ECE 581 Homework 10
Due Thursday 5 AM November 5, 2015 (18 Total Hmwk points) Show work.
Electronic Submission – Please submit via "Assignment" under Sakai

Problem 9-1 (5 points Total) A wide sense stationary random process, whose autocorrelation function is $R_X(\tau) = 2\delta(\tau)$, is the input to a linear time invariant linear system whose magnitude frequency response is $|H(j\omega)| = 3$ for $-100 \leq \omega \leq 100$ and zero otherwise. ($\omega = 2\pi f$)

(a) (3 points) What is the power spectral density function, $S_Y(j\omega)$ of the output random process?

(b) (2 points) Sketch and completely label $S_Y(j\omega)$ versus ω. What is the name of this random process?

Problem 9-2 (5 points Total) Consider an LTI system having an impulse response function $h(t) = 3e^{-2t}U(t)$ where $U(t)$ is the unit step function. Let the input to this system be a white random process, $X(t)$, with power spectral density $S_X(j\omega) = 16.$.

(a) (1 point) Find the mean of the system output.

(b) (2 points) Find the variance of the system output.

(c) (2 points) If the input is now a white Gaussian random process with power spectral density $S_X(j\omega) = 16.$, write down the probability density function for the output $Y(t)$.

Problem 9-3 (8 points Total). A LTI system is described by the impulse response $h(t) = e^{-at}U(t)$. The input is a white random process with autocorrelation function $R_X(\tau) = \frac{N_o}{2}\delta(\tau)$.

(a) (2 points) Determine the autocorrelation function of the output random process $R_Y(\tau)$.

(b) (2 points) What is the power spectral density function of the input?

(c) (2 points) What is the power spectral density function of the output?

(d) (2 points) Find the total average power of the output?

Reference: Problems 9-2, and 9-3 are from Therrien and Tummala (2012) chapter 10, problems 10.10, 10.11 (on closed reserve in Bostock)