

DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutio

Subject : PHYSICS
DPP No. : 2

Topic :- Alternating current

1

(b)

From the relation, $\tan \phi = \frac{\omega L}{R}$

$$\begin{aligned} \text{Power factor } \cos \phi &= \frac{1}{\sqrt{1+\tan^2 \phi}} \\ &= \frac{1}{\sqrt{1+\left(\frac{\omega L}{R}\right)^2}} \\ &= \frac{R}{\sqrt{R^2+\omega^2 L^2}} \end{aligned}$$

2

(a)

$$\frac{1}{L_p} = \frac{1}{L} + \frac{1}{L} = \frac{2}{L} \quad \text{or} \quad L_p = \frac{L}{2}$$

Where L is inductance of each part

$$= \frac{1.8 \times 10^{-4}}{2} = 0.9 \times 10^{-4} \text{ H}$$

$$\therefore L_p = \frac{L}{2} = \frac{0.9 \times 10^{-4}}{2} = 0.45 \times 10^{-4} \text{ H}$$

Resistance of each part, $r = \frac{6}{2} = 3\Omega$

$$\text{Now, } \frac{1}{r_p} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

$$\therefore r_p = 3/2\Omega$$

$$\text{Time constant of circuit} = \frac{L_p}{r_p} = \frac{0.45 \times 10^{-4}}{3/2} = 8\text{A}$$

3

(b)

The applied voltage is given by $V = \sqrt{V_R^2 + V_L^2}$

$$V = \sqrt{(200)^2 + (150)^2} = 250 \text{ volt}$$

4

(d)

The voltage across secondary is zero, as transformer does not work on DC supply.

5

(c)

From $e = \frac{L di}{dt}$, when $\frac{di}{dt} = 1$, $e = L$

6

(b)

$$\frac{L_2}{L_1} = \frac{N_2^2}{N_1^2}$$

$$\therefore L_2 = L_1 \frac{N_2^2}{N_1^2} = 1.5 \left(\frac{500}{100}\right)^2 = 375 \text{ mH}$$

7

(b)

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

$$= \frac{12}{\sqrt{(12)^2 + 4 \times \pi^2 \times (60)^2 \times (0.1)^2}} \Rightarrow \cos \phi = 0.30$$

8

(d)

Magnetic field intensity at a distance r from the straight wire carrying current is

$$B = \frac{\mu_0 i}{2\pi r}$$

As area of loop, $A = a^2$

And magnetic flux, $\phi = BA$

$$\therefore \phi = \frac{\mu_0 i a^2}{2\pi r}$$

The induced emf in the loop is

$$e = \left| \frac{d\phi}{dt} \right| = \left| \frac{d}{dt} \frac{\mu_0 i a^2 v}{2\pi r} \right|$$

$$e = \frac{\mu_0 i a^2}{2\pi r^2} \frac{dr}{dt} = \frac{\mu_0 i a^2 v}{2\pi r^2}$$

Where $v = \frac{dr}{dt}$ is velocity.

9

(c)

$$\text{Phase difference } \Delta\phi = \phi_2 - \phi_1 = \frac{\pi}{6} - \left(-\frac{\pi}{6}\right) = \frac{\pi}{3}$$

10

(b)

$$\text{As } L = \frac{\mu_0 N^2 A}{l}$$

$$\therefore A \rightarrow \frac{2 \times 2 \times 4}{2} \text{ times} = 8 \text{ times}$$

12

(a)

$$i_p = \frac{n_s}{n_p} i_s = \frac{50}{200} \times 40 = 10 \text{ A}$$

13

(a)

$$\text{Current } i = i_0 \sin(\omega t + \phi)$$

$$i_p = i_0 \sin \omega t \cos \phi + i_0 \cos \omega t \sin \phi$$

$$\text{Thus, } i_0 \cos \phi = 10$$

$$i_0 \sin \phi = 8$$

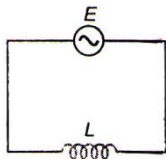
$$\text{Hence, } \tan \phi = \frac{4}{5}$$

14

(d)

In a purely inductive circuit, current is

$$i = i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$$



Which shows that the current lags behind the emf by a phase angle of $\frac{\pi}{2}$ or 90° or the emf leads the current by a phase angle of $\frac{\pi}{2}$ or 90° .

15

(b)

$$P = \frac{V_{rms}^2}{R} = \frac{(30)^2}{10} = 90 \text{ W}$$

17

(c)

In series LCR, the impedance of the circuit is given by

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

At resonance, $X_L = X_C$

$$\therefore Z = R$$

At resonance, the phase difference between the current and voltage is 0° . Current is maximum at resonance

19

(c)

$$e = \frac{E_{piP}}{E_s} = \frac{1100 \times 100}{220} = 500 \text{ A} = 0.5 \text{ kA}$$

20

(c)

$$\text{Impedance } Z = \sqrt{R^2 + X^2} = \sqrt{(8)^2 + (6)^2} = 10\Omega$$

ANSWER-KEY

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