Practical 1

Complex Number

A. Add, Sub, Div, Mul.

```
clc();
a1=4;
b1=5;
a2=7;
b2=4;
z1=complex(a1,b1);
z2=complex(a2,b2);
z3=z1+z2; //for addition
//z3=z1-z2; //for subtraction
//z3=z1*z2; //for multiplication
//z3=z1/z2; //for divition
a3=real(z3);
b3=imag(z3);
figure(0);
clf;
hf=gcf();
hf.background=-2;
ha=gca();
ha.data_bounds=[-5,-5;5,5];
xgrid();
plot([0 a1],[0 b1],'b','LineWidth',3);
plot([0 a2],[0 b2],'r','LineWidth',3);
plot([0 a3],[0 b3],'g','LineWidth',3);
xlabel('Realaxis(re)','fontsize',2);
ylabel('Imaginaryaxis(im)','fontsize',2);
```

```
legend('$\Large{Z_{1}}$','$\Large{Z_{2}}$','$\Large{Z_{3}}$');
plot(0,0,'sk');
plot(a1,b1,'sk');
plot(a2,b2,'sk');
plot(a3,b3,'sk');
r1=sqrt(a1^2+b1^2);
r2=sqrt(a2^2+b2^2);
r3=sqrt(a3^2+b3^2);
phi1=atan(b1/a1)*180/%pi;
phi2=atan(b2/a2)*180/%pi;
phi3=atan(b3/a3)*180/%pi;
printf('%s\t %s\t %s\t %s\n','a','b','r','phi');
printf('%4.2f\t %4.2f\t %4.2f\t %4.2f\n',a1,b1,r1,phi1);
printf('%4.2f\t %4.2f\t %4.2f\t %4.2f\n',a2,b2,r2,phi2);
printf('%4.2f\t %4.2f\t %4.2f\t %4.2f\n',a3,b3,r3,phi3);
```

B. De Mouvies Theorem.

```
clc();
printf("Shaikh Nadim 046");
a1=4;
b1=5;
a2=7;
b2=4;
a3=7;
b3=5;
a4=9;
b4=8;
z1=complex(a1,b1);
z2=complex(a2,b2);
z3=complex(a3,b3);
z4=complex(a4,b4);
n1=4;
n2=5;
n3=12;
n4=2;
z11=z1^n1;
z22=z2^n2;
z33=z3^n3;
z44=z4^n4;
r1=sqrt(a1^2+b1^2);
r2=sqrt(a2^2+b2^2);
r3=sqrt(a3^2+b3^2);
r4=sqrt(a4^2+b4^2);
phi1=atan(b1/a1);
```

```
phi2=atan(b2/a2);
phi3=atan(b3/a3);
phi4=atan(b4/a4);
r11=r1^n1;
r22=r2^n2;
r33=r3^n3;
r44=r4^n4;
phi11=phi1*n1;
phi22=phi2*n2;
phi33=phi3*n3;
phi44=phi4*n4;
p11=r11*(cos(phi11)+%i*sin(phi11));
p22=r22*(cos(phi22)+%i*sin(phi22));
p33=r33*(cos(phi33)+%i*sin(phi33));
p44=r44*(cos(phi44)+%i*sin(phi44));
z=(z11*z22)/(z33*z44);
p=(p11*p22)/(p33*p44);
disp(z);
disp(p);
```

Practical 3
Differential Equation

1.
```
// Defines
x0=0;
xine=0.001;
xf=1;
x=x0:xine:xf;
y=sqrt(x.^2+2*x+0.01);
subplot(2,1,1),plot(x,y),xgrid
ylabel('y(x)','fontsize',2)
title('Analytic solution','fontsize',2)
y0=0.1;
ydiff=ode(y0,x0,x,f)
subplot(2,1,2),plot(x,ydiff,'r'),xgrid
title('Numeric Solution','fontsize',2)
ylabel('y(x)','fontsize',2)
xlabel('x','fontsize',2)
```

2.
```
function ydot=f(t, y)
   ydot=y^2-y*sin(t)+cos(t)
endfunction
y0=0;
t0=0;
t=0:0.1:%pi;
y=ode(y0,t0,t,f);
plot(t,y)
```

3.

```
function xdot=linear(t, x, A, u, B, omega)
  xdot=A*x+B*u(t,omega)
endfunction
function ut=u(t, omega)
  ut=sin(omega*t)
endfunction
A=[1 1;0 2];
B=[1;1];
omega=5;
y0=[1;0];
t0=0;
t=[0.1,0.2,0.5,1];
ode(y0,t0,t,list(linear,A,u,B,omega))
plot(t,u);
```

