GATE 2023 IN 29

EE23BTECH11065 - prem sagar

Question:

Let $y(t)=x(4t)$, where $x(t)$ is a continous-time periodic signal of 100s. the fundamental period of $y(t)$ is (**rounded off to the nearest integer**) (GATE IN 29)

Solution:

Symbol	Value	Description
T	100	fundamental period of $x(t)$
T_1		fundamental period of y(t)
ω_0	$\frac{8\pi}{100}$	fundamental frequency of y(t)

TABLE 1
INPUT PARAMETERS

From Table 1
Applying Fourier series:

$$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{j\frac{2\pi n}{100}t} \tag{1}$$

$$y(t) = x(4t) \tag{2}$$

$$y(t) = \sum_{n=-\infty}^{\infty} c_n e^{j\frac{2\pi n}{400}(4t)} \tag{3}$$

$$= \sum_{n=-\infty}^{\infty} c_n e^{j\frac{8\pi n}{100}t} \tag{4}$$

$$T_1 = \frac{2\pi}{\omega_0} \tag{5}$$

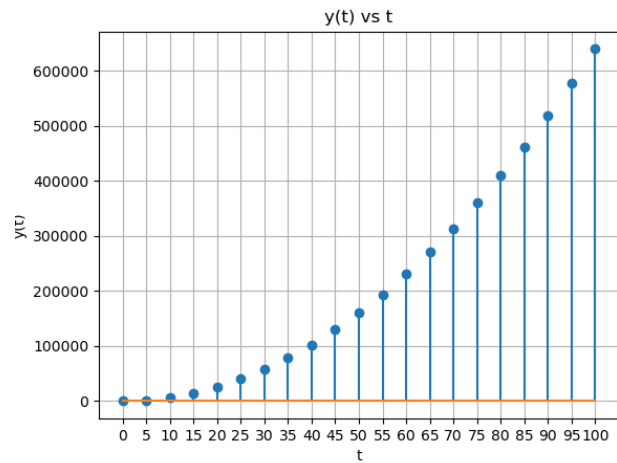$$= \frac{2\pi}{\frac{8\pi}{100}} \tag{6}$$

$$= \frac{100}{4} \tag{7}$$

$$= 25\text{sec} \tag{8}$$

Fig. 1. plot y(t) v/s t