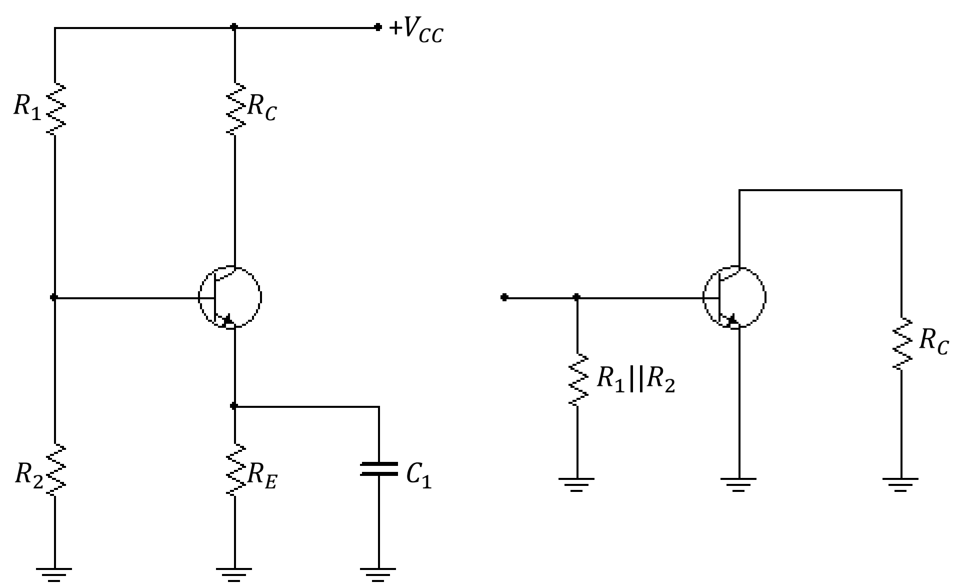
The expression for the attenuation in the base circuit is:

$$\frac{V_b}{V_{in}} = \frac{R_{in}}{R_S + R_{in}}$$

The overall gain A'_v is:

$$A'_v = A_v\left(\frac{V_b}{V_{in}}\right)$$

<u>Emitter-Bypass Capacitor Increases Gain</u>



$\boldsymbol{A_v = \frac{R_C}{r'_e}}$ **as $\boldsymbol{R_E}$ is bypassed**

Example: Calculate the base-to-collector voltage gain of the amplifier in figure A with and without an emitter-bypass capacitor.

