LAB ASSIGNMENT – 5

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COURSE CODE	MAT2002
COURSE NAME	APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS
SLOT	L1+L2
FACULTY	UMA K

EXPERIMENT 4(B): SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATION

Q. Solve in series the equation $\frac{d^2y}{dx^2} + y = 0.$

MATLAB CODE:-

```
clc
clear
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
d2y = diff(dy);
gde = collect(d2y+y,x);
cof=coeffs(gde,x);
A2=solve(cof(1),a2);
A3=solve(cof(2),a3);
y=subs(y,[a2,a3],[A2,A3]);
y=coeffs(y,[a1 a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+ ...)+B(',char(y(2)),'+ ...)'])
```

OUTPUT:-

Command Window

```
Solution is
y=A(1 - x^2/2+ ...)+B(x - x^3/6+ ...)
```

EXPERIMENT 5(A): SOLUTION OF DIFFERENCE EQUATION BY Z-TRANSFORMS

Q. Solve $9y_{n+2}+9y_{n+1}+2y_n=0, n\geq 0$, with $y_0=1$ and $y_1=1$.

MATLAB CODE:-

```
clear all
clc
syms n z y(n) Y
yn=y(n);
yn1=y(n+1);
yn2=y(n+2);
F = input('Input the coefficients [a,b,c]: ');
a=F(1);b=F(2);c=F(3);
nh = input('Enter the non-homogenous part f(n): ');
eqn=a*yn2+b*yn1+c*yn-nh;
ZTY=ztrans(eqn);
IC=input('Enter the initial conditions in the form [y0,y1]:');
y0=IC(1);y1=IC(2);
ZTY=subs(ZTY,{'ztrans(y(n),n,z)','y(0)','y(1)'},{Y,y0,y1});
eq=collect(ZTY,Y);
Y=simplify(solve(eq,Y));
yn=simplify(iztrans(Y));
disp('The solution of the difference equation yn=')
disp(yn);
m=0:20;
y=subs(yn,n,m);
stem(y)
title('Difference equation');
xlabel('n'); ylabel('y(n)');
```

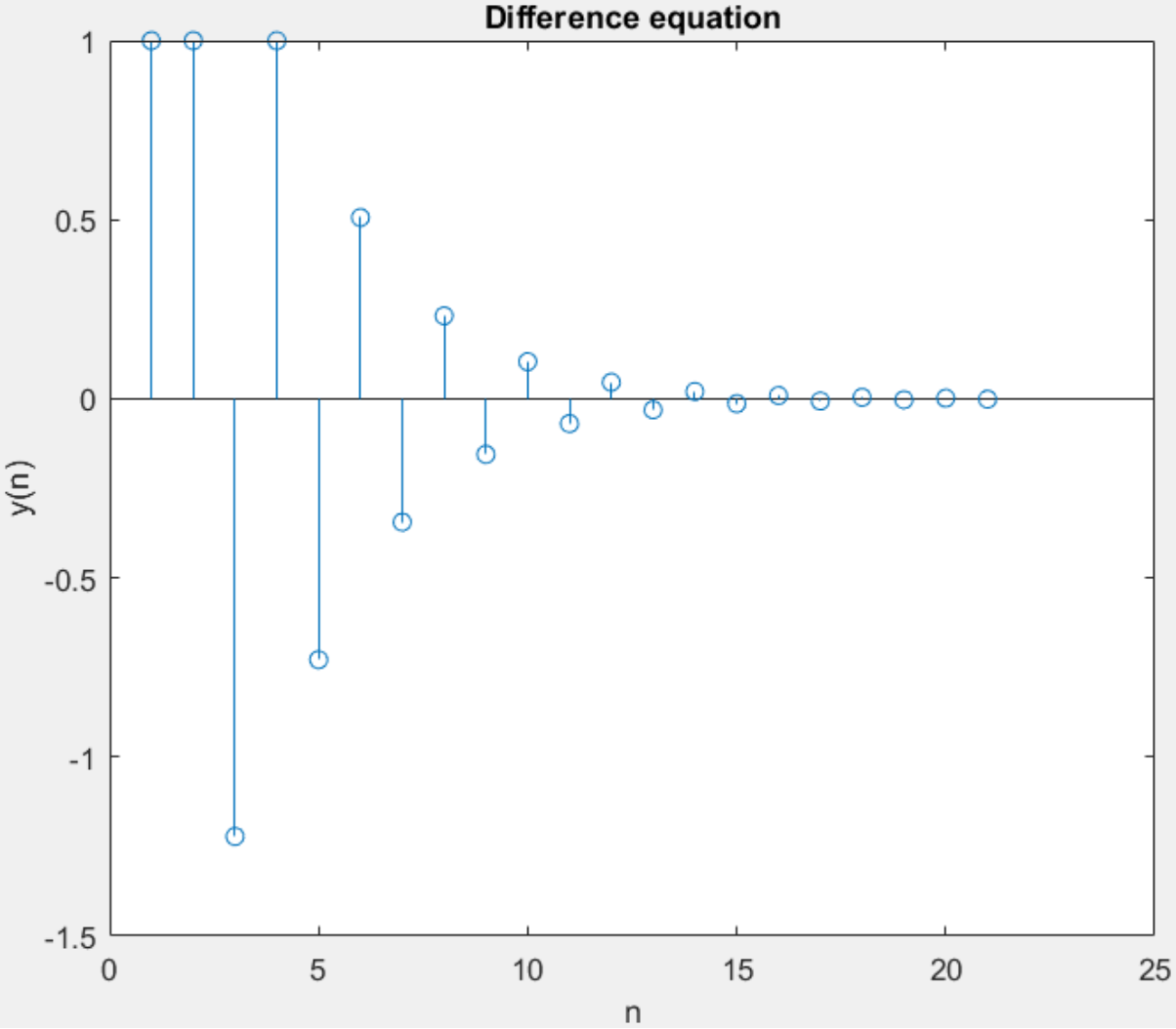
INPUT:-

```
Command Window
Input the coefficients [a,b,c]: [9 9 2]
Enter the non-homogenous part f(n): 0
Enter the initial conditions in the form [y0,y1]:[1 1]
```

