Nalanda Open University
B.Sc. Part-III

Course-Physics
Paper-VIII

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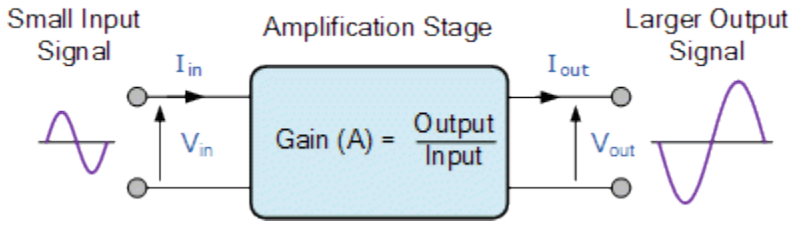
Topic- Amplifier: - An amplifier is an electronic device or circuit which is used to increase the magnitude of the signal applied to its input.



In “Electronics”, small signal amplifiers are commonly used devices as they have the ability to amplify a relatively small input signal, for example, from a sensor such as a photo-device, into a much larger output signal to drive a relay, lamp or loudspeaker, etc .There are many forms of electronic circuits classed as amplifiers, from operational amplifiers and small signal amplifiers upto large signal and power amplifiers. The classification of an amplifier depends upon the size of the signal, large or small, its physical configuration and how it processes the input signal, that is the relationship between input signal and current flowing in the load.

Working of an R.C. Coupled amplifier:- Amplification is a process of increasing the signal strength by increasing the amplitude of a given signal without changing its characteristics. An R.C coupled amplifier is a part of a multistage amplifier, wherein different stages of amplifiers are connected using a combination of resistor (R) and a capacitor (C). The input signal may be a current signal, voltage signal or a power signal. An amplifier will amplify the signal without changing its characteristics and the output will be a modified version of the input signal. They are mainly used in audio and video instruments, communication, controllers etc.

The circuit diagram of a Single Stage Common emitter transistor amplifier is shown in fig. (1),

