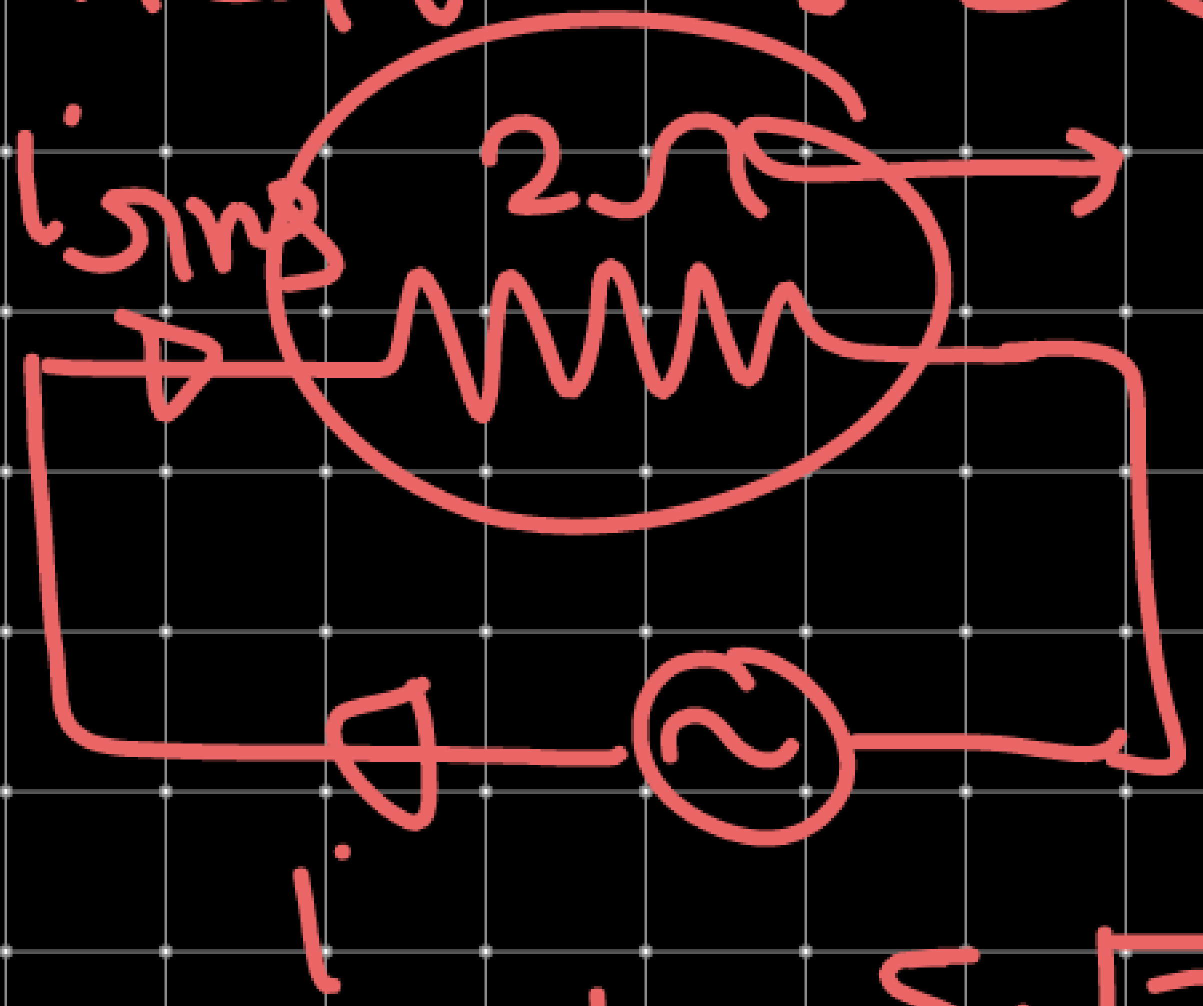
RMS value of Current : It is current equivalent to DC which produce same heat as DC.



