Experiment No 02

BECS 32461

Paper C

SIGNAL GENERATION AND OPERATIONS IN MATLAB

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PROCEDURE

01.

```
subplot(3,2,1);
t_impulse = -5:0.01:5;
impulse_signal = (t_impulse == 0);
plot(t_impulse,impulse_signal,'-b','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('CT Unit Impulse Signal')
grid on

subplot(3,2,2);
t_step = -5:0.01:5;
step_sequence = (t_step >= 0);
plot(t_step,step_sequence,'-b','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('CT Unit Step Signal')
grid on

subplot(3,2,3);
t_ramp = 0:0.01:10;
ramp_sequence = max (t_ramp,0);
plot(t_ramp,ramp_sequence,'-b','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('CT Ramp Signal')
grid on

subplot(3,2,4);
t_exp = 0:30;
a=1.5;
exp_sequence = a.^t_exp;
plot(t_exp,exp_sequence,'-b','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('CT Exponential Signal')
grid on

subplot(3,2,5);
t = -2*pi:0.1:2*pi;
sine_wave = sin(t);
plot(t,sine_wave,'-b','LineWidth',1.2)
xlabel('-2/pi<x<2/pi')
ylabel('sin(x)')
title('CT Sine wave')
grid on

subplot(3,2,6);
cosine_wave = cos(t);
plot(t,cosine_wave,'-b','LineWidth',1.2)
xlabel('-2/pi<x<2/pi')
ylabel('cos(x)')
```
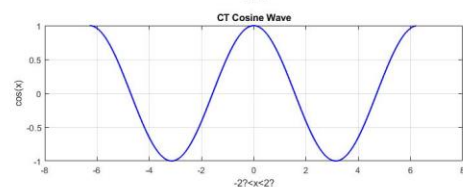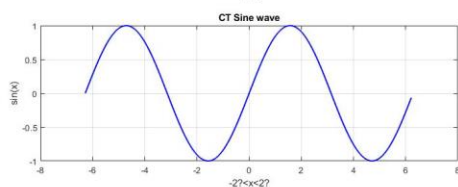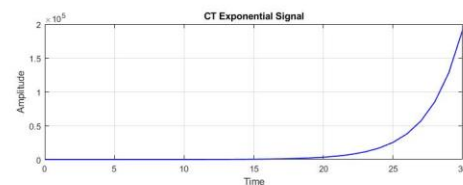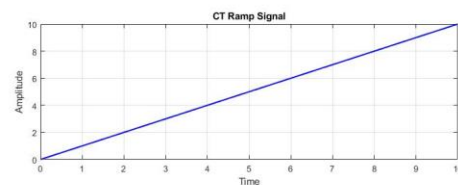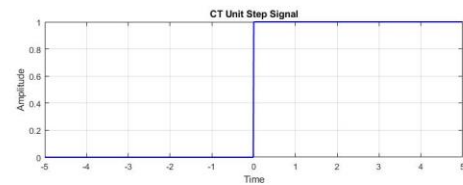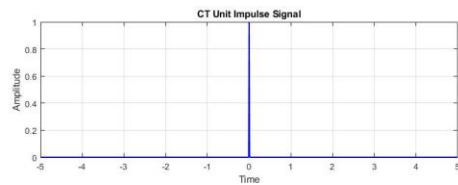
```matlab
title('CT Cosine Wave')
grid on
```