4.

```
function y=u(t)
  y=(sign(t)+1)/2
endfunction
L=0.001
R=10
C=0.000001
function zdot=f(t, y)
  zdot=[y(2); (u(t)-y(1)-L*y(2)/R)/(L*C)];
endfunction
y0=[0;0];
t0=0;
t=0:0.00001:0.001;
```

```
out=ode(y0,t0,t,f);
clf();
subplot(211)
plot(t,out(1,:),"r.--");
subplot(212)
plot(t,out(2,:),"b-..");
```

5.

```
function dx=f(t, x)
   dx(1) = x(2);
   dx(2)= 1/(t+1) + sin(t)*sqrt(t);
endfunction
t= 0:0.01:5*%pi;
t0 = min(t);
y0 = [0; -2];
y = ode(y0, t0, t, f);
plot(t,y(1,:),'Line Width',2)
plot(t,y(2,:),'r','LineWidth',2)
xgrid();
label('St \quad [s]$', 'FontSize',3)
vlabel('Sf(t,x)$','FontSize',3)
title(['Integration of' '$\frac{d^2 x}{dt^2} =
\frac{1}{t+1} + sint(t)\sqrt{t}$'],'FontSize',3)
legend(['$\Large{×}$' '$\Large {dx/dt}$'],2)
```

6.

```
funcprot(0)
clf;
function dx=f(x, y)
  dx=exp(-x);
endfunction
y0=0;
x0=0;
x=[0:0.5:10];
sol=ode(y0,x0,x,f);
plot2d(x,sol,5)
xlabel('x');
ylabel('y(x)');
xtitle('y(x) vs. x');
```

7.

```
funcprot(0)
clf;
function dx=f(x, y)
  dx=x^2-exp(-x)*y;
endfunction
y0=0;
x0=0;
x=[0:0.5:10];
sol=ode(y0,x0,x,f);
plot2d(x,sol,5)
xlabel(‘x’);
ylabel(‘y(x)’);
xtitle(‘y(x) vs. x’);
```

Practical 4

4A. CTFT

1.
```
clear;
clc;
//Fourier transform
A=1;
T=0.5;
fo=1/(2*T);
Wo=2*%pi*fo;
for f=-20:1:20;
   X(f+21)=A*integrate('cos(Wo*t)*cos(2*%pi*f*t)','t',-0.25,0.25);
end
disp(X,'X(0)-->X(20)');
t=-0.25:0.01:0.25;
q=cos(Wo*t);
a=gca();
a.y_location="origin";
a.x_location="origin";
f=-20:1:20;
plot(f,X);
xlabel('Frequency in Hz');
title('Continuous Time Fourier Transform X(jW)');
```

2.
```
clear;
clc;
a=1;
wc=1;
Dt=0.005;
t=0: Dt:10;
xt=(exp(t*(-a+wc))+exp(t*(-a-wc)))/2;
Wmax=2*%pi*1;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
XW=xt*exp(-sqrt(-1)*t'*W)*Dt;
XW_Mag=abs(XW);
[XW_Phase,db]=phasemag(XW);
figure(1)
```

```
plot(t,xt);
xlabel('t in sec.');
ylabel('x(t)');
title('Continous Time Signal')
figure(2)
subplot(2,1,1);
plot(W,XW_Mag);
xlabel('Frequency in Radians/Seconds>W');
ylabel('abs(X(jW))');
title('Magnitude Response(CTFT)');
subplot(2,1,2);
plot(W,XW_Phase*%pi/180);
xlabel('Frequency in Radians/Seconds>W');
ylabel('<X(jW)');
title('Phase Response(CTFT) in Radians');
```

3.

```
clear;
clc;
close;
//CTFT
T1=2;
T=4*T1;
Wo=2*%pi/T;
W=[-Wo,0,Wo];
ak=(2*%pi*Wo*T1/%pi)/sqrt(-1);
XW=[-ak,0,ak];
a=gca();
a.y_location="origin";
a.x_location="origin";
plot2d3('gnn',W,imag(XW),2);
poly1=a.children(1).children(1);
poly1.thickness=3;
xlabel('W');
title('CTFT of sin(Wot)');
```

