CARLETON UNIVERSITY
Department of Systems and Computer Engineering

SYSC 4600 – Digital Communications – Quiz 2 Solutions – Fall 2015

Professor H. Yanikomeroglu   **05 October 2015**   **100 pts, 20 mins**
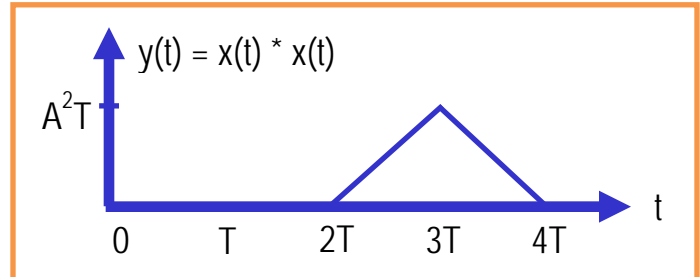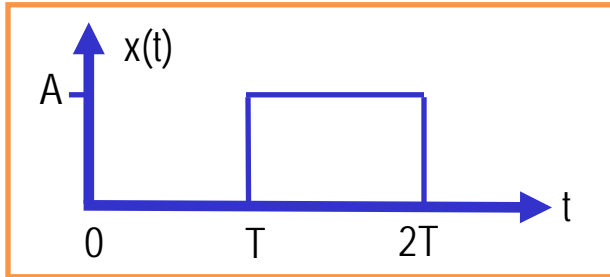
Name: **Student #:**   **E-mail:**

Q1 [60 pts] – Convolution & FT: **a)** y(t) = x(t)*x(t). Sketch y(t).
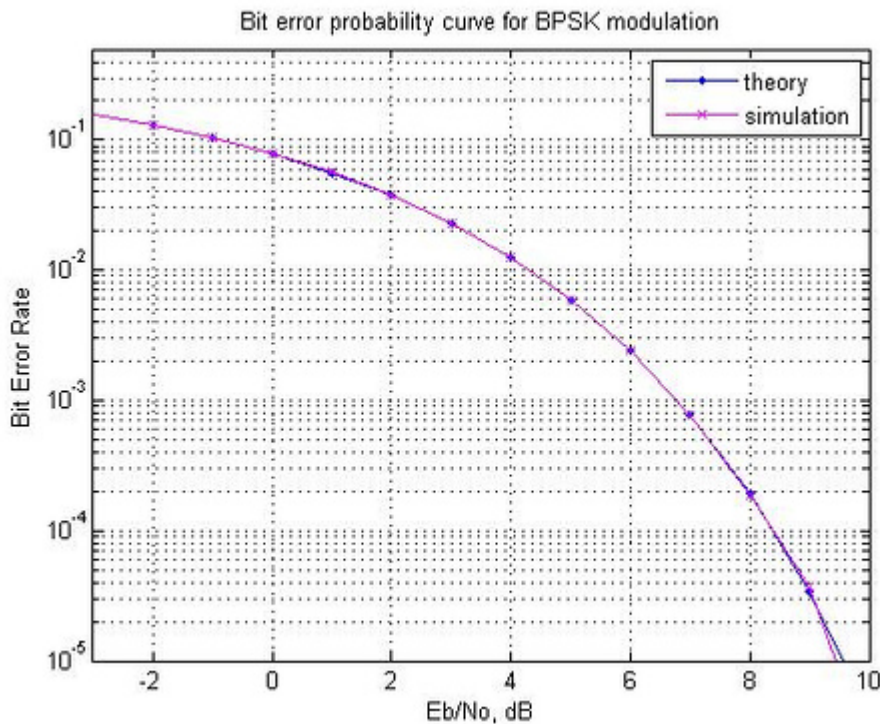
b) |X(f)| is the magnitude of x(t)'s FT. Write the expression for |X(f)| and sketch it.

$|X(f)| = AT \, |\text{sinc}(fT)|$

Q2 [40 pts] – Power Calculations: In the 4G LTE wireless networks, the bandwidth is assigned to applications in terms of "resource blocks (RBs)". The bandwidth of one RB is 200 KHz.

Bit error probability curve for BPSK modulation

Consider an LTE application that uses BPSK modulation; the corresponding BER versus SNR (E_b/N_0) relation is given in the above figure. This application requires a BER of 10^{-4} and it is assigned one RB.

The AWGN power spectral density is N_0 = -174 dBm/Hz, and the receiver noise figure is 8 dB. Find the necessary received signal power, P_s, in Watts.

$P_N = N_0 + B + F$ = -174 dBm/Hz + 53 dBHz + 8 = -113 dBm

BER = 10^{-4} → SNR = 8.5 dB

SNR = $P_S - P_N$
P_S = SNR + P_N = 8.5 dB + -113dBm = -104.5 dBm = -134.5 dBW = 3.55 x 10^{-14} W