02.

```matlab
subplot(3,2,1);
t_impulse = -5:1:5;
impulse_signal = (t_impulse == 0);
stem(t_impulse,impulse_signal,'-b','filled','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('DT Unit Impulse Signal')
grid on

subplot(3,2,2);
t_step = -5:1:5;
step_sequence = (t_step >= 0);
stem(t_step,step_sequence,'-b','filled','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('DT Unit Step Signal')
grid on

subplot(3,2,3);
t_ramp = 0:1:10;
ramp_sequence = max (t_ramp,0);
stem(t_ramp,ramp_sequence,'-b','filled','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('DT Ramp Signal')
grid on

subplot(3,2,4);
t_exp = 0:1:30;
a=1.5;
```

```
exp_sequence = a.^t_exp;
stem(t_exp,exp_sequence,'-b','filled','LineWidth',1.2)
xlabel('Time')
ylabel('Amplitude')
title('DT Exponential Signal')
grid on

subplot(3,2,5);
t = -2*pi:0.2:2*pi;
sine_wave = sin(t);
stem(t,sine_wave,'-b','filled','LineWidth',1.2)
xlabel('-2?<x<2?')
ylabel('sin(x)')
title('DT Sine wave')
grid on

subplot(3,2,6);
cosine_wave = cos(t);
stem(t,cosine_wave,'-b','filled','LineWidth',1.2)
xlabel('-2?<x<2?')
ylabel('cos(x)')
title('DT Cosine Wave')
grid on
```
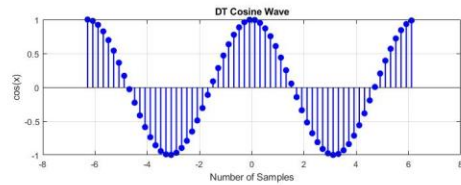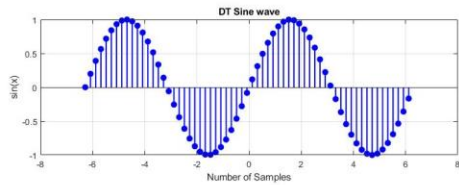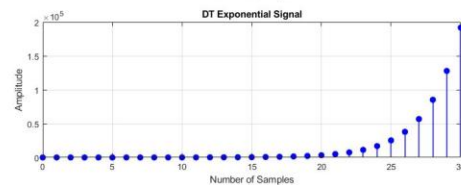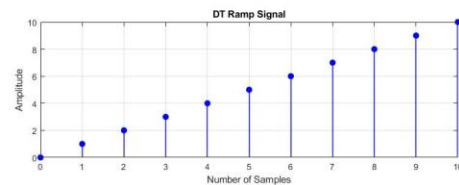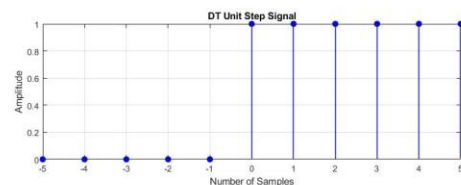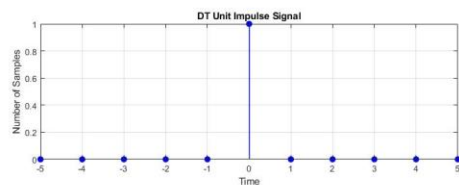
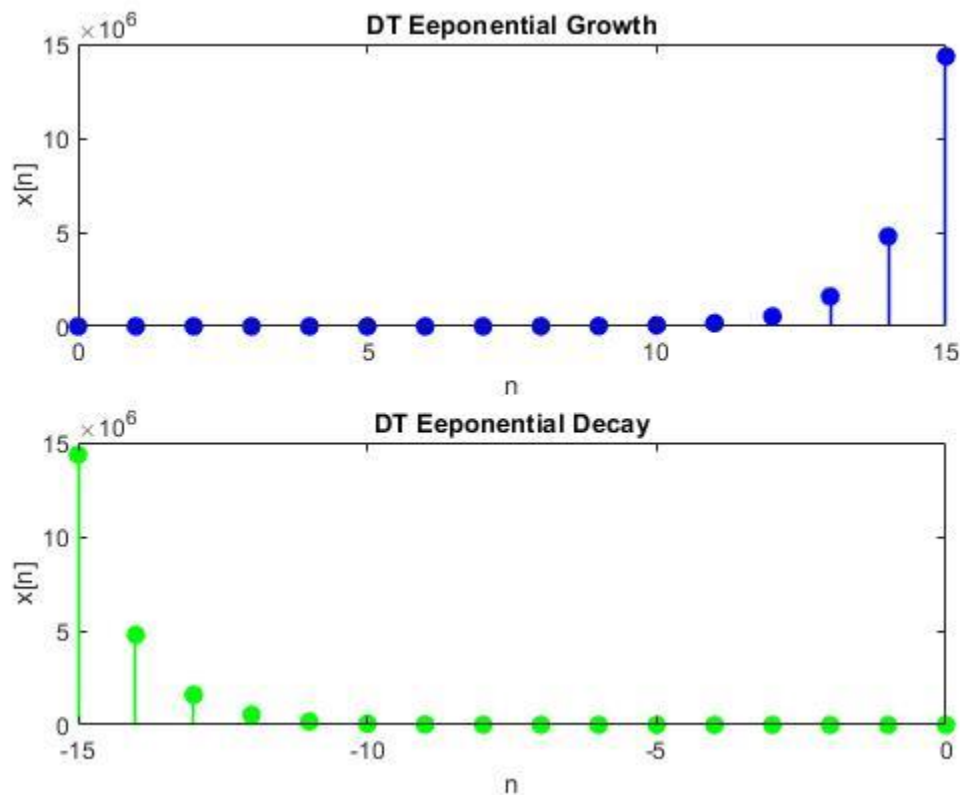**EXERCISE**

