

GATE 2022 IN 14

EE23BTECH11065 - prem sagar

Question:

The output of the system $y(t)$ is related to its input $x(t)$ according to the relation Delay in output $y(t)$:
 $y(t) = x(t) \sin(2\pi t)$. This system is

$$y(t - \tau) = x(t - \tau) \sin(2\pi(t - \tau)) \quad (8)$$

$$y_2(t) = x(t - \tau) \sin(2\pi(t - \tau)) \quad (9)$$

$$y_1(t) \neq y_2(t) \quad (10)$$

- (A) Linear and time-variant
- (B) Non-Linear and time-invariant
- (C) Linear and time-invariant
- (D) Non-linear and time-variant

Solution:

\therefore it is time variant

Symbol	Value	Description
$x(t)$		input signal
$y(t)$	$x(t) \sin(2\pi t)$	output signal
τ		Time delay

TABLE 1
INPUT PARAMETERS

From Table 1

$$y_1(t) \leftrightarrow x_1(t) \quad (1)$$

$$y_2(t) \leftrightarrow x_2(t) \quad (2)$$

$$ay_1(t) + by_2(t) \leftrightarrow ax_1(t) + bx_2(t) \quad (3)$$

$$ay_1(t) + by_2(t) = (ax_1(t) + bx_2(t)) \sin(2\pi t) \quad (4)$$

\therefore satisfies principle of superposition

$$ky(t) \leftrightarrow kx(t) \quad (5)$$

$$ky(t) = k(x(t) \sin(2\pi t)) \quad (6)$$

\therefore satisfies principle of homogeneity

\therefore it is linear

Delay in input $x(t)$:

$$y_1(t) = x(t - \tau) \sin(2\pi t) \quad (7)$$