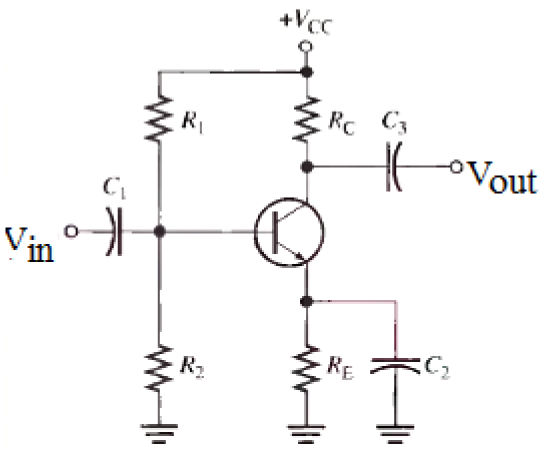
Voltage gain

The voltage gain from emitter to collector is developed as follows (V_{in} = Ve . V_{out} = Vc)



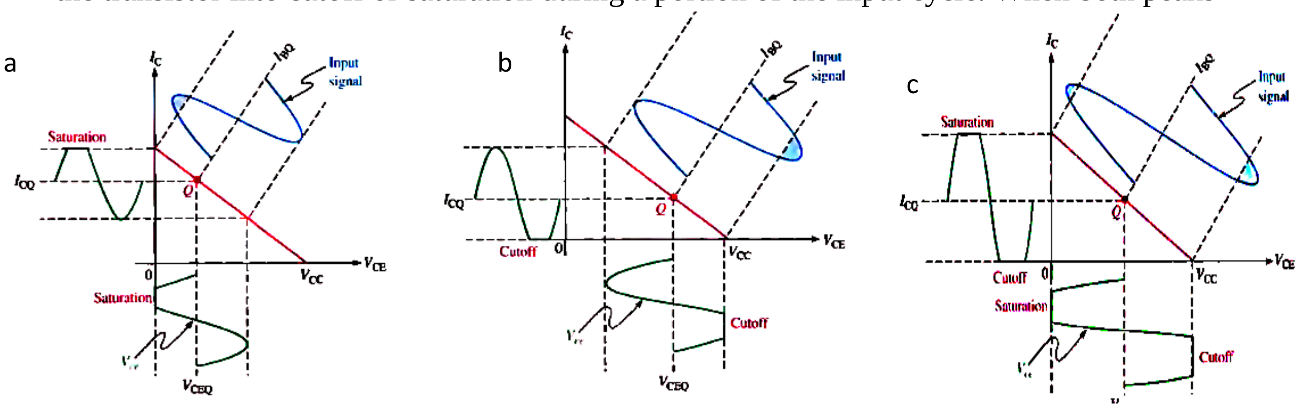
$$V_{in} = V_e, V_{out} = V_c$$

$$A_V = \frac{V_{out}}{V_{in}} = \frac{V_c}{V_e} = \frac{I_C R_c}{I_C (r'_e // R_E)}$$

- Input is at the base. Output is at the collector.
- There is a phase inversion from input to output.
- C 1 and C 3 are coupling capacitors for the input and output signals.
- C 2 is the emitter-bypass capacitor. All capacitors must have a negligible reactance at the frequency of operation. Emitter is at ac ground due to the bypass capacitor.

Waveform Distortion

Under certain input signal conditions the location of the Q-point on the load line can cause one peak of the V_{CE} waveform to be limited or clipped, as shown in parts (a) and (b) of Figure above. In each case the input signal is too large for the Q-point location and is driving the transistor into cutoff or saturation during a portion of the input cycle. When both peaks



are limited as in the Figure (c), the transistor is being driven into both saturation and cutoff by an excessively large input signal. When only the positive peak is limited, the transistor is being driven into cutoff but not saturation. When only the negative peak is limited, the transistor is being driven into saturation but not cutoff.

(a) Transistor is driven into saturation because the Q-point is too close to saturation for the given input signal.
(b) Transistor is driven into cutoff because the Q-point is too close to cutoff for the given input signal.
(c) Transistor is driven into both saturation and cutoff because the input signal is too large.

Exp.9: Common-Emitter Transistor Amplifier

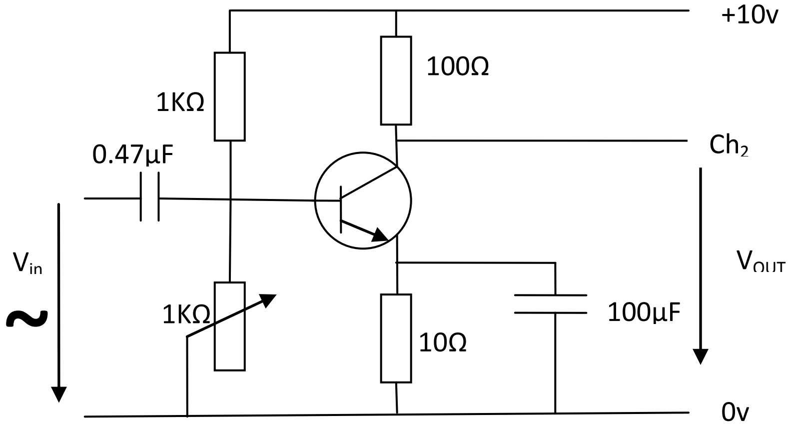
1- *Objectives:*

- Calculate the a.c. Voltage gain.
- The goal of the experiment is to find the relationship between voltage gain A_V and the frequency F of input signal.

2- *Circuit elements:*

- Power supply unit
- Resistor 100 Ω
- Resistor 1 kΩ
- Resistor 10 Ω
- Potentiometer 1 kΩ
- Capacitor 0.47 μF
- Electrolytic capacitor 100 μF
- Transistor BD130,NPN,Eb
- Two channel oscilloscope
- Function generator,
- Set of connecting leads

3-*Circuit Diagram :*



4-*Procedure:*

1. Connect the circuit as shown in figure 1.
2. Display the output voltage (DC) on the oscilloscope.
3. Apply a peak-to-peak voltage Vin,pp = 50 mV,
   f = 5 kHz at the input using the function generator.
4. Calculate the voltage gain.

$$A_V = \frac{V_{out,PP}}{V_{in,PP}}$$

5. Remove the capacitor C_E and calculate the voltage gain.
6. Write your comment.
7. Insert the capacitor C_E in its place and increase the applied frequency then calculate the voltage gain.
8. Write your comment.

5-***Questions:***

1. What function does the resistor R_2 of the output wave have?
2. What is the influence of the capacitance on amplification?
3. What is the influence of increasing the applied input voltage on amplification?