IInd Unit.

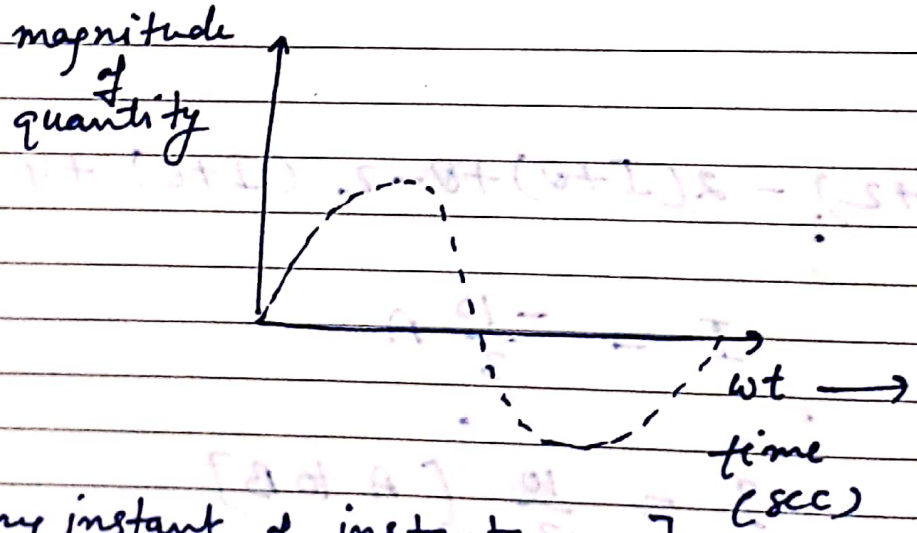
23 Monday

Day (143-222) • Week 22

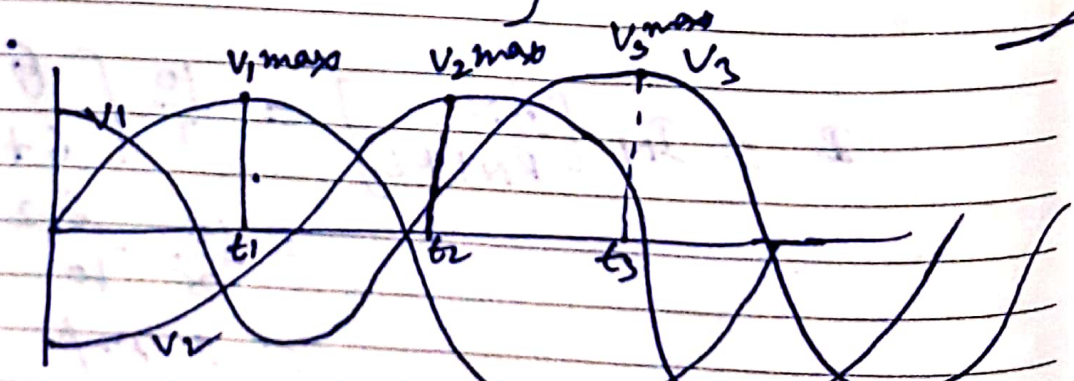
Representation of Single phase AC :→

- Graphical form
- Magnitude form
- mathematical form.

(1) wave form :→



[every instant of instantaneous value.]



Phase lead → V_1 is leading from V_2
V_2 is leading from V_3

Phase lag → V_3 is lagging from V_2
V_2 is lagging from V_1

May'11

Monday	30	2	9	16	23
Tuesday	31	3	10	17	24
Wednesday		4	11	18	
Thursday		5	12	19	26
Friday		6	13	20	27
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Appointment

