ECE301

Test 1

Please provide steps to explain your answer

name:

student ID:

Question 1 (25pts)

Sketch and label carefully each of the following signals:
a.) $x_1(t) = u(t) - u(t-5)$
b.) $x_2(t) = (x_1(2t+1) + x_1(2t-1))u(t)$
b.) $x_3[n] = u[n] - u[n-3]$
c.) $x_4[n] = x_3[(n+1)^2]$

Question 2 (20pts)

For the system given below, x[.] denotes the input, y[.] denotes the output, and u[.] denotes the unit step function. Determine whether the system is linear, time-invariant, memoryless, causal, and boundedinput/bounded output stable. Carefully justify you answers (a simple "yes" or "no" will not suffice); proving or giving a counterexample provides the best justification.

$$y[n] = x[2n] + \sum_{k=-\infty}^{2n^2} 3^{-k}$$

Question 3 (20pts)

Evaluate the convolution $x(t) * h(t)$, where
$x(t) = u(t-1) + u(-3) - 2u(t-4)$ and $h(t) = e^{-t}[u(t) - (u(t-1)]$

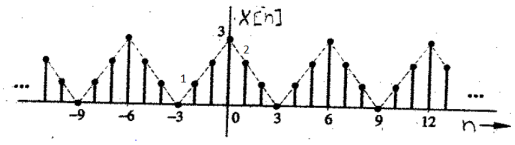

Figure 1: Shape

Question 4 (20pts)

The periodic signal x[n] in fig.1 is the input to an LTI system with frequency response

$$H(e^{jw}) = \frac{e^{jw}}{e^{jw} - .5}$$

(a). What is the period
(b). Find the Fourier series representation of x[n].
(c). Find the Fourier series of the output of the system y[n].

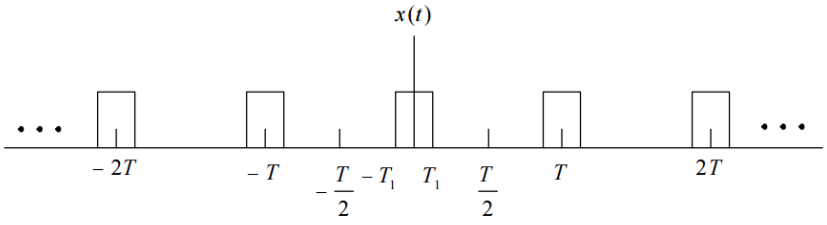

Figure 2: Shape

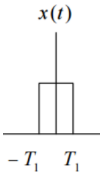

Figure 3: Shape

Question 5 (15pts)

Consider the square wave in Fig.2
(a). Find Fourier series coefficients
(b). Find Fourier transform

Consider the square wave in Fig.3
(a). Find the Fourier transform