ECE 218 Signals and Systems Laboratory 3

I. Preparation

A. Please study the followings,

1) CT (Continuous time) unit step function
2) CT unit impulse function
3) CT Ramp function
4) CT Sinc function.
Look at the following matlab codes and understand how they are written.

Unit Step:
$function\ y = u(t)$
$y = (t \geq 0);$

Ramp:
$function\ r = ramp(t)$
$r = t. * (t \geq 0);$

Rectangle:
$function\ y = rect(t)$
$y = u(t + 0.5) - u(t - 0.5);$

Sinc:
$function\ y = sinc(t)$
$zero = (t == 0); num = (\ zero). * sin(pi * t) + zero;$
$den = (\ zero). * (pi * t) + zero;$

5) Differentiation and integration matlab commands are 'diff' and 'int' commands in matlab.
Practice the following commands in matlab;

$>> diff('sin(2 * pi * t)')$
$>> int('sin(2 * pi * t)')$

6) using matlab help utility read the usage of the following functions SQUARE, SIN, COS, CHIRP, PULSTRAN, RECTPULS, and TRIPULS.

Try the following short matlab program:

$t = -20 : 0.001 : 20;$
$x = rectpuls(t/10);$
$plot(t, x);$
$axis([-20\ 20\ \ -1.5\ 1.5]);$
$xlabel('t');$
$ylabel('x(t));$

B. Study the following discrete time functions

1) Discrete time unit sequence
2) Discrete time impulse sequence
3) Discrete time ramp sequence
4) Discrete time Sinc sequence
Look at the matlab codes of the following discrete time signals, try to understand how they are written. Study matlab functions find, round using matlab help facility.

Discrete time impulse:

$function\ y = impDT(n)$
$y = (n == 0);$
$ss = find(round(n)\ \ = n);$
$\%Find\ noninteger\ values\ of\ n$
$y(ss) = NaN;$
$\%Set\ the\ corresponding\ outputs\ to\ NaN$

Discrete time unit sequence :

$function\ y = impDT(n)$
$y = (n \geq 0);$
$ss = find(round(n)\ \ = n);$
$\%Find\ noninteger\ values\ of\ n$
$y(ss) = NaN;$
$\%Set\ the\ corresponding\ outputs\ to\ NaN$

5) Look at the matlab code for the following function $g[n] = 10e^{-n/4} sin(\frac{3\pi n}{16}) u[n]$

$function\ y = g(n)$
$ss = find(round(n)\ \ = n); \%Find\ non - integers$
$n(ss) = NaN; \%Set\ them\ all\ zero$
$y = 10 * exp(-n/4). * sin(3 * \pi * n/16);$
$y = y. * uDT(n)\%Remove\ negative\ part;$

Now look how g[n], g[n/3] and g[2n] are drawn

```
n=-5:48;
stem(n,g(n));
title('g[n] graph');
xlabel('[n]');
ylabel('g[n]');

figure;
stem(n,g(n/3));
title('g[n/3] graph');
xlabel('[n]');
ylabel('g[n/3]');

figure;
```

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```
stem(n,g(2*n));
title('g[2n] graph');
xlabel('[n]');
ylabel('g[2n]');
```

II. Experimental Work

Practice all the short programs in preparation part. After practice do the followings.

1) Let $x_1[n] = 5cos(2\pi n/8)$ and $x_2[n] = -8e^{-(n/6)^2}$.
Plot the following signals for $-20 \leq n \leq 20$
a) $x_1[n]$
b) $x_2[n]$
c) $x_1[n] \times x_2[n]$
d) $x_1[2n] \times x_2[3n]$
e) $4x_1[n] + 2x_2[n]$
f) $2x_1[n/2] + 4x_2[n/3]$

2) A function g[n] is defined by

$$g[n] = \begin{cases} -2 & \text{if } n \leq -4 \\ n & \text{if } -4 \leq n \leq 1 \\ 4/n & \text{if } 1 \leq n \end{cases}$$

a) Plot g[n]
b) Plot even part of g[n]
c) Plot odd part og g[n]
d) Plot the followings g[2n], g[n/2]