4.

```
clear;
clc;
close;
//CTFT
T1=2;
T=4*T1;
Wo=2*%pi/T;
W=[-Wo,0,Wo];
ak=(2*%pi+Wo*T1/%pi)/sqrt(-1);
XW=[-ak,0,ak];
ak1=(2*%pi*Wo*T1/%pi);
XW1=[ak1,0,ak1];
figure
a=gca();
a.y_location="origin";
a.x_location="origin";
plot2d3('gnn',W,imag(XW),2);
poly1=a.children(1).children(1);
poly1.thickness=3;
xlabel('W');
title('CTFT of sin(Wot)');
figure
a=gca();
a.y_location="origin";
a.x_location="origin";
plot2d3('gnn',W,XW1,2);
poly1=a.children(1).children(1);
poly1.thickness=3;
xlabel('W');
title('CTFT of cos(Wot)');
```

5.

```
clear;
clc;
close;
A=1;
Dt=0.005;
T1=4;
t=-T1/2:Dt:T1/2;
for i=1:length(t)
   xt(i)=A;
end
Wmax=2*%pi*1;
```

```
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
xt=xt';
XW=xt*exp(-sqrt(-1)*t'*W)*Dt;
XW_Mag=real(XW);
subplot(2,1,1);
a=gca();
a.data_bounds=[-4,0;4,2];
a.y_location="origin";
plot(t,xt);
xlabel('t in msec.');
title('Continous Time Signal x(t)');
subplot(2,1,2);
a=gca();
a.y_location="origin";
plot(W,XW_Mag);
xlabel('Frequency in Radians/Seconds');
title('Continous Time Fourier Transform X(jW)')
```

6.

```
clear;
clc;
close;
A=1;
Dt=0.005;
t=-4.5:Dt:4.5;
xt=exp(-A*abs(t));
Wmax=2*%pi*1;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
XW=xt*exp(-sqrt(-1)*t'*W)*Dt;
XW=real(XW);
subplot(1,1,1);
subplot(2,1,1);
```

```
a=gca();
a.y_location="origin";
plot(t,xt);
xlabel('t in sec.');
ylabel('x(t)');
title('Continous Time Signal');
subplot(2,1,2);
a=gca();
a.y_location="origin";
plot(W,XW);
xlabel('Frequency in Radians/Seconds W');
ylabel('X(jW');
title('Continuous-time Fourier Transform');
```

7.

```
clear;
clc;
close;
A=1;
T=1;
Dt=0.005;
t=0:Dt:10;
xt=A*exp(-t/t);
Wmax=2*%pi*1;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
XW=xt*exp(-sqrt(-1)*t'*W)*Dt;
XW_Mag=abs(XW);
[XW_Phase,db]=phasemag(XW);
a=gca();
a.y_location="origin";
plot(t,xt);
xlabel('t in sec.');
ylabel('x(t)');
title('Continuous Time Signal');
figure
subplot(2,1,1);
a=gca();
a.y_location="origin";
plot(W,XW_Mag);
xlabel('Frequency in Radians/Seconds--->W');
ylabel('abs(X(jW))');
```

```
title('Magnitude Response (CTFT)');
subplot(2,1,2);
a=gca();
a.y_location="origin";
a.x_location="origin";
plot(W,XW_Phase*%pi/180);
xlabel('Frequency in Radians/Seconds--->W');
ylabel('<X(jW)');
title('Phase Response(CTFT) in Radians');
```

8.

```
clear;
clc;
wc=1;
Dt=0.005;
t=0:Dt:10;
xt=(exp(t*(-1+wc))-exp(t*(-1-wc)))/(2*%i);
Wmax=2*%pi*1;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
XW=xt*exp(-sqrt(-1)*t'*W)*Dt;
XW_Mag=abs(XW);
[XW_Phase,db]=phasemag(XW);
figure(1)
plot(t,xt);
xlabel('t in sec');
ylabel('x(t)')
title('Continuous Time Signal')
figure(2)
subplot(2,1,1);
plot(W,XW_Mag);
xlabel('Frequency in Radians/Seconds>W');
ylabel('abs(X(jW))');
title('Magnitude Response(CTFT)');
subplot(2,1,1);
plot(W,XW_Phase*%pi/180);
xlabel('Frequency in Radians/Seconds>W');
ylabel('<X(jW)');
title('Phase Response (CTFT) in Radians');
```

