EECS 861
Homework 8

1. Explain the difference between strict sense stationarity and wide sense stationarity.

2. X(t) is a wide sense stationary zero mean, Gaussian random processes with a power spectral density of $S_X(f)=\text{sinc}^2(f)$. [Hint: see Homework 7-problem 5]
   a. Find E[X(0.1)] and Var[X(0.1)], E[X(0.6)] and Var[X(0.6)]
   b. What is the distribution of X(0.1)?
   c. Find P(X(0.1)>1)
   d. What is the covariance matrix for X(0.1) and X(0.6)?
   e. What is the joint distribution of X(0.1) and X(0.6)?
   f. Find P(X(0.6)>1|X(0.1)=1)
   g. Find P(X(5)>1|X(0.1)=1)

3. Determine whether the following functions can be the power spectral density for a WSS real valued random process (YES or NO).
   a) $5rect(5f)$
   b) $100\Lambda(10f)$
   c) $\Lambda(10(f-1000))$
   d) $10e^{-\pi(f-10)^2}$
   e) $e^{-|f|}$
   f) $\delta(f)+\sin(200\pi f)$
   g) $\delta(f)+6\delta(f+10)+6\delta(f-10)$

4. The random process X(t) is WSS. For each of the autocorrelation functions below find the corresponding power spectral density, $S_X(f)$. If $R_{XX}(\tau)$ does not have periodic components then find the E[X] and Var[X]

   a) $R_{XX}(\tau)=64e^{-\pi(\frac{\tau}{0.5})^2}$
   b) $R_{XX}(\tau)=64e^{-|\frac{\tau}{0.5}|}$
   c) $R_{XX}(\tau)=64\Lambda(\frac{\tau}{0.5})$
   d) $R_{XX}(\tau)=64\cos(2000\pi\tau)$

5. A power spectral density for a WSS random process X(t) is

$$S_X(f) = (.016)\Lambda(\frac{f}{100kHz})$$

   a) Find the power in the DC term.
   b) Find $E[X^2(t)]$
   c) Find the % power the band [0, 20 kHz]

6. Chapter 3: Problem 3.22
7. Chapter 3: Problem 3.23 a