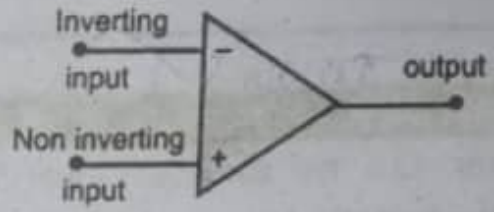
18.7 OPERATIONAL AMPLIFIER

Since the most common use of transistors is as amplifiers. so, in order to avoid from making the amplifier circuits each time by discrete components, the whole amplifier circuit is integrated on a small silicon chip and enclosed inside a protective capsule. The working terminals are connected with the pins of the amplifier out side the capsule. So in this way this amplifier can be easily used without making connections for the amplifier circuit. Such an integrated amplifier is called operational amplifier (op-amp).It performs mathematical operations such as addition, multiplication and integration electronically.

Input and Output connections: The symbolic representation of the op-amp is

(a)

Fig 18.23



(b)

It has two input terminals.

- Inverting input (-)
- Non-inverting input (+)

Any signal applied at the inverting (-) input, appears after amplification to the output terminal with a phase shift of **180°** . Due to this it is called an inverting input.

If the signal is applied at the non-inverting input (+) it is amplified at the output without any change in phase.

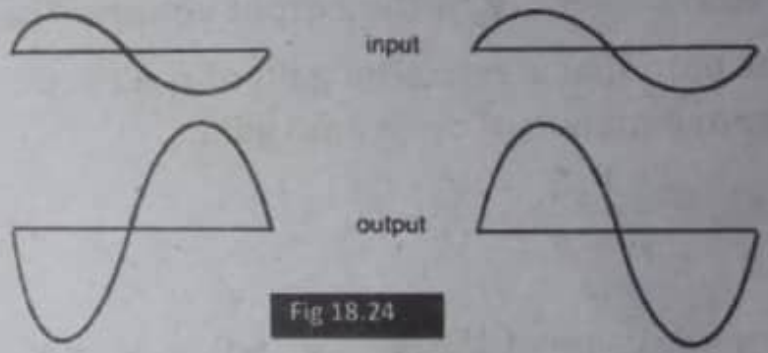


Fig 18.24

(a) (b)

CHARACTERISTIC OF OP-AMP:

An operational amplifier has a large number of characteristics parameters.

(i) Input Resistance:

It is the resistance between the (+) and (-) inputs of the amplifier. Its value is very high and is of the order of several mega ohms.

Due to very high input resistance, practically no current flows between the two input terminals. So both of them are supposed to be at the same potential.

(ii) Output Resistance:

It is the resistance between the output terminal and the ground. Its value is only a few ohms.

(iii) Open Loop Gain:

It is the ratio of output voltage V_o to the voltage difference between non-inverting and inverting inputs when there is no external connection between the output and the inputs. Mathematically

$$A_{OL} = \frac{V_o}{V_+ - V_-} = \frac{V_o}{V_i}$$

The open loop gain of the amplifier is very high. It is of the order of 10^5

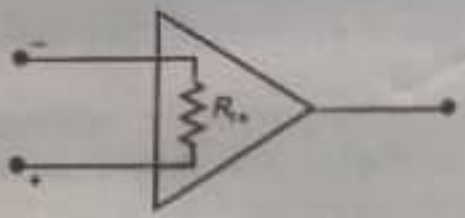


Fig 18.25 (i)

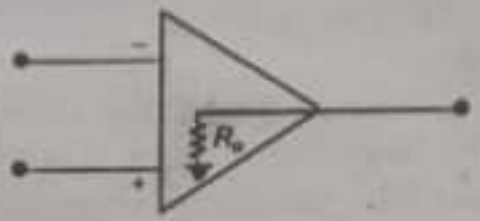


Fig 18.25 (ii)

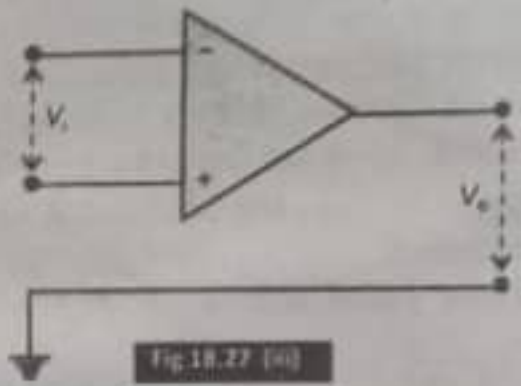


Fig 18.27 (iii)