4B. DTFT

1.

```
clear;
clc;
close;
//DTS Signal
a1 =0.5;
a2 = -0.5;
max_limit = 10;
for n =0:max_limit-1
   x1(n+1) = (a1^n);
   x2(n+1) = (a2^n);
end
n=0:max_limit-1;
// Discrete-time Fourier Transform
Wmax = 2*%pi;
K=4;
k=0:(K/1000):K;
W =k*Wmax/K;
x1 =x1';
x2 =x2';
XW1 =x1* exp(-sqrt(-1)*n'*W);
XW2 =x2* exp(-sqrt(-1 )*n'*W);
XW1_Mag = abs(XW1);
XW2_Mag = abs(XW2);
[XW1_Phase,db] = phasemag(XW1);
[XW2_Phase,db] = phasemag(XW2);
//plot for a>0
figure
```

```
subplot(3, 1, 1);
plot2d3('gnn',n,x1);
xtitle('Discrete Time Sequence x[n] for a>0')
subplot(3, 1, 2);
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW1_Mag);
title('Magnitude Response abs(X(jW))')
subplot(3,1,3 );
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW1_Phase);
title('Phase Response <(X((jW))')
//plot for a<0
figure
subplot(3,1,1);
plot2d3('gnn',n,x2);
xtitle('Discrete Time Sequence x{n] for a>0')
subplot(3,1,2);
a=gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW2_Mag);
title('Magnitude Response abs(X(jW))')
subplot(3,1,3);
a= gca();
a.y_location ="origin";
```

```
a.x_location ="origin";
plot2d(W,XW2_Phase);
title('Phase Response <(X(jW))');
```

2.

```
//Discrete Time Fourier Transform of x[n]=
(a^abs(n) a>0 and a<0
clear;
clc;
close;
//DTS Signal
a =0.5;
max_limit = 10;
n=-max_limit+1:max_limit-1;
x=a^abs(n);
//Discrete-time Fourier Transform
Wmax = 2*%pi;
K=4;
k=0:(K/1000): K;
W=k*Wmax/K;
XW = x*exp(-sqrt(-1)*n'*W);
XW_Mag = real(XW);
//plot for abs(a)<1
figure
subplot(2,1,1);
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d3('gnn',n,x);
```

```
xtitle('Discrete Time Sequence x[n] for a>0')
subplot(2,1,2);
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW_Mag);
title('Discrete Time Fourier Transform
X(exp(;W))')
```

3.

```
//Discrete Time Forier Transform ofx [n]= 1,
abs(n)<=NI
clear;
clc;
close;
//DIS Signal
N1 =2;
n=-N1:N1;
x= ones(1,length(n));
//Discrete-time Fourier Transform
Wmax = 2*%pi;
K=4;
k=0:(K/1000):K;
W =k*Wmax/K
XW =x* exp(-sqrt(-1)*n'*W);
XW_Mag=real(XW);
//plot for abs(a)<1
figure
subplot(2, 1, 1);
```

```
a = gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d3('gnn',n,x);
xtitle('Discrete Time Sequence x[n]')
subplot(2,1,2);
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d( W,XW_Mag);
title('Discrete Time Fourier Transform
X(exp(jW))')
```

4. //Discrete Time Fourier Transform:x[n]= cos(nWo)

```
clear;
clc;
close;
N= 5;
Wo = 2*%pi/N;
W =[-Wo,0, Wo];
XW=[%pi,0,%pi];
figure
a = gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d3('gnn',W,XW,2);
```

```
poly1=a.children(1).children(1);
poly1.thickness =3;
xlabel('w');
title('DTFT of cos(nWo)')
disp(Wo)
```

5.

```
clear;
//Discrete Time Fourier Transform of discrete
sequence x[n]-(n)*(a^n).u[n],a>0 and a<0
clear;
clc;
close;
//DTS Signal
a1=0.5;
a2=-0.5;
max_limit=10;
for n=0:max_limit-1
   x1(n+1)=(n)*(a1^n);
   x2(n+1)=(n)*(a2^n);
end
n=0:max_limit-1;
Wmax=2*%pi;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
x1=x1';
x2=x2';
XW1=x1*exp(-sqrt(-1)*n'*W);
```

```
XW2=x2*exp(-sqrt(-1)*n'*W);
XW1_Mag=abs(XW1);
XW2_Mag=abs(XW2);
[XW1_Phase,db]=phasemag(XW1);
[XW2_Phase,db]=phasemag(XW2);
figure
subplot(3,1,1);
plot2d3('gnn',n,x1);
xtitle('Discrete Time Sequence x<n] for a0)
subplot(3,1,2)')
a =gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW1_Mag);
title('Magnitude Response abs(X(jW))')
subplot(3,1,3);
a = gca();
a.y_location ="origin";
a.x_location ="origin";
plot2d(W,XW1_Phase);
title('Phase Response <(X(jW))')
//plot for a<0
figure
subplot(3,1,1);
plot2d3('gnn',n,x2);
xtitle('Discrete Time Sequence x[n] for a>0')
subplot(3,1,2);
```

