SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

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23EET102 / ELECTRIC CIRCUIT ANALYSIS

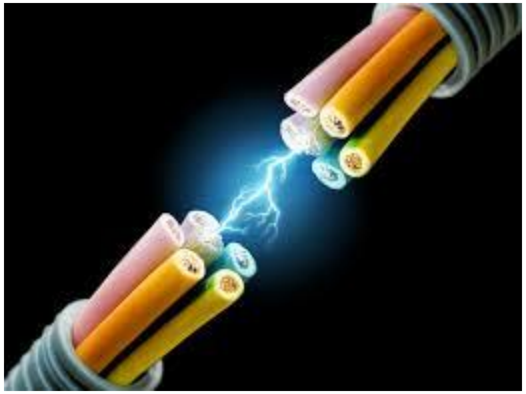
I YEAR / II SEMESTER

UNIT-III: AC CIRCUITS

AC FUNDAMENTALS & RLC-1

TOPIC OUTLINE

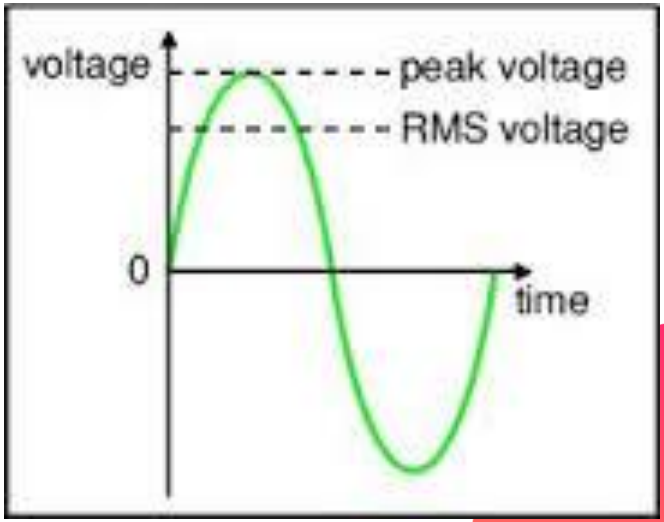
- AC fundamentals
- Peak and RMS
- RLC



AC FUNDAMENTALS

PARAMETER VALUES:

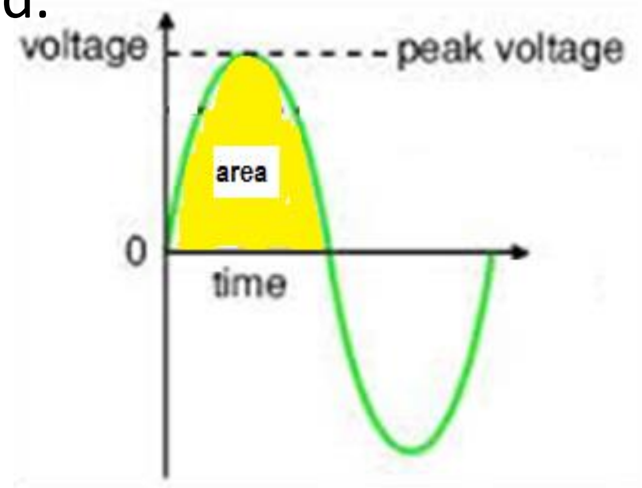
- Instantaneous (v, i)
- Peak (V_m, I_m)
- Average (V_{ave}, I_{ave})
- RMS (V, I or V_{rms}, I_{rms})



Parameters V and I are in sine wave.

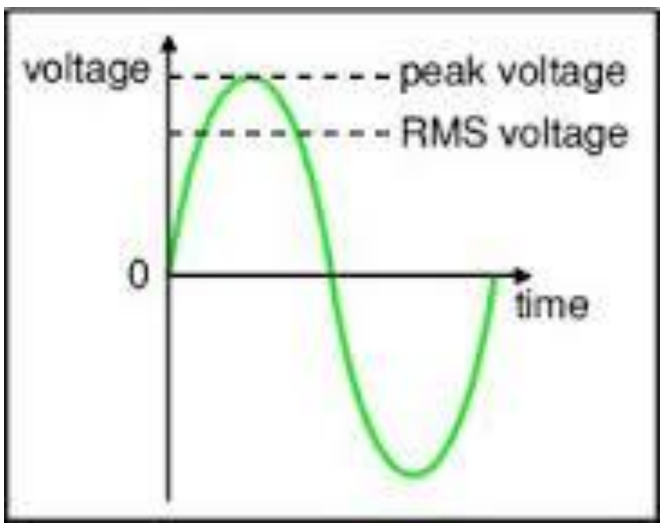
AC FUNDAMENTALS

- **Peak (V_m, I_m) :** It is the maximum value
- **Instantaneous (v, i) :** The values at any instant. It may be voltage or current.
- **Average (V_{ave}, I_{ave}):** Average value is the sum of instantaneous power in one period.
- It is also said to be as area under the curve divided by time.
- Average power - for half cycle is shown
- - for full cycle is ZERO



