

## UNIT-4 OSCILLATOR AND MULTIVIBRATOR

### OSCILLATOR

#### 1. Mention two essential conditions for a circuit to maintain oscillations

The conditions for oscillator to produce oscillation are given by Barkhausen criterion. They are:

- i) The total phase shift produced by the circuit should be  $360^\circ$  or  $0^\circ$
- ii) The Magnitude of loop gain must be greater than or equal to 1 (ie)  $|A\beta| \geq 1$

#### 2. What is the major disadvantage of a Twin-T oscillator?

Twin –T oscillator is operated only at one frequency.

#### 3. Differentiate oscillator from amplifier.

Oscillators

1. They are self-generating circuits. They generate waveforms like sine, square and triangular waveforms of their own. Without having input signal.
2. It have infinite gain
3. Oscillator uses positive feedback.

Amplifiers

1. They are not self-generating circuits. They need a signal at the input and they just increase the level of the input waveform.
2. It have finite gain
3. Amplifier uses negative feedback.

#### 4. State Barkhausen criterion for sustained oscillation. What will happen to the oscillation if the magnitude of the loop gain is greater than unity?

The conditions for oscillator to produce oscillation are given by Barkhausen criterion. They are :

- i) The total phase shift produced by the circuit should be  $360^\circ$  or  $0^\circ$
- ii) The Magnitude of loop gain must be greater than or equal to 1 (ie)  $|A\beta| \geq 1$

In practice loop gain is kept slightly greater than unity to ensure that oscillator work even if there is a slight change in the circuit parameters.

#### 5. Why an LC tank circuit does not produce sustained oscillations. How can this can be overcome?

We know that the inductor coil has some resistance and dielectric material of the capacitor has some leakage. so small part of the originally imparted energy is used to overcome these losses. As a result, the amplitude of oscillating current goes on decreasing and becomes zero when all energy is consumed as losses. So a LC tank circuit does not produce sustained oscillations.

To maintain sustained oscillations, energy must be supplied to the circuit at the same rate at which it is dissipated. In an oscillator, the function of transistor and power supply source is to feed energy to the circuit to overcome the losses at right time.

**6. Draw the electrical equivalent circuit of crystal. and mention its series and parallel resonance frequency.**

The crystal actually behaves as a series RLC circuit in parallel with CM. . Because of presence of CM , the crystal has two resonant frequencies.

One of these is the series resonant frequency  $f_s$ . In this case impedance is very low.

The other is parallel resonance frequency  $f_p$ . In this case impedance is very high.

**7. What are the advantages and disadvantages of RC phase shift oscillators?**

Advantages:

- i. It is best suited for generating fixed frequency signals in the audio frequency range.
- ii. It requires no transformer or inductor, hence less bulky.
- iii. Simple Circuit.

\*Pure sine wave output is possible.

Disadvantages:

- i) It requires a high  $\beta$  transistor to overcome losses in the network.
- ii) These oscillators are not suitable for high frequency operation.
- iii) Frequency of oscillation can not be changed easily. To change the frequency of oscillation, the three capacitor or resistors should be changed simultaneously. This is inconvenient.

**8. What is the necessary condition for a Wien bridge oscillator circuit to have sustained oscillations?**

Then for oscillations to occur in a Wien Bridge Oscillator circuit the following conditions must apply.

- ü With no input signal the Wien Bridge Oscillator produces output oscillations.
- ü The Wien Bridge Oscillator can produce a large range of frequencies.
- ü The Voltage gain of the amplifier must be at least 3.
- ü The network can be used with a Non-inverting amplifier.
- ü The input resistance of the amplifier must be high compared to R so that the RC network is not overloaded and alter the required conditions.
- ü The output resistance of the amplifier must be low so that the effect of external loading is minimised.

**9. Define piezoelectric effect.**

The piezo electric Crystals exhibit a property that if a mechanical stress is applied across one face the electric potential is developed across opposite face and viceversa. This phenomenon is called piezo electric effect.

