Homework #9
Due Su 12/05

Note:

OW  Oppenheim and Wilsky
SSS  Schaum’s Signals and Systems
SPR  Schaum’s Probability, Random Variables, and Random Processes

Be sure to show all your work for credit.

1. (SPR 6.52)
   Let \( X(t) = A \cos(\omega_0 t + \Theta) \), where \( A \) and \( \omega_0 \) are constants, \( \Theta \sim U[-\pi, \pi] \) (Problem 5.20).
   Find the power spectral density of \( X(t) \).

2. (SPR 6.53)
   A random process \( Y(t) \) is defined by
   \[
   Y(t) = AX(t) \cos(\omega_c t + \Theta)
   \]
   where \( A \) and \( \omega_c \) are constants, \( \Theta \) is a uniform r.v. over \((-\pi, \pi)\), and \( X(t) \) is a zero-mean WSS random process with the autocorrelation function \( R_X(\tau) \) and the power spectral density \( S_X(\omega) \). Furthermore, \( X(t) \) and \( \Theta \) are independent. Show that \( Y(t) \) is WSS, and find the power spectral density of \( Y(t) \).

3. (SPR 6.61)
   The input \( X(t) \) to the RC filter below is a white noise specified by \( S_W(\omega) = \sigma^2 \). Find the mean-square value of \( Y(t) \).

   ![Fig. 6-7 RC filter.](image)

4. (SPR 6.65)
   Suppose that the input to the discrete-time filter shown below is a discrete-time white noise with average power \( \sigma^2 \). Find the power spectral density of \( Y[n] \).

   ![Fig. 6-9](image)