



DPP – 1 (Alternating Current)

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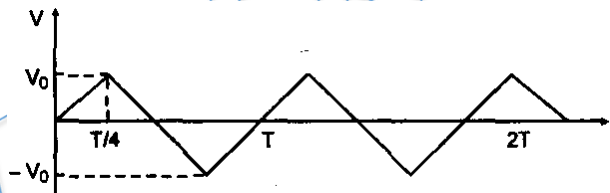
Q 1. The electric current in a circuit is given by $i = 3t$ Here, t is in second and i in ampere. Then rms current for the period $t = 0$ to $t = 1$ s is:

- (a) 3 A (b) 9 A (c) $\sqrt{3}$ A (d) $\sqrt[3]{3}$

Q 2. Average value of voltage from $t = 0$ to $t = \frac{2\pi}{\omega}$ for function: $V = V_0 \sin \omega t$ for $0 \leq t \leq \frac{\pi}{\omega}$ and $V = -V_0 \sin \omega t$ for $\frac{\pi}{\omega} \leq t \leq \frac{2\pi}{\omega}$ is :

- (a) $\frac{V_0}{\sqrt{2}}$ (b) $\left(\frac{2}{\pi}\right) V_0$ (c) $\frac{V_0}{2}$ (d) zero

Q 3. The voltage time ($V - t$) graph for a triangular wave having peak value V_0 is as shown in figure. The rms value of V is:



- (a) $\frac{V_0}{3}$
(c) $\frac{V_0}{\sqrt{2}}$

- (b) $\frac{V_0}{2}$
(d) $\frac{V_0}{\sqrt{3}}$

Q 4. The current through a wire changes with time according to the equation $I = \sqrt{t}$. The correct value of the rms current within the time interval $t = 2$ to $t = 4$ s will be -

- (a) $\sqrt{3}$ A (b) 3 A
(c) 3 A (d) None of these

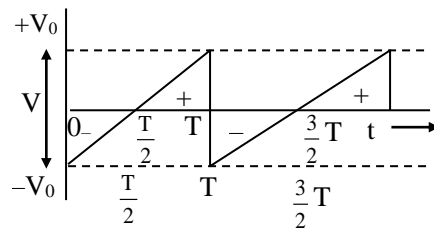
Q 5. In a circuit an A.C. current and a D. C. current are supplied together. The expression of the instantaneous current is given as $i = 3 + 6 \sin \omega t$ Then the rms value of the current is -

- (a) 3 (b) 6 (c) $3\sqrt{2}$ (d) $3\sqrt{3}$

Q 6. The time required for a 50Hz alternating current to increase from zero to 70.7% of its peak value is -

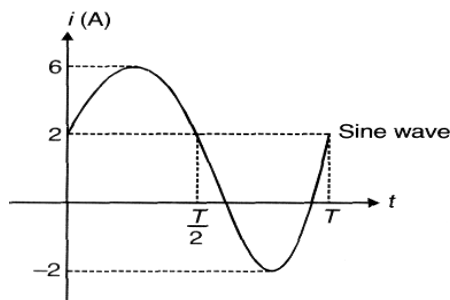
- (a) 2.5 ms (b) 10 ms
(c) 20 ms (d) 14.14 ms

Q 7. Find rms value for the saw-tooth voltage of peak value V_0 as shown in figure.



- (a) V_0 (b) $\frac{V_0}{2}$
 (c) $\frac{V_0}{3}$ (d) none of these

Q 8. The current 'i' through a wire varies with time t as shown in the figure. The effective (rms) value of the current is



- (a) 6A (b) $2\sqrt{3}$
 (c) $2 + 2\sqrt{2}$ A (d) 3 A

Q 9. Instantaneous current in an ac circuit is given $I = i_0 \sin \omega t$. Average value of current from $t=0$ to $t = \frac{3\pi}{\omega}$ is

