

4.5 Tuned amplifier

- Communication circuit widely uses tuned amplifier and they are used in MW & SW radio frequency 550 KHz – 16 MHz, 54 – 88 MHz, FM 88 – 108 MHz, cell phones 470 - 990 MHz
- Band width is 3 dB frequency interval of pass band and –30 dB frequency interval
- Tune amplifiers are also classified as A, B, C similar to power amplifiers based on conduction angle of devices.

Series resonant circuit

Series resonant features minimum impedance (R_S) at resonant.

$$f_r = \frac{1}{2\pi\sqrt{LC}}; q = \frac{L}{R_S} \text{ at resonance } L = \frac{1}{C}, BW = \frac{f_r}{Q}$$

It behaves as purely resistance at resonance, capacitive below and inductive above resonance

Parallel resonant circuit

Parallel resonance features maximum impedance at resonance = $L / R_S C$

$$\text{At resonance } f_r = \frac{1}{2\pi\sqrt{LC - R_S^2/L^2}}; \text{ if } R_S = 0, f_r = \frac{1}{2\pi\sqrt{LC}}$$

At resonance it exhibits pure resistance and below f_r parallel circuit exhibits inductive and above capacitive impedance

Single tuned amplifier

Single Tuned Amplifiers consist of only one Tank Circuit and the amplifying frequency range is determined by it. By giving signal to its input terminal of various Frequency Ranges. The Tank Circuit on its collector delivers High Impedance on resonant Frequency, Thus the amplified signal is Completely Available on the output Terminal. And for input signals other than Resonant Frequency, the tank circuit provides lower impedance, hence most of the signals get attenuated at collector Terminal.

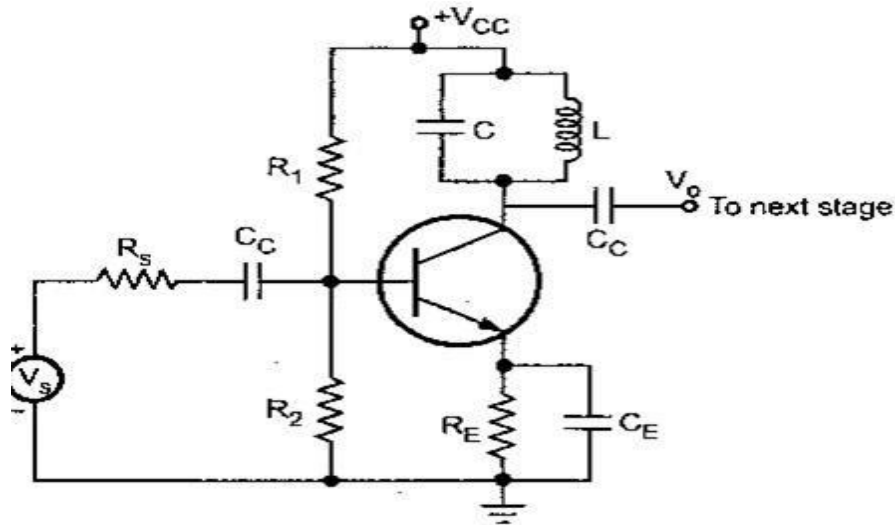


Figure: 4.5.1 Single tuned amplifier

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 148]

Ri- input resistance of the next stage
 R0-output resistance of the generator
 gm Vb'eCc & CE are negligible small
 The equivalent circuit is simplified by

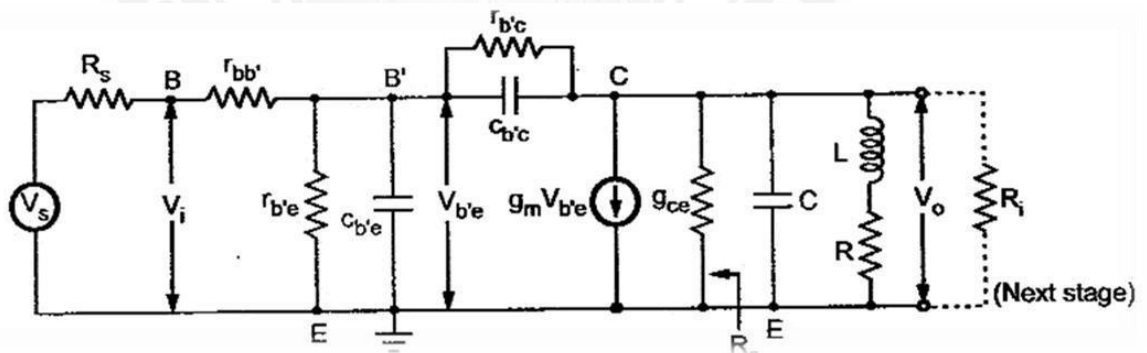


Figure: 4.5.2 Single tuned amplifier equivalent circuit

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 148]

General shape of frequency response of amplifiers:

An audio frequency amplifier which operates over audio frequency range extending from 20 Hz to 20 kHz. Audio frequency amplifiers are used in radio receivers, large public meeting and various announcements to be made for the passengers on railway platforms. Over the range of frequencies at which it is to be used an amplifier should ideally provide the same amplification for all frequencies. The degree to which this is done is usually indicated by the curve known as frequency response curve of the amplifier.

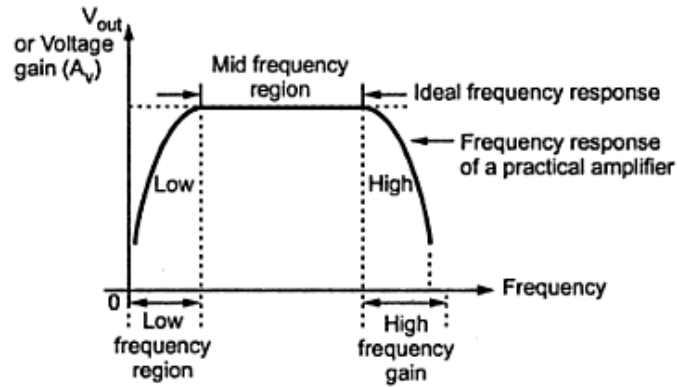


Fig. A typical frequency response of an amplifier
Figure: 4.5.3 Frequency response of an amplifier

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 148]

To plot this curve, input voltage to the amplifier is kept constant and frequency of input signal is continuously varied. The output voltage at each frequency of input signal is noted and the gain of the amplifier is calculated. For an audio frequency amplifier, the frequency range is quite large from 20 Hz to 20 kHz. In this frequency response, the gain of the amplifier remains constant in mid-frequency while the gain varies with frequency in low and high frequency regions of the curve. Only at low and high frequency ends, gain deviates from ideal characteristics. The decrease in voltage gain with frequency is called roll-off.