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NEET, JEE(Mains,Advanced)
अभ्यास ही सबसे बड़ा गुरू है।

Class : 12th Physics
Chapter- 7 : Alternating Current

$i = i_0 \sin\left(\omega t + \frac{\pi}{2}\right)$
$\phi = \pi/2$ or $-\pi/2$
$\cos\phi = 0$
Power(P) $= 0$
Current leads the voltage by $\pi/2$

$i = i_0 \sin(\omega t + \phi)$
$Z = \sqrt{R^2 + X_c^2}$
$X_c = 1/\omega C$
$\tan\phi = 1/\omega CR$
$i_0 = E_0/Z$
• Power factor $\cos\phi = \frac{R^2}{\sqrt{R^2 + X^2}}$
• current leading.

$i = i_0 \sin(\omega t + \phi)$
$Z = \sqrt{R^2 + X_L^2}$
$X_L = \omega L$
$\tan\phi = \omega L/R$
$i_0 = E_0/Z$
• power factor = R/Z
• voltage is leading

$i = i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$
Phase difference b/w V& I, $\phi = \pi/2$
Power factor $\cos(\phi) = 0$
Voltage leads current by $\pi/2$
$P = 0$

$i = i_0 \sin(\omega t)$
$\phi = 0°$
$\cos\phi = 1$
$P = V_0 i_0/2$
Current & voltage both are in same phase

$i = i_0 \sin\left(\omega t \pm \frac{\pi}{2}\right)$
$X = X_L - X_C$
$\phi = \pi/2$
• Power factor = 0, Either voltage or current leading

$i = i_0 \sin(\omega t \pm \phi)$
$Z = \sqrt{R^2 + (X_L - X_C)^2}$
$X = X_C - X_L$
$= \left(\frac{1}{\omega C} - \omega L\right)$
$\tan\phi = \left(\frac{1}{\omega C} - \omega L\right) / R$, $i_0 = \frac{E_0}{Z}$

Inductive (L) circuit
Capacitive (C) circuit
Resistive (R) circuit
R-C circuit
L-C circuit
L-R circuit
L-C-R circuit

Alternating Current

AC Circuits

Impedance
The ratio of emf applied and the current produced in an AC circuit
$Z = E_0/i_0$ Ohm

Reactance
The hindrance offered by inductance or capacitance or both to the flow of AC in AC denoted by (X) Ohm

Contribution
In 1883 Nikola Tesla constructed the first induction motor at the age of 27 years only.

Power in AC Circuit
$P = E_{rms} i_{rms} \cos\phi = \frac{E_0}{\sqrt{2}} \times \frac{i_0}{\sqrt{2}} \cos\phi = \frac{1}{2} E_0 i_0 \cos\phi$

AC Current
Transformer
AC Generator

$i_{rms} = i_0/\sqrt{2}$
$V_{rms} = v_0/\sqrt{2}$
RMS value or root mean square value

$i_{mean} = 2i_0/\pi$
$V_{rms} = 2v_0/\pi$
Mean value or Average value

$i_0 = \sqrt{2}\, i_{rms}$
$v_0 = \sqrt{2}\, v_{rms}$
Peak value or Max^m value

Direction of current changes alternatively
$i = i_0 \sin\omega t$
$v = v_0 \sin\omega t$

It is used to obtain a high AC voltage from a Low-voltage AC source or vice-versa

Efficiency of a transformer
• η = output power/Input power
• 99% efficiency can easily achieved

A device generating alternating current having elements magnet, Armature and graphite Brushes emf induced through coil
$E = NBA\,\omega \sin\omega t$
$i = E/R = NBA\,\omega \sin\omega t/R$

$E_2 = -N_2E_1/N_1$
$i_2 = -N_1E_1/N_2$
If $N_1 > N_1$ it is called step–up Transformer
If $N_1 > N_2$, it is called step–down Transformer