Assignment Number 8

Stochastic Processes course,

Semester 1, 90-91

Science and Research Branch in Azad University

1. Is the Poisson's Impulses process ME?

2. Show that a random process $X(t)$ with mean zero and autocorrelation function $R_X(\tau) = e^{-|\tau|}$ is a complete DE process.

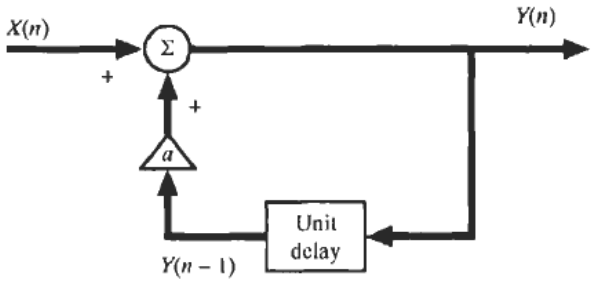
3. Find the power spectral density of below processes
   a) Poisson's Impulses
   b) Telegraphic signal with uniform point distribution λ
   c) Multiple frequency element with random amplitudes and random phases i. e. $X(t) = \sum_{i=1}^{n} A_i e^{j(w_i + B_i)}$

4. A WSS random process $X(t)$ with autocorrelation function $R_X(\tau) = e^{-a|\tau|}$ is applied to the input of an LTI system with impulse response $h(t) = e^{-bt}u(t)$ (a and b are a real positive constants). Find the autocorrelation function of the output $Y(t)$ of the system.

5. Two random process $X(t)$ and $Y(t)$ are given by $X(t) = A\cos(wt + \theta)$ and $Y(t) = A\sin(wt + \theta)$ wher A and w are constants and θ is a uniform R. V. over (0, 2π). Find the crosscorrelation function and cross power spectral density of $X(t)$ and $Y(t)$.

6. Let $X(t)$ and $Y(t)$ be both zero-mean and WSS random processes. Consider the random process $Z(t)$ defind by $Z(t) = X(t) + Y(t)$. determine the autocorrelation function and the power spectral density of $Z(t)$,
   a) If $X(t)$ and $Y(t)$ are jointly WSS.
   b) If $X(t)$ and $Y(t)$ are orthogonal.

7. The discrete time system shown below consiste of one unit delay element and one scalar multiplier a ($a < 1$). The input $X(n)$ is discrete-time white noise with average power σ^2. Find the spectral density and average power of the output $Y(n)$.



8. Suppose that the input to the filter shown below is a white noise with average power σ^2. Find the power spectral density of $Y(t)$.