

- 1 the current , i in an ac circuit is given by the equation  $I=30 \sin 100t$  where t is the time in seconds. Deduce the following from this equation (i) Peak value of the current. (ii) R.M.S value of the current.**

Given the equation for the current  $I(t) = 30 \sin(100\pi t)$ , let's deduce the peak value and the RMS value of the current.

(i) Peak Value of the Current:

The peak value of a sinusoidal function is the maximum absolute value it reaches. For the function  $I(t) = 30 \sin(100\pi t)$ , the peak value is the amplitude of the sine function, which is 30 amperes.

So, the peak value of the current  $I_{peak} = 30 \text{ A}$ .

(ii) R.M.S Value of the Current:

The Root Mean Square (RMS) value of a periodic function  $f(t)$  over one period  $T$  is defined as:

$$f_{RMS} = \sqrt{\frac{1}{T} \int_0^T [f(t)]^2 dt}$$

For the function  $I(t) = 30 \sin(100\pi t)$ , we are dealing with a sinusoidal function over one full cycle. The period  $T$  of this function is the time taken for one complete cycle, which is given by:

$$T = \frac{2\pi}{100\pi} = \frac{2}{100} = 0.02$$

seconds.

Now, to determine the RMS value, we'll use the formula:

$$I_{RMS} = \sqrt{\frac{1}{T} \int_0^T [I(t)]^2 dt}$$

Plugging in the given equation  $I(t) = 30 \sin(100\pi t)$  into the formula, we get:

$$I_{RMS} = \sqrt{\frac{1}{0.02} \int_0^{0.02} [30 \sin(100\pi t)]^2 dt}$$

$$I_{RMS} = \sqrt{50 \int_0^{0.02} [30^2 \sin^2(100\pi t)] dt}$$

Now, integrating  $[30^2 \sin^2(100\pi t)]$  over one full cycle (from  $t = 0$  to  $t = 0.02$ ) can be done using trigonometric identities and properties of integration. The result will be:

$$I_{RMS} = 30$$

Therefore, the RMS value of the current  $I_{RMS} = 30$  A.

In conclusion, from the equation  $I(t) = 30 \sin(100\pi t)$ : (i) The peak value of the current  $I_{peak} = 30$  A. (ii) The RMS value of the current  $I_{RMS} = 30$  A.