AMPLIFIER

Prepared By
Anne Jose M
Department of Physics,
Little Flower College, Guruvayoor

Amplifier

An electronic circuit that is used to amplify or increase the strength of an input parameter of the input ac signal.

Input parameter	Type of amplifier
current	current amplifier
voltage	voltage amplifier
power	power amplifier

Most amplifiers used transistors for their action.

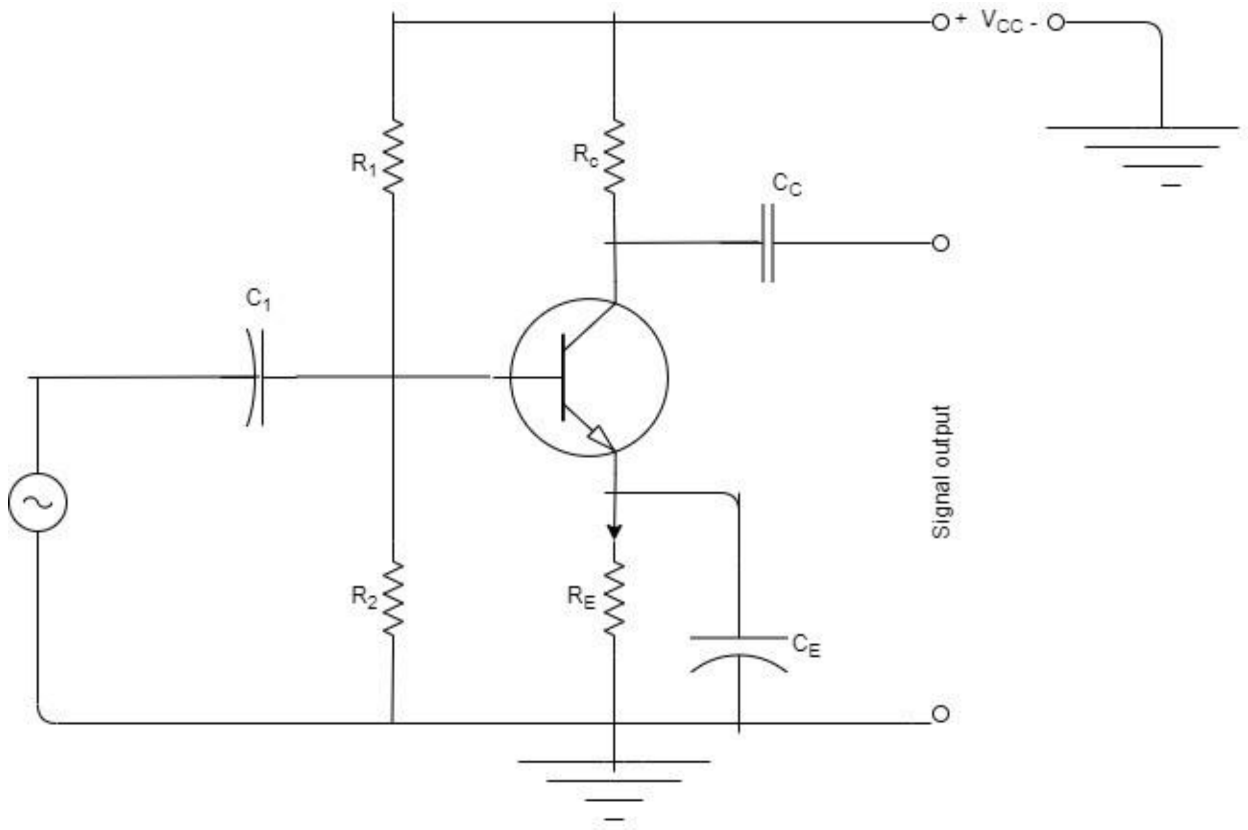
Amplifier

- An electronic circuit that is used to amplify or increase the strength of an input parameter.

Input parameter	Type of amplifier
current	current amplifier
voltage	voltage amplifier
power	power amplifier

Most amplifiers used transistors for their action.

Single Stage Common Emitter Amplifier



Various circuit elements

Biasing circuit

R_1, R_2 provide voltage divider bias

R_E provides stabilization.