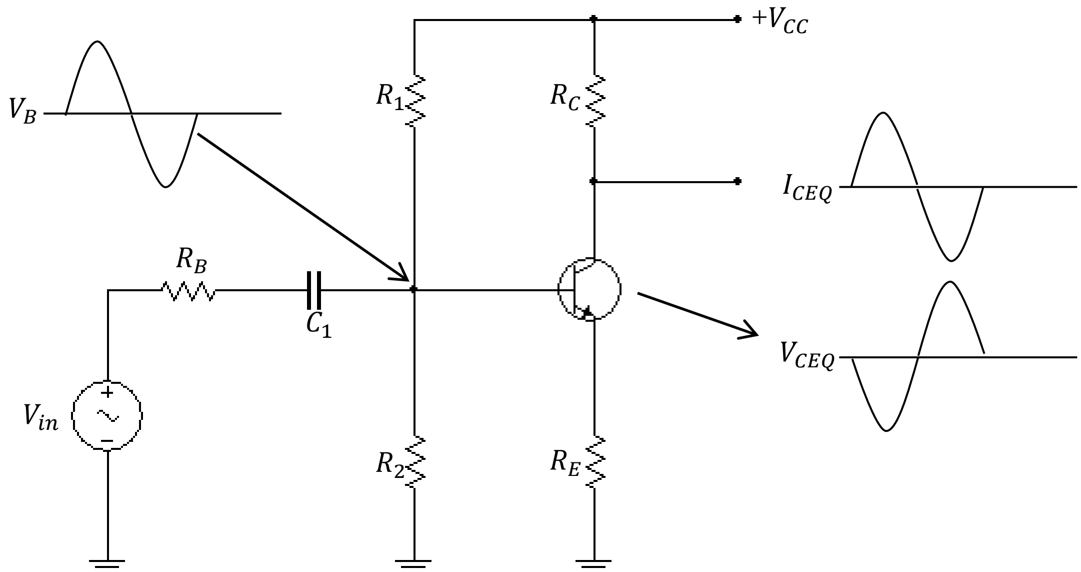
$$\boldsymbol{r'_e = 10.4\Omega}$$

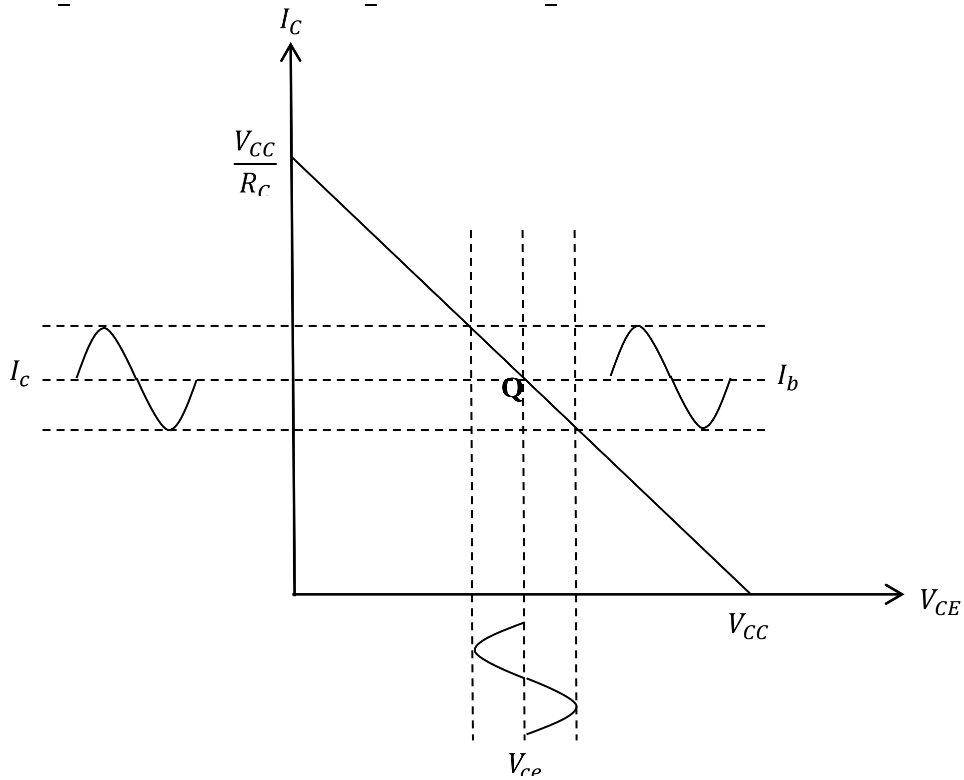
Without emitter-bypass capacitor

$$\boldsymbol{A_v = \frac{R_C}{r'_e + R_E} = \frac{1k\Omega}{610.4\Omega} = 1.64}$$

With emitter-bypass capacitor

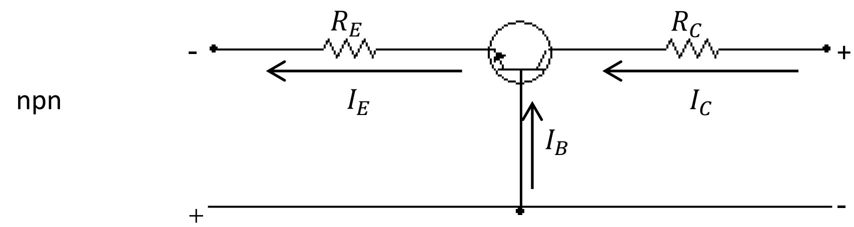
$$A_v = \frac{R_C}{r'_e} = \frac{1k\Omega}{10.4\Omega} = 96.5$$





B- Common-Base (CB) Configuration

- When the transistor is connected with the base as the common or grounded terminal, it is called a common-base connection.