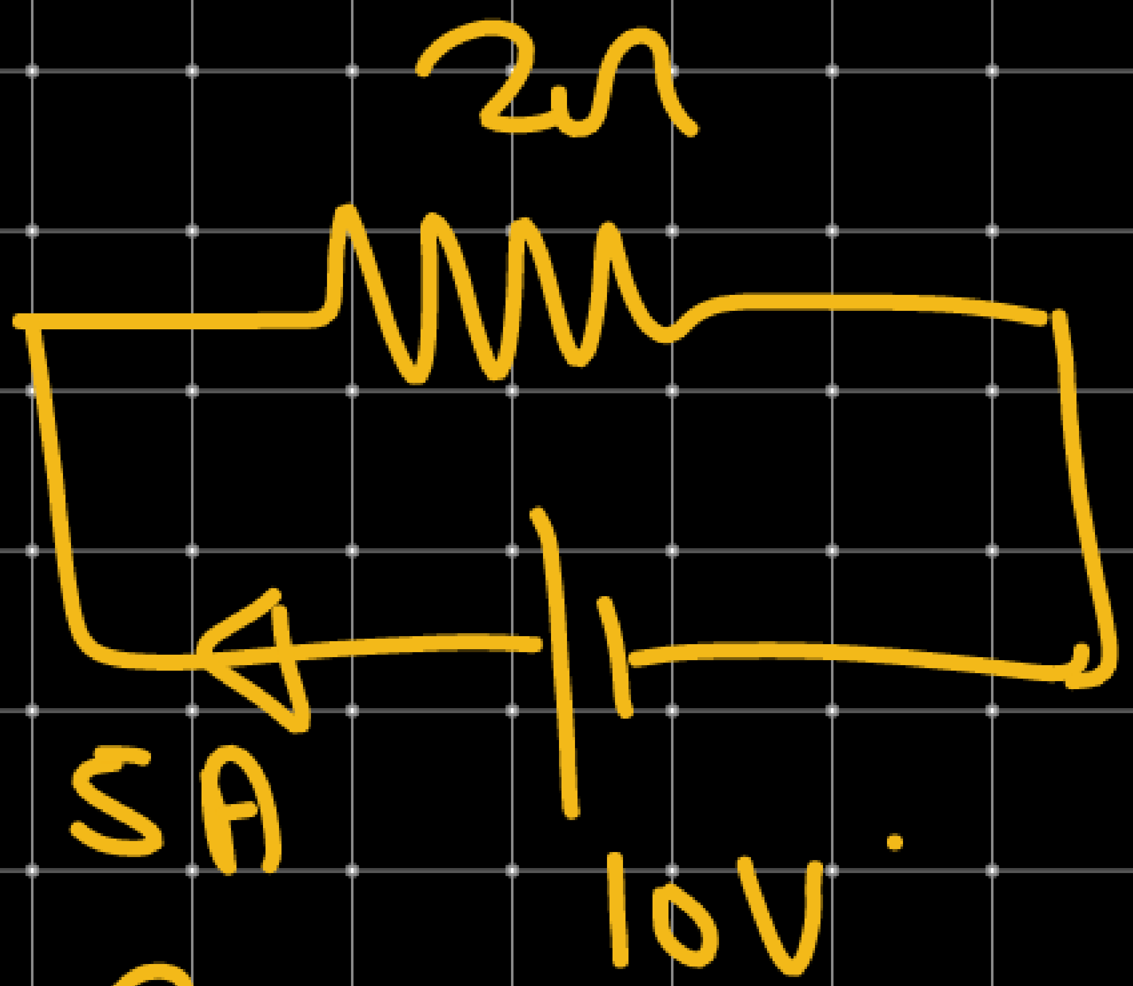
$i_{rms}^2 R t = E$

$5^2 \times 2 \times 1 = E$

$E = 50 J$

$i = 5\sqrt{2} \sin 100\pi t$

$i_{rms} = \frac{i_0}{\sqrt{2}} = \frac{5\cancel{\sqrt{2}}}{\cancel{\sqrt{2}}} = 5 \text{ Amp}$



$E = i^2 R t$

$= 5^2 \times 2 \times 1 = 25 \times 2$

$= 50 J$

⇒ How to find rms value.

ABLES KOTA

$$i = i_0 \sin\omega t$$

Root Mean square value → RMS value

Step I) Square $(i_0 \sin\omega t)^2 = i_0^2 \sin^2\omega t$

(Step II) Mean. $\langle i_0^2 \sin^2\omega t \rangle = i_0^2 \times \frac{1}{2} = \frac{i_0^2}{2}$

Root $\sqrt{\frac{i_0^2}{2}} = \frac{i_0}{\sqrt{2}}$

$i = (2 \sin 100\pi t)$ A

$i = i_0 \sin \omega t$

→ Pea value of current $= 2$ Amp

→ $i_{rms} = ?$ $\frac{i_0}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$ Amp.

