Solution

ALTERNATING CURRENT WS 2

Class 12 - Physics

1.

(d) 198 V

Explanation: $V_{av} = \frac{2}{\pi}V_0 = \frac{2}{\pi} \times \left(V_{rms} \times \sqrt{2}\right) = \frac{2\sqrt{2}}{\pi} \cdot V_{rms}$
$= \frac{2\sqrt{2}}{\pi} \times 220 = 198V$

2.

(c) Over a full cycle the capacitor C does not consume any energy from the voltage source.

Explanation: The current in a capacitor is ahead of voltage in phase by 90^o.
$P_{av} = \varepsilon_{ms} I_{rms}\, cos\left(-\frac{\pi}{2}\right) = 0$

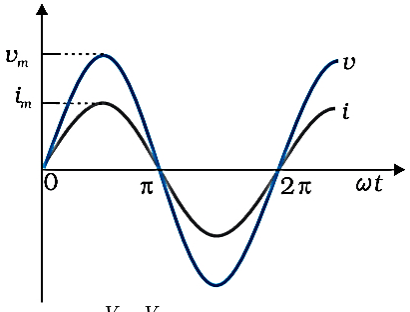
3.

(c) Assertion is correct statement but reason is wrong statement.

Explanation: Faraday's laws of electromagnetic induction are consequences of conservation of energy. It involves only transformation of energy into electrical energy. In purely resistive circuit, current and voltage are in the same phase.

4. The instantaneous value of alternating voltage applied V = V_0sinωt ...(i)

If i is the instantaneous current in the circuit and di/dt, the rate of change of current in the circuit at that instant, then instantaneous induced emf
$\varepsilon = -L\frac{di}{dt}$
According to Kirchhoff's second law in closed circuit. or
V + ε = 0 $\Rightarrow$ V - L$\frac{di}{dt}$ = 0
V = L$\frac{di}{dt}$ or $\frac{di}{dt}$ = $\frac{V}{L}$
or $\frac{di}{dt}$ = $\frac{V_0 \sin\omega t}{L}$ or di = $\frac{V_0 \sin\omega t}{L}$dt
i = $\frac{V_0}{L}\int \sin\omega t dt = \frac{V_0}{L}\left\{-\frac{\cos\omega t}{\omega}\right\} = -\frac{V_0}{\omega L}\cos\omega t$
$= -\frac{V_0}{\omega L}\sin\left(\frac{\pi}{2} - \omega t\right)$
or i = $\frac{V_0}{\omega L}\sin\left(\omega t - \frac{\pi}{2}\right)$ ...(ii)
This is required expression for current or
i = i_0 sin $\left(\omega t - \frac{\pi}{2}\right)$ ...(iii)
Graphically



5. $\tan\phi = \frac{V_L - V_C}{V_R}$
$= \frac{20-20}{40} = 0$
$\therefore$ Phase difference $\phi = 0^\circ$

6. i. Maximum emf generated = ε = NBAω
ε = NBA $\times 2\pi$f
Or, ε = 100 $\times$ 0.01 $\times$ 0.1 $\times$ 2π $\times \frac{50}{60}$
$\therefore \varepsilon = \frac{\pi}{6}$V = 0.52 V

ii. The average emf generated in the coil over complete rotation is 0.

7. The full cycle of alternating current consists of two half cycles, For one half, current is positive and for other half, current is negative. Therefore, for a full cycle, the net value of current average out to zero. Hence, the alternating current cannot be

measured by DC ammeter.