ROOT MEAN SQUARE (RMS)

The RMS value of a set of values (or a continuous-time waveform) is the square root of the arithmetic mean of the squares of the original values.



$$rms = \frac{Vpeak}{\sqrt{2}} \text{ (for an undistorted sine wave)}$$

$$rms = \frac{Vpeak}{\sqrt{3}} \text{ (for an undistorted triangle wave)}$$

$$rms = \frac{Vpeak}{1} \text{ (for a symmetrical square wave)}$$

RMS

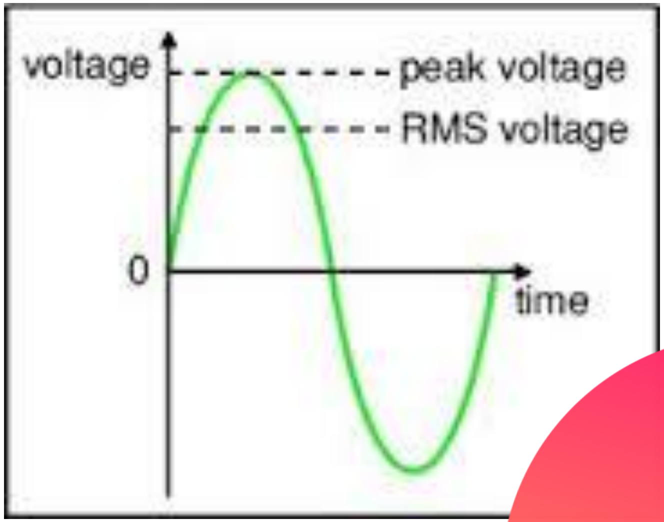
RMS value for I and V is given

$$I = I_P \sin \omega t$$

$$V = V_P \sin \omega t$$

Where,

ωt = radians per second

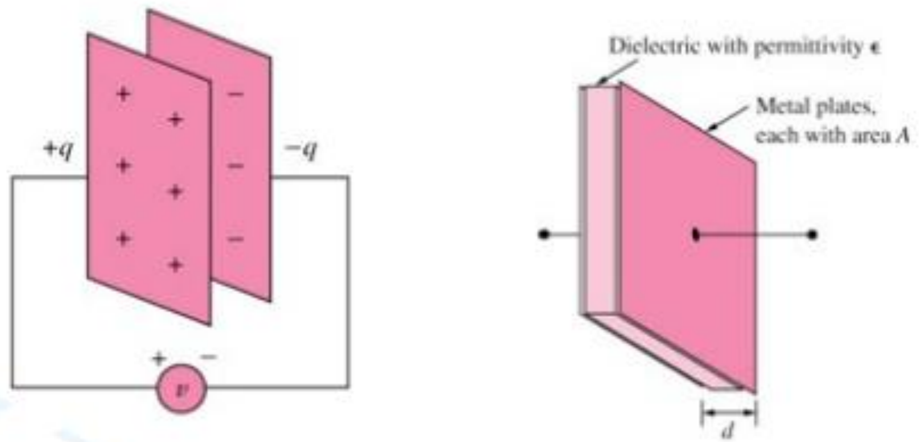


RESISTOR

- Resistance to the flow of the current. Measured in Ohms Ω
- It opposes an Electric Current

CAPACITOR

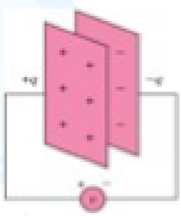
- A capacitor is a passive element designed to **store energy** in its **electric field.**



- A **capacitor** consists of two conducting plates separated by an insulator (or dielectric).

CAPACITOR

- **Capacitance** *C* is the ratio of the charge *q* on one plate of a capacitor to the voltage difference *v* between the two plates, measured in farads (F).