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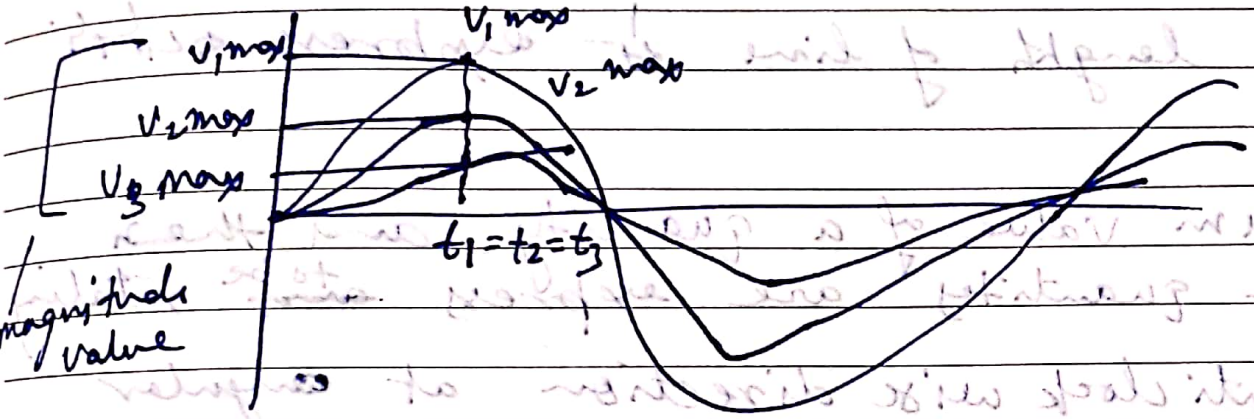
frequency of all the quantity should be the same.



Peak value in same time, it means there is no phase difference.

All waveforms reaches (+ve) peak value in different time is phase difference

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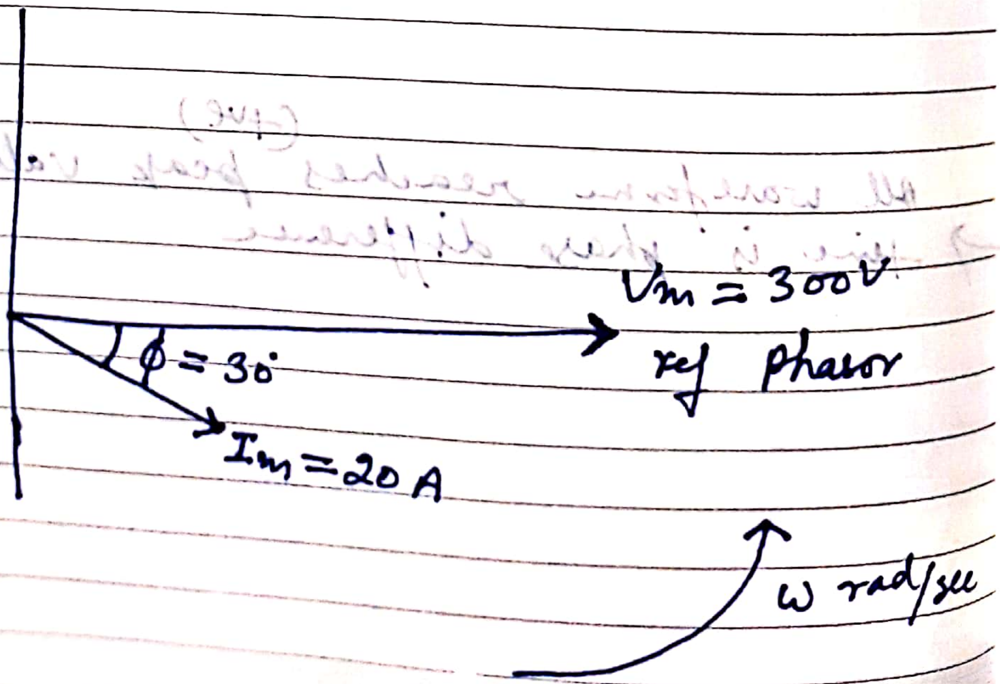
② **Phasor :-** किसी समय की सभी quantities को definite length of line से express करते हैं।

Maximum value of a quantity and then all the quantities are express to be rotating by anticlockwise direction at angular velocity ωt/sec or सभी quantity को घूमता हुआ माना जाता है। ωt रेडियन/sec की velocity से anticlockwise direction में and they are seprated by a certain angle θ from each other.



