L – 13:	**Analysis of Double Tuned Amplifiers;**

Definition;

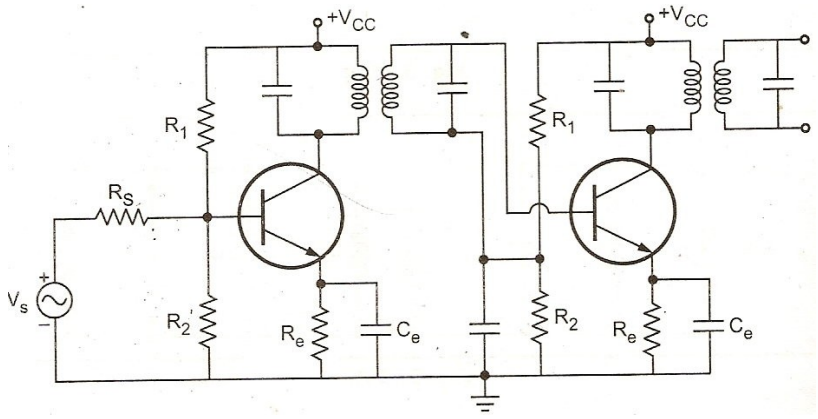
A synchronously tuned amplifier is an amplifier having more than one tuned circuit with each tuned circuit having the same centre frequency and bandwidth.

A double tuned amplifier consists of inductively coupled two tuned circuits, one L_1, C_1 and the other L_2, C_2 in the collector terminals. A change in the coupling of the two tuned circuits results in change in the shape of the frequency response curve.

- By proper adjustment of the coupling between the two coils of the two tuned circuits, the required results (high selectivity, high voltage gain and required bandwidth) may be obtained.

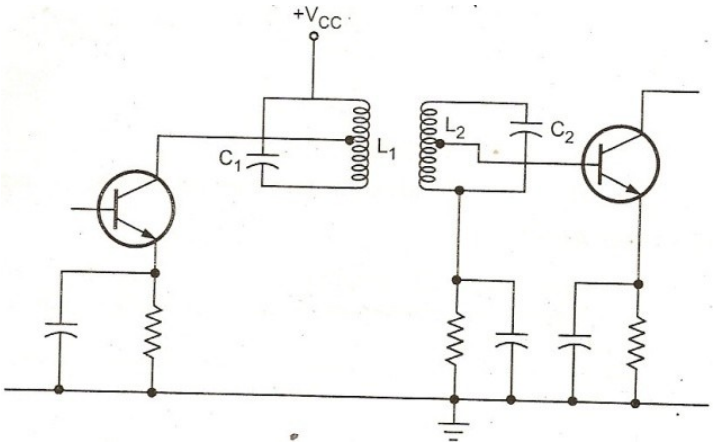
A double tuned amplifier is used in intermediate-frequency amplifier. It operates at a

fixed frequency, so the tuning adjustments are set when the transformer is being manufactured. The circuit can provide a wide bandwidth and gives steep sides to the response curve.



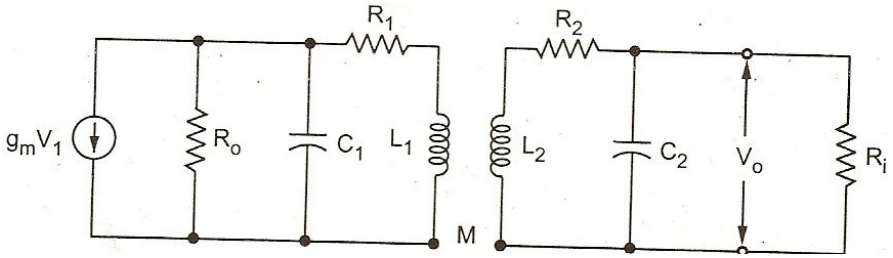
The figure shows a double tuned RF amplifier in CE configuration. The voltage developed across one tuned circuit is coupled inductively to another tuned circuit. Both circuits are tuned to the same frequency.

Diagram of the coupling section,



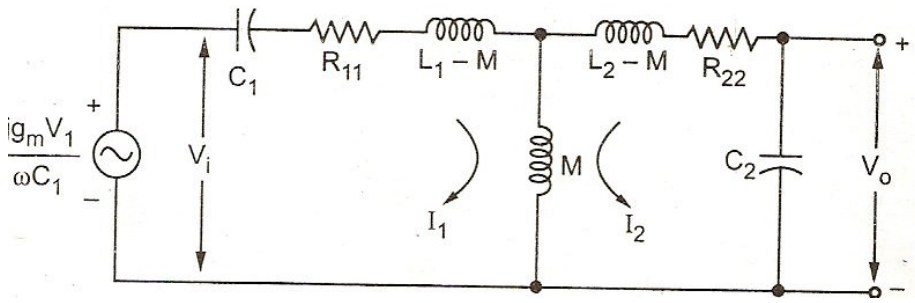
A transistor which is a current source with its output resistance R_o is replaced by a voltage source. $C_1 \text{ and } L_1$ are tank circuit components of the primary side, while $C_2 \text{ and } L_2$ represents tank circuit components of the secondary side.

