1) What is white noise?

2) Bandpass stochastic processes can be represented by a lowpass equivalent or by an in-phase and quadrature components. Summarize the relation between their autocorrelations and power spectral densities.

3) Prove the following properties of Hilbert transform
   a) If \( x(t) = \sin \omega_0 t \), then \( \hat{x}(t) = -\cos \omega_0 t \).
   b) \( \hat{x}(t) = -x(t) \).

4) The random process, \( v(t) = X \cos(2\pi f_c t) - Y \sin(2\pi f_c t) \), where \( X \) and \( Y \) are random variables. Show that \( v(t) \) is wide-sense stationary if and only if \( E(X) = E(Y) = 0 \), \( E(X^2) = E(Y^2) \), and \( E(XY) = 0 \).

5) A low-pass Gaussian process \( X(t) \) has a power spectral density of

\[
S(f) = \begin{cases} 
N_0 / 2 & |f| < B \\
0 & \text{otherwise} 
\end{cases}
\]

Determine the autocorrelation and the power spectral density of \( Y(t) = X^*(t) \)

Hint: multiplication in time results in convolution in frequency

From \textit{Digital communications} (Fifth Edition) by John Proakis & Masoud Salehi,

6) Problem 2.11
7) Problem 2.57