- (a) Zero (b) i_0 (c) $\frac{i_0}{2}$ (d) $\frac{2i_0}{3\pi}$

Answer Key

Q.1 c	Q.2 b	Q.3 d	Q.4 a	Q.5 d
Q.6 a	Q.7 d	Q.8 b	Q.9 d	

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Written Solution

**DPP-1 AC- Generation of AC, Instantaneous,
Peak, Average and RMS Value of AC**

By Physicsaholics Team

Q.1) The electric current in a circuit is given by

$$i = 3t$$

Here, t is in second and i in ampere. Then rms current for the period $t = 0$ to $t = 1$ s is:

$$i_{\text{rms}}^2 = \frac{\int_0^1 9t^2 dt}{\int_0^1 dt} = \frac{\left[9 \frac{t^3}{3} \right]_0^1}{1} = 3$$

$$i_{\text{rms}} = \sqrt{3}$$

(a) 3 A

(b) 9 A

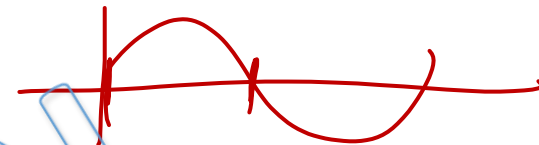
~~(c) $\sqrt{3}$ A~~

(d) $\sqrt[3]{3}$

$$y = f(x)$$

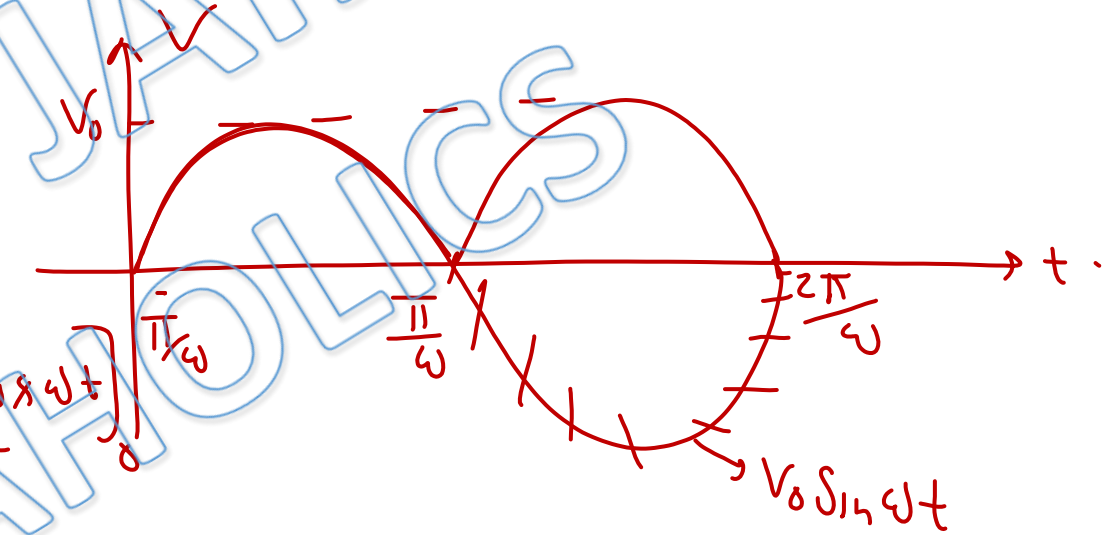
$$y_{\text{rms}} = \sqrt{\frac{\int [f(x)]^2 dx}{\int dx}}$$

$$y = f(x), \quad y_{av} = \frac{\int f(x) dx}{\int dx}$$



Q.2) average value of voltage from $t = 0$ to $t = \frac{2\pi}{\omega}$ for function: $V = V_0 \sin \omega t$ for $0 \leq t \leq \frac{\pi}{\omega}$ and $V = -V_0 \sin \omega t$ for $\frac{\pi}{\omega} \leq t \leq \frac{2\pi}{\omega}$ is :

$$\begin{aligned} & V_{av} \text{ from } t=0 \text{ to } t = \frac{2\pi}{\omega} \\ &= \text{'' '' , } t=0 \text{ to } t = \frac{\pi}{\omega} \\ &= \frac{\int_0^{\pi/\omega} V_0 \sin \omega t dt}{\int_0^{\pi/\omega} dt} = \frac{\omega V_0 \left(-\frac{1}{\omega}\right) [\cos \omega t]_0^{\pi/\omega}}{\pi} \end{aligned}$$



