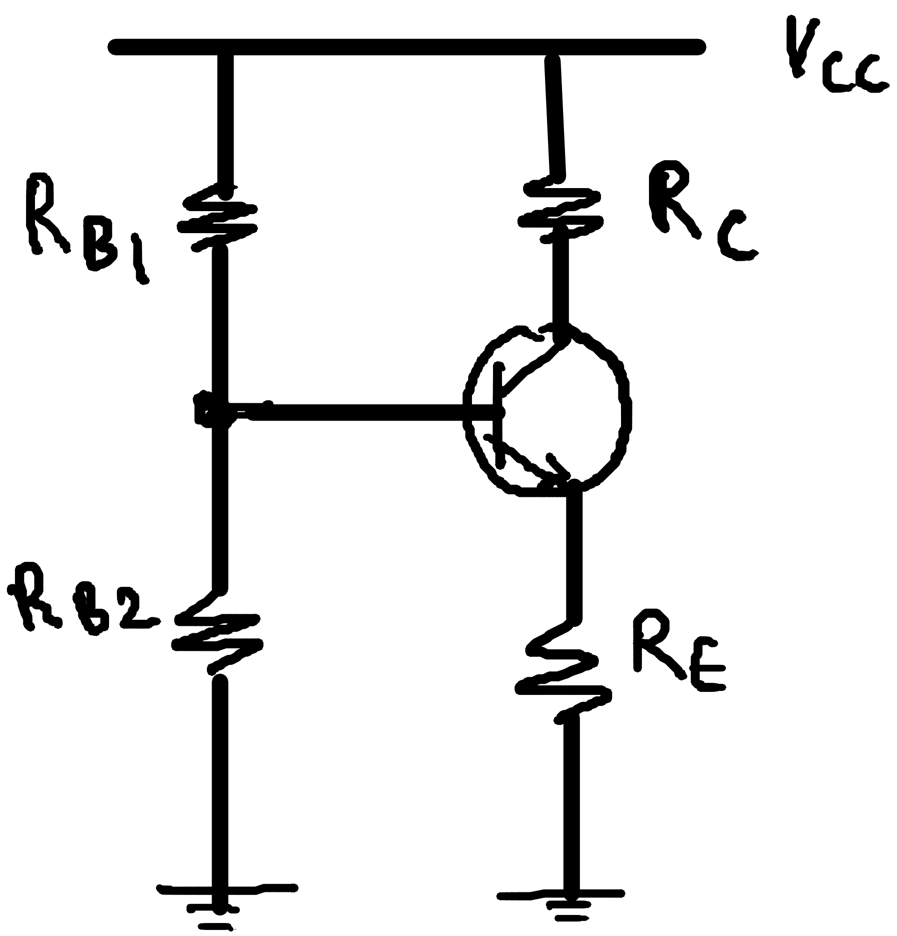




$I_B \uparrow \quad I_C \uparrow$

$V_{CE} \downarrow$

#



Voltage divider bias.

$R_{B1} = 500\,k$

$R_C = 2k$

$R_{B2} = 40\,k$

$R_E = 2k$

β : 50 to 100

ΔI_B

ΔI_C

ΔV_{CE}