

KFUPM-EE DEPT.
EE571- Digital Communications I
Dr. Ali Muqaibel

Assignment # 2

ver. 2

Due:

- 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) $\hat{\hat{x}}(t) = -x(t)$.
- 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 $Y(t) = X^2(t)$

Hint: multiplication in time results in convolution in frequency

From *Digital communications* (Fifth Edition) by John Proakis & Masoud Salehi,

- 6) Problem 2.11
- 7) Problem 2.57