Lab Report # 05

CSE301 - L Signals & Systems Lab

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Class Section: "A"

Submitted to:

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301L: Signals & Systems Lab

LAB ASSESSMENT RUBRICS

Marking Criteria	**Exceeds expectation (5-4)**	**Meets expectation (3-2)**	**Does not meet expectation (1)**	**Score**
1. Realization of Experiment	Program compiles (noerrors and no warnings). Program always works correctly and meets the specification(s). Completed between 71-100% of the requirements.	Program compiles (no errors and some warnings). Some details of the program specification are violated, program functions incorrectly for some inputs. Completed between 41-70% of the requirements.	Program fails to or compile with lots of warnings. Program only functions correctly in very limited cases or not at all. Completed less than 40% of the requirements.	30%
2. Ability to apply required code utility or data structure	Able to apply required data type or data structure and produce correct results. Familiarize and selects proper functions for simulation of given problem using software tools like MATLAB.	Able to apply required data type or data structure but does not produce correct results. Need guidance to select proper functions for simulation of given problem using software tools like MATLAB.	Unable to identify required data type or data structure. Incapable of selecting proper functions for simulation of given problem using software tools like MATLAB.	20%
3. Documentation	Clearly and effectively documented including descriptions of all variables/functions. Specific purpose is noted for each function, control structure, input requirements and output results.	Basic documentation including descriptions of all variables/functions. Specific purpose is noted for each function and control structure.	No documentation included.	10%

4. Ability to run/debug	Executes Matlab codes without errors, excellent user prompts, good use of symbols, spacing in output. Thorough and organized testing has been completed and output from test cases is included.	Executes Matlab codes without errors. User prompts are understandable, minimum use of symbols or spacing in output. Some testing has been completed.	Does not execute Matlab codes due to errors. User prompts are misleading or nonexistent. No testing has been completed.	20%
5. Results compilation	Show processed results effectively by conducting simple computations and plotting using collected data	Show processed results effectively by conducting simple computations and plotting using collected data with minor error	Unable to show processed results effectively by conducting simple computations and plotting using collected data with minor error	10%
6. Efficiency	Excellent use of CPU and Memory.	Good but not smart use of CPU and Memory.	Inefficient use of CPU and Memory.	10%
7. Lab Performance (Team work and Lab etiquettes)	Actively engages and cooperates with other group members in an effective manner. Respectfully and carefully observes safety rules and procedures	Cooperates with other group members in a reasonable manner. Observes safety rules and procedures with minor deviation.	Distracts or discourages other group members from conducting the experiment. Disregards safety rules and procedures.	10%

Instructor:

Name: ___________________________

Signature: ________________________

COMPLEX NUMBERS:

Complex numbers are numbers that are composed of a real part and an imaginary part, written in the form of "a+bi", where a and b are real numbers and i is the imaginary unit, defined as the square root of -1. The real part of a complex number represents the horizontal axis on the complex plane, while the imaginary part represents the vertical axis. The complex plane is a 2-dimensional plane in which complex numbers can be plotted as points.

COMPLEX EXPONENTIAL SIGNALS

A complex exponential signal is a signal of the form x(t) = Ae^(j*omega*t), where "A" is the amplitude, "omega" is the frequency, "t" is time, and "j"=sqrt{-1} is the imaginary unit. The signal is said to be complex because it has both real and imaginary components, and exponential because it has a constant base raised to a time-varying exponent.