Input capacitor C_{in}

- To couple the input signal to the base of the transistor
- To prevent the input dc from affecting the biasing conditions

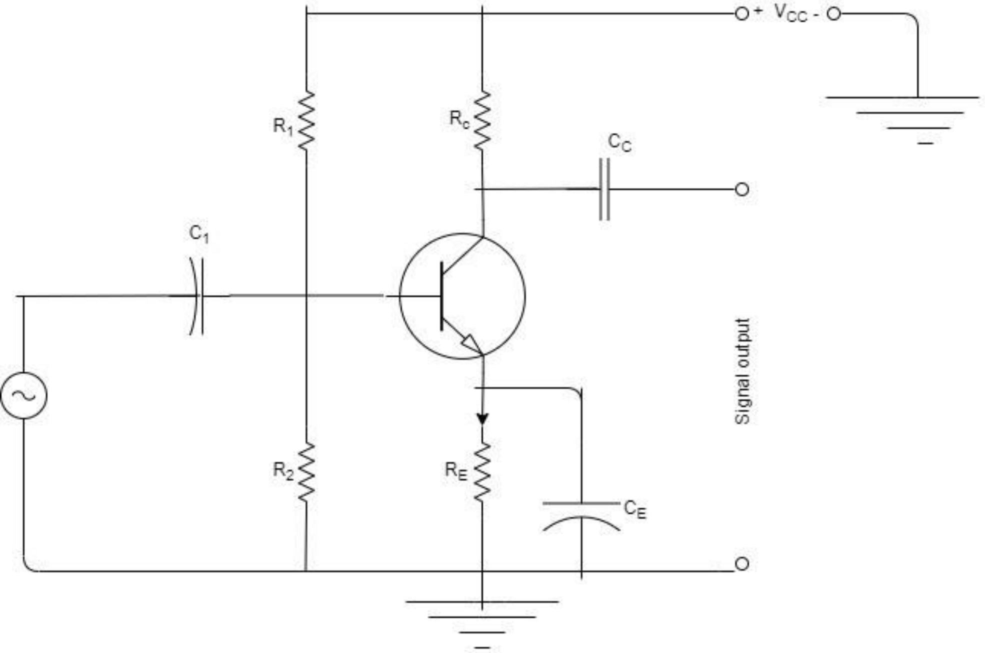
Emitter bypass capacitor C_E

- To provide low reactance path to the amplified a.c. signal.

Coupling capacitor C_C

- To couple one stage of amplifier to the next stage.
- To isolate dc of one stage from the next stage.

Various circuit currents



Base Current

Total base current = dc base current + ac base current
$i_B = I_B + i_b$

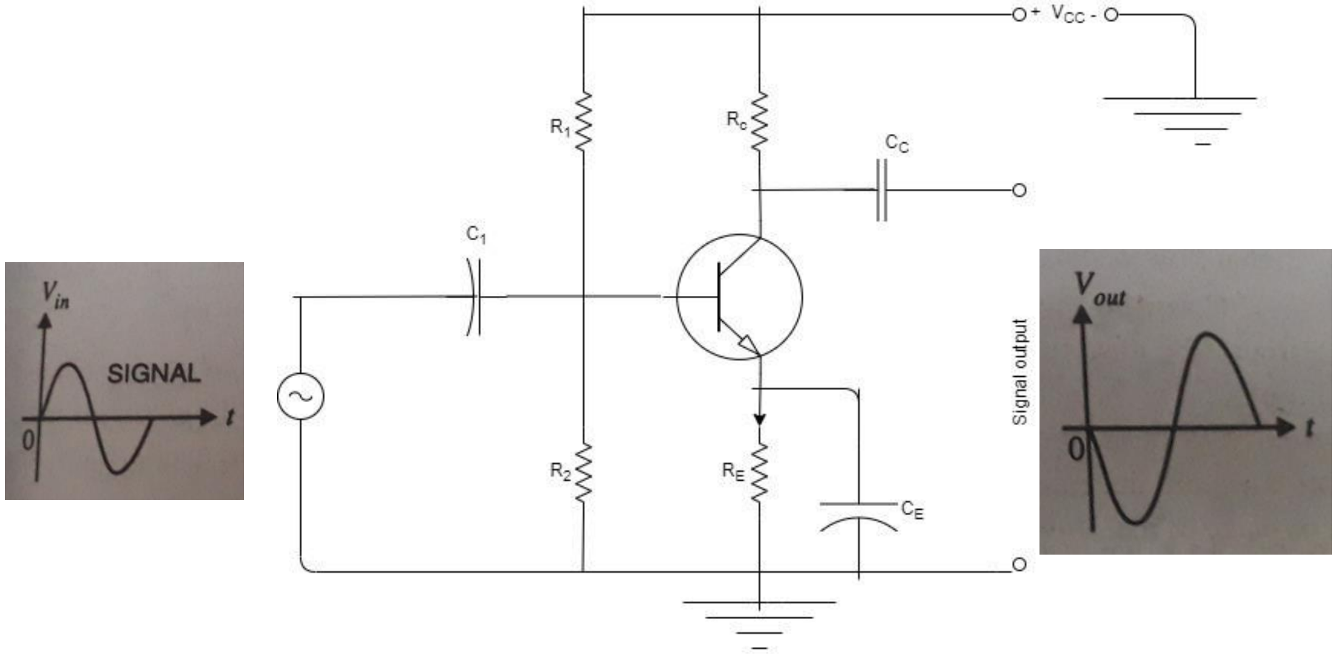
Collector Current

Total collector current = dc collector current + ac collector current
$i_C = I_C + i_c$ where $I_C = \beta\ I_B$ is the zero signal collector current and
$i_c = \beta\ i_b$ is the collector current due to signal.

