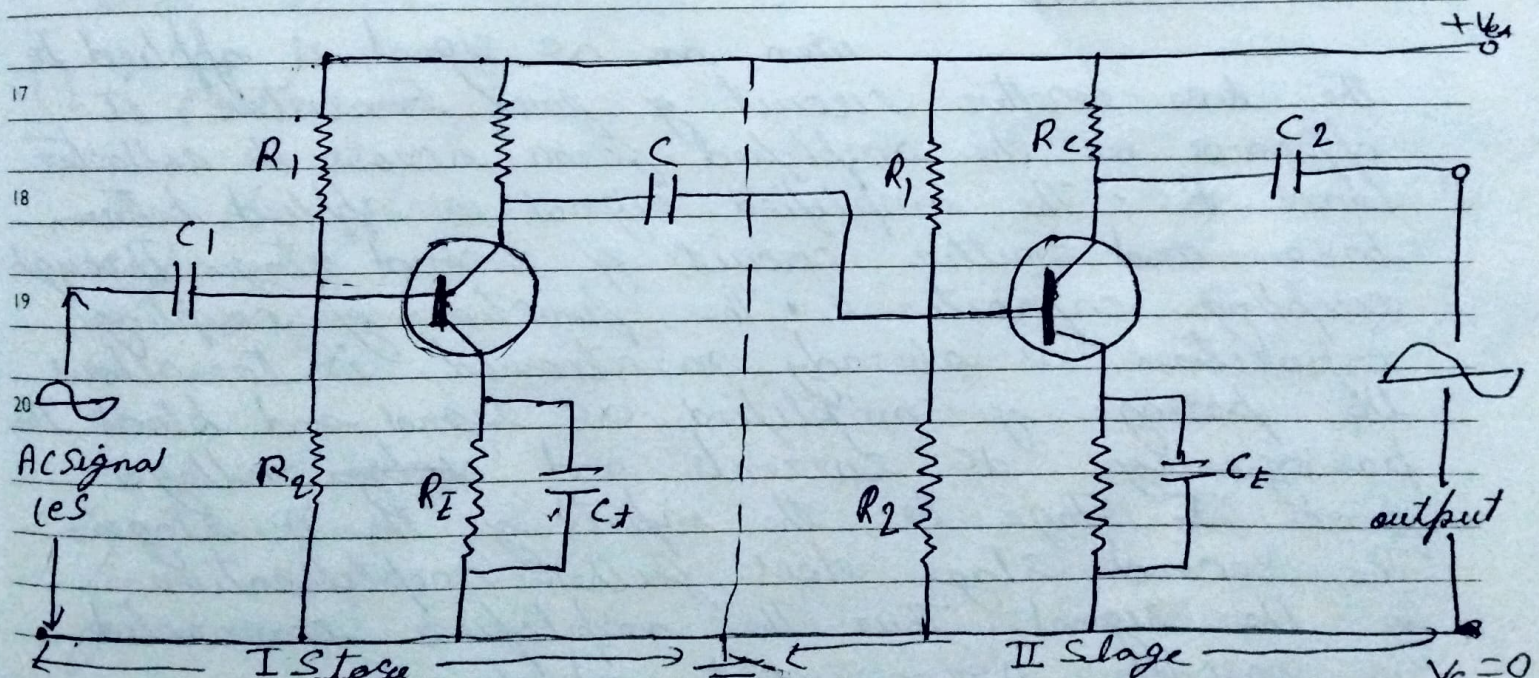
R-C COUPLED AMPLIFIER

R.C coupling is the most popular coupling because it is cheap and provides an excellent audio fidelity over a wide range of frequencies. Moreover transistor voltage amplifiers often use CE configuration because of the combined voltage and current gains of this circuit. fig represents a two stage RC coupled CE amplifier. The resistor RC is used as a load impedance of I stage and the capacitor C is used to allow the passage of the amplified ac signal from I stage to the input of II stage. This capacitor also blocks the passage of dc voltage and currents and hence is sometimes called the blocking capacitor.



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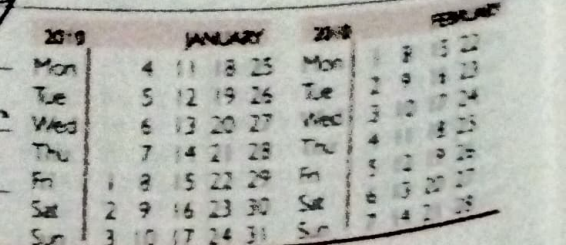
The resistances R1, R2 and RE form the biasing and stabilization circuit. The emitter by pass capacitor CE is such that its reactance $\frac{1}{\omega C_E} \ll R_E$; hence it by passes the ac component of emitter current and the potential difference across RE is due to dc component of the current. The input capacitor C_1 couples the ac signal voltage to the base of the transistor. In the absence of C_1, the signal source will be in parallel with R_2 and bias voltage of base will change. Thus the function of C_1 is to allow only the ac from signal source to flow through the input circuit.

