

3.11 Example with Solutions

Example 1: Derive the bandwidth of a synchronous tuning system with three single tuned amplifiers. Assume bandwidth of individual stage is 10KHz.

Solution:

$$BW_n = BW_1 \sqrt{2^{1/n} - 1}$$

$$= 10 \times 10^3 \sqrt{2^{1/3} - 1} = 5.095 \text{KHz}$$

3.12 Two Marks Question and Answers

1. What do you mean by tuned amplifiers?

The amplifiers which amplify only selected range of frequencies (narrow band of frequencies) with the help of tuned circuits (parallel LC circuit) are called tuned amplifiers.

2. What are the various types of tuned amplifiers?

1. Small signal tuned amplifiers
 - a. Single tuned amplifiers
 - i. Capacitive coupled
 - ii. Inductively coupled (or) Transformer coupled
 - b. Double tuned amplifiers
 - c. Stagger tuned amplifiers

2. Large signal tuned amplifiers

3. What is the response of tuned amplifiers?

The response of tuned amplifier is maximum at resonant frequency and it falls sharply for frequencies below and above the resonant frequency.

4. When tuned circuit is like resistive, capacitive and inductive?

- (1) At resonance, circuit is like resistive.
- (2) For frequencies above resonance, circuit is like capacitive.
- (3) For frequencies below resonance, circuit is like inductive.

5. What are the various components of coil losses?

- (1) Copper loss
- (2) Eddy current loss
- (3) Hysteresis loss

6. Define Q factor of resonant circuit.

- (1) It is the ratio of reactance to resistance.
- (2) It also can be defined as the measure of efficiency with which inductor can store the energy.

$$Q = 2\pi \cdot (\text{Maximum Energy Stored per cycle} / \text{Energy dissipated per cycle})$$

7. What is dissipation factor?

- 1) It is defined as $1/Q$.
- 2) It can be referred to as the total loss within a component.

8. Define unloaded and loaded Q of tuned circuit.
- (1) The unloaded Q or Q_U is the ratio of stored energy to dissipated energy in a reactor or resonator.
 - (2) The loaded Q or Q_L of a resonator is determined by how tightly the resonator is coupled to its terminations.
9. Why quality factor is kept as high as possible in tuned circuits?
- i. When Q is high, bandwidth is low and we get better selectivity. Hence Q is kept as high as possible in tuned circuits.
 - ii. When Q is high inductor losses are less.
10. List various types of cascaded Small signal tuned amplifiers.
- i. Single tuned amplifiers.
 - ii. Double tuned amplifiers.
 - iii. Stagger tuned amplifiers.
11. What are single tuned amplifiers?
- Single tuned amplifiers use one parallel resonant circuit as the load impedance in each stage and all the tuned circuits are tuned to the same frequency.
12. What are double tuned amplifiers?
- Double tuned amplifiers use two inductively coupled tuned circuits per stage, both the tuned circuits being tuned to the same frequency.
13. What are stagger tuned amplifiers?
- Stagger tuned amplifiers use a number of single tuned stages in cascade, the successive tuned circuits being tuned to slightly different frequencies.
- (OR)
- It is a circuit in which two single tuned cascaded amplifiers having certain bandwidth are taken and their resonant frequencies are adjusted that they are separated by an amount equal to the bandwidth of each stage. Since resonant frequencies are displaced it is called stagger tuned amplifier.
14. What is the effect of cascading single tuned amplifiers on bandwidth?
- Bandwidth reduces due to cascading single tuned amplifiers.
15. List the advantages and disadvantages of tuned amplifiers.
- Advantages:
- i. They amplify defined frequencies.
 - ii. Signal to Noise ratio at output is good.
 - iii. They are well suited for radio transmitters and receivers.
 - iv. The band of frequencies over which amplification is required can be varied.
- Disadvantages:
- i. Since they use inductors and capacitors as tuning elements, the circuit is bulky and costly.
 - ii. If the band of frequency is increased, design becomes complex.
 - iii. They are not suitable to amplify audio frequencies.
16. What are the advantages of double tuned amplifier over single tuned amplifier?

- i. It provides larger 3 dB bandwidth than the single tuned amplifier and hence provides the larger gain-bandwidth product.
- ii. It provides gain versus frequency curve having steeper sides and flatter top.

17. What the advantages are of stagger tuned amplifier?

The advantage of stagger tuned amplifier is to have better flat, wideband characteristics.

- i. Mention the applications of class C tuned amplifier. Class C amplifiers are used primarily in high-power, high-frequency applications such as Radio-frequency transmitters.
- ii. In these applications, the high frequency pulses handled by the amplifier are not themselves the signal, but constitute what is called the Carrier for the signal.
 - i. Amplitude modulation is one such example.
 - ii. The principal advantage of class-C amplifier is that it has a higher efficiency than the other amplifiers.

18. What is Neutralization?

The technique used for the elimination of potential oscillations is called neutralization. (OR) The effect of collector to base capacitance of the transistor is neutralized by introducing a signal that cancels the signal coupled through collector base capacitance. This process is called neutralization.

19. What is rice neutralization?

It uses center tapped coil in the base circuit. The signal voltages at the end of tuned base coil are equal and out of phase.