

[Alternating Current]

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- ① Define average value of a.c. over half a cycle.
Established the relationship between the 'average value' and the 'peak value' of an alternating current.
- ② An alternating emf of peak value 350V is applied across an a.c. ammeter of resistance 100Ω . What is the reading of the ammeter? [Ans - 2.47A]
- ③ A sinusoidal emf is applied to a circuit containing an inductor only. Show that the current lags behind the voltage by $\pi/2$ radian. Also derive an expression for the reactance of an inductor, when connected across an a.c. source. Give its unit.
- ④ A 200 mH (pure) inductor and a 5 μ F (pure) capacitor are connected, one by one, across a sinusoidal ac voltage source $V = 70.7 \sin(1000t)$ volt. Obtain the expressions for the current in each case.
Ans (i) $I = 0.3535 \left(1000t - \frac{\pi}{2} \right)$ Amp.
(ii) $I = 0.3535 \left(1000t + \frac{\pi}{2} \right)$ Amp.
- ⑤ A coil of resistance 300Ω and inductance 1H is connected across an alternating voltage of frequency $\frac{300}{2\pi}$ Hz. Calculate the phase difference between the voltage and current in the circuit. [A $\rightarrow \phi = 45^\circ$]
- ⑥ An 80V, 800W heater is to be operated on a 100V, 50 Hz supply. Calculate the inductance of the choke required. [Ans - $L = 0.019$ H]

7) What do you mean by sharpness of resonance in a series resonant circuit?

8) An inductor $L = 0.4 \text{ H}$, a capacitor $C = 10 \mu\text{F}$ and a resistor $R = 400 \Omega$ are connected in series to an ac source $V = 40 \sin(1000t + \pi/3)$ volt. Calculate -

(i) Impedance of the circuit

(ii) peak value of current

$$\left[\begin{array}{l} \text{Ans - (i) } 500 \Omega \\ \text{(ii) } 0.08 \text{ A} \end{array} \right]$$

9) A light bulb is rated at 100 W for a 220 V supply. Find (a) the resistance of the bulb (b) the peak voltage of the source and (c) the rms current through the bulb. [Ans (a) 484Ω (b) 311 V (c) 0.45 A]

10) An alternating voltage and the corresponding current in a circuit are given by

$$E = 110 \sin(\omega t + \pi/6) \text{ and } I = 5 \sin(\omega t - \pi/6) \text{ respectively}$$

Find the impedance and the average power dissipation in it.

$$[\text{Ans - } 22 \Omega, 1375 \text{ W}]$$

11) Calculate the current drawn by the primary of a transformer, which steps down 200 V to 20 V to operate a device of resistance 20Ω . Assume the efficiency of the transformer to be 80% .

$$[\text{Ans } I_1 = 0.125 \text{ A}]$$

12) A generator develops an emf of 120 V and has a terminal potential difference of 115 V , when the armature current is 25 A . What is the resistance of the armature? [Ans - 0.2Ω]

13) For very high frequency a.c. supply, a capacitor behaves like a pure conductor. Why?