OUTPUT:-

```
Command Window
The solution of the difference equation yn=
5*(-1/3)^n - 4*(-2/3)^n
```

FIGURE:-



EXPERIMENT 5(B):

SOLUTION OF HOMOGENEOUS LINEAR DIFFERENCE EQUATION

Q. The deer population of a region was 200 at a certain time. After 1 year the population increased to 220. Given that the increase in population from $(n+1)^{st}$ and $(n+2)^{nd}$ years is twice the increase from n^{th} and $(n+1)^{st}$ years. Write a recurrence relation that defines the deer population at time n and hence solve it.

MATLAB CODE:-

```
clear all
clc
syms n k1 k2 L
F = input('Input the coefficients [a,b,c]: ');
a=F(1);b=F(2);c=F(3);
ch_eqn=a*L^2+b*L+c; %Characteristic equation
L=solve(ch_eqn);
L1=L(1);L2=L(2);
D=b^2-4*a*c;
if(D>0) % Roots are real and different
y1=L1^n;
y2=L2^n;
elseif (D==0)% Roots are real and equal
 y1=L1^n;
 y2=n*L1^n;
else % Roots are complex
 rho=abs(L1); t=angle(L1);
 y1 = (rho^n)*cos(n*t);
 y2 = (rho^n)*sin(n*t);
end
yn = k1*y1+k2*y2;
check=input('If initial conditions are known, then enter 1 else enter 0:');
if (check == 1)
 IC=input('Enter the initial conditions [y(0),y(1)]');
 eq1=(subs(yn,n,0)-IC(1));
 eq2=(subs(yn,n,1)-IC(2));
 [k1,k2]=solve(eq1,eq2);
 yn=simplify(subs(yn));
 m=0:20;
y=subs(yn,n,m);
stem(y)
title('Difference equation');
xlabel('n'); ylabel('y(n)');
end
disp('The Solution of the given Homogeneous equation is y_n= ');
disp(collect(collect(yn,y1),y2))
```