(a) $\frac{V_0}{\sqrt{2}}$

(b) $\left(\frac{2}{\pi}\right) V_0$

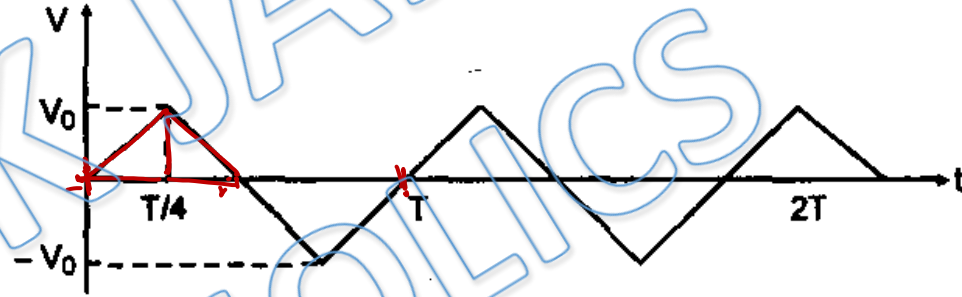
(c) $\frac{V_0}{2}$

(d) zero

$$\begin{aligned} &= \frac{-V_0}{\pi} [\cos \pi - \cos 0] \\ &= \frac{2V_0}{\pi} \end{aligned}$$

Q.3) The voltage time (V —t) graph for a triangular wave having peak value V_0 is as shown in figure. The rms value of V is:

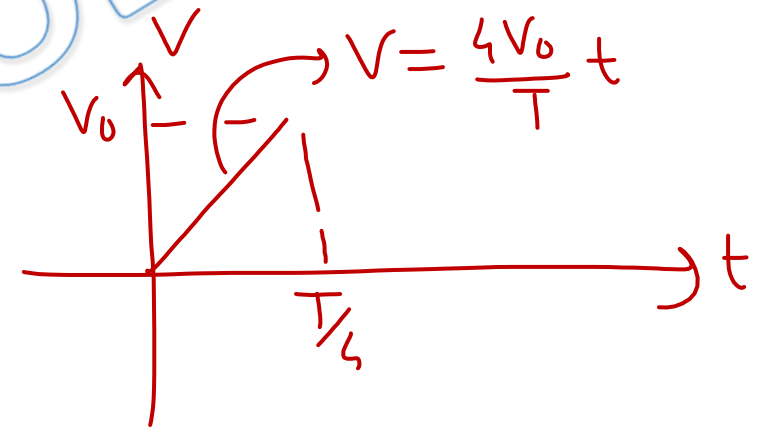
rms value over long time interval
 = " " from $t=0$ to $t=T/4$



$$= \sqrt{\frac{\int_0^{T/4} \left(\frac{4V_0}{T}t\right)^2 dt}{\int_0^{T/4} dt}}$$

- (a) $\frac{V_0}{3}$
- (b) $\frac{V_0}{2}$
- (c) $\frac{V_0}{\sqrt{2}}$
- (d) $\frac{V_0}{\sqrt{3}}$

$$= \sqrt{\frac{\frac{16}{T^2} \times \frac{4V_0^2}{T} \left[\frac{t^3}{3}\right]_0^{T/4}}{\frac{T}{4}}} = \sqrt{\frac{64}{T^3} \times \frac{T^3 V_0^2}{64 \times 3}} = \frac{V_0}{\sqrt{3}}$$



Q.4) The current through a wire changes with time according to the equation $I = \sqrt{t}$. The correct value of the rms current within the time interval $t = 2$ to $t = 4$ s will be -

$$I = \sqrt{t}$$

$$I^2 = t$$

$$\langle I^2 \rangle = 3$$

~~(a) $\sqrt{3}$ A~~

(c) 3 A

(b) 3 A

(d) None of these

Q.5) In a circuit an A.C. current and a D. C. current are supplied together. The expression of the instantaneous current is given as

$i = 3 + 6 \sin \omega t$ Then the rms value of the current is –

$$i_{rms}^2 = \frac{\int (9 + 36 \sin^2 \omega t + 36 \sin \omega t) dt}{\int dt}$$

$$= \frac{\int [9 + 18(2 \sin^2 \omega t)] dt}{\int dt} + 36 \frac{\int \sin \omega t dt}{\int dt}$$