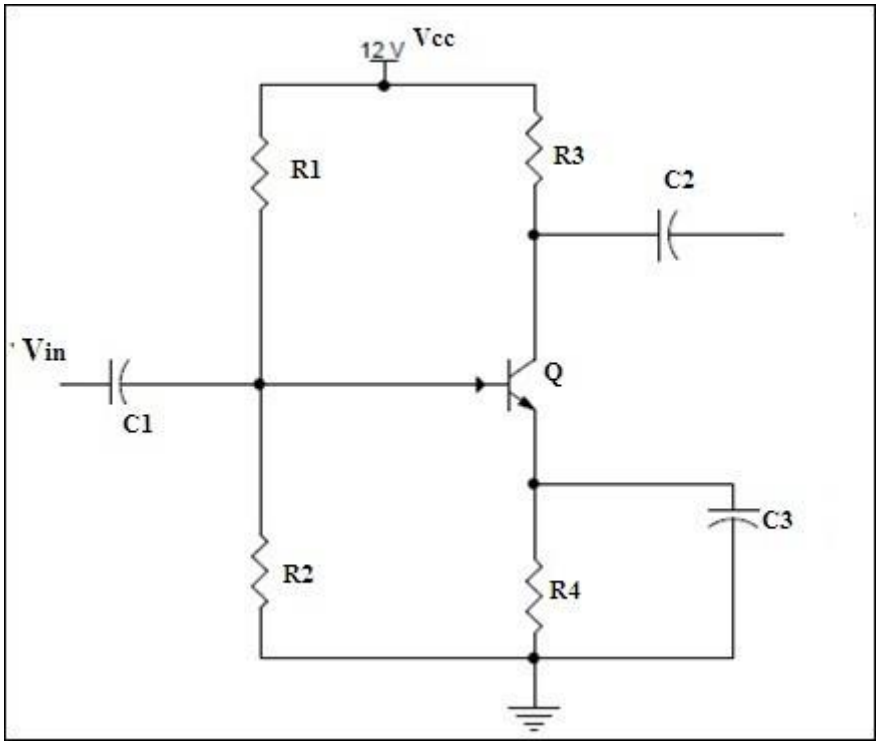


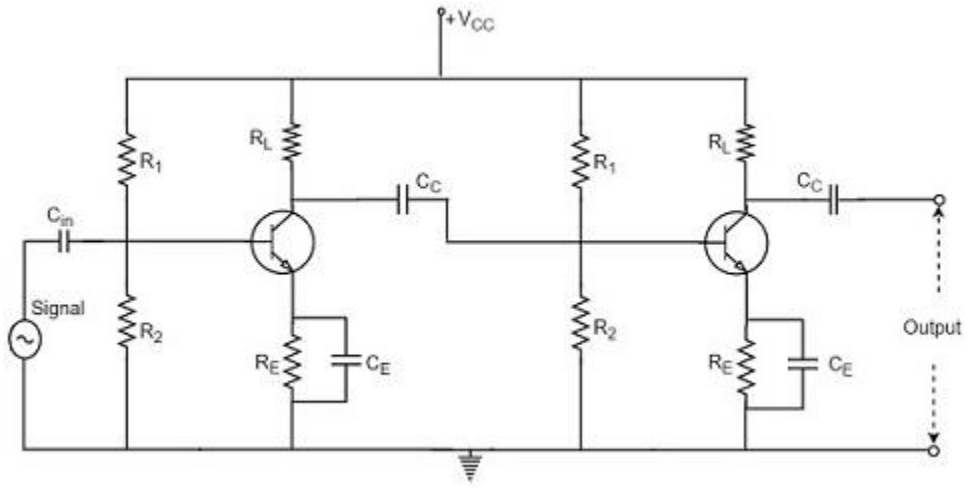
Figure – (1)

Explanation of circuit given in fig. (1):- A single stage common emitter R-C coupled amplifier is a simple and elementary amplifier circuit to make weak signals to be stronger for further amplification. The Capacitor C1 at the input acts as a filter which is used to block the DC voltage and allow any AC voltage to the transistor. If any external DC voltage reaches the base of the transistor, it will alter the biasing conditions and affects the performance of the amplifier. R_1 and R_2 are useful for providing proper biasing to the bipolar transistor and necessary base voltage to drive the transistor in active region. The region between cut off and saturation region is called as active region .The region where the bipolar transistor operation is completely switched off is called cut off region and completely switched on is called saturation region respectively.

Resistor R_3 (collector register) R_4 (emitter resistor) are used to drop voltage of Vcc. Both resistors should drop Vcc voltage by 50% in the above circuit.

The emitter capacitor C_3 and emitter resistor R_4 makes a negative feedback for making the circuit operation more stable.

Two stage Common Emitter Amplifier:-



|◄——— First Stage ———►|◄— Second Stage —►|

Figure - (2)

Explanation of circuit given in fig. (2):- When input AC signal is applied to the base of the transistor of the 1st stage of RC coupled amplifier, it is then amplified across the output of the 1st stage. This amplified voltage is applied to the base of next stage of the amplifier through the coupling capacitor cout where it is further amplified and re-appears across the output of the second stage. Thus, the successive stage amplifies the signal and the overall gain is raised to the desired level. Much higher gain can be obtained by connecting a number of amplifier stages in succession.

R-C coupling in amplifiers is most widely used to connect the output of first stage to the input (base) of the second stage and so on with a constant amplification over a wide range of frequencies.

Voltage gain:- Voltage gain of an amplifier is defined as the ratio of output power to the input power. It can be expressed either in decibel (dB) or in numbers and represents how much an amplifier is able to amplify a signal given to it,

i.e., Voltage gain (Vg) = Output voltage / input voltage = Vout / Vin

or, Voltage gain(Av) = Vout / Vin

Where Vout is output power of an amplifier
and Vin is input power of an amplifier

Gain in DB = 10log (Pout/Pin)