→ $\omega = ?$ 100π

⇒ $T = ?$ $T = \frac{2\pi}{\omega} = \frac{2 \times \cancel{\pi}}{100\cancel{\pi}} = \frac{1}{50}$

$f = 50$ Hz

$\Rightarrow \quad i = i_0 \sin \omega t$

$i_0 \rightarrow$ Peak value of current.

$$\frac{i_0}{\sqrt{2}} = i_{rms}.$$

यहाँ याद रखना है:-

$\langle \sin\theta \rangle = 0$

$\langle \cos\theta \rangle = 0$

$\langle \sin^2\theta \rangle = \frac{1}{2}$

$\langle \cos^2\theta \rangle = \frac{1}{2}$

$\langle \sin\omega t \rangle = 0$

$\langle \cos\omega t \rangle = 0$

$\langle \sin^2\omega t \rangle = \frac{1}{2}$

$\langle \cos^2\omega t \rangle = \frac{1}{2}$

$\langle \sin\theta \rangle = 0$

$\langle \sin 2\theta \rangle = 0$

$\langle \sin\theta \cos\theta \rangle = 0$

$\langle \sin^2\theta \rangle = \frac{1}{2}$

$\langle \cos^2\theta \rangle = \frac{1}{2}$

$\boxed{\langle \sin\omega t \cos\omega t \rangle = 0}$

$\langle \sin^2\omega t \rangle = \langle \cos^2\omega t \rangle = \frac{1}{2}$

Q2) Imp

TYPE

$i = 3 + 4\sin\omega t$.

Find rms value of current.

Step I:- Square - $(3+4\sin\omega t)^2 = 9 + 16\sin^2\omega t + 24\sin\omega t$

Step II - mean $\quad 9 + 16 \times \langle \sin^2\omega t \rangle + 24 \langle \sin\omega t \rangle$

$= 9 + 16 \times \frac{1}{2} + 24 \times 0 = 9 + 8 = 17$

Step III - root. $\quad \sqrt{17}$ Amp $= i_{rms}$

Q) find i_{rms} $\quad i = i_1 \sin\omega t + i_2 \cos\omega t$

ABLES KOTA

Step I :- Square. $\quad i_1^2 \sin^2\omega t + i_2^2 \cos^2\omega t + 2 i_1 i_2 \sin\omega t \cos\omega t$

$$\langle i_1^2 \sin^2\omega t \rangle + \langle i_2^2 \cos^2\omega t \rangle + \langle 2 i_1 i_2 \sin\omega t \cos\omega t \rangle$$

Step II) mean. $= i_1^2 \times \frac{1}{2} + i_2^2 \times \frac{1}{2} + 2 i_1 i_2 \times 0$

$$= \frac{i_1^2}{2} + \frac{i_2^2}{2} = \frac{i_1^2 + i_2^2}{2}$$

Step III) $\langle \sqrt{\ } \rangle$

$$i_{rms} = \sqrt{\frac{i_1^2 + i_2^2}{2}}$$

$\Rightarrow$ by maths)

$$i = i_0 \sin \omega t$$

$$i_{av} = \frac{\int i\,dt}{\int dt} = \frac{\int_{t_1}^{t_2} i_0 \sin \omega t\,dt}{\int_{t_1}^{t_2} dt}$$

$$\Rightarrow \quad \boxed{i_{rms} = \left[\frac{\int i^2\,dt}{\int dt}\right]^{1/2}}$$

Q4) find rms value of current $i = 2\sqrt{t}$ Amp in interval of 2 to 4 sec.

$$i_{rms} = \left[\frac{\int 4t\,dt}{\int dt}\right]^{1/2}$$

$$= \left[\frac{\left[\cancel{4}^{2}t^2/\cancel{2}\right]_2^4}{\left[t\right]_2^4}\right]^{1/2}$$

$$\left[\frac{\left[\cancel{2}t^2\right]_2^4}{\cancel{(4-2)}}\right]^{1/2}$$

$$\left(\left[t^2\right]_2^4\right)^{1/2}$$

$$= \left[4^2 - 2^2\right]^{1/2}$$

$$= (16-4)^{1/2} = 12^{1/2}$$

$$i_{rms} = \sqrt{12}$$

$$i_{rms} = \sqrt{4 \times 3}$$

$$= 2\sqrt{3} \text{ Amp}$$

Q5) Find rms value of current for interval of 0 to 2 sec $i = 2t$ Amp.