OBJECTIVES OF THE LAB

- Gain familiarity with Complex Numbers and plot them
- Complex exponential signals
- Real exponential signals

TASK 01

Write MATLAB function zprint, which takes a complex number and returns it real part, imaginary part, magnitude, phase in radians, and phase in degrees

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task1.m

Task1.m | zprint.m

```matlab
%Task-1
clear all
clc
z = 4+5i;
[realPart,imgPart,magnitude, phaseInRad,phaseInDegree] = zprint(z)
```

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\zprint.m

Task1.m | zprint.m

```matlab
function[realPart,imgPart,magnitude, phaseInRad,phaseInDegree]= zprint(z)
realPart = real(z);
imgPart = imag(z);
magnitude = abs(z);
phaseInRad = angle(z);
phaseInDegree= rad2deg(phaseInRad);
end
```

OUPUT:

Command Window

```
realPart =

     4


imgPart =

     5


magnitude =

    6.4031


phaseInRad =

    0.8961


phaseInDegree =

   51.3402
```

TASK 02

Compute the conjugate ź (i.e. z_conj [give variable name]) and the inverse 1/z (i.e. z_inv [give variable name]) for any complex number z. Display the results numerically with zprint.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task2.m

Task2.m | zprintTask2.m

```matlab
%Task-2
clear all
clc
z = 9+8i;
zprintTask2(z);
```

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\zprintTask2.m

Task2.m | zprintTask2.m

```matlab
function zprintTask2(z)
z_conj = conj(z);
z_inv = inv(z);
disp('------Conjugate is : ------');
disp(z_conj)
disp('------Inverse is : ------');
disp(z_inv)
```

OUPUT:

Command Window

```
------Conjugate is : ------
   9.0000 - 8.0000i

------Inverse is : ------
   0.0621 - 0.0552i

>>
```

TASK 03

Take two complex number and compute z1 +z2 and display the results numerically using zprint.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task3.m

Task3.m | zprintTask3.m

```
%Task-3
clear all
clc
z1=7+5i;
z2=4+12i;
zprintTask3(z1,z2);
```

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\zprintTask3.m

Task3.m | zprintTask3.m

```
function zprintTask3(complex_1,complex_2)
Addition = complex_1 + complex_2
```

OUPUT:

Command Window

```
Addition =

  11.0000 +17.0000i

>>
```

TASK 04

Take two complex numbers and compute z1z2 and z1/z2. Use zprint to display the results numerically.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task4.m

Task4.m | zprintTask4.m

```
%Task-4
clear all
clc
z1=7+5i;
z2=4+12i;
zprintTask4(z1,z2);
```

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\zprintTask4.m

Task4.m | zprintTask4.m

```
function zprintTask4(comp_1,comp_2)
z1multiplyZ2 = comp_1*comp_2
z1DivideZ2 = comp_1/comp_2
```

OUPUT:

Command Window

```
z1multiplyZ2 =

  -3.2000e+01 + 1.0400e+02i


z1DivideZ2 =

   0.5500 - 0.4000i
```

TASK 05

Determine the complex conjugate of the exponential signal given in above example and plot its real and imaginary portions.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task5.m