6.

```
clear;
clc;
close;
n=1:100;
x2=[3/4,sin(0.75*%pi*n)./(%pi*n)];
x1=[1/2,sin(0.5*%pi*n)./(%pi*n)];
x=x1.*x2;
Wmax=%pi;
K=1;
k=0:(K/1000):K;
W=k*Wmax/K;
n=0:100;
XW1=x1*exp(-sqrt(-1)*n'*W);
XW2=x2*exp(-sqrt(-1)*n'*W);
XW=x*exp(-sqrt(-1)*n'*W);
XW1_Mag=real(XW1);
XW2_Mag=real(XW2);
XW_Mag=real(XW);
figure
subplot(3,1,1)
a=gca();
a.y_location="origin";
a.x_location="origin";
plot(W,XW1_Mag);
title('DTFT X1(exp(jW))');
subplot(3,1,2);
a=gca();
a.y_location="origin";
a.x_location="origin";
plot(W,XW2_Mag);
title('DTFT X2(exp(jw))');
subplot(3,1,3)
a=gca();
a.y_location="origin";
a.x_location="origin";
plot(W,XW_Mag);
title('Multiplication Property of DTFT');
```

7.

```
clear;
clc;
close;
a1=0.5;
a2=-0.5;
max_limit=10;
for n=0:max_limit-1
   x1(n+1)=((-1)^n)*(a1^n);
   x2(n+1)=((-1)^n)*(a2^n);
end
n=0:max_limit-1;
Wmax=2*%pi;
K=4;
k=0:(K/1000):K;
W=k*Wmax/K;
x1=x2';
x2=x2';
XW1=x1*exp(-sqrt(-1)*n'*W);
XW2=x2*exp(-sqrt(-1)*n'*W);
XW1_Mag=abs(XW1);
XW2_Mag=abs(XW2);
[XW1_Phase,db]=phasemag(XW1);
```

```
[XW2_Phase,db]=phasemag(XW2);
figure
subplot(3,1,1);
plot2d3('gnn',n,x1);
xtitle("Discrete Time Sequence x[n] for a>0");
subplot(3,1,2);
a=gca();
a.y_location="origin";
a.x_location="origin";
plot2d(W,XW1_Mag);
title('Magnitude Response abs(X(jW))');
subplot(3,1,3);
a=gca();
a.y_location="origin";
a.x_location="origin";
plot2d(W,XW1_Mag);
title('Phase Response <(X(jW))');
figure
subplot(3,1,3);
plot2d3('gnn',n,x2);
xtitle('Discrete Time Sequence x[n] for a>0');
subplot(3,1,2);
```

4C. Inverse CTFT

1.

```
clear;
clc;
close;
A =1;
Dw =0.006;
W1=4;
w=-W1/2:Dw:W1/2;
for i = 1:length(w)
   XW(i) = A;
end
XW= XW';
plot(w,XW);
xlabel(' w in radians');
title('Continuous Time Fourier Transform x(t)')
t= -%pi:%pi/length(w):%pi;
xt1=(1/(2*%pi))*XW*exp(sqrt(-l)*w'*t)*Dw;
xt=real(xt1);
a = gca();
a.y_location ="origin";
a.x_location ="origin";
plot(t,xt);
xlabel( 't time in Seconds');
title('Inverse Continuous Time Fourier Transform
x(t)')
```

2.

```
clear;
clc;
close;
A=1;
Dw= 0.005;
W1=4;
w=-W1/2:Dw:W1/2;
for i=1:length(w)
   if w(i)==0 then
     XW(i)=2*%pi;
   else
     XW(i)=0;
   end
end
XW=XW';
subplot(2,1,1)
plot(w,XW)
t=3*%pi:%pi/length(w):3 *%pi;
xt=(1/(2*%pi)) *XW *exp(sqrt(-1)*w'*t)*Dw;
xt =real(1+xt);
subplot(2,1,2)
plot(t,xt);
xlabel(' tSec');
title('Time domain signal x(t)')
```