01.

```
n_step=0:15;
step_sequence=(n_step>=0);
a=3;
x=a.^n_step.*step_sequence;

subplot(2,1,1)
stem(n_step,x,'-b','filled','LineWidth',1.2)
xlabel('n')
ylabel('x[n]')
title('DT Eeponential Growth')


subplot(2,1,2)
a=2;
stem(-n_step,x,'-g','filled','LineWidth',1.2)
xlabel('n')
ylabel('x[n]')
title('DT Eeponential Decay')
```
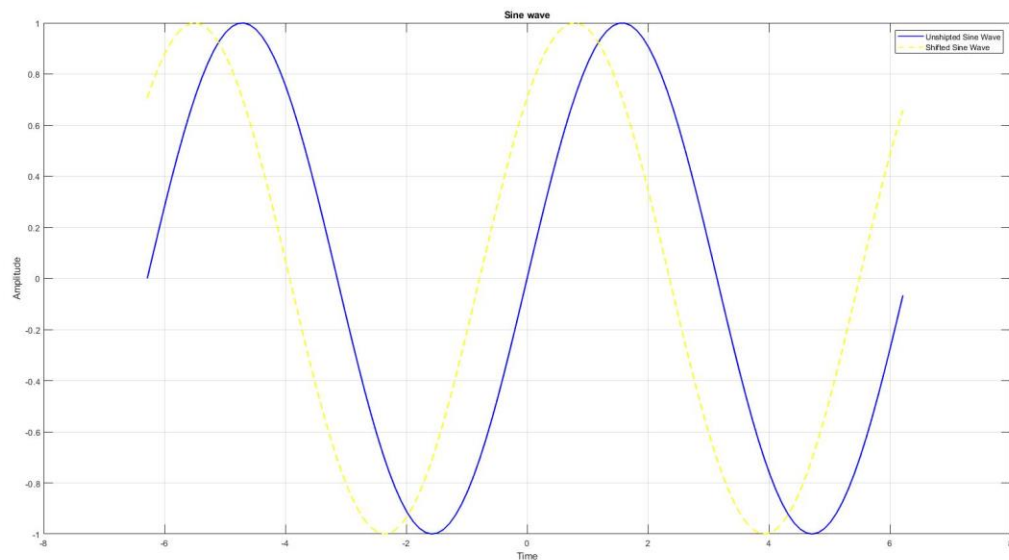
02.

```matlab
t = -2*pi:0.1:2*pi;
theta = pi/4;
unshipted_sine_wave = sin(t);
plot(t,unshipted_sine_wave,'-b','LineWidth',1.5)
xlabel('Time')
ylabel('Amplitude')
title('Sine wave')
grid on
hold on

shipted_sine_wave = sin(t + theta);
plot(t,shipted_sine_wave,'--y','LineWidth',1.5)
xlabel('Time')
ylabel('Amplitude')

legend('Unshipted Sine Wave','Shifted Sine Wave')
```