$$\Rightarrow \quad i_{rms} = \left[\frac{\int_0^2 i^2\,dt}{\int_0^2 dt}\right]^{1/2}$$

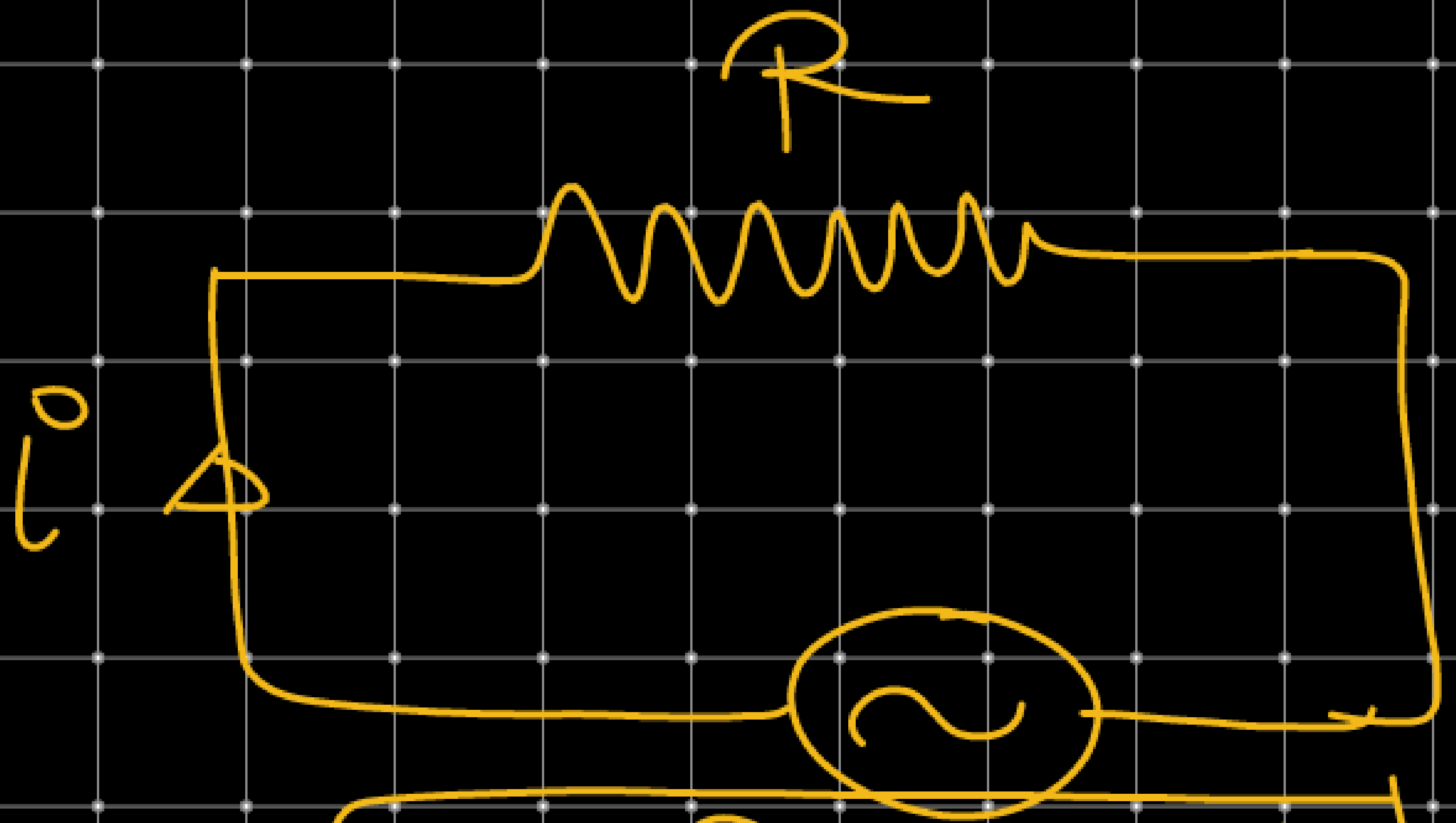
H.W.

NEET) I_0 & I are peak value & rms value of current. find relation b/w I_0 & I

$$I_{rms} = \frac{I_0}{\sqrt{2}}$$

$$I = \frac{I_0}{\sqrt{2}}$$

⇒ AC Source with Resistor.



