Multi stage Amplifier

→ The o/p from a singe stage ampr is usually insufficient to drive a o/p device.

→ In other words, the gain of single stage ampr is not enough for practical purpose. So, more than one ~~am~~ stage amplification is required.

→ To achieve the o/p of one stage is coupled with i/p of next stage. The resulting system is referred as Mulistage ampr.

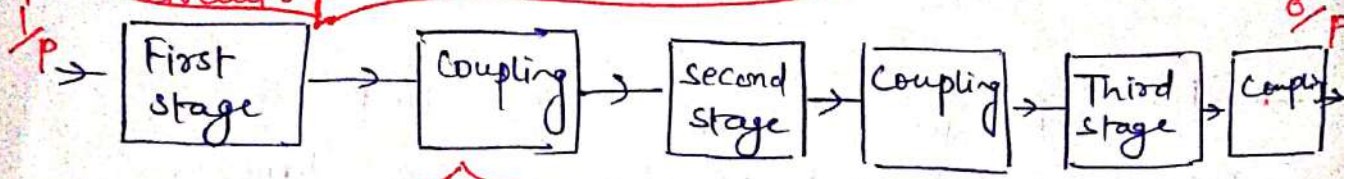
→ For ex – In a transistor radio receiver, the no of amplification stage is six or more.

Multi stage Transistor Ampr

A transistor circuit containing more than one stage of amplification is known as Multistage Transistor ampr.

In a multi stage ampr, a no of single stage ampr are connected in cascade arrangement. (o/p of one stage is connected to i/p of next stage).

each stage consist of one transistor & associated circuitry



The purpose of coupling device

i) Transfer A.C O/p to next stage

ii) To isolate DC from next stage.

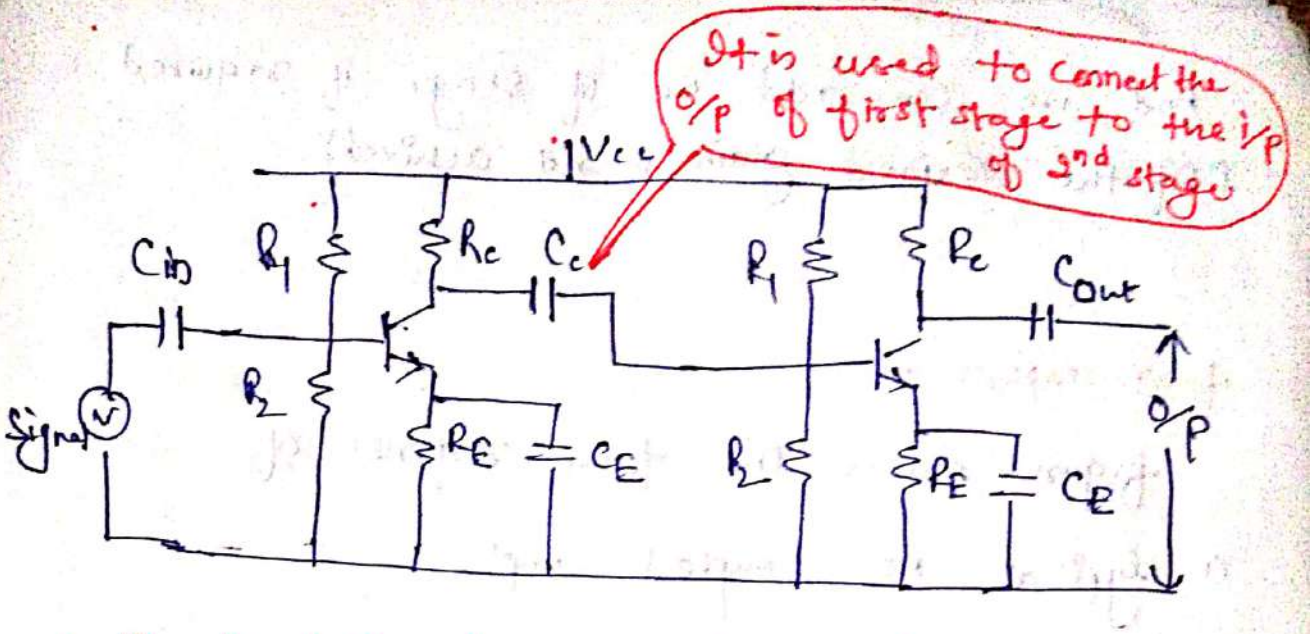
Name of Coupling	Name of multistage Ampr
Rc coupling	Rc coupled Ampr
Transformer coupling	Transformer coupled Ampr
Direct coupling	Direct coupled Ampr.