03.

```
t = -5:0.01:10;
step_sequence = (t >= 0);
del_step_sequence = (t >= 0);
ramp_sequence = max (t,0);
z = ramp_sequence - 2*del_step_sequence;

subplot(3,1,1);
plot(t,step_sequence,'-m','LineWidth',1.5)
xlabel('t')
ylabel('u(t)')
grid on

subplot(3,1,2);
plot(t,ramp_sequence,'-b','LineWidth',1.5)
xlabel('t')
ylabel('r(t)')
grid on

subplot(3,1,3);
plot(t,z,':g','LineWidth',1.5)
xlabel('t')
ylabel('Z(t)')
grid on
```
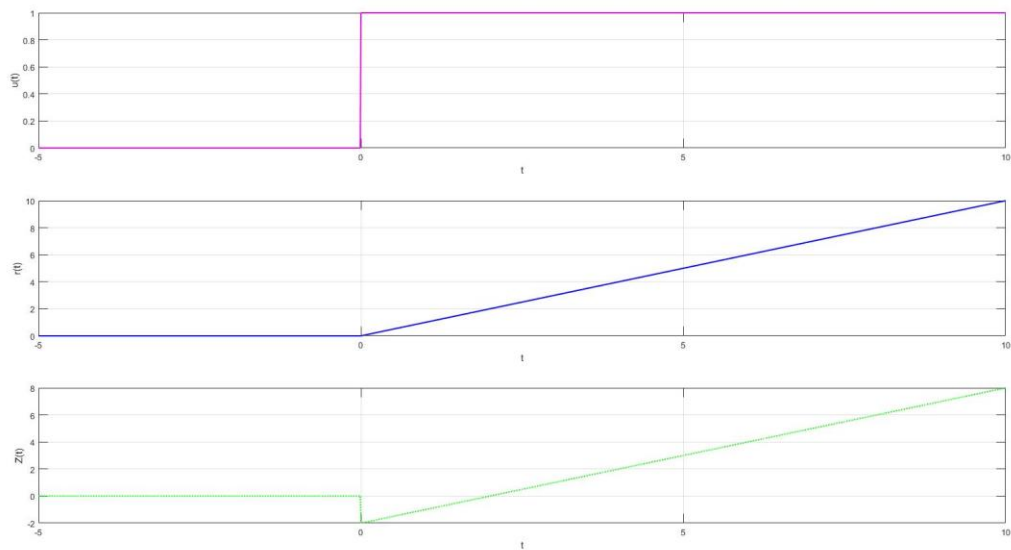
04.

```matlab
A = 1;
M = 0.5;
fc = 50;
fm = 5;
t = 0: 0.001: 0.5;

carrier = A*cos(2*pi*fc*t);
modulating = M*sin(2*pi*fm*t);
Xam = A*cos(2*pi*fc*t) .*(2 + M*sin(2*pi*fm*t));

subplot(3,1,1);
plot(t, carrier, 'k', 'LineWidth', 1.5);
xlabel('t');
ylabel('Amplitude)');
title('The Carrier Signal');
grid on;

subplot(3,1,2);
plot(t, modulating, 'k', 'LineWidth', 1.5);
xlabel('t');
ylabel('Amplitude)');
title('The Modulating Signal');
grid on;

subplot(3,1,3);
plot(t, Xam, 'k', 'LineWidth', 1.5);
xlabel('t');
ylabel('Amplitude)');
title('The AM Signal');
grid on;
```

