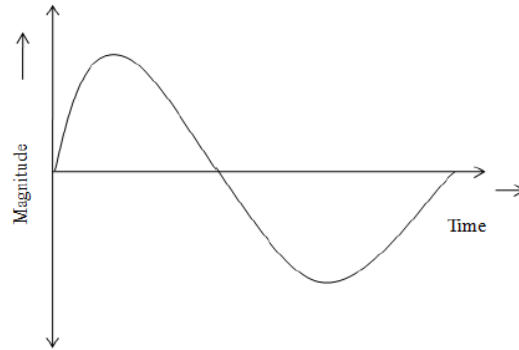## 1.12 INTRODUCTION TO AC CIRCUIT

Introduction

An alternating current or voltage is defined as the current or Voltage whose magnitude varies from instant to instant and half cycle current is one direction and other half cycle current is in opposite direction in a definite time function. The model sine wave is shown in fig.
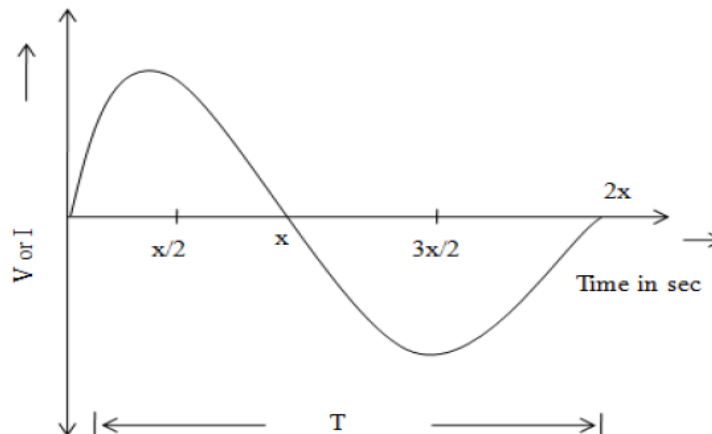

1.12.1 Generation of A.C. Voltage

The Emf induced in a generator in two ways

1. Rotating a coil in a magnetic field
2. Rotating a magnetic field with in a coil

In a A.C. generator the second method is widely used.

Definition Cycle

One complete set of positive and negative values of alternating quantity is known as cycle. One cycle is said to Spread Over 360° or 2π radians

Time Period (T)

Time taken by a alternating quantity for one complete one cycle is called time period T. For a 50HZ supply the time period is 1/50 sec 50.

Frequency:

The number of cycle of an alternating quantity per second is called frequency. The unit of frequency is in cycles/sec or HZ (Hertz).

Amplitude

- The maximum value of an alternating quantity (positive or negative) is called amplitude.

Phase and Phase Difference:

In an alternating current or voltage, reach maximum and minimum value at the same instant with respect to the reference quantity then these quantities are in the phase with each other. On other hand these quantities are reaches maximum and minimum with respect to time other than reference quantity than there is phase difference between these quantities.
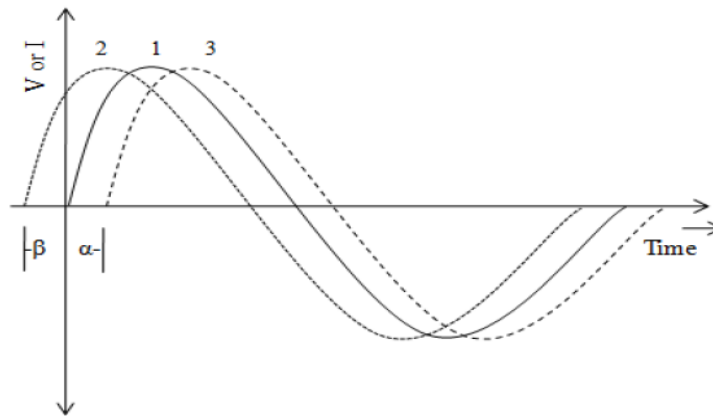
Root Mean Square (R.M.S) Value:

The R.M.S value of an alternating current is given by that steady (D.C) current which, when flowing through a given circuit for a given time produces the same heat as produced by the alternating current when flowing through the same circuit for the same time.

Average Value of an Alternating Current:

The average value of an alternating current is expressed by that steady current which transfer by that alternating current during the same time.

In case of symmetrical alternating current the average value over a complete cycle is zero.

Form Factor And Ampitude Factor:

Form factor is defined as the ratio of r.m.s value to average value

For sine wave form factor

$$K_F = \frac{r.m.s \ value}{Average \ value}$$

$$= \frac{0.707 I_m}{0.637 I_m}$$

$$K_F = 0.11$$

Power

- The instantaneous power in ac circuits can be obtained by taking product of the instantaneous values of current and voltage.

$$P = V \times i$$

Power factor: (cos ϕ)

- It is defined as factor by which the apparent power must be multiplied in order to obtain the true power.

It is the ratio of true power to apparent power

$$Power \ factor = \frac{True \ power}{Apparent \ power}$$

$$= \frac{VI \cos \phi}{VI} = \cos \phi$$

- The numerical value of cosine of the phase angle between the applied voltage and the current drawn from the supply voltage gives the power factor. It cannot be greater than one.

- It is also defined as the ratio of resistance to the impedance.

$$\cos \phi = \frac{R}{Z}$$

- The nature of power factor is always determined by position of current with respect to the voltage.

- If current lags voltage, power factor is said to be lagging. If current leads voltage power factor is said to be leading.