GATE 2021 EC

EE:1205 Signals and systems
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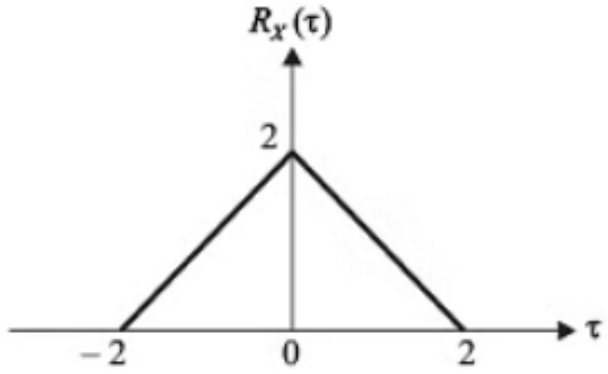
Question 47:
The autocorrelation function $R_x(\tau)$ of a wide-sense stationary random process $X(t)$ is shown in the figure. The average power of $X(t)$ is ?



Solution: Here $R_x(0) = 2$

Parameter	Description
$R_x(\tau)$	Autocorrelation function
$X(t)$	Stationary random process
P_x	Average power

TABLE 0
VALUES

Average power of X(t) is given as mean square value of X(t), i.e.

$$P_x = E\left[X^2(t)\right] \tag{1}$$
$$= E\left[X(t)X(t)\right] \tag{2}$$

$$E(x) = \int_{-\infty}^{\infty} x f(x)\,dx \tag{3}$$

$$R_x(t) = \int_{-\infty}^{\infty} E\left[X(\tau)X(\tau+t)\right]dt \tag{4}$$

Using this autocorrelation factor,

$$R_x(0) = E\left[X(t)X(t+0)\right] \tag{5}$$
$$= E\left[X(t)X(t)\right] \tag{6}$$
$$\tag{7}$$

From equations (1) and (6)

$$P_x = R_x(t) \tag{8}$$
$$\implies P_x = 2W \tag{9}$$