05.
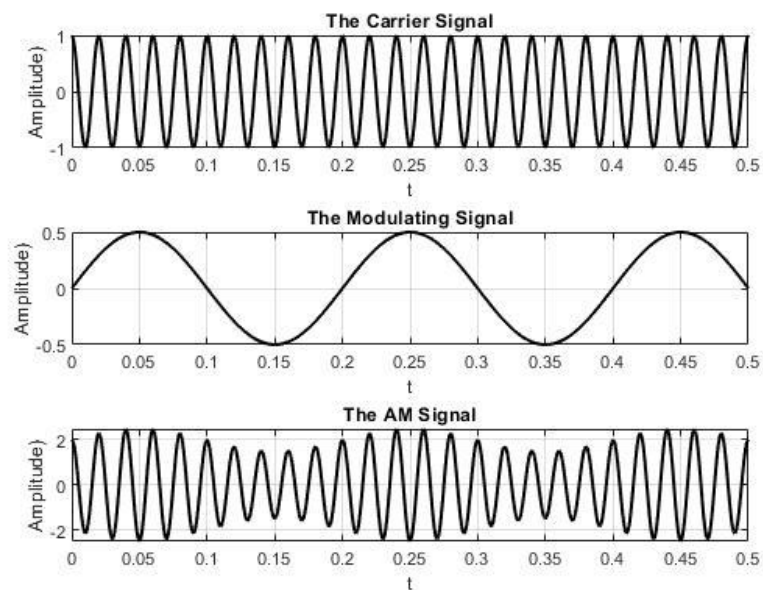
```matlab
t = 0:0.001:6;
v = 5*sin(2*pi*1*t);
n = v + 1.5*sin(2*pi*60*t) + 0.8*sin(2*pi*70*t) + 0.6*sin(2*pi*120*t) +
0.2*randn(size(t));

ts = 0:0.1:6;
v_sampled = 5*sin(2*pi*1*ts);
n_sampled = v_sampled + 1.5*sin(2*pi*60*ts) + 0.8*sin(2*pi*70*ts) +
0.6*sin(2*pi*120*ts) + 0.2*randn(size(ts));


subplot(3,1,1);
plot(t,v,'r','LineWidth',1.2);
title('Original Signal v(t)');
xlabel('t');
ylabel('v(t)');
grid on;

subplot(3,1,2);
plot(t,n,'r','LineWidth',1.2);
title('Noisy Signal n(t)');
xlabel('t');
ylabel('n(t)');
grid on;

subplot(3,1,3);
stem(ts,n_sampled,'r','filled');
title('Discrete-Time Noisy Signal n(t)');
xlabel('t');
ylabel('n(t)');
grid on;
```

Original Signal v(t)

Noisy Signal n(t)

Discrete-Time Noisy Signal n(t)
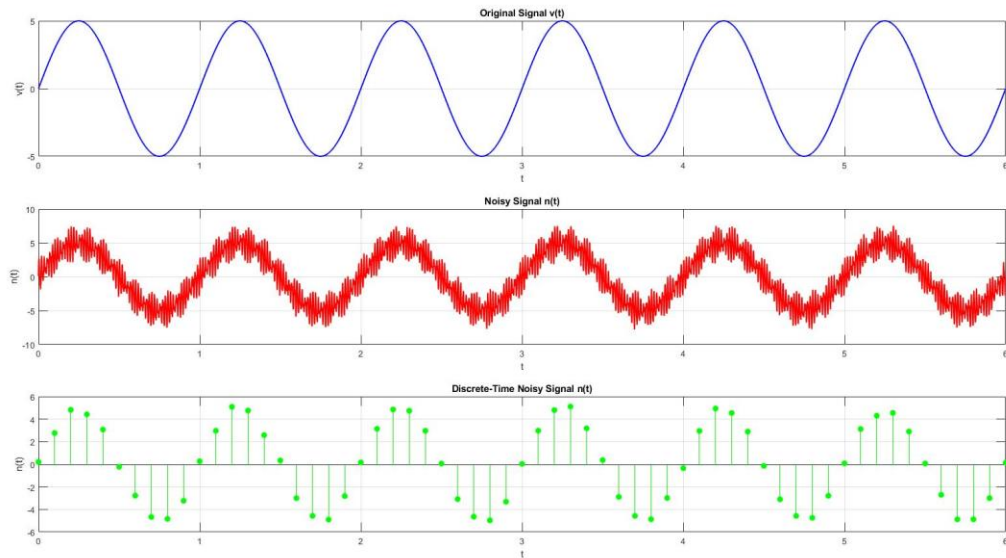
06.

```
t = 0:0.01:60;
x = 2*sin(0.1*pi*t);

y = x;
y(x > 1) = 1;
y(x < -1) = -1;

figure;

subplot(3,1,1);
plot(t,x,'b','LineWidth',1.2);
title('Original Signal x(t)');
xlabel('t');
ylabel('x(t)');
grid on;

subplot(3,1,2);
plot(t,y,'--g','LineWidth',1.2);
title('Clipped Signal y(t)');
xlabel('t'); ylabel('y(t)');
grid on;

subplot(3,1,3);
plot(t,x,'b','LineWidth',1.2); hold on;
plot(t,y,'g--','LineWidth',1.2);
title('Comparison of x(t) and y(t)');
xlabel('t');
ylabel('Amplitude');
legend('x(t)','y(t)');
grid on;
```

Original Signal x(t)

Clipped Signal y(t)

Comparison of x(t) and y(t)