V = 30° leading from current I

$V_m = 300V$

$I_m = 20A$

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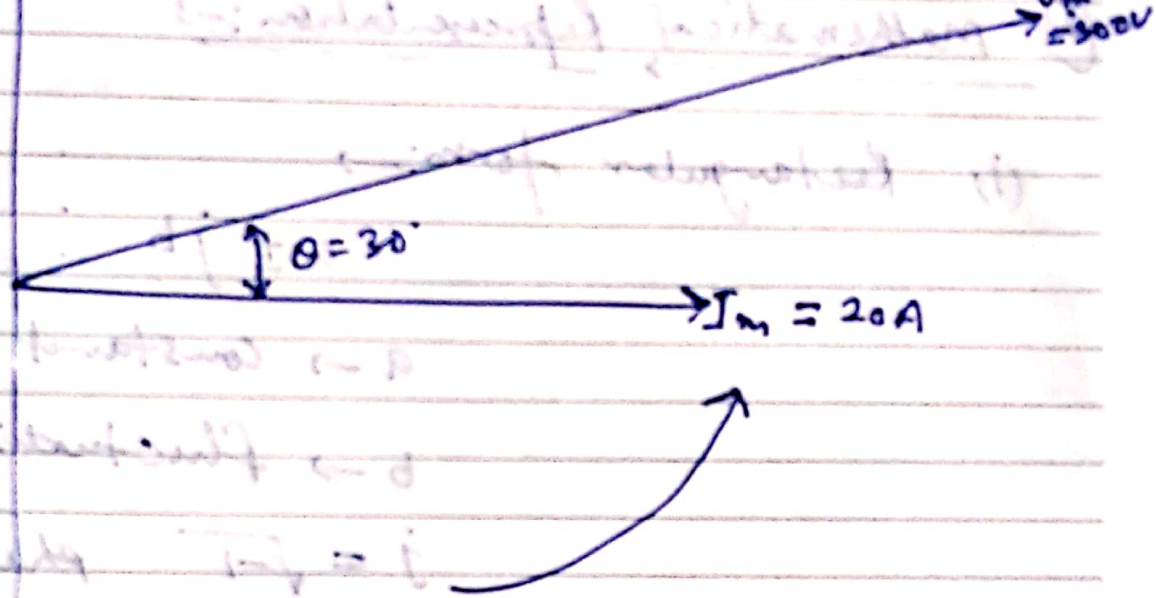

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June'11

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Tuesday		7	14	21	28
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② Mathematical Representation :→

(i) Rectangular form :→

$$a \pm jb$$

a → constant Part of alternating quantity

b → fluctuating Part — "

$j = \sqrt{-1}$ phase shift of 90°

+ ⇒ leading condition of quantity

− ⇒ Lagging condition

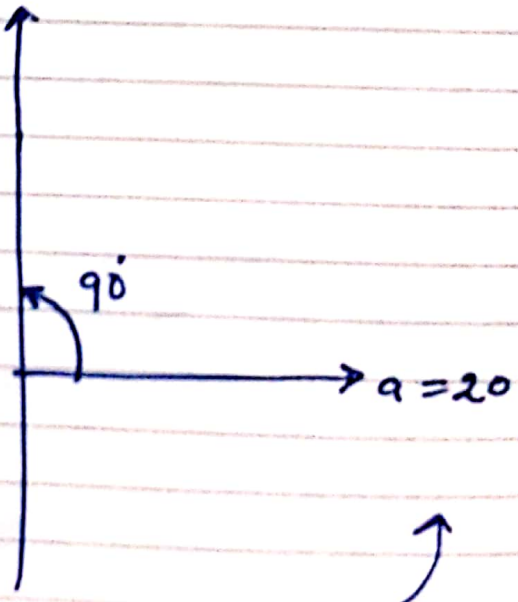
Ex

$a = 20$

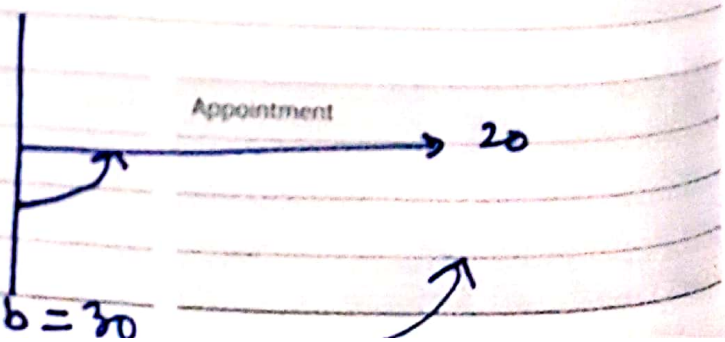
$b = 30$

$a + jb$

$20 + j30$



$20 - j30$



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$\phi = \tan^{-1}\frac{b}{a}$.

