

TWO MARKS Q & A

1. Define a system when is it called linear system?

Ans : Mathematically a 'system' is a functional relationship between the input $X(t_0)$ and output $Y(t)$

The input and output relationship can be written as

$$Y(t) = f [x(t) : -\infty < t < \infty] ; -\infty < t < \infty$$

A system is said to be linear if superposition applies that is if

$$Y_1(t) = f [x_1(t)]$$

$$Y_2(t) = f [x_2(t)]$$

Then for a linear system,

$$f [a_1x_1(t) + a_2x_2(t)] = a_1Y_1(t) + a_2Y_2(t)$$

2. State the properties of a linear filter.

Ans. Let $\{X_1(t)\}$ and $\{X_2(t)\}$ be any two processes and 'a' and 'b' be two constants. If L is a linear filter then

$$L [aX_1(t) + bX_2(t)] = aL [X_1(t)] + bL [X_2(t)]$$

3. Define average power in the response of a linear system.

Ans : If $Y(t)$ is the response process of the input process $X(t)$ determined by the system f

$$P_{YY} = \frac{1}{2\pi} \int_{-\infty}^{\infty} S_{XX}(\omega) |H(\omega)|^2 d\omega$$

4. State any two properties of cross power density spectrum.

Ans : (1) $S_{XY}(\omega) = S_{YX}(-\omega)$

(2) $\text{Re} [S_{XY}(\omega)]$ is an even function of ω and $\text{Im} [S_{XY}(\omega)]$ is an odd function of ω .

5. State the convolution form of the output of linear time invariant system.

Ans : If $X(t)$ is the input and $h(t)$ be the system weighting function and $Y(t)$ is the output, then

$$\begin{aligned} Y(t) &= X(t) \cdot h(t) \\ &= \int_{-\infty}^{\infty} h(u) X(t-u) du \end{aligned}$$

