Indian Institute of Information Technology, Allahabad

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Course Name: Electrical Engineering

EXPERIMENT NO: 6

Objective:

To find out the current in single phase AC circuit.

Materials/ Component Required:

Bread board, Digital Multi meter, Resistance, Function generator, Connecting Wires.
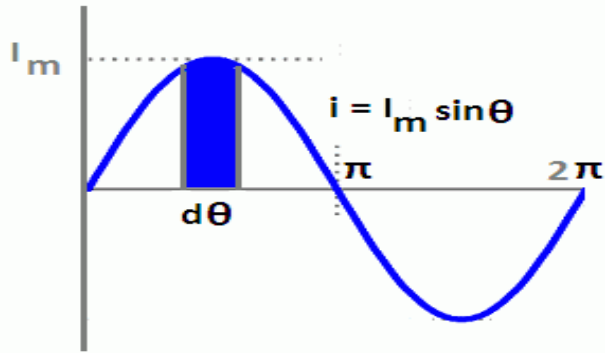
Theory:

The root mean square (RMS) is defined as the square root of the mean square (the arithmetic mean of the squares of a set of numbers). RMS value of the function I(t) (current) is the constant current that yields the same power dissipation as the time-averaged power dissipation of the current I(t).

Circuit Diagram:
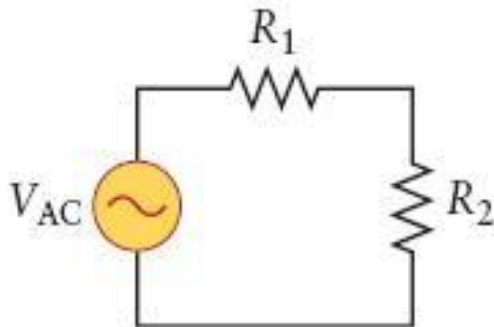
$$RMS\ Value = \sqrt{1/T \int_{0}^{T} f(x)^2\, dx}$$

Calculation:

The term *rms* stands for (square) root of the mean of the squares of the instantaneous current values.

$$\therefore \quad I_{rms} = \sqrt{\frac{1}{\pi} \int_0^\pi i^2 \, d\theta}$$

$$I_{rms}^2 = \frac{1}{\pi} \int_0^\pi I_m^2 \sin^2\theta \, d\theta = \frac{I_m^2}{\pi} \int_0^\pi \sin^2\theta \, d\theta$$

$$= \frac{I_m^2}{\pi} \int_0^\pi \left(\frac{1 - \cos 2\theta}{2}\right) d\theta = \frac{I_m^2}{2\pi} \int_0^\pi (1 - \cos 2\theta) \, d\theta$$

$$= \frac{I_m^2}{2\pi} \left| \theta - \frac{1}{2} \sin 2\theta \right|_0^\pi$$

$$= \frac{I_m^2}{2\pi} \left| \left(\pi - \frac{1}{2}\sin 2\pi\right) - \left(0 - \frac{1}{2}\sin 2 \times 0\right) \right|$$

$$= \frac{I_m^2}{2\pi} |\pi - 0 - 0 + 0| = \frac{\pi}{2\pi} I_m^2 = \frac{I_m^2}{2}$$

$$\therefore \quad I_{rms} = \sqrt{\frac{I_m^2}{2}} = \frac{I_m}{\sqrt{2}} = 0.707 \, I_m$$

Result:

Precautions:

a) Connections should be verified before clicking run button.
b) The resistance to be chosen should be in K ohm range.
c) Best performance is being obtained within 50Hz to 1Mhz.