3.

```
clear;
clc;
A=1;
Dw=0.006;
W1=4;
w=-W1/2:Dw:W1/2;
for i=1:length(w)
   XW(i)=A;
end
XW=XW;
plot(w,XW);
xlabel('           w in Radius');
title('Continuous Time Fourier Transform x(t)')
t=-%pi:%pi/length(w):%pi;
xt=(1/(2*%pi))*XW*exp(sqrt(-1)*w*t)*Dw;
xt=real(xt);
figure
a=gca();
a.y_location="origin";
a.x_location="origin";
plot(t,xt);
xlabel('        t Time in Seconds');
title('Inverse Continuous Time Fourier Transform x(t)');
```

4D. Inverse DTFT

1.

```
clear;
clc;
wc=1;
y=1;
for n=-%pi:%pi/80:%pi
  if n<-wc|n>wc then
    X(1,y)=1;
    y=y+1;
  else X(1,y)=0;
    y=y+1;
  end
 end
n=-%pi:%pi/80:%pi;
a = gca ();
a.y_location="origin";
a.x_location="origin";
plot(n,X);
xlabel('Frequency in Radians/Seconds' );
title ('X(e^jw)) at Wc=1');
A=1/%pi;
for k=-10:10
x(k+11)=A* integrate('cos(w*k)','w'.wc,%pi);
end
figure(1); k=-10:10;
a = gca ();

a.y_location="origin";
```

```
a.x_location="origin";
plot2d3(k,x);
xlabel('Time in Seconds' );
title ('x(n) at Wc-1');
```

2.

```
clear;
clc;
wc=1;
y=1;
for n=-%pi:%pi/80:%pi
if n<-wc | n>wc then
 X(1,y)=1;
 y=y+1;
else X(1,y)=1;
y=y+1;
end
end
n=-%pi:%pi/80:%pi;
a =gca ();
a.y_location ="origin";
a.x_location ="origin";
plot(n,X);
xlabel ( 'Frequency in Radians/Seconds' ); title
('X(e^jw)) at Wc=1');
A=1/%pi;
for k=-10:10
x(k+11)=A*integrate('cos(w*k)','w',wc,%pi);
```

```
end
figure( 1 );
k=-10:10;
a = gca ();
a.y_location ="origin";
a.x_location ="origin";
plot2d3(k,x);
xlabel ('Time in Seconds' );
title ('x(n) at Wc=1');
```

Practical 5

5A. Z-Transform

1.
```
clc;clear;
close;
function [za]=ztransfer(sequence, n)
   z=poly(0,'z','r')
   za=sequence*(1/z)^n'
endfunction
x1=[2 -1 3 2 1 0 2 3 -1];
n=4:4
zz=ztransfer(x1,n);
disp ("Z-transform of sequence is:",zz);
disp('ROC is the entire plane except z = 0 and z =
%inf');
```

2.
```
clc;clear;
function [za]=ztransfer(sequence, n)
   z=poly(0,'z','r');
   za=sequence*(1/z)^n'
endfunction
x=[1,2,3,4,5,6,7];
n3= 0:length(x)-1;
X=ztransfer(x,n3);
disp('X(z)=');
disp(X);
funcprot(0);
```

3.
```
clc;clear;
function [za]=ztransfer(sequence, n)

   z=poly(0,'z','r')

   za=sequence*(1/z)^n'

endfunction
x=[1,2,3,4,5,6,7];
n1=-2:length(x)-3;
X=ztransfer(x,n1);
disp('X(z)=',X)
funcprot(0)
```

4.
```
clear;clc;
function [za]=ztransfer(sequence, n)

   z=poly(0,'z','r')
   za=sequence*(1/z)^n'

endfunction

x=[1,2,3,4,5,0,7];
n=0:length(x)-1;
X=ztransfer(x,n);
disp(X);
funcprot(0);
```

5.

```
clear;clc;

function [za]=ztransfer(sequence, n)

   z=poly(0,'z','r')
   za=sequence*(1/z)^n'
endfunction
x=[4,2,-1,0,3,-4];
n=-2:length(x)-3;
X=ztransfer(x,n);
disp(X,'X(z)=');
funcprot(0);
```

6.

```
 clc;clear;
function [za]=ztransfer(sequence, n)
   z=poly(0,'z','r')

   za=sequence*(1/z)^n'

endfunction

x1=[1,-3,2];
n1=0:length(x1)-1;
X1=ztransfer(x1,n1);
x2=[1,2,1];
n2=0:length(x2)-1;
X2=ztransfer(x2,n2);
X=X1*X2;
disp('X(z)=',X);
z=poly(0,'z');
X=[1;-z^-1;-3*z^-2;z^-3;2*z^-4];
n=0:4;
Z1=z^n';
x=(X.*Z1);
disp('x[n]=',x);
```

