

### Tutorial Problem for coming week

1. The input  $X(t)$  is a W.S.S, and its power spectrum is  $S_{XX}(w)$ , and the output  $Y(t)=X(t)+X(t-T)$ . Find the power spectrum of  $Y(t)$
2. The input  $X(t)$  is a W.S.S, and its power spectrum is  $S_{XX}(w)$ , and the output  $Y(t)=aX(t)+Y(t-T)$ . Find the power spectrum of  $Y(t)$
3. The random process  $X(t)=A\cos(\Omega t+\Theta)$ , where  $A$  is a real constant,  $\Omega$  is an random variable with density  $f_{\Omega}(w)$ , and  $f_{\Omega}(w)=f_{\Omega}(-w)$ ,  $\Theta$  is an random variable independent of  $\Omega$  and uniform in the interval  $(0,2\pi)$ . Find the power spectrum of  $X(t)$ .
4. Amplitude modulation is defined as multiplying the message signal  $m(t)=M\cos(\Omega t)$  with the carrier as  $c(t)=\cos(wt)$  i.e. modulated signal  $x(t)=M\cos(\Omega)\cos(wt)$ , Here  $w \gg \Omega$ . Observed modulated signal  $y(t)=x(t)+w(t)$ , where  $w(t)$  is WGN evaluate the PSD of  $y(t)$
5. Let the speech signal is  $s[n] = a^n u[n]$ . and  $v[n]$  is a random signal whose autocorrelation is  $R_{vv}[\tau] = \delta[\tau]$ .
  - (a) Find  $P_{vv}(w)$ .
  - (b) Suppose that  $y[n] = s[n] + v[n]$  Find PDS of  $y[n]$ .
  - (c) You want to create a filter  $h[n]$  so that  $z[n] = h[n] * y[n]$ , in order to minimize  $E (z[n] - s[n])^2$ . Find  $H(w)$ .