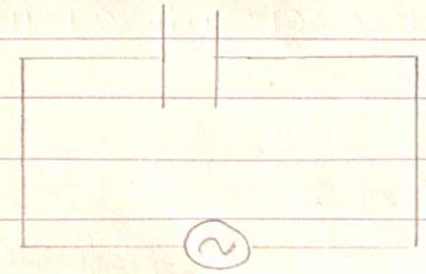
A.C through a Capacitor:



Given:

$e = E_p \sin \omega t$ — (1)

C = Capacitance

Let Q be charge stored in the Capacitor at the instant t.

i = Current flowing through the circuit at the instant.

E.m.f eq^n. at the instant t:

$$\frac{Q}{C} = e = E_p \sin \omega t$$

$$Q = C E_p \sin \omega t$$

Differentiating $i = \frac{dQ}{dt} = \omega C E_p \cos \omega t$

$$i = \omega C E_p \sin(\omega t + \pi/2) \quad \text{— (2)}$$

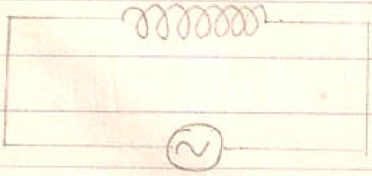
$I_p = \omega C E_p \rightarrow (3)$

$i = I_p \sin(\omega t + \pi/2) - (4)$

Comparing eq^ns (1) and (4) in a pure capacitor the P.d across the Capacitor, lags the current by phase angle $\pi/2$.

Reactance of the Capacitor $X_c = \frac{E_p}{I_p} = \frac{1}{\omega c} = \frac{1}{2\pi f c} - (5)$

Power factor: $\phi = \pi/2$ = The phase difference between the P.d across the circuit and the Current flowing through the circuit.



The average power consumed over a complete cycle $P = E_{r.m.s} \cdot I_{r.m.s} \cos\phi$.

where $\cos\phi$ = power factor of the circuit

$= \cos\pi/2 = 0$

$\therefore P = 0$

Hence when A.C flows through a pure inductance the average power consumed over a complete cycle is zero & hence it is known as "Wattless" current.