



FRESCO notes



GIPTA[®]
ECO 

Experiment I

P1) Calculate the RMS values of the following waveforms using the formula

$$V_{rms} = \sqrt{\frac{1}{T} \int_0^T v(t)^2 dt}$$

a-) Sinusoidal waveform

$$\begin{aligned} v(t) &= V_m \sin\left(\frac{2\pi}{T}t\right) \text{ for } 0 \leq t \leq T \\ V_{rms} &= \sqrt{\frac{1}{T} \int_0^T V_m^2 \sin^2\left(\frac{2\pi}{T}t\right) dt} \\ &= \sqrt{\frac{1}{T} V_m^2 \left(\frac{t}{2} - \frac{\sin(4\pi t/T)}{4\pi} \right) \Big|_0^T} \\ &= \sqrt{\frac{1}{T} V_m^2 \cdot \frac{T}{2}} = \frac{V_m}{\sqrt{2}} \end{aligned}$$

b-) Square Waveform

$$v(t) = V_m \text{ for } 0 \leq t \leq \frac{T}{2}$$

$$v(t) = -V_m \text{ for } \frac{T}{2} \leq t \leq T$$

$$\begin{aligned} V_{rms} &= \sqrt{\frac{1}{T} \left(\int_0^{T/2} V_m^2 dt + \int_{T/2}^T V_m^2 dt \right)} \\ &= \sqrt{\frac{1}{T} V_m^2 \left(\frac{T}{2} \cdot 1 + \left(T - \frac{T}{2} \right) \cdot 1 \right)} \end{aligned}$$

c-) Triangular waveform

$$v(t) = \frac{4V_m}{T}t \text{ for } 0 \leq t \leq \frac{T}{4}$$

$$v(t) = 2V_m - \frac{4V_m}{T}t \text{ for } \frac{T}{4} \leq t \leq \frac{3T}{4}$$

$$v(t) = -\frac{4V_m}{T}t + 3V_m \text{ for } \frac{3T}{4} \leq t \leq T$$