CLASSIFICATION OF AMPLIFIERS

Amplifiers are classified as below —

1. **Based on output**: On the basis of output signal, amplifiers are — voltage, current and power amplifiers. The amplifier raises voltage level, is called voltage amplifier (CB), the amplifier raises current, called current amplifier (CC) and the amplifier which raises the power level of input signal, is called power amplifier (CE).

2. **Based on frequency response)**: On the basis of frequency (response), there are two amplifier→ Audio amplifiers and Radio amplifiers. An amplifier which amplify a signal of frequency ranging from 20Hz to 20kHz, is called Audio amplifier.

The amplifier which amplify a signal of frequency range lying in radio frequency (some MHz to hundred of Mega Hertz), is called Radio amplifier.

3. **Based on input signal amplitude**:- On this basis, there are two types — (i) Small signal amplifier (An amplifier which amplify small signal i.e small amplitude signal), is called small-signal amplifier. (ii) Large signal amplifier.

4. On the bias condition: On this basis, there are following amplifiers ——

(i) Class A amplifier: An amplifier, in which collector current flows for full cycle of input signal

(ii) Class B amplifier: An amplifier, in which collector current flows for half-cycle of input signal.

(iii) Class C amplifier: An amplifier, in which collector current flows for less than the half-cycle of input signal.

(iv) Class D amplifier: An amplifier which operates for digital pulse using digital technique (using sample-and-hold circuitry) to recreate output from many pieces of input signal. The major advantage of class D amplifier is that the amplifier is 'ON' (using power) only for short intervals and hence overall efficiency is very high.

5. Based on Coupling method: When output of one stage amplifier is connected to the input of next stage, then this is called coupling. On this basis, there are following types of amplifiers ——

(i) RC coupled amplifier

(ii) LC " "

(iii) Transformer " "

(iv) Direct " "

6. Based on transistor configuration: On this basis, there are following types —

(i) Common - Base (CB)
(ii) Common - Emitter (CE)
(iii) Common - Collector (CC)

CLASSIFICATION OF IDEAL AMPLIFIER

On the basis of input and output impedances of an amplifier relative to the source and load impedances, Amplifiers are classified as — Voltage, Current, transconductance and transresistance amplifiers.

i) **Voltage amplifier**: An amplifier which provides output voltage proportional to the input voltage and proportionality factor is independent of the magnitude to source and load resistance, is called voltage amplifier. Fig. 1. shows a basic block diagram of voltage amplifier

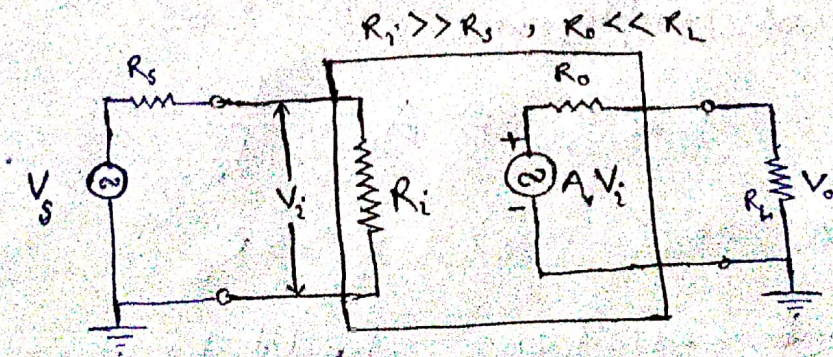

Fig-1.

In voltage amplifier,

$$V_o \propto V_i \Rightarrow A_v = \frac{V_o}{V_i}$$

and $R_i >> R_s$ & $R_o << R_L$

Ideally, input resistance $R_i = \infty$ and output resistance $R_o = 0$.

ii) Current amplifier :- An amplifier which provides output current proportional to the signal current and proportionality factor is independent of source resistance R_s and load resistance R_L, is called current amplifier. A basic block diagram of current amplifier is shown in fig-2.

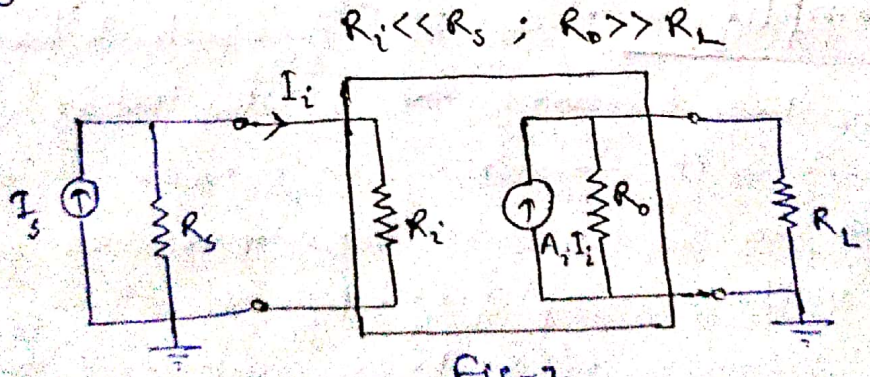

fig-2

In current amplifier,

$$I_o \propto I_i \Rightarrow A_i = \frac{I_o}{I_i}$$

$R_s >> R_i$ and $R_o >> R_L$

i.e input resistance should be small enough and output resistance should be large enough. Ideally,

