NOTE:

Try doing these problems individually. Up to 2 students can submit a single write-up. **However, you are not allowed to partner with ANYONE with whom you have partnered before in this class.** If there are confusions or questions, see the Instructor. A thorough understanding of the problems is important for successfully attempting the Quizzes and Exams. Partial credit may be given for incorrect answers if you show that you attempted to solve the problem.

Problems:

Chapter 3, Problems 3.1.1, 3.1.4, 3.2.2, 3.2.3, 3.3.4, 3.3.5, 3.5.2, 3.5.7, 3.6.5, 3.6.6, 3.6.9

Additional problems:

1. Find the Autocorrelation function of the deterministic signal $A \sin(2\pi f_c t + \phi)$. What is the power spectral density for this signal?
2. Consider two real signals $X$ and $Y$. First assume that these signals are deterministic. Prove the following equation (with usual notations!): 
   \[ R_{YX}(\tau) = R_X(\tau) \ast h(\tau) \]
   Next prove the above equation if $X$ and $Y$ are WSS random processes.
3. Consider two WSS random processes $X(t)$ and $Y(t)$. Show that their sum $Z(t) = X(t) + Y(t)$ is also WSS when $X(t)$ and $Y(t)$ are independent.
4. In above problem, let $Y(t) = X(t-t_0)$ where $t_0$ is a constant. Thus $Y(t)$ is not independent of $X(t)$ anymore. Is the sum $Z(t) = X(t) + Y(t)$ WSS? Why? Why not?
5. Let $X(t)$, a WSS stochastic process, is input to an LTI filter with impulse response $h(t)$. Let $Y(t)$ is the output of the LTI filter such that $Y(t) = X(t) \ast h(t)$. Define $Z(t) = X(t) - Y(t)$. Find the PSD of $Z(t)$. What is $E[Z^2(t)]$?