INPUT:-

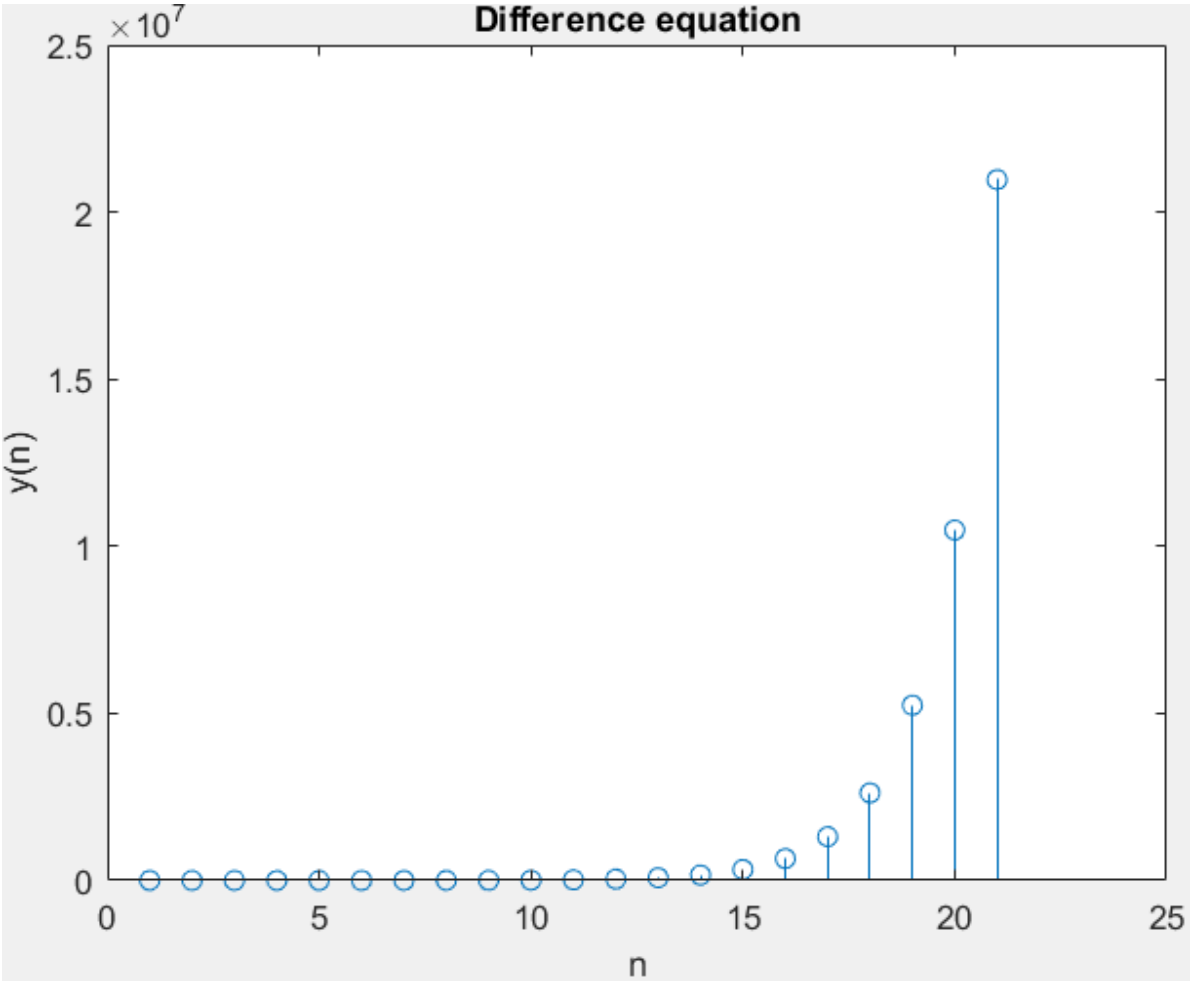
Command Window

```
Input the coefficients [a,b,c]: [1 -3 2]
If initial conditions are known, then enter 1 else enter 0: 1
Enter the initial conditions [y(0),y(1)]: [200 220]
```

OUTPUT:-

```
Command Window
   The Solution of the given Homogeneous equation is y_n=
   20*2^n + 180
```

FIGURE:-



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