DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 5

Topic :-Alternating current

1 **(d)**

$$i = \frac{220}{\sqrt{(20)^2 + (2 \times \pi \times 50 \times 0.2)^2}} = \frac{220}{66} = 3.33\,A$$

2 **(a)**

$E_s = \frac{n_s}{n_P} E_P = \frac{4200}{2100} \times 120 = 240\text{V}$

$i_s = \frac{n_s}{n_P} i_P = \frac{2100}{4200} \times 10 = 5\text{ A}$

3 **(b)**

$$i_{r.m.s.} = \frac{i_0}{\sqrt{2}} = \frac{4}{\sqrt{2}} = 2\sqrt{2}\ ampere$$

4 **(a)**

As the current i leads the emf e by $\frac{\pi}{4}$, it is an $R - C$ circuit

$\tan\phi = \frac{X_C}{R}$

or $\tan\frac{\pi}{4} = \frac{\frac{1}{\omega C}}{R}$

$\therefore$ $\omega CR = 1$

As $\omega = 100\text{ rads}^{-1}$

The product of $C - R$ should be $\frac{1}{100}\text{s}^{-1}$.

5 **(d)**

Phase angle $\phi = 90°$, so power $P = Vi\cos\phi = 0$

6 **(d)**

Current lags the voltage if $\omega L > \frac{1}{\omega C}$

$$f > \frac{1}{2\pi\sqrt{LC}} \Rightarrow f > f_r$$

7 **(c)**

$$v = \frac{\omega}{2\pi} = \frac{120 \times 7}{2 \times 22} = 19\,Hz$$

$$V_{r.m.s} = \frac{240}{\sqrt{2}} = 120\sqrt{2} = 170\,V$$

8 **(c)**

For an $R-C$ circuit

Applied voltage, $V=\sqrt{V_R^2+V_C^2}$

$\therefore \quad 50=\sqrt{(40)^2+V_C^2}$

$\Rightarrow \quad V_C=30\text{ V}$

9 **(d)**

Power factor

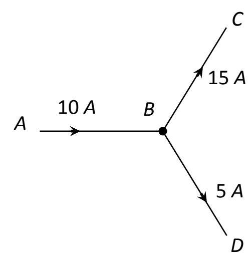
$$\cos\phi=\frac{R}{\sqrt{R^2+\omega^2L^2}}$$

$$=\frac{30}{\sqrt{(30)^2+(100)^2\times(400\times10^{-3})^2}}$$

$$=\frac{30}{\sqrt{900+1600}}=\frac{30}{50}=0.6$$

10 **(a)**

Yes, in AC if branch AB has R, BC has a capacitor C, and BD has a pure inductance L



11 **(c)**

At A :$X_C>X_L$

At B :$X_C=X_L$

At C :$X_C<X_L$

12 **(c)**

Here: Current in the circuit

$(i)=15\,mA=15\times10^{-3}A$

Resistance $R=4000\,Volt$

Applied voltage in the circuit $=240\,V$

At any instant, the emf of the battery is equal to the sum of potential drop on the resistor and the emf developed in the induction coil

Hence, $E=iR+L\frac{di}{dt}$

$$240=15\times10^{-3}\times4000+L\frac{di}{dt}$$

Hence, $L\frac{di}{dt}=240-60=180\,V$

13 **(b)**

L/R represents time constant of R-L circuit. Therefore, its dimensions are $[M^0L^0T^1]$.

14 **(a)**

This is a parallel circuit, For oscillation, the energy in L and C will be alternately maximum

15 **(a)**

The current in a coil is given by

$i = i_0 e^{-t/\tau}$

Now, $i = \frac{i_0}{\eta}$ $in\, t = t_0$

$\therefore \quad \frac{i_0}{\eta} = i_0 e^{-t_0/\tau}$

$e^{-t_0/\tau} = \eta^{-1}$

Taking log of both sides,

$-\frac{t_0}{\tau}\log_e e = -1 \log_e \eta$

$\frac{t_0}{\tau} = \log_e \eta$

$\tau = t_0/\log_e \eta = t_0/\text{In}\eta$

16 **(b)**

Since voltage is lagging behind the current, so there must be no inductor in the box

17 **(b)**

Average power dissipated in an AC circuit

$$P_{av} = V_{\text{rms}} I_{\text{rms}} \cos\phi \qquad \text{...(i)}$$

Where the term $\cos\phi$ is known as power factor.

Given, $V_{\text{rms}} = 100$ V, $R = 100\ \Omega$, $\phi = 30°$

$\therefore \quad I_{\text{rms}} = \frac{V_{\text{rms}}}{R} = \frac{100}{100} = 1$ A

Putting the values in Eq. (i), we get

$$P_{av} = 100 \times 1 \times \cos 30°$$

$$= 100\frac{\sqrt{3}}{2}$$

$$= 50\sqrt{3} = 86.6 \text{ W}$$

18 **(c)**

$$\tan\phi = \frac{\omega L - \frac{1}{\omega C}}{R}$$

ϕ being the angle by which the current leads the voltage.

Given, $\phi = 45°$

$$\therefore \quad \tan 45° = \frac{\omega L - \frac{1}{\omega C}}{R}$$

$$\Rightarrow \quad 1 = \frac{\omega L - \frac{1}{\omega C}}{R}$$

$$\Rightarrow \quad R = \omega L - \frac{1}{\omega C}$$

$$\Rightarrow \quad C = \frac{1}{\omega(\omega L - R)}$$

$$= \frac{1}{2\pi f(2\pi f L - R)}$$

20 **(d)**

In an $L - C - R$ circuit in resonance condition

$$X_L = X_C \quad \text{or} \quad X_C - X_L = 0$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	D	A	B	A	D	D	C	C	D	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	C	B	A	A	B	B	C	C	D