Emitter Current

Total emitter current = dc emitter current + ac emitter current
$i_E = I_E + i_e$

Phase Reversal



Working

Input is fed between base and emitter.

Output is taken from collector and emitter.

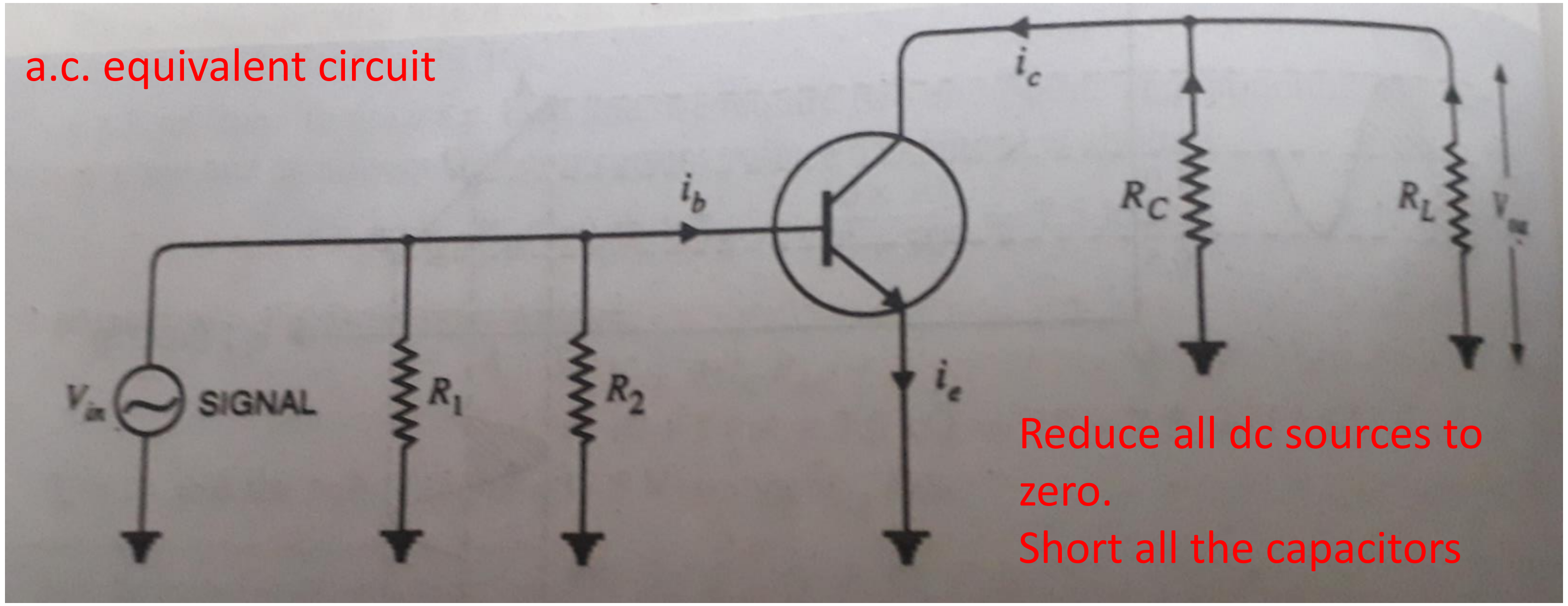
Total instantaneous output voltage $v_{CE} = V_{CC} - i_C \, R_C$

Signal voltage increases during positive half cycle → base current increases → collector current increases → voltage drop $i_C R_C$ increases → output voltage v_{CE} decreases

ie, as the signal voltage is increasing in the positive half cycle, the output voltage is increasing in the negative direction. ie output is 180° out of phase with the input.

Voltage gain

Ratio of ac output voltage to the ac input signal.



Load R_C *parallel to* R_L.

