Gate EE - 18

EE23BTECH11216 - P.kalyan

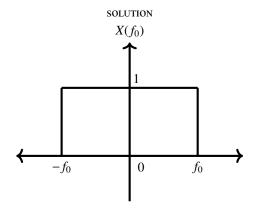
QUESTION

The Fourier transform $x(\omega)$ of the signal x(t) is given by

$$X(\omega) = \begin{cases} 1, & \text{for } |\omega| < \omega_0 \\ 0, & \text{for } |\omega| > \omega_0 \end{cases}$$

- (A) x(t) tends to be an impulse as $W_0 \to \infty$.
- (B) x(0) decreases as W_0 increases. (C) At $t = \frac{\pi}{2W_0}$, $x(t) = -\frac{1}{\pi}$. (D) At $t = \frac{\pi}{2W_0}$, $x(t) = \frac{1}{\pi}$.

(GATE EE 2023)



By taking inverse Fourier transform,

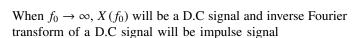
$$x(t) = \frac{\sin(t)}{\pi t} \tag{1}$$

$$x\left(\frac{\pi}{2(2\pi f_0)}\right) = \frac{2(2\pi f_0)}{\pi^2} \tag{2}$$

So, option (C) and (D) are wrong.

$$x(0) = \lim_{t \to 0} \frac{\sin(2\pi f_0) t}{\pi t} = \frac{2\pi f_0}{\pi}$$
 (3)

So, $x(0) \propto f_0 \Rightarrow \text{Option } (B) \text{ is wrong.}$



So, option (A) is correct

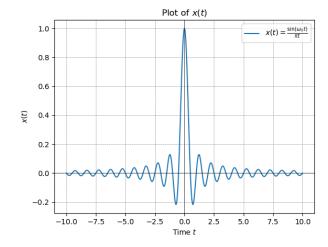


Fig. 0. plot of X(t)