OPERATION →

When an ac signal is applied to the base-emitter circuit of first transistor, it appears in the amplified form across the collector load Rc. The amplified signal is applied between base and emitter circuit of second stage through coupling capacitor C. The function of coupling capacitor, as already mentioned, is to allow the passage of amplified ac signal and block the passage of dc currents and ~~voltage~~ voltages from I stage to the input of the II stage. The second stage does further amplification of the signal. Thus the amplifiers connected in cascade arrangement amplify the signal and the overall gain is considerably increased.



It may be mentioned that the net (overall gain is less than the product of gains of individual stages due to the fact that the effective load impedance of an amplifier stage is reduced due to shunting effect of the input resistance of the next stage.

Frequency Response ⇒

The voltage gain of the amplifier usually depends on the frequency of ac signal applied. This is due to the fact that different reactive components (L and C) of the amplifier have different impedances for different frequencies. The total frequency range is generally divided into three ranges.

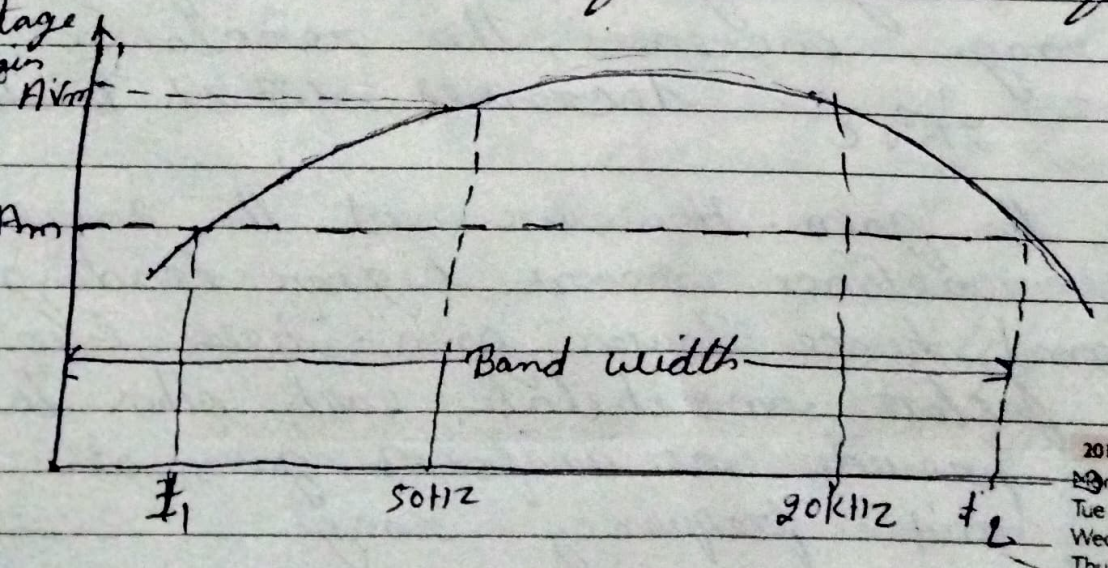
(i) Mid frequency Range ⇒

(50 HZ < V ≤ 20 KHZ)

In this frequency range the effect of coupling capacitor C is such that it maintains a uniform voltage gain. When the frequency V in this range, increases, the reactance $X_C = \frac{1}{\omega C} = \frac{1}{2\pi V C}$ decreases which tends to increase the gain. However at the same time, lower reactance means higher loading of I stage and hence lower gain. These two factors annihilate each other to provide a uniform gain at mid frequency range.

ii) High Frequency Range → (V > 20KHZ). At high frequencies the reactance of coupling capacitor is very small and it acts like a short circuit. This increases the loading effect of the next stage and serves to reduce the voltage gain. Moreover the capacitive reactance of base emitter junction $\frac{1}{\omega C_{be}} = \frac{1}{2\pi f C_{be}}$ decreases which causes an increase in base current. Due to these factors the voltage gain decreases with decrease of frequency.

(iii) Low Frequency Range → (V < 50HZ). At low frequencies the reactance of coupling capacitor C is quite high and hence a very small part of the signal will pass from the first stage to the next stage. Moreover CE has large reactance at low frequencies, hence it can not shunt the emitter resistance RE. These two factors cause fall of voltage



gain with decrease of frequencies in low frequency range.

The frequency response curve of RC coupled amplifier is shown in fig.