BEEC

Home Assignment

[CO-2]

① (a) The current in a circuit is given by $I = 40 \sin(628)t$ Calculate i) Frequency ii) RMS value iii) Average value iv) form F. v) Peak factor.

Sol: Given, $I = 40 \sin(628)t$

i) General form $I = A \sin(2\pi ft)$

$$2\pi f = 628$$

$$f = \frac{628}{2\pi} = \frac{628}{2 \times 3.14} \Rightarrow \text{frequency}(f) = 100 \text{ Hz}$$

ii) RMS value:

For a sinusoidal function $I = A \sin(\omega t)$

$$I_{rms} = \frac{A}{\sqrt{2}} = \frac{40}{\sqrt{2}}$$

$$\boxed{I_{rms} = 28.28A}$$

iii) Average Value:

The average value of a sinusoidal function over one complete cycle is $I_{avg} = 0$. This is because the positive & Negative values over a cycle cande each othee out.

iv) Form Factor: The form factor is the ratio of RMS value to the average value.

$$\boxed{FF = \sqrt{2}}$$

v) Peack Factor: $\text{Peack F} = \frac{40}{I_{rms}} = \frac{40}{28.28} = 1.414$.

(b) Write the polar form of the voltage given by $v(t) = \sin[50\pi t + \pi/3]$ v obtain its rectangular form?

Sol: The polar form of a sinsoidal voltage is:

$$v(t) = A\sin(\omega t + \phi)$$

but given $v(t) = \sin(50\pi t + \pi/3)$ v.

$A = 1$

$\omega = 50\pi$

$\phi = \pi/3$

$$v(t) = A\sin(\omega t + \phi) = A(\cos(\phi) + j\sin(\phi))$$

$$v(t) = 1(\cos(\pi/3) + j\sin(\pi/3))$$

$$\boxed{v(t) = \frac{1}{2} + j\frac{\sqrt{3}}{2}}$$ (Rectangular form of the voltage)

(c) The current drawn by a pure capacitance of 50μF is 1.642 A from 220V ac supply, find the supply frequency.

Sol: Given, $I = 1.642$A, $V = 220$V, $C = 50\mu$F

We know $X_c = \frac{1}{2\pi fC} \rightarrow f = \frac{1}{2\pi X_c C}$

$$f = \frac{1}{2 \times 1.642 \times 3.14 \times 10^{-6} \times 50 \times 10^{-6}}$$

$$f = \frac{1}{0.000163}$$

$$f \approx 6135.58\text{Hz}$$

∴ the supply frequency is approximately 6135.58 Hz.

(2) (a) A 200μF Capacitor is connected across is 240V, 50Hz System Determine i) The Capacitance reactance ii) R.M.S Value of current iii) Equations for voltages and currents?

Sol: i) $X_c = \frac{1}{2\pi fc}$

$= \frac{1}{2\pi(50 \times 200)}$

$= \frac{1}{2 \times 3.14 \times 50 \times 200 \times 10^{-6}}$

$X_c = 318.31\ \Omega$

ii) $I_{rms} = \frac{V}{X_c}$

$I_{rms} = \frac{240}{318.31}$

$I_{rms} = 0.754A.$

iii) $I(t) = I_{rms} \sin(2\pi ft + \phi)$

$V(t) = I_{rms} X_c \cos(2\pi ft + \phi)$

Substitute the values → $I(t) = 0.754 \sin(2\pi t(50) + \phi)$

$V(t) = (0.754)(318.31)\cos(2\pi t(50) + \phi)$

(b) Calculate the form factor & peak factor of a triangular wave in which the voltage rises uniform from 0 to 1V volts its time T seconds & completes the cycle by instant fall back to zero?

Sol:- $V_{rms} = \frac{V_{peak}}{\sqrt{3}}$ Given 0 to 1V, so peak = 1

$V_{rms} = \frac{1}{\sqrt{3}}$

$V_{avg} = \frac{V_{peak}}{2} = \frac{1}{2}$

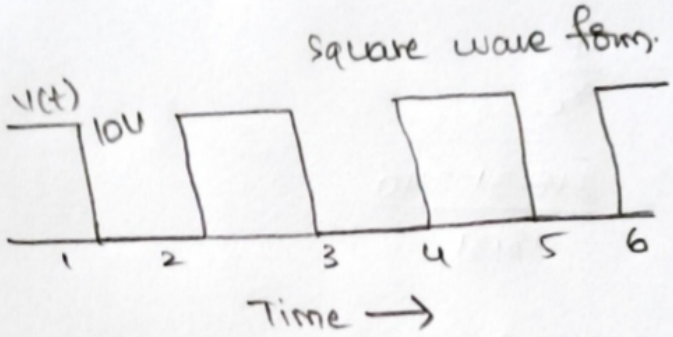
- Form factor (F.F) $= \frac{V_{rms}}{V_{avg}} = \frac{\frac{1}{\sqrt{3}}}{\frac{1}{2}} = \frac{2}{\sqrt{3}}$

$$\boxed{F.F = 1.155}$$

- Peak factor $= \frac{V_{peak}}{V_{rms}} = \frac{1}{\frac{1}{\sqrt{3}}} = \frac{\sqrt{3}}{1} = \sqrt{3} = 1.732$

$$\boxed{P.F = 1.732}$$

① Calculate the average & RMS values of the square wave.



Sol:

$v(t) = 10$ for $0 < t < 1$

0 for $2 < t < 1$

$$V_{rms} = \sqrt{\frac{\int_0^2 (v^2(t))dt}{2}} = \sqrt{\frac{\int_0^2 (10)^2 dt}{2}}$$

$$\boxed{V_{rms} = 7.071\,V}$$

$$V_{avg} = \int_0^2 \frac{v(t)\,dt}{2} = \int_0^2 \frac{10\,dt}{2}$$

$$\boxed{V_{avg} = 5}$$