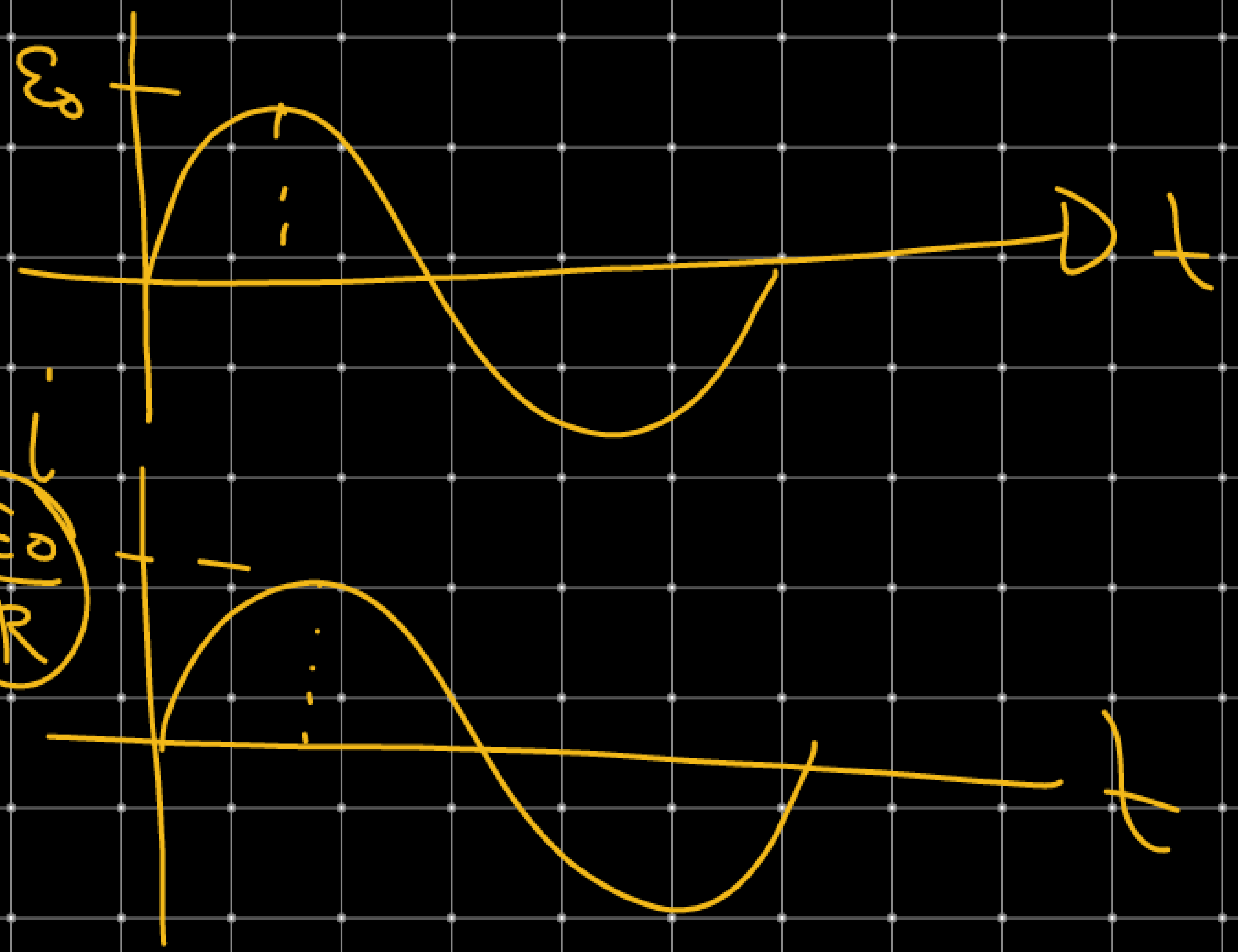
Phase difference b/w $\mathcal{E}$ & i is zero.