In the *equivalent circuit* the series and parallel resistances are combined into series elements to form an equivalent circuit for double tuned amplifier.



In a *simplified equivalent circuit* diagram the current generator in parallel with C_1 is replaced with a voltage generator in series with C_1 source

$$\therefore R_{11} = \frac{\omega_0^2 L_1^2}{r_1} + R_1 \quad \text{and} \quad R_{22} = \frac{\omega_0^2 L_2^2}{r_2} + R_2$$

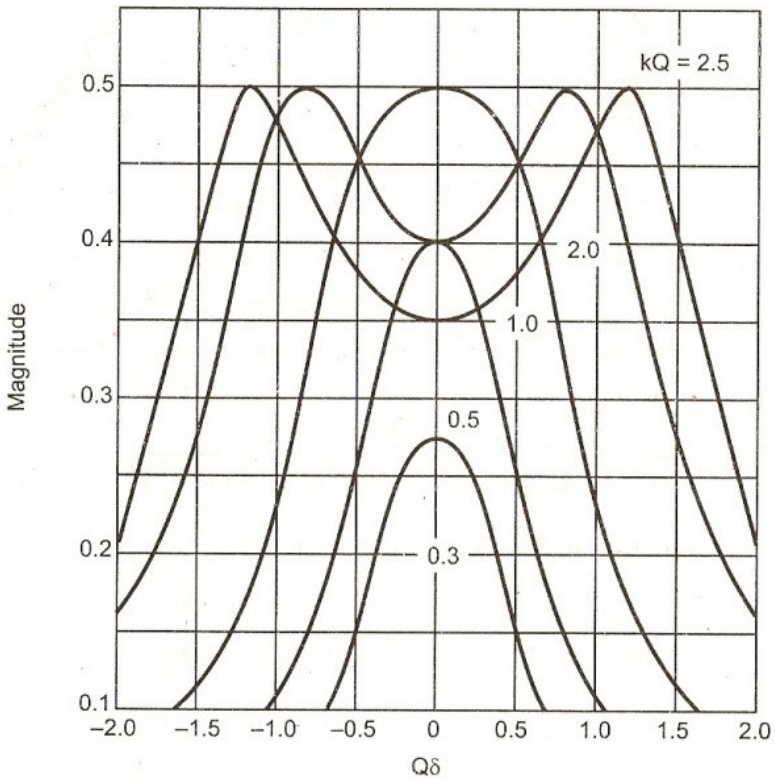


Advantages of tuned amplifiers

- They amplify defined frequencies;
- Signal to noise ratio at output is good;
- They are well suited for radio transmitters and receivers
- The band of frequency over which amplification is required can be varied;

Disadvantages;

- Since they inductors and capacitors as tuning elements, the circuit is bulky and costly;
- If the band of frequency is increased, design becomes complex;
- They are suitable to amplify audio frequencies.

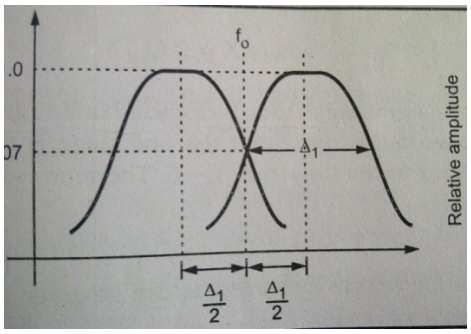


Stagger Tuned Amplifiers

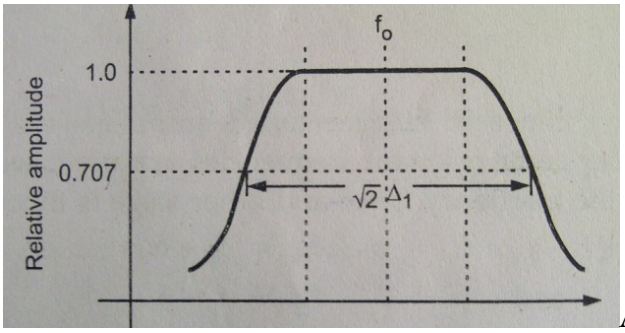
Definition;

> Stagger tuning is method of producing a wide bandwidth in a multistage IF amplifier by tuning to different frequencies by a special amount.

A double tuned amplifier gives a greater bandwidth with steeper sides and flat top, but alignment of a double tuned amplifier is difficult. To overcome this problem two single tuned cascaded amplifiers having certain bandwidth are taken and their resonant frequencies adjusted so that they are separated by an equal interval to the bandwidth of each stage. Since their resonant frequencies are displaced or staggered, they are known as stagger tuned amplifiers.



Stagger tuning means that the tuned circuit consists of two tank circuits, each tuned to a slightly different frequency, i.e. one staggered from the other. Stagger tuning widens the band-pass of the circuit so that it will accept wider signals or several narrow signal that are within the band-pass



Advantages of stagger tuned amplifiers;-

- They have better flat, wideband characteristics as compared to single tunes amplifiers.
- Reduction in intelligible crosstalk between identical channel of of adjacent carrier systems as a result of using slightly different frequency allocations for the different systems.