② Trigonometrical form :→

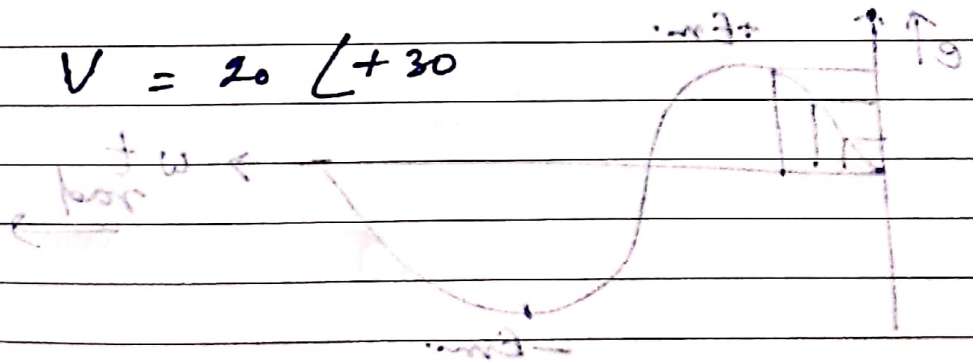
$$V = a\cos\theta \pm jb\sin\theta$$

③ Polar form :→

$$V = |\bar{V}| \angle \pm\theta$$

$V = 20 \angle -30^\circ$

$V = 20 \angle +30$



Sunday 29

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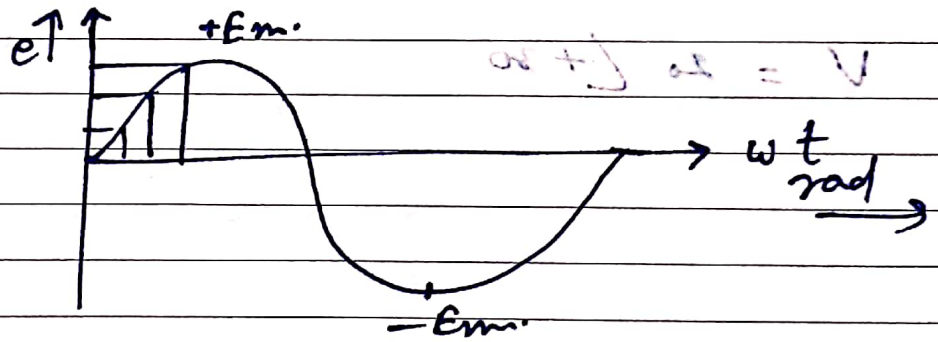
Magnitud form :→ Its four types :→

(i) Instantaneous values
(ii) Peak value or maximum value / Amplitude.
(iii) Average value representation
(iv) RMS value (Root mean squar) value.

(i) Instantaneous value :→



$e = E_m \sin \omega t$

$v = V_m \sin \omega t$

$i = I_m \sin \omega t$

$$v = 200 \sin 35t \ V$$

$$v = V_m \sin \omega t$$

$V_m = 200$

$\omega = 35$

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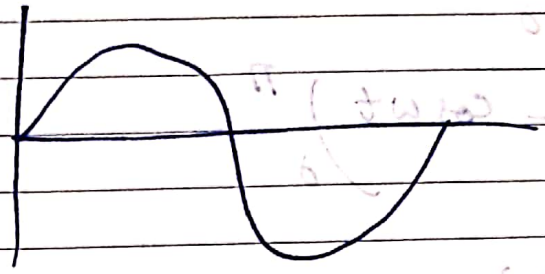
(ii) Peak value.