### **10. What is the principle behind operation of a crystal oscillator?**

The principle behind the operation of crystal is piezoelectric effect. According to this effect, if a mechanical stress is applied across one face the electric potential is developed across opposite face and viceversa.

### **11. What are the advantages and disadvantages of wein bridge oscillators? Advantages:**

1. Provides a stable low distortion sinusoidal output over a wide range of frequency.
2. The frequency range can be selected simply by using decade resistance boxes.
3. The frequency of oscillation can be easily varied by varying capacitances C1 and C2 simultaneously. The overall gain is high because of two transistors.

Disadvantages :

1. The circuit needs two transistors and a large number of other components.
2. The maximum frequency output is limited because of amplitude and the phase-shift characteristics of amplifier.

## **MULTIVIBRATOR**

### **1. Give two applications of bistable multivibrators**

- Used to generate symmetrical square wave. This is possible by using triggering pulses of equal interval, corresponding to the frequency required.
- Used as a memory element in shift registers, counters, etc.,.
- Used for the performance of many digital operations like counting and storing of digital information.
- Can be used as a frequency divider

### **2. How does a diode act as a comparator?**

A Comparator Circuit is used to identify the instant at which the arbitrary input waveform attains a particular reference level. Basically it is a clipper circuit. A simple diode comparator and its equivalent circuit is given as

### **3. What is meant by clipper circuit?**

The electronic circuits which are used to clip off the unwanted portion of the waveform, without distorting the remaining part of the waveform are called clipper circuits.

### **4. What is the 'tilt' applicable to RC circuits? Give an expression for tilt.**

In high pass RC network, Tilt is defined as the decay in the amplitude of the output voltage waveform, when the input maintains its level constant.

Percentage of tilt is given by

#### **5. What type of distortion is observed in astable multivibrator?**

It can be seen that, in the collector waveforms shown in the figure there is certain distortion present. Instead of  $[V_{c1}, V_{c2}]$  exact square wave, we are getting the vertical rising edges little bit rounded. This is called rounding. For a square wave output such a rounding is undesirable and must be eliminated.

#### **6. What is meant by clamper circuit?**

The electronic circuits which are used to add a dc level as per the requirement to the ac output signal are called clamper circuits.

It is also known as dc inserter or dc restorer.

#### **7. Give two applications of Schmitt Trigger circuit..**

- It is used as a amplitude comparator
- It can be used as a squaring circuit.
- It can be used as a sine wave to square wave converter

#### **8. Why do we call astable multivibrator as free running multivibrator?**

An astable multivibrator is called free running multivibrator because it generates square waves of its own without any external triggering pulse.

#### **9. Define the threshold points in a Schmitt trigger circuit.**

- Schmitt trigger is a type of comparator with two different threshold voltage levels on points (UTP, LTP).
- Whenever the input signal goes over the high threshold levels, the output of the comparator is switched high. The output will remain in this same state as long as the input voltage is above the low threshold level.
- When the input voltage goes below this level, the output will switch. These threshold voltage levels are called threshold points.

#### **10. What is a regenerative comparator? Give example circuit.**

Regenerative comparator is a circuit, compares its input voltage to a “threshold voltage”, because it has two threshold voltages(the upper and lower trigger voltages). The threshold voltage depends on the output state. If the input voltage is higher than the upper trigger voltage, the output will be high.

A small amount of the output voltage is effectively added to the input voltage before it is compared to a fixed threshold. So it uses positive (or) regenerative feedback.

E.g.: Schmitt Trigger

**11. Distinguish between symmetrical and unsymmetrical triggering methods.**

Symmetrical triggering uses only one trigger input and unsymmetrical triggering uses two trigger input.

**12. Why Monostable multivibrator is also called as delay circuit?**

Used to introduce time delay as gate width is adjustable.