Equivalent load for a.c. is

$$R_{AC} = R_C \parallel R_L = \frac{R_C \times R_L}{R_C + R_L}$$

Output volage $V_{out} = i_c\, R_{AC}$

Input volage $V_{in} = i_b\, R_{in}$

Open circuit Voltage gain $A_v = \frac{V_{out}}{V_{in}} = \frac{i_c\, R_C}{i_b\, R_{in}} = \beta\, \frac{R_C}{R_{in}}$ = current gain x resistance gain

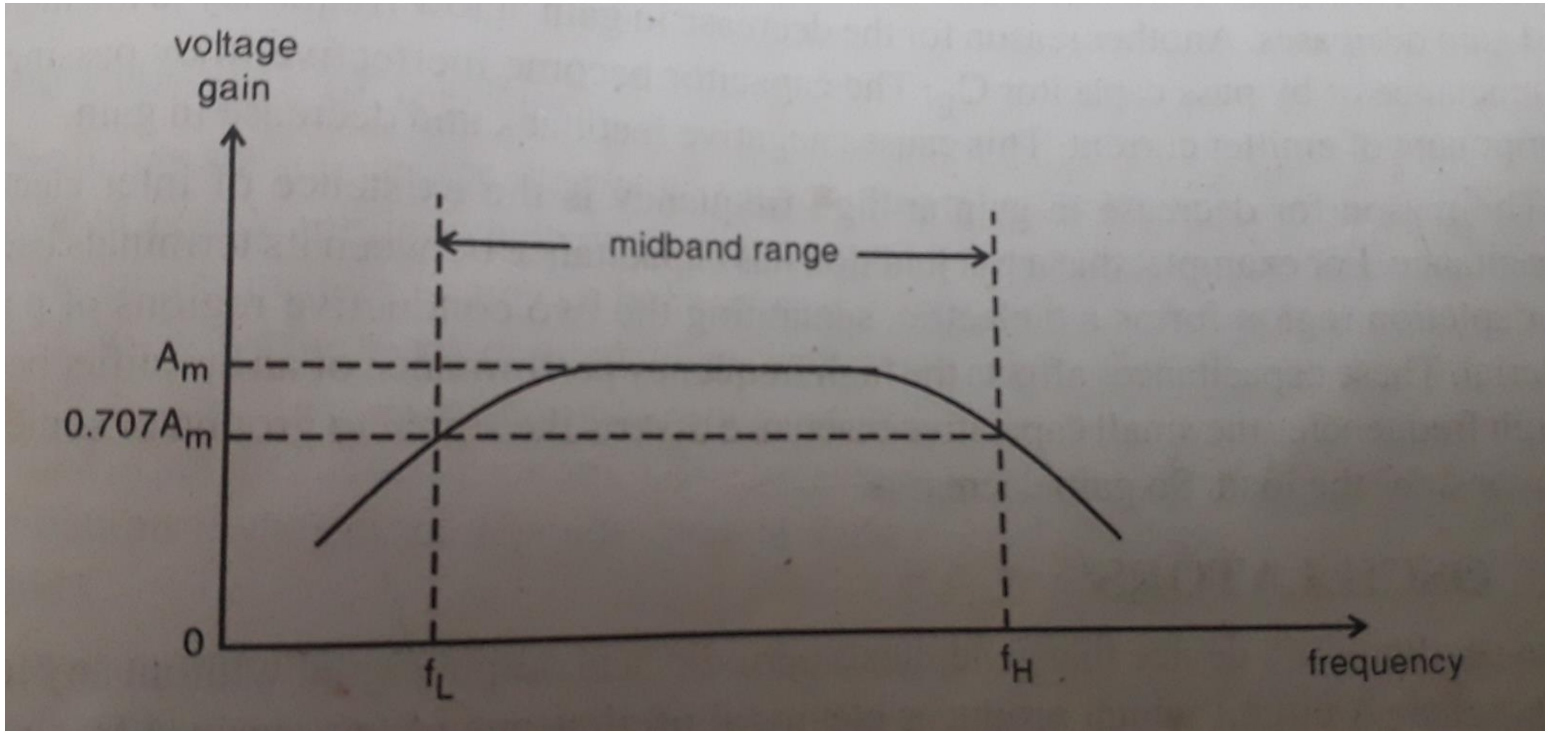
Voltage gain $A_v = \frac{V_{out}}{V_{in}} = \frac{i_c\, R_{AC}}{i_b\, R_{in}} = \beta\, \frac{R_{AC}}{R_{in}}$

Power gain $A_p = \frac{i_c^2\, R_C}{i_b^2\, R_{in}} = \beta^2\, \frac{R_C}{R_{in}}$ = current gain x voltage gain

Power gain $A_p = \frac{i_c^2\, R_{AC}}{i_b^2\, R_{in}} = \beta^2\, \frac{R_{AC}}{R_{in}}$

Frequency Response and Band width

Frequency response is the curve between voltage gain and signal frequency of an amplifier



Band width of an amplifier is the difference between upper and lower cut off frequencies.

BW=$f_H - f_L$

THANK YOU