

# ECE 218 Signals and Systems Laboratory 4

## I. PREPARATION

### A. Do the followings

1) Draw the following signals by hand.

- $s1(t) = u(t - 1)$
- $s2(t) = u(2t + 4)$
- $s3(t) = u(3t + 1) + u(t - 1) + u(t - 3) + 3u(t - 5)$
- $s4(t) = r(t + 1)$
- $s5(t) = r(t + 1) - 2r(t) + r(t - 1)$
- $s6(t) = r(t - 1) - 2r(t - 4)$
- $s7(t) = \delta(2t - 1) + \delta(3t - 2) + \delta(4t + 3) + \delta(2t - 4)$
- $s8(t) = u(t - 2) + \delta(t - 1) + u(t + 4)$
- $s9(t) = u(t + 1) + \delta(t - 2)$

2) Draw the following discrete time signals by hand.

- $s1[n] = \delta[n - 2]$
- $s1[n] = \delta[n - 2] + \delta[2n - 6] + \delta[n - 2] + \delta[n - 2]$
- $s3[n] = u[n - 2] - u[n - 5]$
- $s4[n] = u[n - 2] + \delta[n - 5]$
- $s5[n] = \delta[n - 2]n^2 + u[n - 2] + 1$
- $s6[n] = r[n] - 2r[n - 2] + r[n - 4]$

3) Write matlab programs that draw the signals  $s5(t)$ ,  $s6(t)$ ,  $s8(t)$  in part(1). Obtain all the figures and copy them to a word file.

4) Write matlab programs that draw the signals  $s3[n]$ ,  $s5[n]$  and  $s6[n]$  in preparation part (2). Obtain all the figures and copy them to a word file.

Note: Matlab Functions are given below

Unit Step:

*function*  $y = u(t)$   
 $y = (t \geq 0);$

Ramp:

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

Impulse:

*function*  $y = imp(t)$   
 $y = (t == 0);$

For discrete time case

Discrete time impulse:

*function*  $y = impDT(n)$   
 $y = (n == 0);$

```
ss = find(round(n) ~= n);
if(~ isempty(ss))
y(ss) = NaN;
end
```

Discrete time unit step sequence :

```
function y = stepDT(n)
y = (n >= 0);
ss = find(round(n) ~= n);
%Find noninteger values of n
if(~ isempty(ss))
y(ss) = NaN;
end
```

Discrete time ramp sequence :

```
function y = rampDT(n)
pos = (n > 0);
y = n .* pos;
ss = find(round(n) ~= n);
if(~ isempty(ss))
y(ss) = NaN;
end
```

## II. EXPERIMENTAL WORK

1) Draw the following discrete time signals using matlab

- $s1[n] = \delta[n - 3]$
- $s1[n] = \delta[2n - 2] + \delta[2n - 6] + \delta[2n - 10] + \delta[n - 8]$
- $s3[n] = u[n + 2] - u[n - 5]$
- $s4[n] = u[n + 2] + \delta[n - 5]$
- $s5[n] = \delta[n - 3]n^2 + u[n - 4]$
- $s6[n] = r[n] - 2r[n - 2] + r[n - 4]$
- $s7[n] = r[n + 2] - 2r[n - 2] + r[n - 6]$

2) Let  $x_1[n] = 5\cos(2\pi n/8)$  and  $x_2[n] = -8e^{-(n/6)^2}$ . Plot the following signals for  $-20 \leq n \leq 20$

- $x_1[n]$
- $x_2[n]$
- $x_1[2n]$
- $x_2[n/3]$
- $2x_1[n/2] + 4x_2[n/3]$

3) 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 of  $g[n]$
- d) Plot the followings  $g[2n]$ ,  $g[n/2]$