RC coupled Transistor Ampr

In Rc coupled ampr, Capacitor is used as coupling device.

→ This is the most popular type of coupling because it is cheap & provides excellent audio fidelity over a wide range of freq.

→ Usually used for voltage amplification.



→ R_1, R_2 & R_E form the biasing & stablization network.

→ C_E offers low reactance path to the signal.

→ C_c transmits A.C signal but blocks D.C which prevents DC interface between stages.

As the coupling from one stage to next stage is achived by coupling capacitor followed by shunt resistors, therefore such ampr is called resistance — capacitance coupled ampr.

Operation –

→ When Ac signal is applied to the base of ~~first~~ transistor, it appears in amplified form across its collector load R_c.

→ The amplified signal developed across R_c is given to base of next stage through C_c.

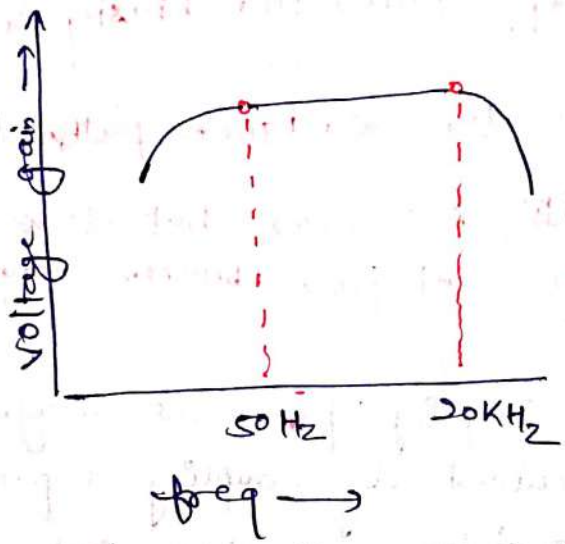
→ The second stage does further amplification of the signal.

→ In this way, the cascade connection (one after another) & with no of stages amplify the signal.

And we can add no of stage if required (of the desired gain is not achived).

freq. response —

figure shows the freq. response of a typical Rc coupled ampr.



At Low freq. At ($<50Hz$), the reactance of Ce is quite high, and hence very small part of signal will pass from one stage to next.

At High freq — At high freq ($>20KHz$) the reactance of Ce is very small & it behaves as a S.C. This increase the loading effect of next stage & serve to reduce the voltage gain.

At mid freq. ($50Hz$ to $20KHz$). - Here the voltage gain of ampr is constant.

Advantages –
Very cost effective (as resistors & capacitors are very cheap.

Disadvantage –
Impedance Matching is poor & has low voltage gain.

