**Assignment 2**

1. A wide-sense stationary random process $x(t)$ passes through the system as shown in Figure 1. Obtain the relationship between $S_x(f)$ and $S_y(f)$.
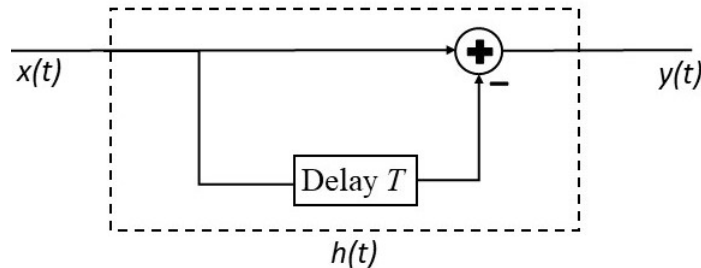
$$y(t) = x(t) - x(t - T)$$



Figure 1:

2. A wide-sense stationary white process $m(t)$ band-limited to $B$ Hz is sampled at the Nyquist rate. Each sample is transmitted by a basic pulse $p(t)$ multiplied by the sample value. This is a PAM signal. Show that PSD of the PAM signal is $2BR_m(0) \mid P(f) \mid^2$.

3. Given a random process $x(t) = kt$, where k is an RV uniformly distributed in the range (-1, 1).

   (a) Sketch the ensemble of this process.
   (b) Determine $\overline{x(t)}$.
   (c) Determine $R_X(t_1, t_2)$.
   (d) Is the process wide-sense stationary?
   (e) Is the process ergodic?
   (f) If the process is wide-sense stationary, what is its power $P_s$ [ that is, its mean square value $\overline{x^2(t)}$ ] ?

4. If $x(t)$ and $y(t)$ are both independent binary signals, each taking on values -1 and 1 only, with
$$P_x(1) = Q = 1 - P_x(-1)$$
$$P_y(1) = P = 1 - P_y(-1)$$

   determine $P_z(z_i)$ where z = x + y.