$R_i = 0$ and $R_o = \infty$

(iii) Transconductance amplifier

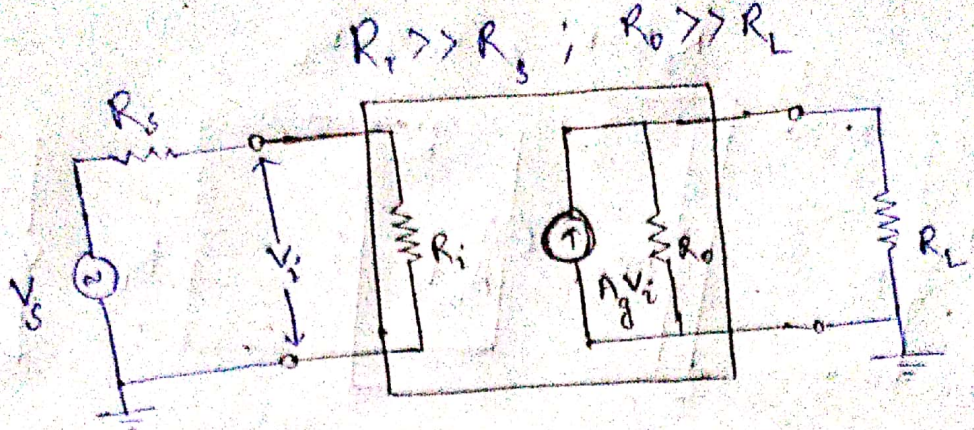

Fig-3.

An amplifier which provides output current proportional to the input voltage and proportionality factor is independent of source and load resistances R_s and R_L is called Transconductance amplifier. In this amplifier,

$$I_o \propto V_i \Rightarrow I_o = A_g V_i \Rightarrow A_g = \frac{I_o}{V_i}$$

$\Rightarrow A_g = \frac{I_o}{V_i}$ = Transconductance, hence, amplifier is called transconductance amplifier. In this amplifier,

$$R_i >> R_s \text{ and } R_o >> R_L$$

i.e both R_i and R_o should be large enough. Ideally, $R_i = \infty$, $R_o = \infty$.

(v) Transresistance amplifier :-

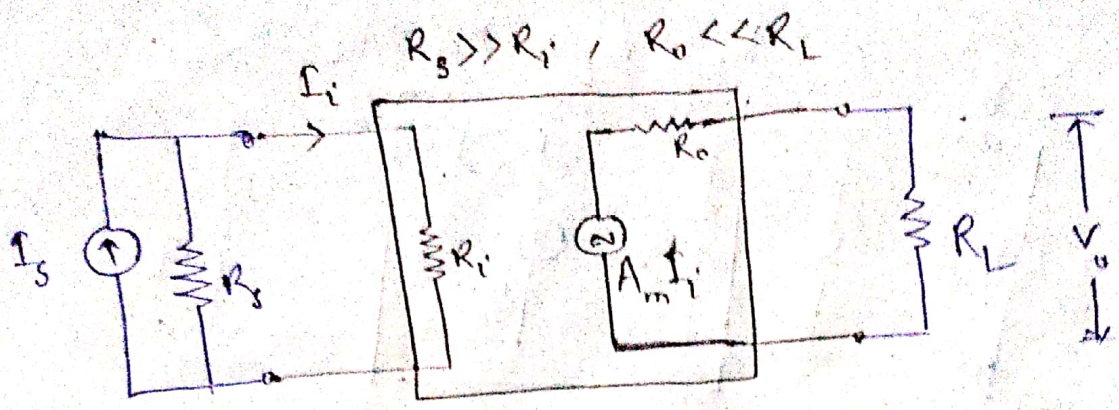

Fig- 4.

An amplifier which provides output voltage proportional to the signal current and proportionality factor is independent of R_s and R_L, is called transresistance amplifier. Fig. 4 shows a basic block diagram of transresistance amplifier.

Here,

$$V_o \propto I_i \Rightarrow V_o = A_m I_i \Rightarrow A_m = \frac{V_o}{I_i}$$

$A_m = \frac{V_o}{I_i}$ = Trans-resistance, hence amplifier is called transresistance amplifier. In this amplifier, $R_s >> R_i$ and $R_o << R_L$. i.e input and output resistance should be small enough. Ideally, $R_i = 0$, $R_o = 0$

Parameter	Voltage amp.	Current amp.	Transconductance amp.	Transresistance amp.
Gain	$A_v = \frac{V_o}{V_i}$	$A_i = \frac{I_o}{I_i}$	$A_g = \frac{I_o}{V_i}$	$A_m = \frac{V_o}{I_i}$
R_i	$R_i >> R_s$; $R_i = \infty$	$R_i << R_s$; $R_i = 0$	$R_i >> R_s$; $R_i = \infty$	$R_i << R_s$; $R_i = 0$
R_o	$R_o << R_L$; $R_o = 0$	$R_o >> R_L$; $R_L = \infty$	$R_o >> R_L$; $R_o = \infty$	$R_o << R_L$; $R_o = 0$