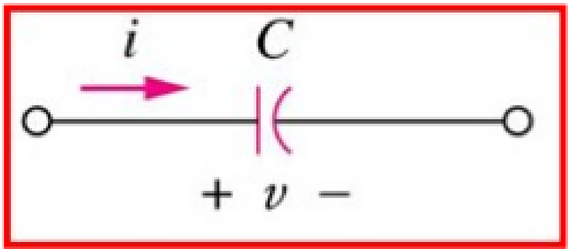


$$q = C\,v \quad \text{and} \quad C = \frac{\varepsilon A}{d}$$

- Where ε is the permittivity of the dielectric material between the plates, A is the surface area of each plate, d is the distance between the plates.
- Unit: F, pF (10^{-12}), nF (10^{-9}), and **μF (10^{-6})**

CAPACITOR

- If *i* is flowing into the +ve terminal of C
  - Charging => *i* is +ve
  - Discharging => *i* is –ve



- The current-voltage relationship of capacitor according to above convention is

$$i = C\frac{dv}{dt}$$

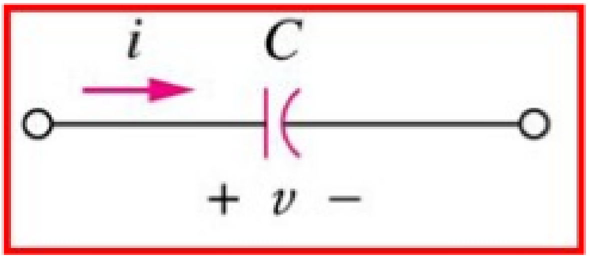
and

$$v = \frac{1}{C}\int_{t_0}^{t} i\,dt + v(t_0)$$

CAPACITOR

- The energy, ***w***, stored in the capacitor is

$$w = \frac{1}{2} C v^2$$



- A capacitor is
  - an **open circuit** to dc (dv/dt = 0).
  - its voltage **cannot change abruptly.**

CAPACITOR

Example 1

The current through a 100-μF capacitor is

$$i(t) = 50\sin(120\pi t) \text{ mA.}$$

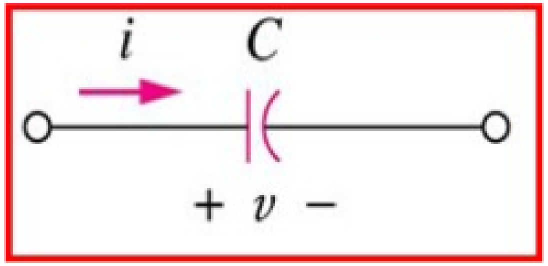
Calculate the voltage across it at t =1 ms and t = 5 ms.

Take $v(0)$ =0.

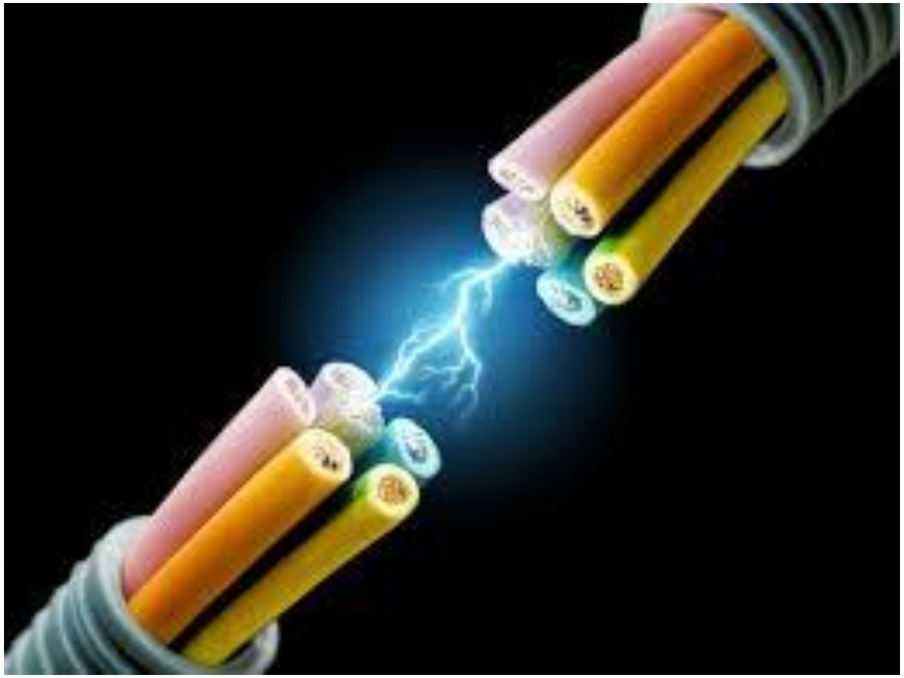
Answer:

$v(1ms)$ = 93.14mV

$v(5ms)$ = 1.7361V



RECAP….



…THANK YOU