DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :-Alternating current

1 **(a)**

Impedance of LCR circuit will be minimum at resonant frequency so

$$V_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{1 \times 10^{-3} \times 0.1 \times 10^{-6}}}$$

$$= \frac{10^5}{2\pi} Hz$$

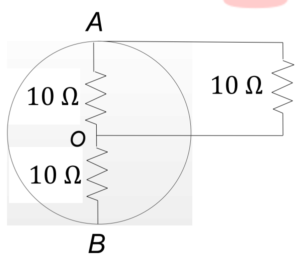
2 **(b)**

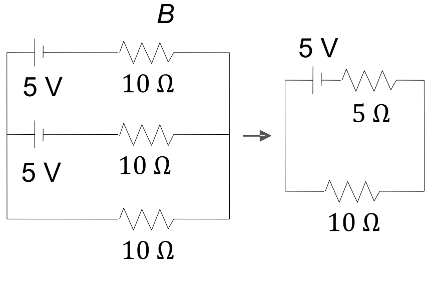
Here, resistance of rod $= 2\Omega . r = 0.1$ m, $B = 50$ T, along $z-$ axis $\omega = 20$ rads^{-1}.

Potential difference between centre of the ring and the rim is

$$V = \frac{1}{2}B\omega r^2 = \frac{1}{2} \times 50 \times 20 \times (0.1)^2 = 5 \text{ V}$$

The equivalent circuit of the arrangement is shown in figure





Current through external resistance,

$$i = \frac{E}{R + r} = \frac{5}{10 + 5} = \frac{1}{3} \text{A}$$

3 **(c)**

$\tan\phi = \frac{\omega L}{R} = \frac{2\pi \times 50 \times 0.21}{12} = 5.5 \Rightarrow \phi = 80°$

5 **(d)**

$e = Ldi/dt = 4 \times \frac{5}{1/1500} = 30000\text{V} = 30\text{kV}$

7 **(a)**

$X_L = 2\pi f L = 2\pi\left(\frac{50}{\pi}\right) \times 1 = 100\Omega$

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

$= \frac{1}{2\pi\left(\frac{50}{\pi}\right) \times 20 \times 10^{-6}}$

$= 500\ \Omega$

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

$= \sqrt{(300)^2 + (400)^2}$

$= 500\ \Omega$

9 **(d)**

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

$R = 10\Omega, X_L = \omega L = 2000 \times 5 \times 10^{-3} = 10\Omega$

$X_C = \frac{1}{\omega C} = \frac{1}{2000 \times 50 \times 10^{-6}} = 10\Omega$, *i.e.*, $Z = 10\Omega$

Maximum current $i_0 = \frac{V_0}{Z} = \frac{20}{10} = 2A$

Hence $i_{rms} = \frac{2}{\sqrt{2}} = 1.4\ A$ and $V_{rms} = 4 \times 1.41 = 5.64\ V$

11 **(d)**

$V = \sqrt{V_R^2 + (V_L - V_C)^2}$

$\because V_R = V \ \because V_L = V_C$

$\therefore$ Reading of voltmeter $= 220V$

Reading of ammeter $I_{rms} = \frac{E_{rms}}{Z}$

$= \frac{220}{100} = 2.2A$

12 **(a)**

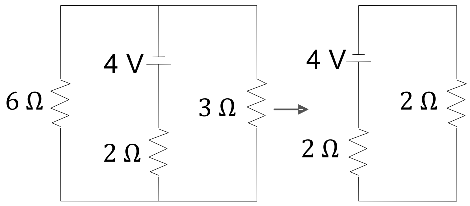
Motion emf induced in the connector

$e = Blv = 2(1)(2) = 4$ V

This acts as a cell of emf 4 V and internal resistance 2 Ω.6Ω and 3 Ω resistors are in parallel.

$$\therefore \frac{1}{R_P} = \frac{1}{6} + \frac{1}{3} = \frac{1+2}{6} = \frac{3}{6} = \frac{1}{2}$$

$$R_P = 2\ \Omega$$



$\therefore$ Current through the connector (i)

$$= \frac{E}{R_P + r} = \frac{4}{2+2} = 1\text{ A}.$$

Magnetic force on the connector

$$= Bil = (1)(1) = 2\text{ N}$$

Therefore, to keep the connector moving with a constant velocity, a force of 2 N has to be applied to the right side.

13 **(c)**

Heat produced by ac $= 3 \times$ Heat produced by dc

$\therefore i_{rms}^2 Rt = 3 \times i^2\ Rt \Rightarrow i_{rms}^2 = 3 \times 2^2$

$\Rightarrow i_{rms} = 2\sqrt{3} = 3.46\ A$

14 **(d)**

Brightness $\propto P_{\text{consumed}} \propto \frac{1}{R}$. For bulb, $R_{ac} = R_{dc}$, so brightness will be equal in both the Cases

15 **(c)**

$$E = 141 \sin 628t$$

$$\therefore \quad E_{rms} = \frac{E_0}{\sqrt{2}}$$

$$= \frac{141}{1.41} = 100\text{ V}$$

and $\quad v = \frac{\omega}{2\pi}$

$$= \frac{628}{2 \times 3.14} = 100\text{ Hz}$$

16 **(c)**

Here, $R = 10\ \Omega$. As is known,

$|dq| = \frac{d\phi}{R} = |i\ dt| =$ area under $i - t$ graphs.

$$\therefore \frac{d\phi}{R} = \frac{(4)(0.1)}{2} = 0.2$$

$d\phi = 0.2\ R = 0.2\ \times 10 = 2\ \text{ Wb}$

17 **(a)**

From $\phi = Mi$

$$\frac{M_1}{M_2} = \frac{\phi_1}{\phi_2} = \frac{10^{-3} \times 200}{0.8 \times 10^{-3} \times 400} = \frac{10}{16} = 0.625$$

18 **(a)**

Here, $V_{rms} = 220\text{V}$, $\text{v} = 50$ Hz

Peak value of voltage $V_0 = \sqrt{2}\, V_{\text{rms}} = 220\sqrt{2}$ V

∴ The instantaneous value of voltage is

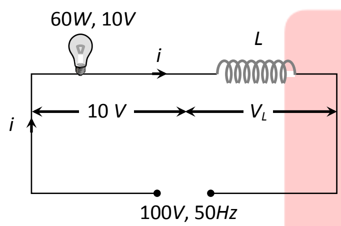
$$V = V_0 \sin 2\pi v t = 220\sqrt{2} \sin 2\pi \times 50t$$
$$= 220\sqrt{2} \sin 100\pi t$$

19 **(d)**

$$e = \frac{MdI}{dt} = 0.09 \times \frac{20}{0.006} = 300\text{V}$$

20 **(a)**

Current through the bulb $i = \frac{P}{V} = \frac{60}{10} = 6A$



$$V = \sqrt{V_R^2 + V_L^2}$$

$(100)^2 = (10)^2 + V_L^2$

$\Rightarrow V_L = 99.5\ Volt$

Also $V_L = iX_L = i \times (2\pi v L)$

$\Rightarrow 99.5 = 6 \times 2 \times 3.14 \times 50 \times L$

$\Rightarrow L = 0.052\ H$

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