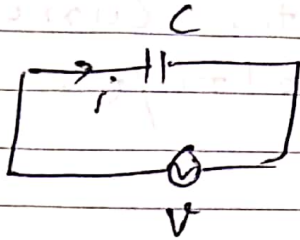


# A.C CIRCUIT CONTAINING PURE Capacitor.

Day (197-168) • Week 29



We know that,

$$v = V_m \sin \omega t \quad \text{--- (1)}$$

$$i = \frac{dq}{dt} \quad (\text{in case of capacitance})$$

$$q = CV$$

$$= C V_m \sin \omega t$$

So,

$$i = \frac{d}{dt} C V_m \sin \omega t$$

$$= C V_m \frac{d}{dt} \sin \omega t$$

$$i = C V_m \omega \cos \omega t$$

$$= \frac{V_m}{\omega C} \cos \omega t$$

We know that  $\sin\left(\frac{\pi}{2} + \theta\right) = \cos \theta =$

and  $I_m = \frac{V_m}{\omega C}$

$$i = I_m \sin\left(\omega t + \frac{\pi}{2}\right) \quad \text{--- (2)}$$

Sunday 17

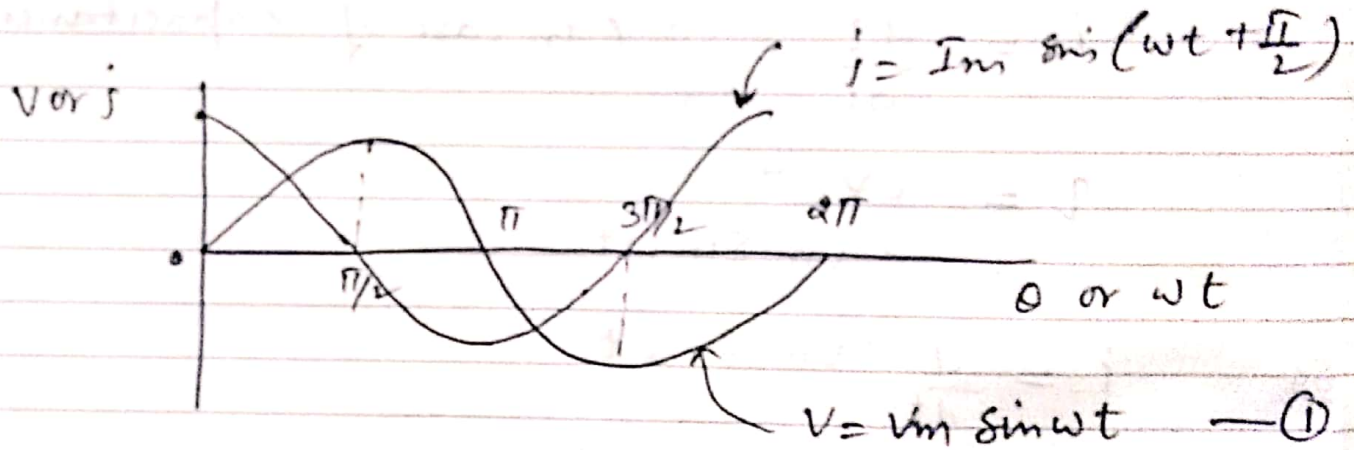
August '11

Monday	1	8	15	22	29
Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	31
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	

Comparison eq<sup>n</sup> ① and eq<sup>n</sup> ②

in case of capacitance the current is leading 90° as compared to voltage.

wave diagram



in the case of pure capacitance current is leading to the applied voltage by 90°

Instantaneous Power

$$p = Vi$$

$$= V_m \sin \omega t \cdot I_m \sin \left( \omega t + \frac{\pi}{2} \right)$$

$$= \frac{V_m I_m}{2} \sin 2\omega t \cos \omega t$$

$$= \frac{V_m}{\sqrt{2}} \frac{I_m}{\sqrt{2}} \sin 2\omega t$$

$$= V_{rms} I_{rms} \sin 2\omega t$$

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

Notes

Appointment

Average Power

Day (200 105) \* Week (11)

$$P_{av} = V_{rms} \cdot I_{rms} \cdot (\cos \phi)$$

$$= (0) \text{ Zero}$$

Capacitive Reactance

in the expression.

$$I_m = \frac{V_m}{\frac{1}{\omega C}}$$

$\frac{1}{\omega C}$  is the capacitive reactance

and is denoted by  $X_c$

$$\therefore X_c = \frac{1}{\omega C}$$

Notes

Appointment

		August '11				
Monday	1	8	15	22	29	
Tuesday	2	9	16	23	30	
Wednesday	3	10	17	24	31	
Thursday	4	11	18	25		
Friday	5	12	19	26		
Saturday	6	13	20	27		
Sunday	7	14	21	28		

Ex A capacitor of 100  $\mu\text{F}$  is connected across a 200 V, 50 Hz single phase supply. Calculate

- (i) the reactance of the capacitor.
- (ii) rms value of the current
- (iii) maximum current

Ans

given,

$$C = 100 \mu\text{F}$$

$$V = 200 \text{ V} \rightarrow V_{\text{rms}}$$

$$f = 50 \text{ Hz}$$

(i) Reactance of capacitor.

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$$

$$= \frac{1}{2\pi \times 50 \times 100}$$

$$= 31.83 \Omega.$$

(ii) rms value of current

$$I_m = \frac{V_m}{1/\omega C} = \frac{V_m}{X_C}$$

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

$$I_{\text{rms}} = \frac{V_{\text{rms}}}{X_C}$$

Appointment

$$= \frac{200}{31.83}$$

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

11 July

$$I_{rms} = 6.203 \text{ A}$$

Thursday

Day (202-163) • Week 30

21

(iii)

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

$$\begin{aligned} I_m &= I_{rms} \sqrt{2} \\ &= 6.203 \times \sqrt{2} \\ &= 8.886 \text{ A} \end{aligned}$$

Notes

Appointment

August '11

Monday	1	8	15	22	29
Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	31
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	