(a) 3

(b) 6

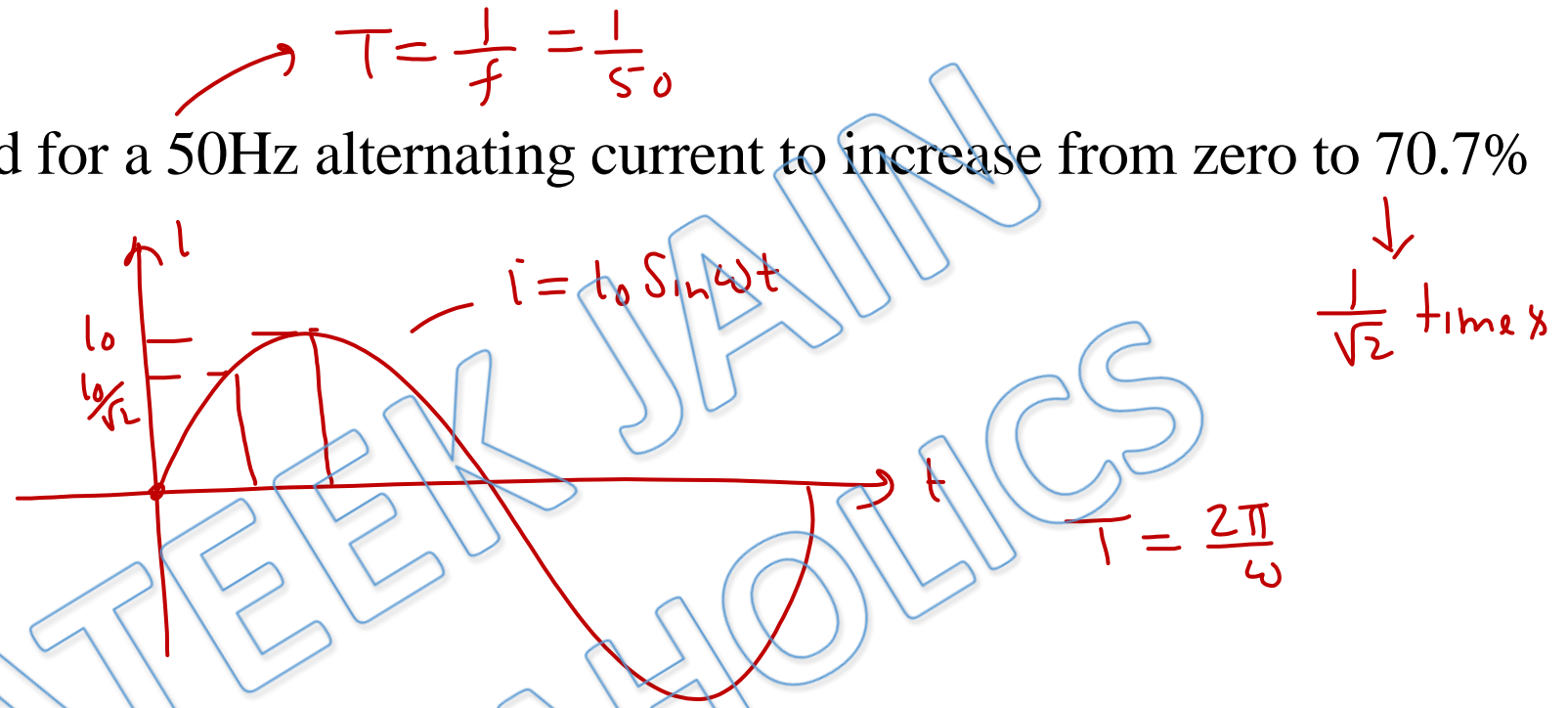
(c) $3\sqrt{2}$

(d) $3\sqrt{3}$

$$= \frac{\int_0^{2\pi/\omega} [9 + 18(1 - \cos 2\omega t)] dt}{\int_0^{2\pi/\omega} dt} = \frac{\int 27 dt}{\int dt} - \frac{\int_0^{2\pi/\omega} 18 \cos 2\omega t dt}{\int dt}$$

$$= 27 + 0$$

Q.6) The time required for a 50Hz alternating current to increase from zero to 70.7% of its peak value is -