5B. Inverse Z-Transform

1.
```
clear//find inverse z-transform using long division,method
clc,
clear;
z=poly(0,'z');
x=ldiv(z^3-10*z^2-4*z+4,2*z^2-2*z-4,4);
disp(x,'x[n]=');
```

2.
```
clear//find inverse z-transform
clc,
clear;
z=poly(0,'z');
x=ldiv((z+1),(z-1/3),4);
disp(x,'x[n]=');
```

3.
```
clear//find inverse z-transform using long division
clc,
clear;
z=poly(0,'z');
x=ldiv(z,(z-0.5),4);
disp(x,'x[n]=');
```

4.
```
clear//find input x(n)
//x(z)=1/(2*z^(-2)+2*z^(-1)+1
clc,
close;
z=%z;
a=(2+2*z+z^2);
b=z^2;
h=ldiv(b,a,6)
disp(h,"First six values of h(n)=");
```

Practical 7

Impulse Response Using Laplace

1.
```
 clear;
clc; clear; close;
s = poly(0, 's');
N = (s+1)*(s+3);
D=(s+2)*(s+4);
F=N/D;
disp('Given Transfer Function: ', F);
zero = roots(N);
pole = roots(D);
disp('Zeros of transfer function: ', zero);
disp('Poles of transfer function: ', pole);
plzr(F);
```

2.
```
clear;
clc; clear; close;
s = poly(0, 's');
I = 3*s/(s+2)/(s+4);
disp('Given Transfer Function: ', I);
zero = roots(3*s);
pole = roots((s+2)*(s+4));
disp('Zero of transfer function: ', zero);
disp('Poles of transfer function: ', pole);
plzr(I);
```

3.
```
clear;
clc; clear; close;
s = poly(0, 's');
F = 10*s/(s^2+2*s+2);
disp('Given Transfer Function: ', F);
zero = roots(10*s);
pole = roots(s^2+2*s+2);
disp('Zero of transfer function: ', zero);
disp('Poles of transfer function: ', pole);
plzr(F);
```

4. //Response to initial condition (Transfer Function)

```
clear; clc;
//xdel(winsid()); //close all windows

s = %s;
N = 0.1*s^2+0.35*s;
D = s^2+3*s+2;
G = syslin('c', N, D);

t = linspace(0,8,200);
u = ones(1,200);
y = csim(u,t,G);

plot(t,y);
xtitle('Response to initial conditions', 't Sec', 'Response');
xgrid(color('gray'));
//We cannot use the 'step' version of csim directly
//as direct feedback sets to zero for the 'step' option
```

5.

//Impulse response of a Second Order System

```
clc;clear;

s = %s;
G = syslin('c', 1, s^2+0.2*s+1);

t = 0:0.5:50;
y = csim('impulse', t, G);
plot(t, y);
xtitle('Impulse Response of 1/(s^2 +0.2*s+1)', 't sec', 'Response');
xgrid(color('gray'));
```

Practical 8

Impulse Response using fourier transform

```
1. clear;
clc;
close;
disp("system given is
dy(t)/dt+2y(t)=x(t)+dx(t)/dt");
disp("taking fourier transform on both sides we
get");
disp("H(w)-Y(w)/X(w)-1-(1/(2+%)*w))");
w=-10:0.1:10;
dw=.1;
Hw=1-ones(1,length(w))./(2+%i*w);
t=0:0.1:10;
d=gca()
plot(w,Hw);
poly1=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('X(w)','w')
for i=1:length(t)
   if t(i)==0 then
      delta(i)=1;
   else
      delta(i)=0;
   end
end
```

```
h=delta'-exp(-2*1);
figure;
d=gca()
plot(t,(h));
poly1=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('h(t)','t')
```

2.
```
clear;
clc;
close;
disp("dy(t)/dt+2y(t)=x(t)");
w=0:0.1:10;
t=w;
dw=.1;
Xw=ones(1,length(w))./(1+%i*w);
Hw=ones(1,length(w))./(2+%i*w);
Yw=Xw.*Hw;
y=Yw*exp(%i*t'*w)*dw.*31;
d=gca()
plot(t,y);
poly1=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('y(t)','t')
yy=exp(-t)-exp(-2*t);
disp("y(t)=exp(-t)-exp(-2*t)")
```

```
figure
d=gca()
plot(t,yy);
polyl=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('y(t)','t')
```