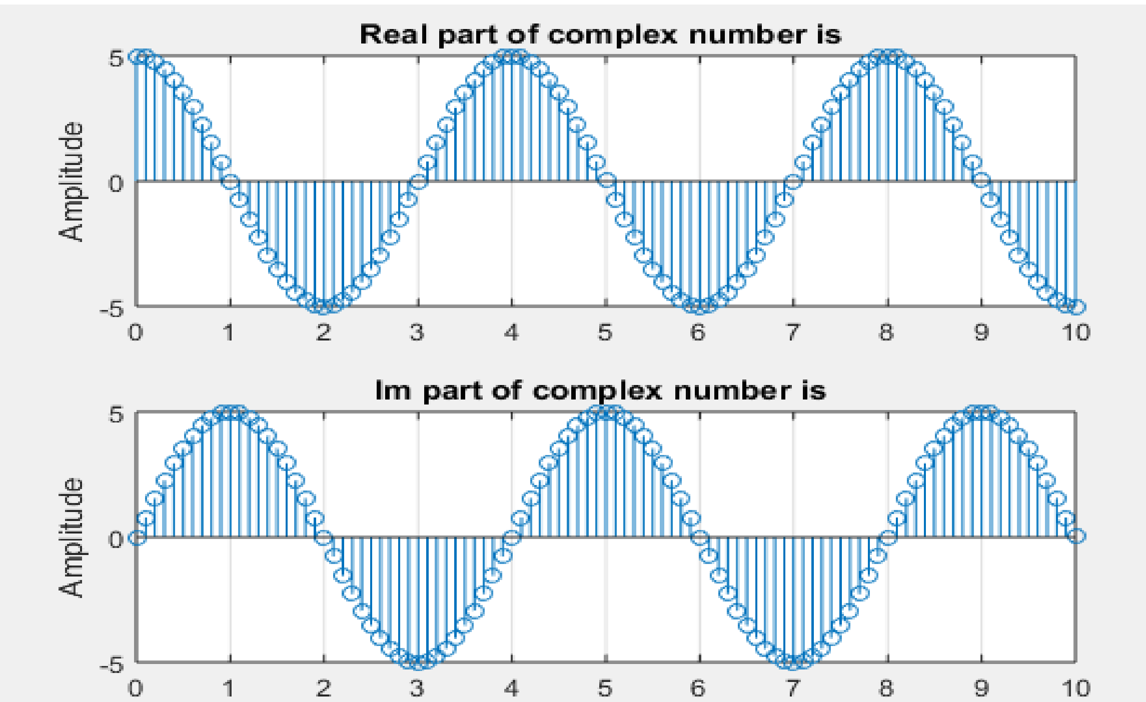
Task5.m

```
%Task-5
%x=k * exp(a*n*i);
clear all
clc
count = 0:0.1:10;
k = 5; % Where K is amplitude of signal
a = pi/2;
expo = k*exp(a*count*i);

subplot(2,1,1)
stem(count, real(expo))
title('Real part of complex number is ')
ylabel('Amplitude')
grid
%Imaginary part

subplot(2,1,2)
stem(count, imag(expo))
title('Im part of complex number is ')
ylabel('Amplitude')
grid
```

OUPUT:



TASK 06

Generate the complex valued signal and plot its magnitude, phase, the real part, and the imaginary part in separate subplots.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task6.m

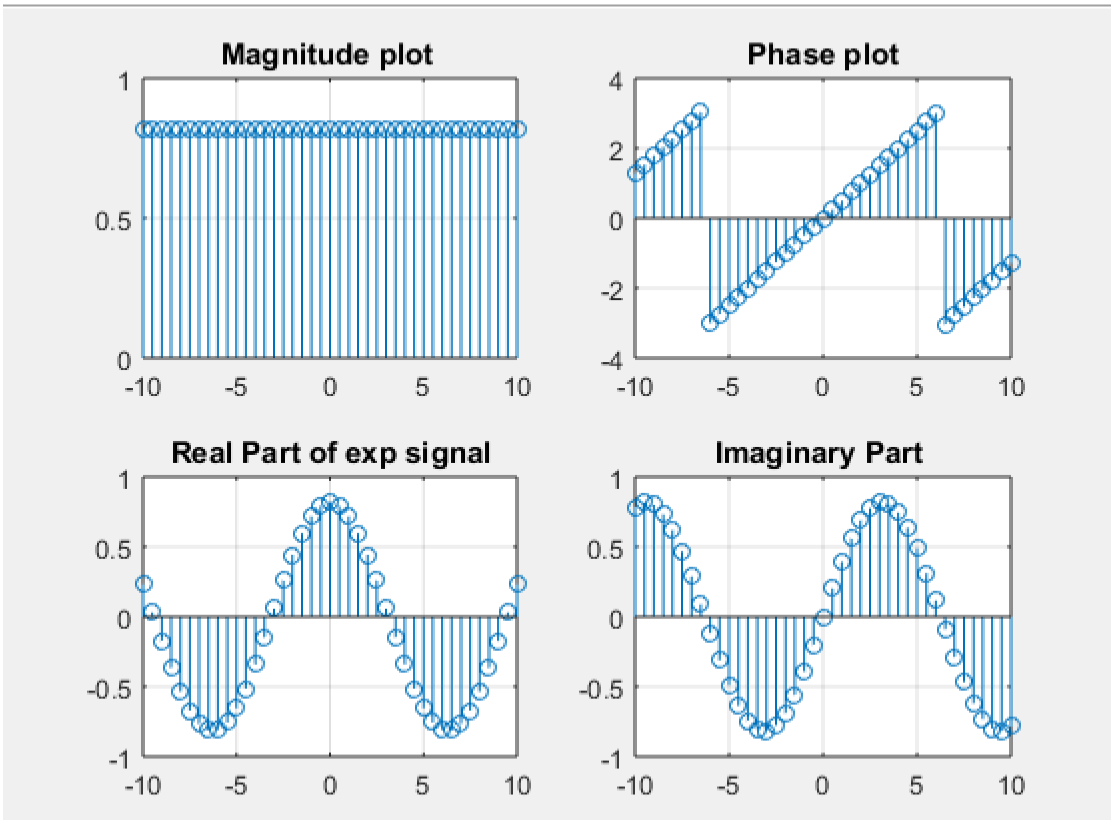
Task6.m

```
%Task-6
clear all
clc
% x'(n) = A e(j w0 n + ø)
n=-10:0.5:10;
k=1; %Amplitude of signal

y =k*exp(-0.2+0.5i*n);
subplot(2,2,1);
stem(n, abs(y));
title('Magnitude plot ');
grid
% Ploting of phase
subplot(2,2,2)
stem(n, angle(y));
title('Phase plot')
grid
% Real part
subplot(2,2,3)
stem(n, real(y));
title('Real Part of exp signal')
grid

% Imaginary Part
subplot(2,2,4)
stem(n, imag(y))
title('Imaginary Part ')
grid
```