~~(a) 2.5 ms~~

(c) 20 ms

(b) 10 ms

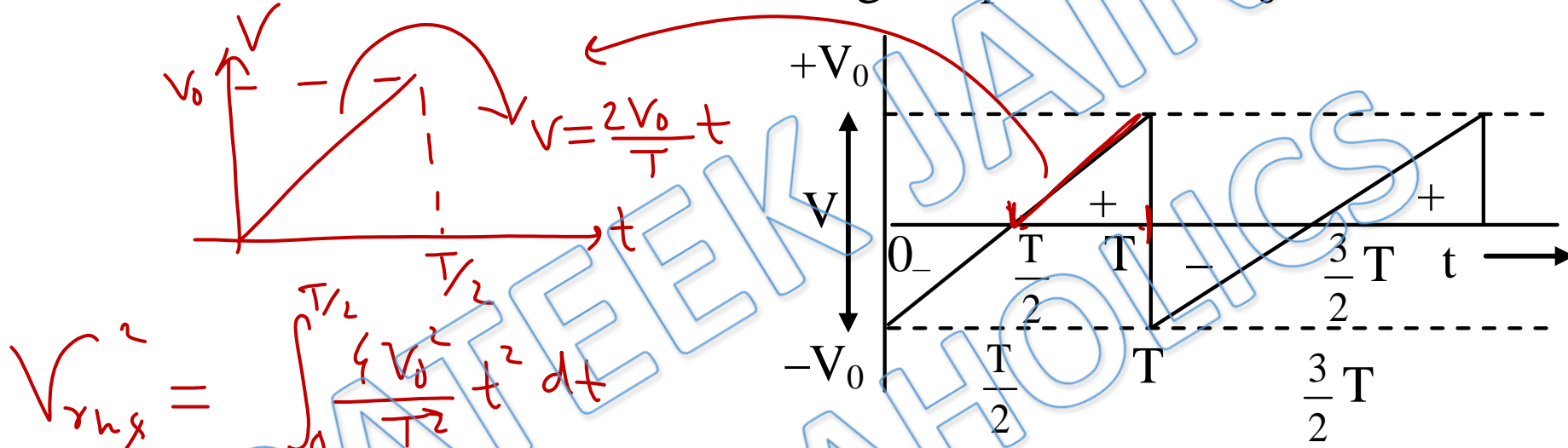
(d) 14.14 ms

$$\omega t = \frac{\pi}{4}$$

$$t = \frac{\pi}{4\omega} = \frac{T}{8} = \frac{1}{50 \times 8} \text{ Sec}$$

$$= \frac{1000}{8 \times 400} \text{ ms}$$

Q.7) Find rms value for the saw-tooth voltage of peak value V_0 as shown in figure.



$$V_{rms}^2 = \frac{\int_0^{T/2} 4 \frac{V_0^2}{T^2} t^2 dt}{\int_0^{T/2} dt}$$

(a) V_0

(b) $\frac{V_0}{2}$

(c) $\frac{V_0}{3}$

(d) none of these

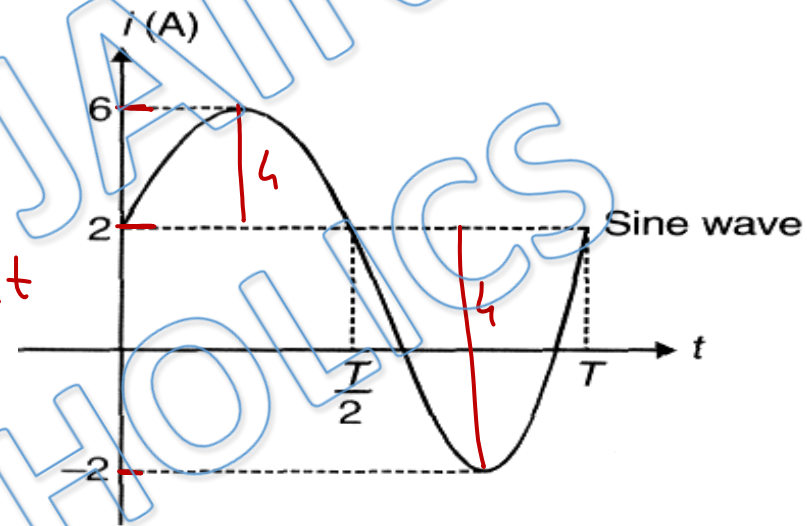
$$= \frac{4V_0^2 \times \left[\frac{t^3}{3} \right]_0^{T/2}}{T^2 T \left[\frac{t}{1} \right]_0^{T/2}}$$