3.

```
clear;
clc;
close;
disp("dy(t)/dt+2y(t)=x(t)");
w=0.1:0.1:10;
t=w;
dw=.1;
Xw=ones(1,length(w))./(%i*w);
Hw=ones(1,length(w))./(2+%i*w);
Yw=Xw.*Hw;
y=Yw*exp(%i*t'*w)*dw;
d=gca()
plot(t,y);
poly1=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('y(t)','t')
yy=0.5*(1-exp(-2*t));
disp("y(t)=0.5(1-exp(-2*t))")
figure
```

```
d=gca()
plot(t,yy);
polyl=d.children.children;
poly1.thickness=3;
poly1.foreground=2;
xtitle('y(t)','t')
```

Practical 9

4A. System Response Using Z-Transform

1.
```
clear;
clc;
close;
n=0:1:20;
x=[1 zeros(1,20)];
b=[1 -0.5];
a=[1 -1 3/16];
yanaly=0.5*(0.75).^n+0.5*(0.25).^n;//analytical solution
ymat=filter(b,a,x);
subplot(3,1,1);
plot2d3(n,x);
xlabel('n');
ylabel('x(n)');
title('INPUT SEQUENCE(IMPULSE FUNCTION)');
subplot(3,1,2);
plot2d3(n,yanaly);
xlabel('n');
ylabel('y(n)');
title('OUTPUT SEQUENCE yanaly');
```

2.

```
clear;
clc;
close;
n=0:1:20;
x=n;
b=[0 1 1];
a=[1 -0.7 0.12];
yanaly=38.89*(0.4).^n-26.53*(0.3).^n-12.36+4.76*n;//analytical solution
```

```
ymat=filter(b,a,x);
subplot(3,1,1);
plot2d3(n,x);
xlabel('n');
ylabel('x(n)');
title('INPUT SEQUENCE(RAMP FUNCTION)')

subplot(3,1,2);
plot2d3(n,yanaly);
xlabel('n');
ylabel('y(n)');
title('OUTPUT SEQUENCE yanaly')

subplot(3,1,3);
plot2d3(n,ymat);
xlabel('n');
ylabel('y(n)');
title('OUTPUT SEQUENCE ymat');
```

3.

```
clear;
clc;
close;
n=0:1:20;
x=ones(1,length(n));
b=[0 1];
a=[1 -1 -1];
yanaly=0.447*(1.618).^n-0.447*(-0.618).^n;//analytical solution
ymat=filter(b,a,x);
subplot(3,1,1);
plot2d3(n,x);
xlabel('n');
ylabel('x(n)');
title('INPUT SEQUENCE(STEP FUNCTION)')

subplot(3,1,2);
plot2d3(n,yanaly);
xlabel('n');
ylabel('y(n)');
title('OUTPUT SEQUENCE yanaly')

subplot(3,1,3);
plot2d3(n,ymat,zf);
xlabel('n');
ylabel('y(n)');
title('OUTPUT SEQUENCE ymat');
```

4.

```
clear;
clc;
close;

z=%z;
a=(z+0.5)*(z-1);
b=z+0.2;
h=ldiv(b,a,4);
disp(h,"h(n)=");
```

4B. Impulse Response Using z-transform

1.
```
clear; clc;
close;
z=%z
HIZ=((z)*(z+1))/(z^2-z+0.5);
scf(1);
plzr(HIZ);
```

2.
```
clear;
clc;
close;
z=%z
HIZ=(z)/(z^2-z-1);
scf(1);
plzr(HIZ);
```

3.
```
clear;
clc;
close;
z=%z
HIZ=((z)*(z-1))/((z-0.25)*(z-0.5));
scf(1);
plzr(HIZ);
```

4.
```
clear;
clc;
close;
z=poly(0,'z');
H=(1+z)/(1+3/4*z+1/8*z^2);
pole=roots(1+z);
zero=roots(1+3/4*z+1/8*z^2);
disp(H,'System Transfer Function H(z)=');
disp(zero, 'System zeros are at');
disp(pole, 'System poles are at ');
```

5.
```
clear;clc;
z=%z;
az=2*z*(2+1);
bz=(z-1/3)*((z^2)+1/4)*((z^2)+4*z+5);
poles=roots(bz)
zeroes=roots(az)
h=az/bz
plzr(h)
```