DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 7

Topic :-Alternating current

1 **(c)**

Power remains constant in a ideal step down transformer.

2 **(b)**

$V = 50 \times 2 \sin 100\pi t \cos 100\pi t = 50 \sin 200\pi t$

$\Rightarrow V_0 = 50\ volts$ and $v = 100 Hz$

3 **(b)**

Capacitive reactance is given by

$X_C = \frac{1}{\omega C}$

Where C is capacitance and ω the angular frequency $(\omega = 2\pi f)$.

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

$\Rightarrow \quad X_C \propto \frac{1}{f}$

Hence, when frequency f increases capacitive reactance decreases.

4 **(a)**

Power factor $= \cos\phi = \frac{R}{Z}$

$= \frac{12}{15} = \frac{4}{5} = 0.8$

5 **(d)**

Given $\omega L = \frac{1}{\omega C} \Rightarrow \omega^2 = \frac{1}{LC}$

Or $\omega = \frac{1}{\sqrt{10^{-3} \times 10 \times 10^{-6}}} = \frac{1}{\sqrt{10^{-8}}} = 10^4$

$X_L = \omega L = 10^4 \times 10^{-3} = 10\ \Omega$

6 **(b)**

$i_s = \frac{E_s}{Z} = \frac{22}{220} = 0.1$ A

7 **(a)**

The instantaneous value of voltage is

$E = 100\sin(100t)\,V$ ...(i)

Compare it with $E = E_0\sin(\omega t)V$

We get

$E_0 = 100V, \omega = 100rads^{-1}$

The rms value of voltage is

$$E_{rms} = \frac{E_0}{\sqrt{2}} = \frac{100}{\sqrt{2}}V = 70.7V$$

The instantaneous value of current is

$$I = 100\sin\left(100t + \frac{\pi}{3}\right)mA$$

Compare it with

$I = I_0\sin(\omega t + \phi)$

We get

$I_0 = 100mA, \omega = 100\text{rads}^{-1}$

The rms value of current is

$$I_{rms} = \frac{I_0}{\sqrt{2}} = \frac{100}{\sqrt{2}}mA = 70.7mA$$

8 **(a)**

Resistance , $R = \frac{100}{10} = 10\ \Omega$

Inductive reactance , $X_L = 2\pi fL$

$$\frac{100}{8} = 2\pi \times 50 \times L$$

$$\Rightarrow\ L = \frac{1}{8\pi}\text{H}$$

$X'_L = 2\pi f'L = 2\pi \times 40 \times \frac{1}{8\pi} = 10\ \Omega$

Impedance of the circuit is $Z = \sqrt{R^2 + {X'_L}^2}$

$= \sqrt{(10)^2 + (10)^2}$

$= 10\sqrt{2}\ \Omega$

Current in the circuit is $i = \frac{V}{Z} = \frac{150}{10\sqrt{2}} = \frac{15}{\sqrt{2}}\text{A}$

9 **(a)**

$\because (X_C) >> (X_L)$

10 **(a)**

$i_{rms} = \frac{200}{280} = \frac{5}{7}A$. So $i_0 = i_{rms} \times \sqrt{2} = \frac{5}{7} \times \sqrt{2} \approx 1A$

12 **(d)**

In series $L - R$ circuit, impedance is given by

$$Z = \sqrt{R^2 + X_L^2}$$

Where R is the resistance and X_L the inductive reactance.

Given, $R = 8\Omega, X_L = 6\Omega$

$\therefore$ $Z = \sqrt{(8)^2 + (6)^2}$

$= \sqrt{64 + 36}$

$= \sqrt{100} = 10\ \Omega$

14 **(a)**

If the current is wattles then power is zero. Hence phase difference $\phi = 90°$

15 **(a)**

In LCR circuit; in the condition of resonance $X_L = X_C$, $i.e.$, circuit behaves as resistive circuit. In resistive circuit power factor is maximum

16 **(c)**

$$I_{av} = \frac{\int_0^{T/2} i\,dt}{\int_0^{T/2} dt} = \frac{\int_0^{T/2} I_0 \sin(\omega t) dt}{T/2}$$

$$= \frac{2I_0}{T}\left[\frac{-\cos\omega t}{\omega}\right]_0^{T/2} = \frac{2I_0}{T}\left[-\frac{\cos\left(\frac{\omega T}{2}\right)}{\omega} + \frac{\cos 0°}{\omega}\right]$$

$$= \frac{2I_0}{\omega T}[-\cos\pi + \cos 0°] = \frac{2I_0}{2\pi}[1+1] = \frac{2I_0}{\pi}$$

17 **(c)**

At resonance, $\omega L = \frac{1}{\omega C}$

Current flowing through the circuit,

$$I = \frac{V_R}{R}$$

$$= \frac{100}{1000} = 0.1\text{ A}$$

So, voltage across L is given by

$$V_L = IX_L = I\omega L$$

But $\omega L = \frac{1}{\omega C}$

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

$$= \frac{0.1}{200 \times 2 \times 10^{-6}} = 250\text{ V}$$

18 **(b)**

When the direction of current is reversed, moving from B to A.

$$V_B - V_A = \left[5 \times 10^{-3}(-10^3) + 15 + 1 \times 5\right]$$

$= 15$ volt

19 **(b)**

The instantaneous voltage through the given device

$e = 80 \sin 100\pi t$

Comparing the given instantaneous voltage with standard instantaneous voltage

$e = e_0 \sin \omega t.$

We get $e_0 = 80\ V$

Where e_0 is the peak value of voltage

Impedance $(Z) = 20\Omega$

Peak value of current $I_0 = \frac{e_0}{Z}$

$= \frac{80}{20} = 4\text{A}$

Effective value of current (root mean square value of current).

$I_{rms} = \frac{I_0}{\sqrt{2}}$

$= \frac{4}{\sqrt{2}} = 2\sqrt{2} = 2.828$ A

20 **(b)**

Charging current, $I = \frac{E}{R} e^{-\frac{t}{RC}}$

Taking log both sides,

$\text{Log}\, I = \log\left(\frac{E}{R}\right) - \frac{t}{RC}$

When R is doubled, slope of curve increases. Also at $t = 0$, the current will be less. Graph Q represents the best.

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