OUPUT:



Magnitude plot
1
0.5
0
-10
-5
0
5
10
Phase plot
4
2
0
-2
-4
-10
-5
0
5
10
Real Part of exp signal
1
0.5
0
-0.5
-1
-10
-5
0
5
10
Imaginary Part
1
0.5
0
-0.5
-1
-10
-5
0
5
10

TASK 07

Generate a real-exponential x=a * exp (n) for a=0.7 and n ranging from 0-10. Find the discrete time as well as the continuous time version of this signal. Plot the two signals on same graph (holding both the graphs).

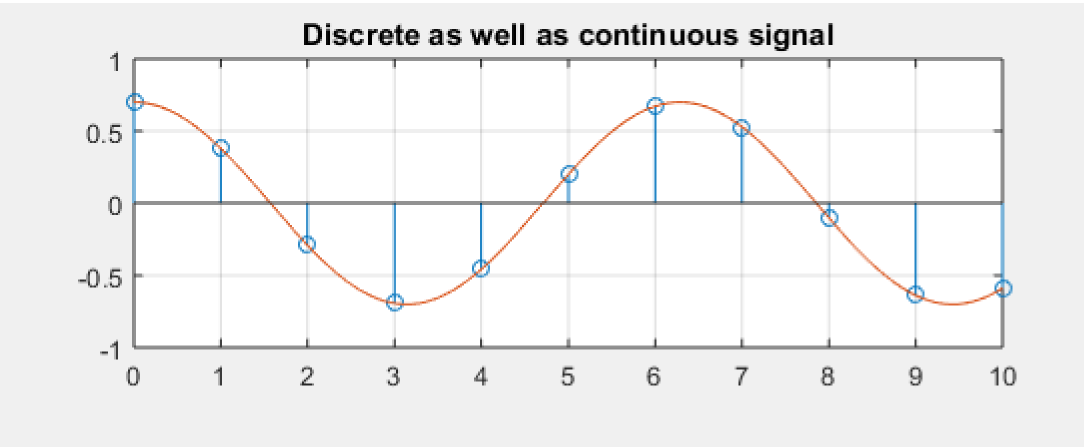
CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task7.m

Task7.m

```
%Task-7
clear all
clc
n = 0:10;
a = 0.7; % Part-B Repeat with value a=1.3
discreteSignal = a*exp(n*i);
t = 0:0.01:10;
contiSignal = a*exp(t*i);
subplot(2,1,1)
stem(n, real(discreteSignal));
hold on
plot(t, real(contiSignal));
title('Discrete as well as continuous signal')
grid
```

OUPUT:



TASK 08

Multiply the two discrete signals x1=5 exp (i*n*pi/4) and x2= a * exp(n) (use point-by-point multiplication of the two signals). Plot the real as well as the exponential parts.