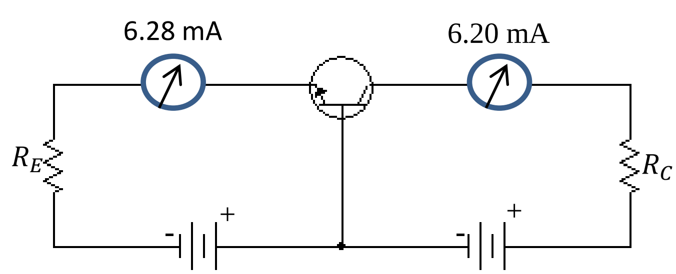


Current Gain:

- Since I_E is the input current, I_C is the output current, the current gain :

$$\alpha_{dc} = \frac{I_C}{I_E}$$

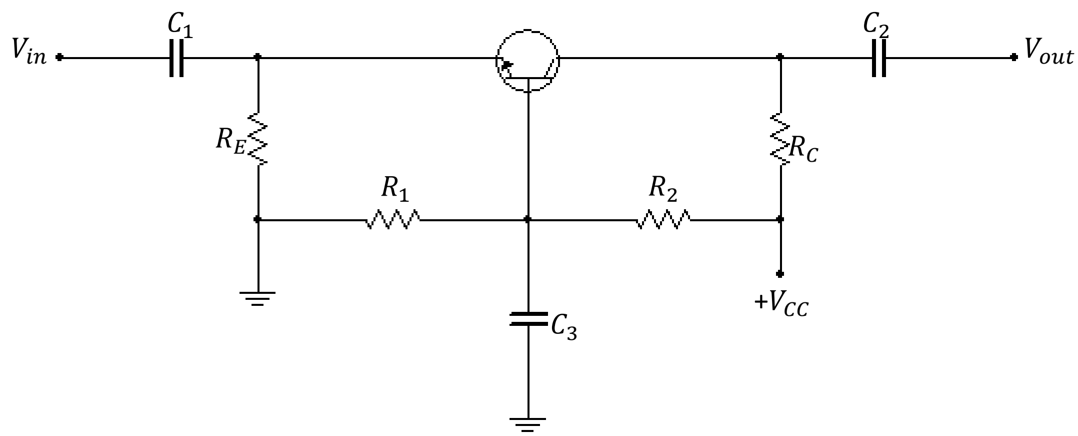
- Because $I_C \equiv I_E$, the value α_{dc} is near unity
  Example: Determine α_{dc} for the common-base circuit:



$$\boldsymbol{\alpha_{dc} = \frac{I_C}{I_E} = \frac{6.20mA}{6.28mA} = 0.987}$$

B1: Common-Base Amplifier

- The base is the common terminal and is at ac ground because of capacitor C_2 , the input signal is applied at the emitter. The output is capacitively coupled from the collector.



Voltage Gain of CB Amplfier

- The voltage gain from the emitter to the collector is developed as follows:

$$\boldsymbol{A_v = \frac{V_{out}}{V_{in}} = \frac{I_c R_C}{I_e r'_e} = \frac{I_e R_C}{I_e r'_e}}$$

$$\boldsymbol{A_v = \frac{R_C}{r'_e}}$$

Which is the same as in Common-Emitter Amplifier.

Input Impedance of CB Amplifier

- The impedance looking in at the emitter is:

$$R_{in(emitter)} = \frac{V_{in}}{I_{in}} = \frac{V_e}{I_e} = \frac{I_e r'_e}{I_e}$$

$$R_{in(emitter)} = r'_e \qquad (A)$$

- R_E , of course, appears in parallel with $R_{in(emitter)}$, however, r'_e is normally small compared to R_E that the expression in equation (A) is valid for the total input impedance also.