Transformer Coupled Amp^r

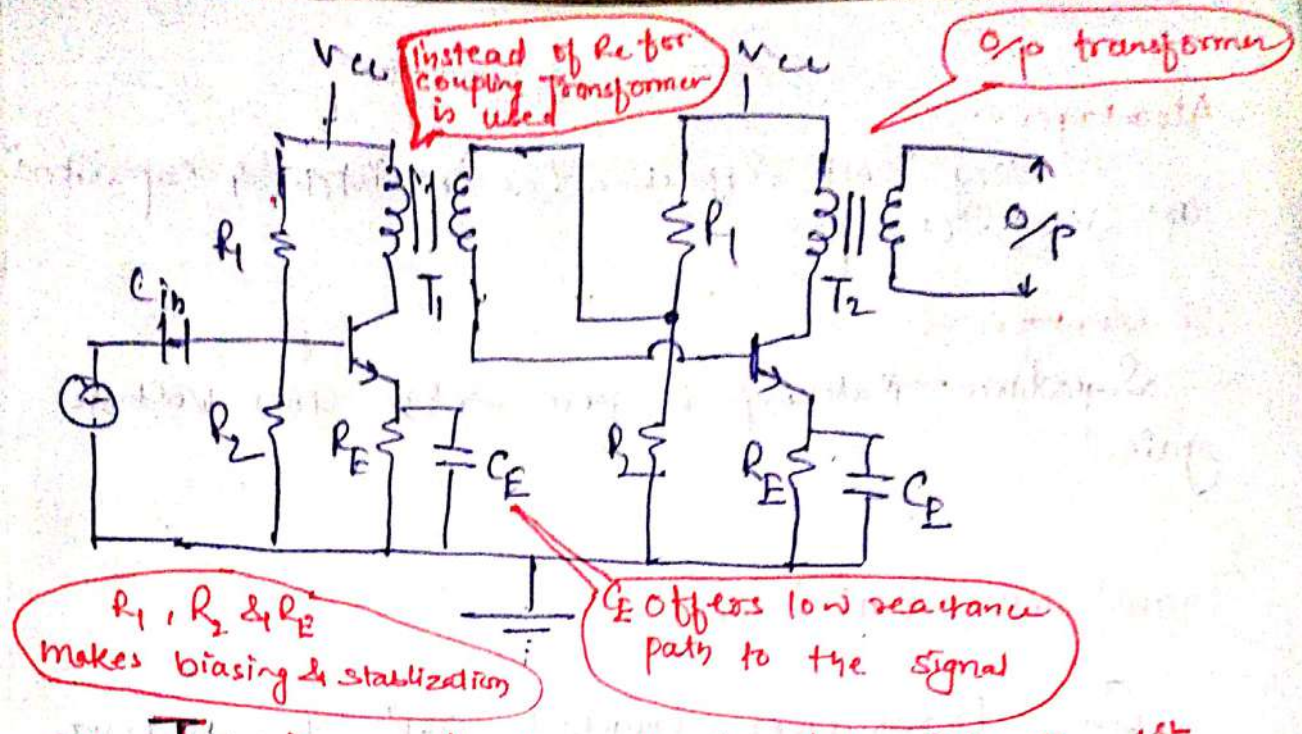
In Transformer coupled amp^r Transformer is used for coupling.

The Benifit with Transformer is high voltage gain & high power gain.

→ This is due to in R.C coupled amp^r the effective load (R_{AC}) of each stage is decreased due to low resistance presented by i/p of each stage to preceding stage.

→ In other words, i/p impedance of amp^r is low while its o/p impedance is high.

→ & when they are coupled to make multistage amp^r, the high o/p impedance of one stage comes in || with low i/p impedance of next stage. Hence effective load is decreased. This prob can be overcome by Transformer coupled amp^r



→ T_1 is used to feed the o/p of 1st stage to i/p of 2nd stage.

→ R_c is replaced by Primary winding of T_1 & secondry winding is connected between Potential devider (R_1 & R_2 of 2nd stage) & base of 2nd stage.

→ When Ac signal is applied to the i/p of the base of 1st transistor then it's get amplified by transistor & appears at the collector which is Primary winding of Transformer.

→ Transformer which is used as a coupling device in the circuit has a property of impedance changing (because of turn ratio)

→ means resistance of a stage can be reflected as high load resistance to the previous stage.

