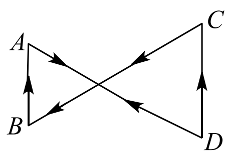
DPP
DAILY PRACTICE PROBLEMS

Class : XIIth **Solutions** **Subject : PHYSICS**
Date : **DPP No. : 9**

Topic :-Alternating current

1 **(d)**
As the magnetic field directed into the paper is increasing at a constant rate, therefore, induced current should produce a magnetic field directed out of the paper. Thus current in both the loops must be anti-clock-wise.



As area of loop on right side is more, therefore, induced emf o right side of loop will be more compared to the emf induced on the left-side of the loop
$\left[\therefore e = -\frac{d\phi}{dt} = -A\frac{dB}{dt}\right]$

2 **(b)**
Given, $L = 30$ mH
$V_{rms} = 220$ V
$f = 50Hz$
Now, $X_L = \omega L = 2\pi f L$
$= 2 \times 3.14 \times 50 \times 30 \times 10^{-3}$
$= 9.42\ \Omega$
The rms current in the coil is
$i_{rms} = \frac{V_{rms}}{X_L} = \frac{220V}{9.42\ \Omega}$=23.4 A

3 **(c)**
$$P = V_{r.m.s.} \times i_{r.m.s.} \times \cos\phi = \frac{100}{\sqrt{2}} \times \frac{100 \times 10^{-3}}{\sqrt{2}} \times \cos\frac{\pi}{3}$$
$$= \frac{10^4 \times 10^{-3}}{2} \times \frac{1}{2} = \frac{10}{4} = 2.5\ watt$$

4 **(d)**

Initial flux linked with inner coil when $i = 0$ is zero. Final flux linked with inner coil when $i = i$ is $\left(\frac{\mu_0 i}{2\pi b}\right)\pi a^2$

$\therefore$ Change in flux, $d\phi = \left(\frac{\mu_0 i}{2\pi b}\right)\pi a^2$

As $dq = \frac{d\phi}{R}$

$\therefore$ Total charge circulating the inner coil is

$= \left(\frac{\mu_0 i}{2\pi b}\right)\frac{\pi a^2}{R} = \frac{\mu_0 i a^2}{2Rb}$

5 **(a)**

Induced emf produced in coil

$$e = \frac{-d\phi}{dt} = \frac{-d}{dt}(BA)$$

$$\therefore \quad |e| = A\frac{dB}{dt} = 0.01 \times \frac{1}{1 \times 10^{-3}}$$

$$|e| = 10 \text{ V}$$

Current produced in coil,

$$i = \frac{|e|}{R} = \frac{10}{2} = 5 \text{ A}$$

Heat evolved $= i^2 Rt$

$$= (5)^2 \times (2) \times 1 \times 10^{-3} = 0.05 \text{ J}$$

6 **(c)**

Power = Rate of work done in one complete cycle.

or $P_{av} = \frac{W}{T}$

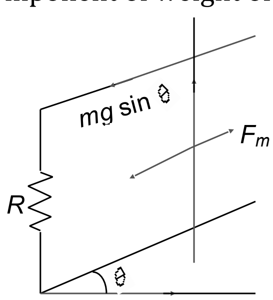
or $P_{av} = \frac{(E_0 I_0 \cos\phi)T/2}{T}$

or $P_{av} = \frac{E_0 I_0 \cos\phi}{2}$

Where $\cos\phi$ is called the power factor of an AC circuit.

7 **(c)**

Terminal velocity of the rod is attained when magnetic force on the rod (Bil) balances the component of weight of the rod(mgsin θ), figure.



ie, $Bil = \text{mg} \sin\theta$

$B\left(\frac{e}{R}\right)l = \text{mgsin}\,\theta$

$\frac{Bl}{R}(e) = \text{mgsin}\,\theta$

$\frac{Bl}{R}(Blv_r) = \text{mgsin}\,\theta$

$r_T = \frac{\text{mg}\,R\,\sin\theta}{B^2l^2}$

8 **(a)**

$X_C = \frac{1}{2\pi vC} \Rightarrow C = \frac{1}{2\pi vX_C} = \frac{1}{2\times\pi\times\frac{400}{\pi}\times 25} = 50\ \mu F$

10 **(c)**

Here, $M = 2\text{H}$, $d\phi = 4\ \text{Wb}$, $dt = 10\ \text{s}$

As $\phi = M\,i$

$d\phi = M\,di$

Or $di = \frac{d\phi}{M} = \frac{4}{2} = 2\ \text{A}$

Also, $d\phi = M\,(di) = 2(1)$

$= 2\ \text{Wb}$

11 **(a)**

$\tan\phi = \frac{X_L}{R} = \frac{\sqrt{3}\,R}{R} = \sqrt{3} \Rightarrow \phi = 60° = \pi/3$

12 **(c)**

Time difference $= \frac{T}{2\pi}\times\phi = \frac{(1/50)}{2\pi}\times\frac{\pi}{4} = \frac{1}{400}s = 2.5m\text{-}s$

13 **(a)**

Here, Resistance, $R = 3\Omega$

Inductive reactance, $X_L = 10\Omega$

Capacitive reactance, $X_C = 14\Omega$

The impedance of the series LCR circuit is

$Z = \sqrt{R^2 + (X_C + X_L)^2} = \sqrt{(3)^2 + (14-10)^2}$

$Z = 5\Omega$

14 **(d)**

In purely inductive circuit voltage leads the current by 90°

15 **(a)**

Q factor is given by $\frac{1}{R}\sqrt{\frac{L}{C}}$

So, for large quality factor the inductance should be large and resistance and capacitance must be small

16 **(b)**

As, power factor $=\frac{\text{true power}}{\text{apparent power}}$

$=\cos\phi$

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

$\therefore$ power factor $=\cos\phi=\frac{R}{Z}$

In a non-inductive circuit, $X_L=X_C$

$\therefore$ Power factor $=\cos\phi=\frac{R}{\sqrt{R^2}}=\frac{R}{R}=1$

$\therefore$ $\phi=0°$

This is the maximum value of power factor. In a pure inductor or an ideal capacitor

$\phi=90°$

$\therefore$ Power factor $=\cos\phi=\cos 90°=0$

Average power consumed in a pure inductor or ideal capacitor

$P=E_v.I_v\cos 90°=\text{zero}$

Therefore, current through pure L or pure C, which consumes no power for its maintenance in the circuit is called ideal current or wattles current.

17 **(d)**

Potential difference across the capacitor = emf induced across $HE=Blv$ which is constant. Therefore, charge stored in the capacitor is constant. Hence current in the circuit $HKDE$ is zero.

18 **(b)**

$e=-LdI/dt=-5\times(-2)=+10\text{ V}$

19 **(b)**

Resistance of a bulb $=\frac{(\text{Rated voltage})^2}{\text{Rated power}}$

$=\frac{(220)^2}{100}=484\ \Omega$

Peak voltage of the source, $V_0=220\sqrt{2}\,V=311\,V$

20 **(a)**

As $M=\frac{\mu_0 N_1 N_2 A}{l}$, therefore, M becomes 4 times

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