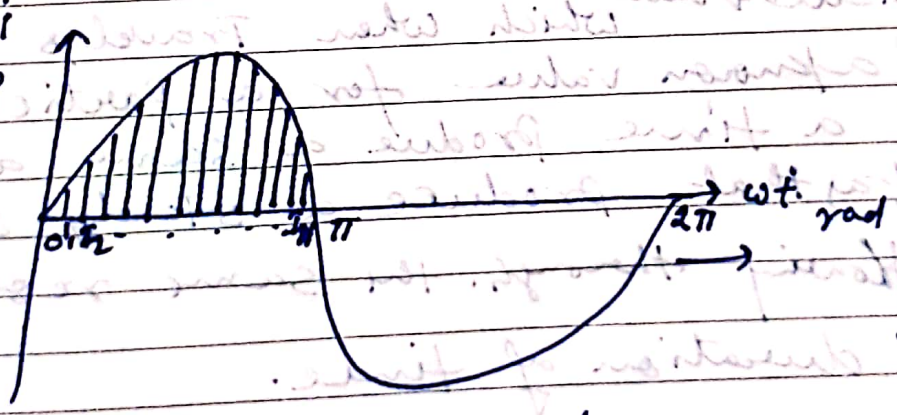


emf ⇒ E_o, E_m, E

Voltage ⇒ V_o, V_m, V

Current ⇒ I_o, I_m, I

(iii) Average value :→



$$\text{Average} = \frac{\text{Sum of all values}}{\text{No of values.}}$$

Taking the area of alternation of $0 \to \pi$ and diving it into all possible divisions.

$$I_{av} = \int_0^{\pi} \frac{I_m \sin \omega t}{\pi} \, d\omega t$$

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$$I_{av} = \frac{I_m}{\pi} \int_0^{\pi} \sin \omega t \, d\omega t$$

$$I_{av} = \frac{I_m}{\pi} \left(-\cos \omega t \right)_0^{\pi}$$

$$I_{av} = \frac{I_m}{\pi} (2)$$

$$\boxed{I_{av} = \frac{2}{\pi} I_m}$$

(iv) **RMS value :-** Root mean square value is that particular value which when travelled from a resistor of a known value for a particular duration of a time produce a same amount of a heat as that produce a steady state current flowing through the same resistor for same duration of time.

$I^2R =$ [x·C]

20 V

$i = BC$

Time = 60 sec.

same

$S = AC$

RMS value of AC

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Root of Mean of square value of A

$i = I_m \sin \omega t$

squaring both the sides.

$i^2 = I_m^2 \sin^2 \omega t$

$= I_m^2 \left(\frac{1 - \cos 2\omega t}{2} \right)$

Taking average of given value

$$i_{av}^2 = \frac{I_m^2}{2} \int_0^{\pi} \left(\frac{1 - \cos 2\omega t}{\pi - 0} \right) d\omega t$$

$$i_{av}^2 = \frac{I_m^2}{2\pi} \left[(\omega t)_0^{\pi} - \left(\frac{\sin 2\omega t}{2} \right)_0^{\pi} \right]$$

$$i_{av}^2 = \frac{I_m^2}{2\pi} \left[\pi - 0 \right]$$

square rooting both sides

$$\boxed{i_{rms} = \frac{I_m}{1.\sqrt{2}}} \qquad \boxed{V_{rms} = \frac{V_m}{\sqrt{2}}}$$