$$\Delta\phi = (\omega t - \omega t) = 0$$

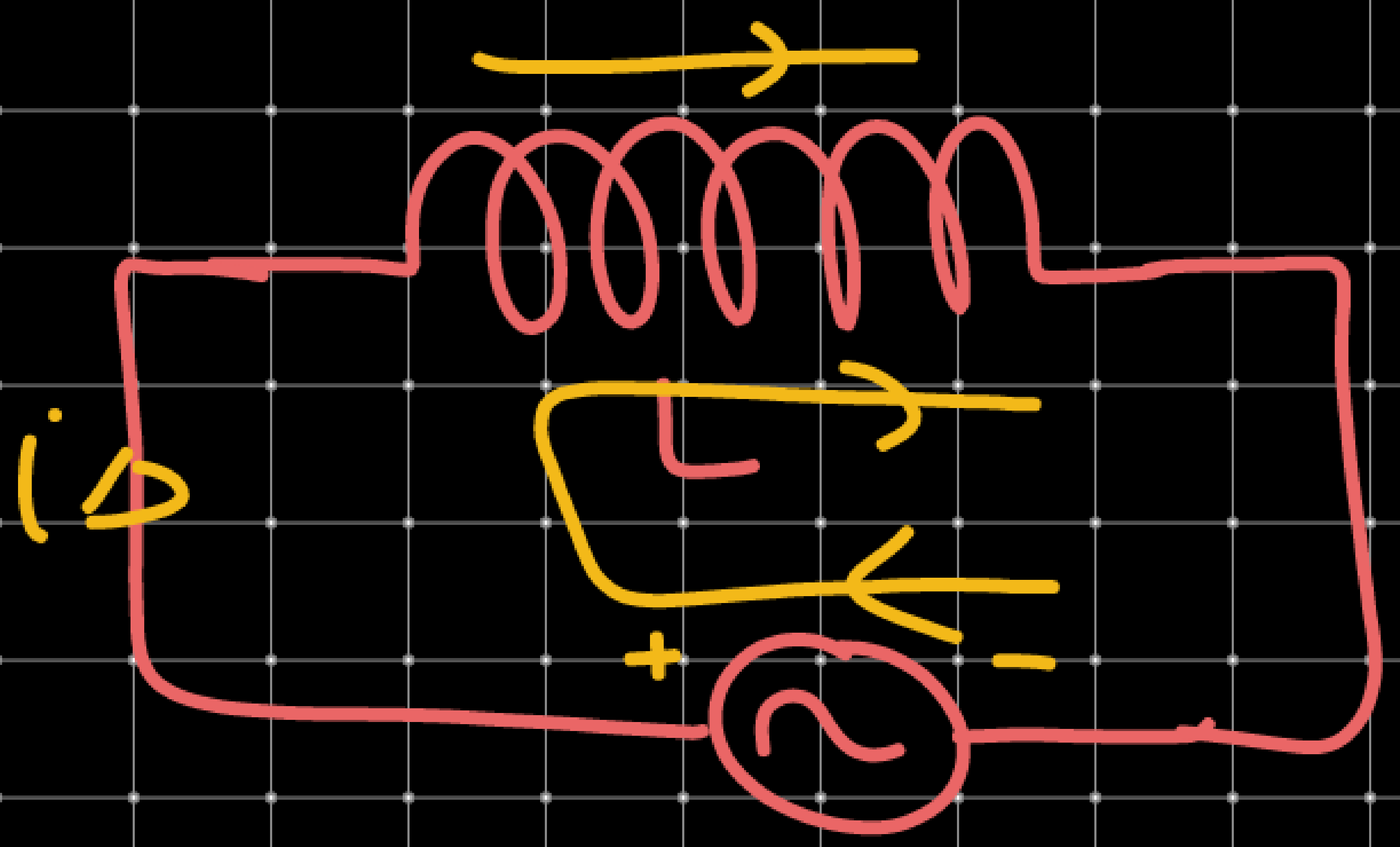
$$\boxed{\mathcal{E} = \mathcal{E}_0 \sin\omega t}$$

$$\boxed{i = \frac{\mathcal{E}_0}{R}\sin\omega t}$$

$$i = i_0 \sin\omega t \qquad i_0 = \frac{\mathcal{E}_0}{R}$$



⇒ AC Source connected with inductor.



$\boxed{KVL}$

$$\varepsilon_0 \sin\omega t - L\frac{di}{dt} = 0$$

$$\varepsilon_0 \sin\omega t = L\frac{di}{dt}$$

$$\frac{\varepsilon_0}{L}\sin\omega t\, dt = di$$

$$E = E_0 \sin\omega t.$$

⇒

$$\int di = \frac{\varepsilon_0}{L}\int \sin\omega t\, dt$$

$$i = \frac{\varepsilon_0}{L}\left(-\frac{\cos\omega t}{\omega}\right) = \frac{\varepsilon_0}{\omega L}\left(-\cos\omega t\right)$$