1 Operational Amplifier

An **operational amplifier** (*OP-Amp*) *is a circuit that can perform such mathematical operations as addition, subtraction, integration and differentiation.*

Fig. 1 shows the block diagram of an operational amplifier. Note that *OP*-Amp is a multistage amplifier. The three stages are: differential amplifier input stage followed by a high-gain *CE* amplifier and finally the output stage. *The key electronic circuit in an OP-Amp is the* **differential amplifier.** A differential amplifier (*DA*) can accept two input signals and amplifies the difference between these two input signals.

The following points may be noted about operational amplifiers (*OP*-Amps) :

(*i*) The input stage of an *OP*-Amp is a *differential amplifier* (*DA*) and the output stage is

typically a class *B* push-pull emitter follower.

(*ii*) The internal stages of an *OP*-Amp are *direct-coupled i.e*., no coupling capacitors are used.

The direct coupling allows the *OP*-Amp to amplify d.c. as well as a.c. signals.

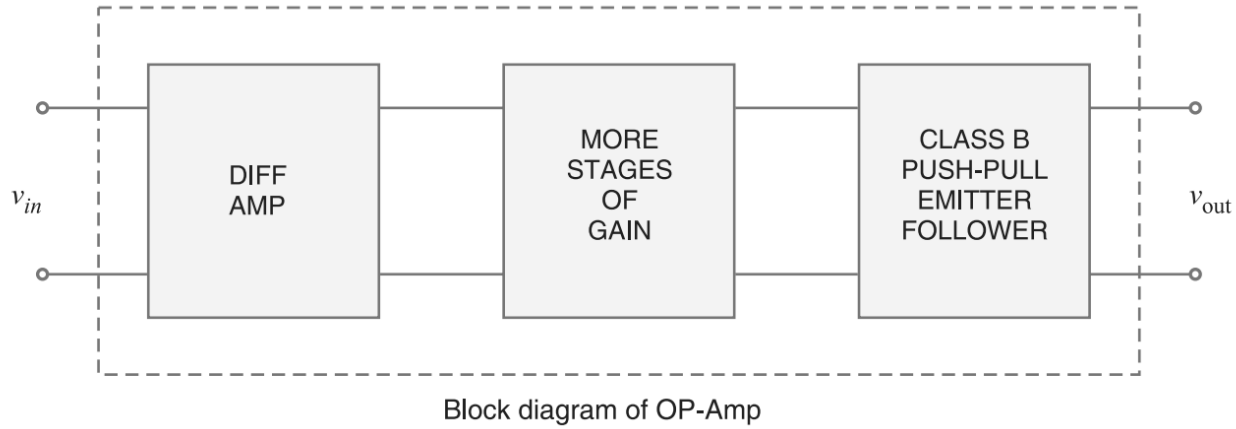
(*iii*) An OP-Amp has *very high input impedance* (ideally infinite) and *very low output*

impedance (ideally zero). The effect of high input impedance is that the amplifier will draw a very small current (ideally zero) from the signal source. The effect of very low output impedance is that the amplifier will provide a constant output voltage independent of current drawn from the source.

(*iv*) An OP-Amp has *very high *open-loop voltage gain* (ideally infinite); typically more than

200,000.

(*v*) The OP-Amps are almost always operated with negative feedback. It is because the openloop voltage gain of these amplifiers is very high and we can sacrifice the gain to achieve the advantages of negative feedback including large bandwidth (*BW*) and gain stability.



Block diagram of OP-Amp

Fig. 1