$$\boxed{E_{rms} = \frac{E_m}{\sqrt{2}}}$$

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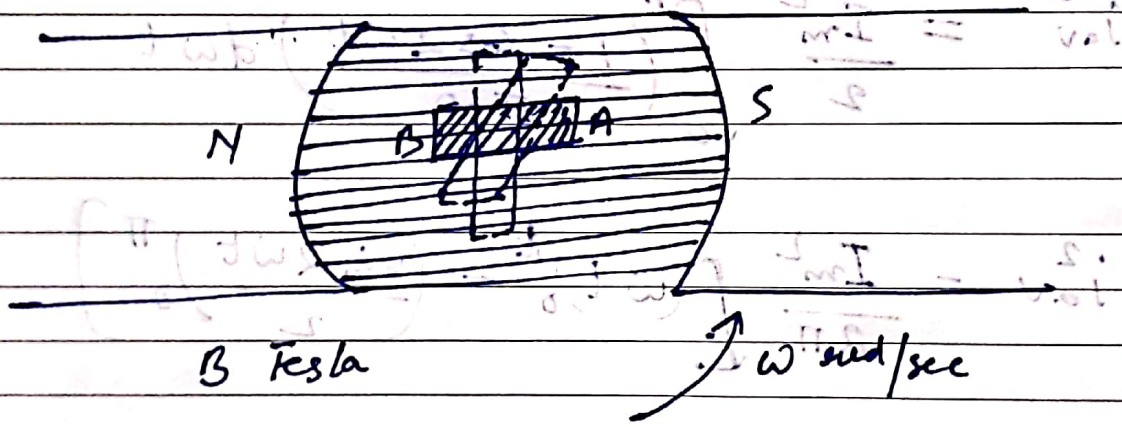
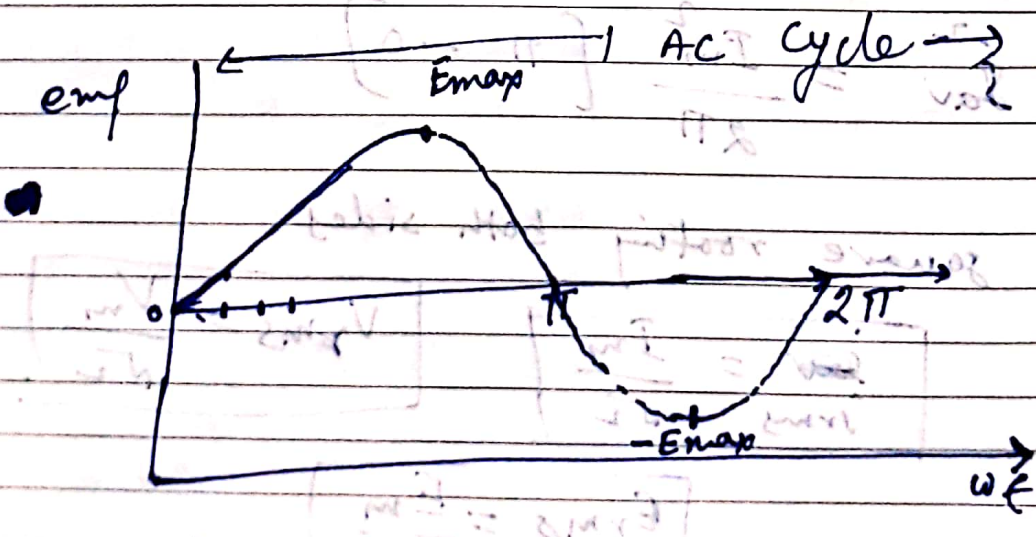
Introduction of Single phase AC :→

- Generation of ϕ AC
- Basic terms used
- emf eqn for ϕ AC

(i) Generation of an Single ϕ AC





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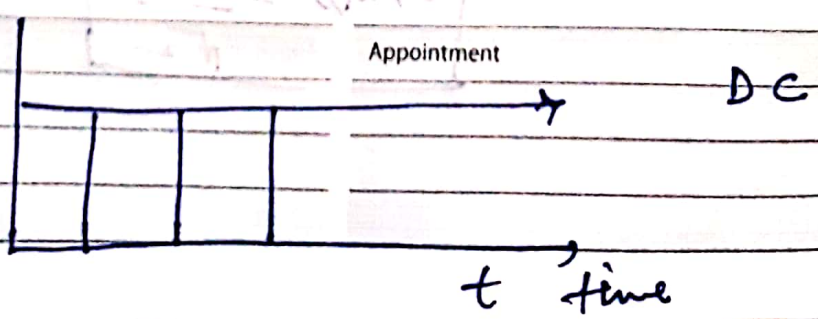

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$$e = -N \frac{d\phi}{dt}$$

Basic Term used in Single phase AC

(a) Circuits
(b) Alternating current
(c) Cycle
(d) frequency. (50 Hz) (60 Hz)
(e) phase of Difference.
(f) Leading and lagging

