

**KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS**  
**ELECTRICAL ENGINEERING DEPARTMENT**

**FALL 2011 (111)**

**EE 570 Stochastic Processes**

QUIZ #3

**Name:**

**ID:**

**Q1.** Let  $X(t)$  be a Gaussian process with power spectral density

$$S_x(\omega) = \begin{cases} 4 & \text{for } 90 \leq \omega \leq 110 \\ 0 & \text{otherwise} \end{cases}$$

Find the probability that  $P\{|X(10)| \leq 5\}$ .

**Q2.** Let  $X(t)$  be a WSS signal which is observed in the presence of an independent additive interference  $I(t)$  given by

$$I(t) = \cos(2\pi f_0 t + \theta)$$

Here  $\theta$  is uniformly distributed over  $(0, 2\pi)$  and  $f_0 = 60\text{Hz}$ . In other words, we observe the signal  $Z(t) = X(t) + I(t)$  instead of observing  $X(t)$ . To remove this interference, we process  $Z(t)$  by forming the following signal

$$Y(t) = Z(t) - Z(t - T) \tag{1}$$

1. Is  $I(t)$  WSS? Justify your answer.

2. How would you choose  $T$  to get rid of the effect of  $I(t)$ ?
3. Describe the relation between  $Y(t)$  and  $Z(t)$  in terms of convolution with an impulse response  $h(t)$ .
4. Find the power spectral density of  $Y(t)$
5. Is the strategy in (1) a good one to filter out the interference and retain the original signal  $X(t)$ ?  
Explain your answer.