$$= \frac{4V_0^2}{T^3} \times \frac{T^3}{8 \times 3} \Rightarrow V_{rms} = \frac{V_0}{\sqrt{3}}$$

Q.8) The current 'i' through a wire varies with time t as shown in the figure. The effective (rms) value of the current is

$$i = 2 + 4 \sin \omega t$$

$$i_{rms}^2 = \frac{\int_0^{2\pi/\omega} (4 + 16 \sin^2 \omega t + 16 \sin \omega t) dt}{\int_0^{2\pi/\omega} dt}$$



(a) 6A

$$= \frac{\int_0^{2\pi/\omega} [4 + 8(1 - \cos 2\omega t)] dt}{2\pi/\omega}$$

(b) ~~$2\sqrt{3}$~~

(c) $2 + 2\sqrt{2}$ A

$$= \frac{\int_0^{2\pi/\omega} 12 dt}{2\pi/\omega} - \frac{8 \int_0^{2\pi/\omega} \cos 2\omega t dt}{2\pi/\omega} = 12$$

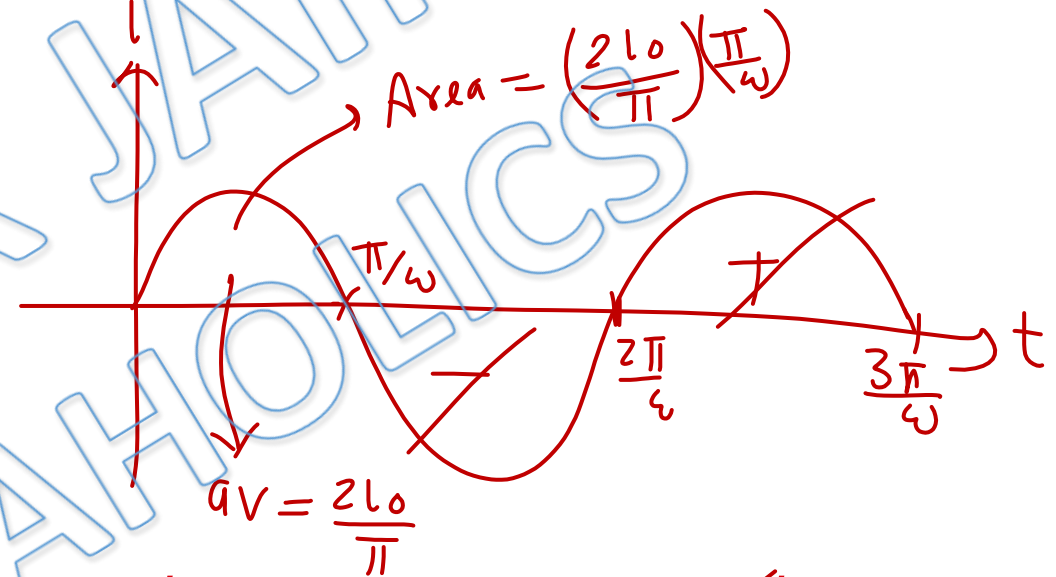
(d) 3 A

Q.9) Instantaneous current in an ac circuit is given $I = i_0 \sin \omega t$. Average value of current from $t = 0$ to $t = \frac{3\pi}{\omega}$ is

$$\text{Total Area} = \left(\frac{2i_0}{\pi}\right) \left(\frac{\pi}{\omega}\right)$$

$$\text{Time} = \frac{3\pi}{\omega}$$

$$av = \frac{2i_0}{3\pi}$$



(a) Zero

(b) i_0

(c) $\frac{i_0}{2}$

(d) $\frac{2i_0}{3\pi}$

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