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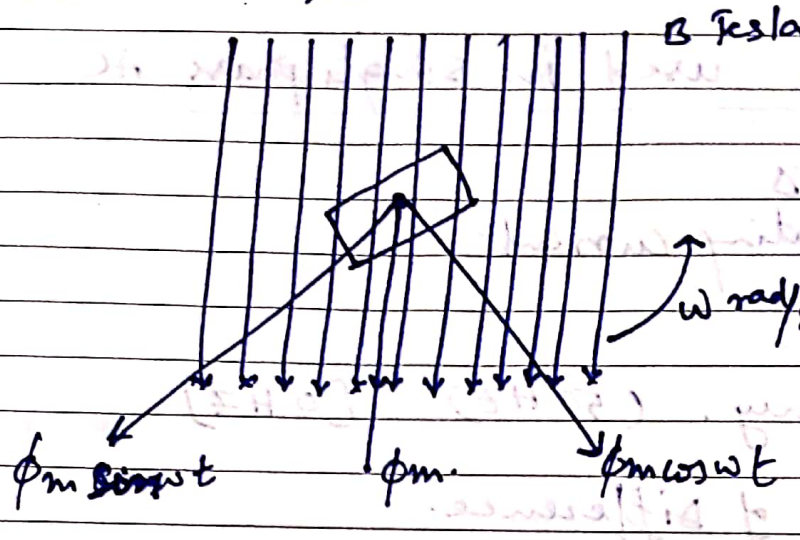
Derivation of Emf Equation :→



$$e = -N \frac{d\phi}{dt} \quad \text{——— (1)}$$

for the given condition

$$\phi = \phi_m \cos \omega t$$

Putting $\phi = \phi_m \cos \omega t$ in eq^n (1)

$$e = -N \frac{d}{dt} \phi_m \cos \omega t$$

$$e = -N \phi_m \frac{d}{dt} \cos \omega t$$

$$e = -N \phi_m (-\omega \sin \omega t)$$

$$e = N \omega \phi_m \sin \omega t$$

Here $N \omega \phi_m = E_m$ represents

June'11
Monday 6 13 20 27
Tuesday 7 14 21 28
Wednesday 1 8 15 22 29
Thursday 2 9 16 23 30
Friday 3 10 17 24
Saturday 4 11 18 25
Sunday 5 12 19 26

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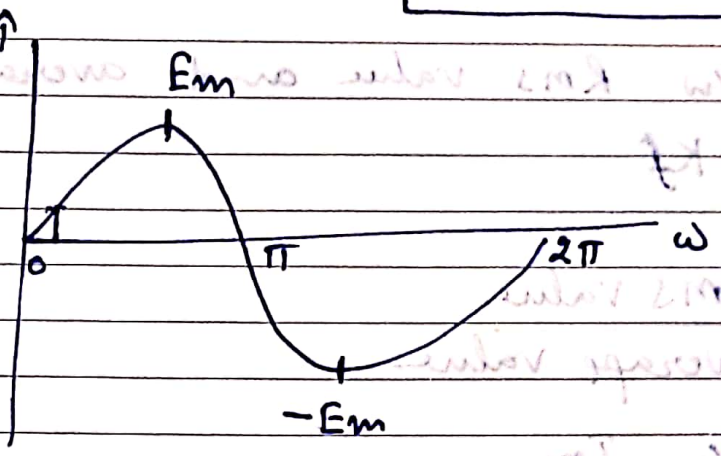
$e = E_m \sin \omega t$

$V = V_m \sin \omega t$
$i = I_m \sin \omega t$

instantaneous values.



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form factor :-

Ratio b/w Rms value and average value.

i.e → K_f

$$K_f = \frac{\text{RMS value}}{\text{Average value}}$$

$$= \frac{2/\pi \; I_m}{I_m/\sqrt{2}}$$

$$K_f = 1.11$$

Peak factor :-

Ratio b/w max value and RMS value

→ K_p

$$K_p = \frac{\text{Max Value}}{\text{Rms value}}$$

$$= \frac{I_m}{I_m/\sqrt{2}}$$

$$K_p = \sqrt{2}$$

$$\boxed{K_p = 1.414}$$

ne'11
nday 6 13 20 27
sday 7 14 21 28
nesday 1 8 15 22 29
sday 2 9 16 23 30
3 10 17 24
lay 4 11 18 25
y 5 12 19 26

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