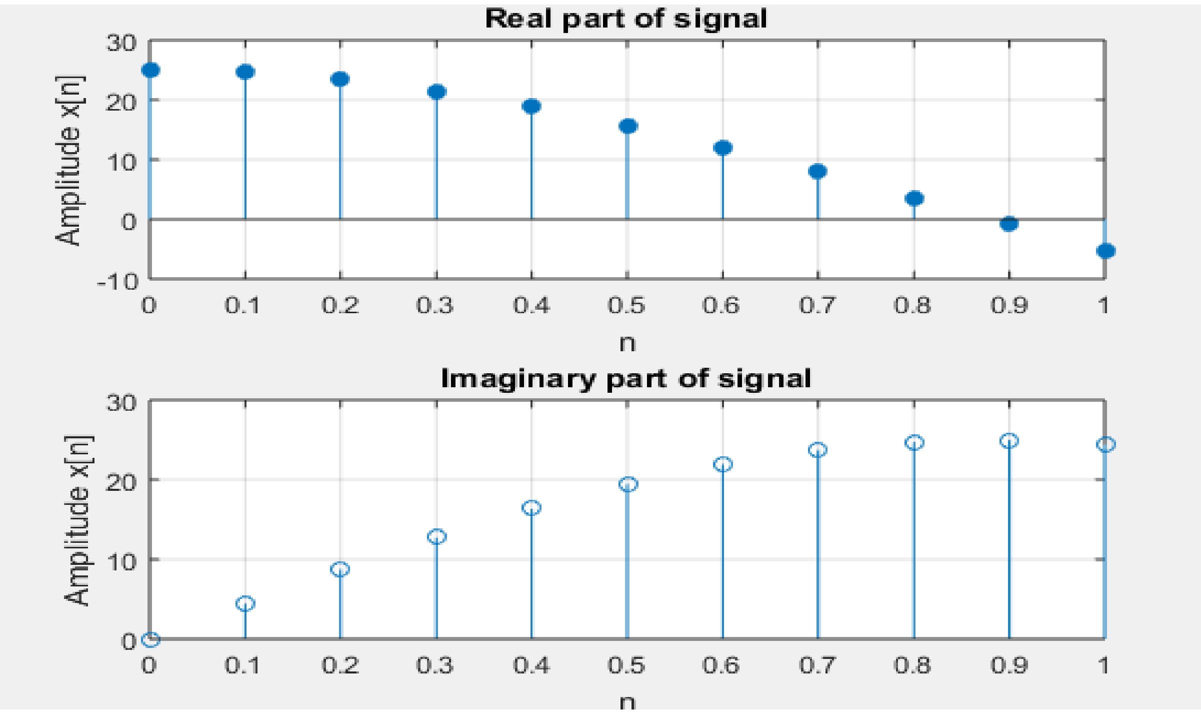
CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task8.m

Task8.m

```
%Task-8
clear all
clc
n = 0:0.1:1;
k = pi/4;
a=5;
x1 =a*exp(i*n*k);
x2 = a*exp(i*n);
multiply = x1.*x2;
subplot(2,1,1);
stem(n, real(multiply), 'Filled')
title('Real part of signal');
xlabel('n')
ylabel('Amplitude x[n]')
grid
subplot(2,1,2);
stem(n, imag(multiply));
title('Imaginary part of signal');
xlabel('n')
ylabel('Amplitude x[n]')
grid
```

OUPUT:



TASK 09

Plot the discrete signal x=a^|n| for n ranging from -10 to 10. Draw two subplots for 0<a1