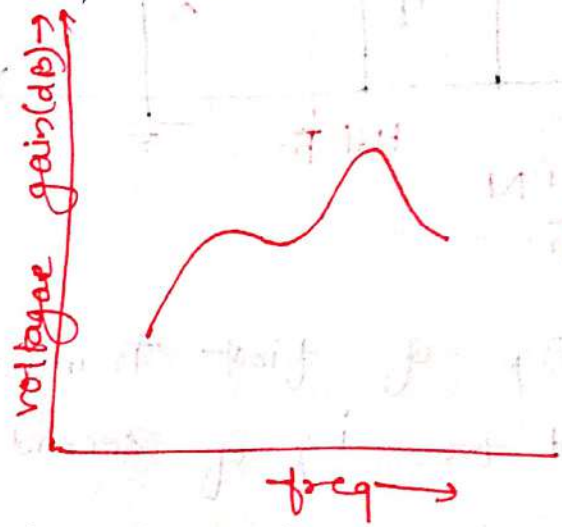
→ So, Transformer coupling provides good impedance b/w the stages of ampr.

freq Response of Transformer Coupled Amp

At low freq. the reactance of primary begins to fall, resulting in decreased gain.

At high freq, the capacitance b/w turns of winding acts as bypass condenser to reduce the o/p voltage & hence gain.

So, the amplification of audio signals will not be proportionate & some distortion will also get induced, which is called freq. distortion.



Advantage

→ Gain Achived is higher

→ An excellent impedence matching is provided.

Disadvantage

→ Bulky & costly due to use of Transformer.

→ freq. distortion is higher

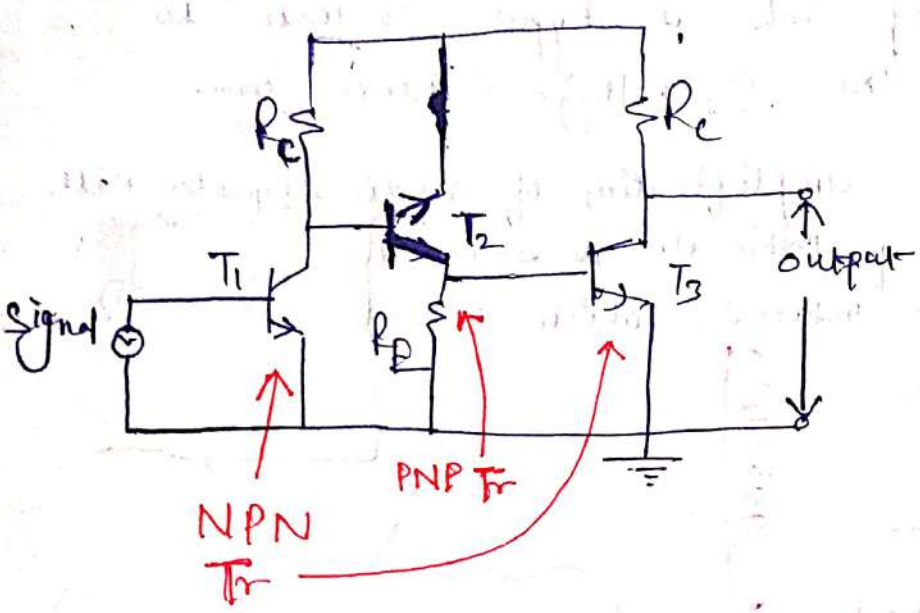
Application

→ Mostly used for impedance matching.

→ Used for Power amplification.

Direct Coupled Amp^r :-

The other type coupling amp^r is direct coupled amp^r. It is especially used to amplify lower freq.



→ The o/p of first transistor T_1 is connected to i/p of second stage T_2

→ The variation of one transistor tend to cancel the variation in other

→ The rise in the collector current & β of one transistor is cancelled by other transistor.

→ Operation

signal is applied to base of T_1 ⇒ signal is amplified & o/p appears at collector of T_1.

This o/p is applied to the base of T_2 ← Signal is further amplified

Advantage

→ The circuit is simple because of minimum use of resistor
→ cost effective bacause of min no of component use & no use of Transformer.

Disadvantage

→ It can't be used for high freq.
→ The operating pint is shift due to temp.

Application

→ Low freq application
→ Low current application.

Comparision

S. No.	Particular	RC coupling	Transformer coupling	Direct coupling
01.	Freq. Response	Excellent in audio freq. range	Poor	Best
02	Cost	Less	More	Least
03.	space & weight	Less	More	Least
04.	Impedance Matching	not good	Excellent	good
05.	Use	used for voltage amplification	For Power amplification	for very low freq.

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