KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

EE 570 **ELECTRICAL ENGINEERING DEPARTMENT** Dec. 14, 2011

HOMEWORK #6

Due Date: Dec. 19, 2011

Q1 Solve problem 9.29 from the textbook.

Q2 Solve problem 9.31 from the textbook.

Q3 Solve problem 9.35 from the textbook.

Q4 The cross correlation of two jointly WSS real processes $X(t)$ and $Y(t)$ is given by

$$R_{xy}(\tau) = B\tau e^{-W\tau}u(\tau)$$

where $u(\tau)$ is the step function and $B, W > 0$. Find $S_{yx}(\omega)$.

Q5 Let $X(t)$ and $Y(t)$ be two real jointly WSS stochastic processes. Determine which of the following functions are valid. For those that ate not, state at least one reason.

1. $R_{xx}(\tau) = e^{-|\tau|}$
2. $R_{xx}(\tau) = \sin(3\tau)$
3. $S_{xy}(\omega) = 5 + j\omega^2$
4. $S_{xx}(\omega) = \frac{8\exp(-3|\tau|)}{1+\omega^2}$
5. $S_{xx}(\omega) = 18\delta(\omega)$

Q6 Let $X(t)$ be a stationary signal with autocorrelation

$$R(\tau) = 10exp(-|\tau|)$$

and let $N(t)$ zero mean white noise signal independent of $X(t)$ with variance $\sigma_n^2 = 10^{-3}$. The signal $Y(t) = X(t) + N(t)$ is applied to the filter with frequency response

$$H(\omega) = \frac{2}{(1+j\omega)^3}$$

1. What is the signal to noise ratio at the input?
2. Find the spectrum of the input signal $S_{yy}(\omega)$
3. Find the spectrum of the output signal and the signal to noise ration at the output