11.9.4.4

EE23BTECH11027 - K RAHUL*

QUESTION:

The continuous time signal $x(t)$ is described by:

$$x(t) = \begin{cases} 1, & \text{if } 0 \le t \le 1 \\ 0, & \text{elsewhere} \end{cases} \tag{1}$$

If $y(t)$ represents $x(t)$ convolved with itself, which of the following options is/are TRUE?

A $y(t) = 0$ for all $t < 0$

B $y(t) = 0$ for all $t > 1$

C $y(t) = 0$ for all $t > 3$

D $\int_{0.1}^{0.75} \frac{dy(t)}{dt}$ dt $\neq 0$

SOLUTION:

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

$$= \int_{t-1}^{t} x(k)dk \tag{3}$$

If $t < 0$, $y(t) = 0$, thus A is True. If $1 < t < 2$, then $y(t) = 1$, thus B is False. If $t > 3$, then $y(t) = 0$, thus C is True.

$$\int_{0.1}^{0.75} dy(t) = y(0.75) - y(0.1) \tag{4}$$

$$= \int_{0}^{0.75} 1dk - \int_{0}^{0.1} 1dk \tag{5}$$

$$= -0.25 \tag{6}$$

Thus, option 4 is correct too.