Assignment -V

1. Evaluate the power density spectrum of the response of a linear time invariant system when excited by a random process X(t)
2. Write properties of power density spectrum and cross density spectrum
3. Find the average power in the random process X(t)=A cos($\omega_0 t+\Theta$) where A and ω_0 are constants andΘ is uniformly distributed random variable in the interval $(0,\pi/2)$
4. Given $R_{xx}(\tau) = (A/2)\ \text{Cos}\ \omega_0\tau$, find $S_{xx}(\omega)$
5. Derive the expression for cross power density spectrum
6. State and prove Wiener Kinchine theorem (Prove that autocorrelation function and power spectral density form Fourier transform pair).
7. Show that the spectra of the time function $e^{-\alpha|t|}[1+\alpha|t|]$ is equal to $4\alpha^3/(\alpha^2+\omega^2)^2$
8. Find the auto correlation of Random Process when PSD is given $4/(4+w^2)$.
9. Determine, which of the following functions cannot be a valid

power density functions i) $e^{-(\omega-1)^2}$ ii) $\frac{\omega^4}{1+\omega^2+j\omega^6}$ iii) $\frac{\cos(3\omega)}{1+\omega^2}$

10. A random process has auto correlation function

$R_{xx}(\tau) = 1-|\tau|, \qquad |\tau \le 1|$

$= 0 \qquad$ *otherwise* Determine PSD.

11. Find the psd of a WSS Random process X(t) whose auto correlation function is

$$R_{xx}(\tau) = a\,e^{-b|\tau|}$$

12. The cross power spectral density is given by

$S_{XY}(w) = K + \frac{j\omega}{W} \qquad -W < \omega < W$

$= 0 \qquad\qquad elsewhere$

Where W>0 and K are constants. Find cross correlation function