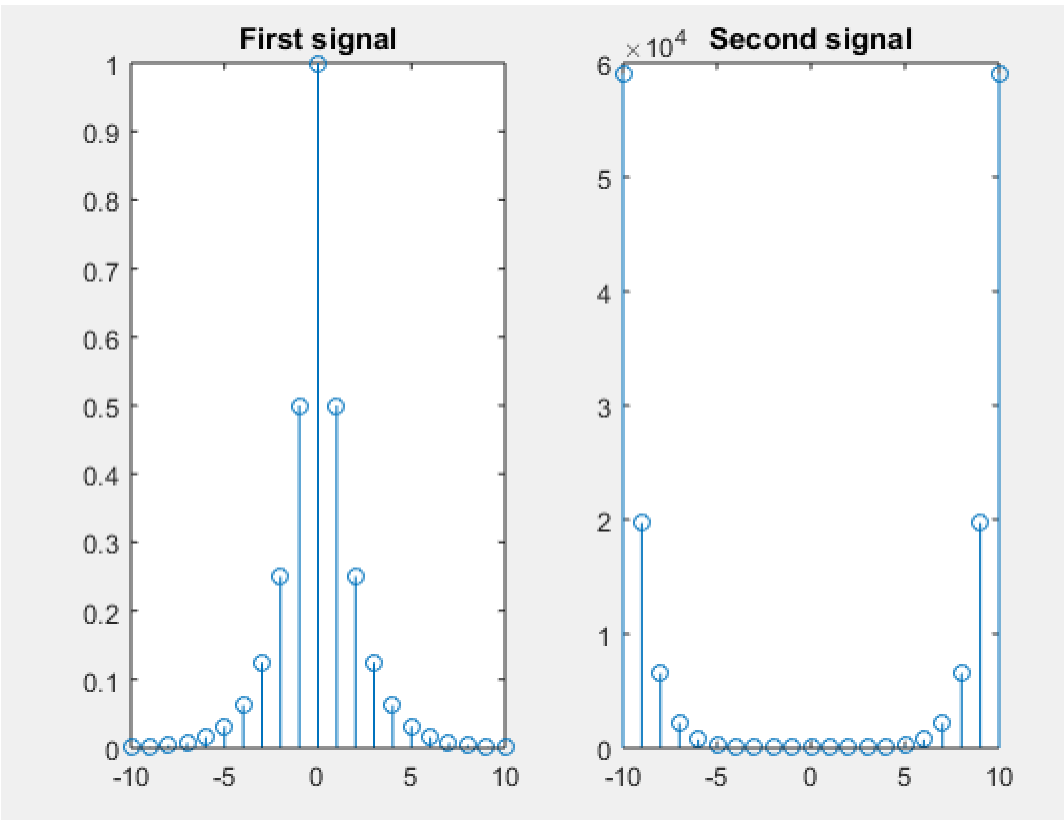
CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task9.m

Task9.m

```
% Task-9
clear all
clc
n = -10:10;
a1 = 0.5; % 0<a<1
a2 = 3; % a>1
x1 = a1.^abs(n);
subplot(1,2,1)
stem(n, x1)
title('First signal')
%Now for a2
x2 = a2.^abs(n);
subplot(1,2,2)
stem(n, x2)
title('Second signal')
```

OUPUT:



TASK 10

Generate the signal x(t) = Ae(jωt + π) for A = 3, π= -0.4, and ω = 2π(1250). Take a range for t that will cover 2 or 3 periods.

CODE:

Editor - E:\Computer_System-Engineering\Fourth Semester\Signal and System Lab\Lab-05\Task10.m

Task10.m

```
%Task- 10
clear all
clc
%Part-a
t = linspace(0,3/125,1000);
A=3;
phi = -0.4;
w = 2*phi*125;
x_t = A*exp(i*(w*t+phi));
subplot(2,1,1)
plot(t, real(x_t));
title('Real Part')
xlabel('Time (s)')
ylabel('Amplitude')
grid
subplot(2,1,2)
plot(t, imag(x_t));
title('Imaginary part')
```

OUPUT: