LAB ASSIGNMENT – 4

NAME	PRIYAL BHARDWAJ
REG. NO.	18BIT0272
COURSE CODE	MAT2002
COURSE NAME	APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS
SLOT	L1+L2
FACULTY	UMA K

EXPERIMENT 3(B):

Solution of Linear differential equations by Laplace transforms

Q. Solve y''+2y'+10y=1+5$(t-5), y(0)=1, y'(0)=2 .

MATLAB CODE:-

```
clear all
clc
syms t s y(t) Y
dy(t)=diff(y(t));
d2y(t)=diff(y(t),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(x): ');
eqn=a*d2y(t)+b*dy(t)+c*y(t)-nh;
LTY=laplace(eqn,t,s);
IC = input('Enter the initial conditions in the form [y0,Dy(0)]: ');
y0=IC(1);dy0=IC(2);
LTY=subs(LTY,{'laplace(y(t), t, s)','y(0)','D(y)(0)'},{Y,y0,dy0});
eq=collect(LTY,Y);
Y=simplify(solve(eq,Y));
yt=simplify(ilaplace(Y,s,t));
disp('The solution of the differential equation y(t)=')
disp(yt);
ezplot(yt,[y0,y0+2]);
```

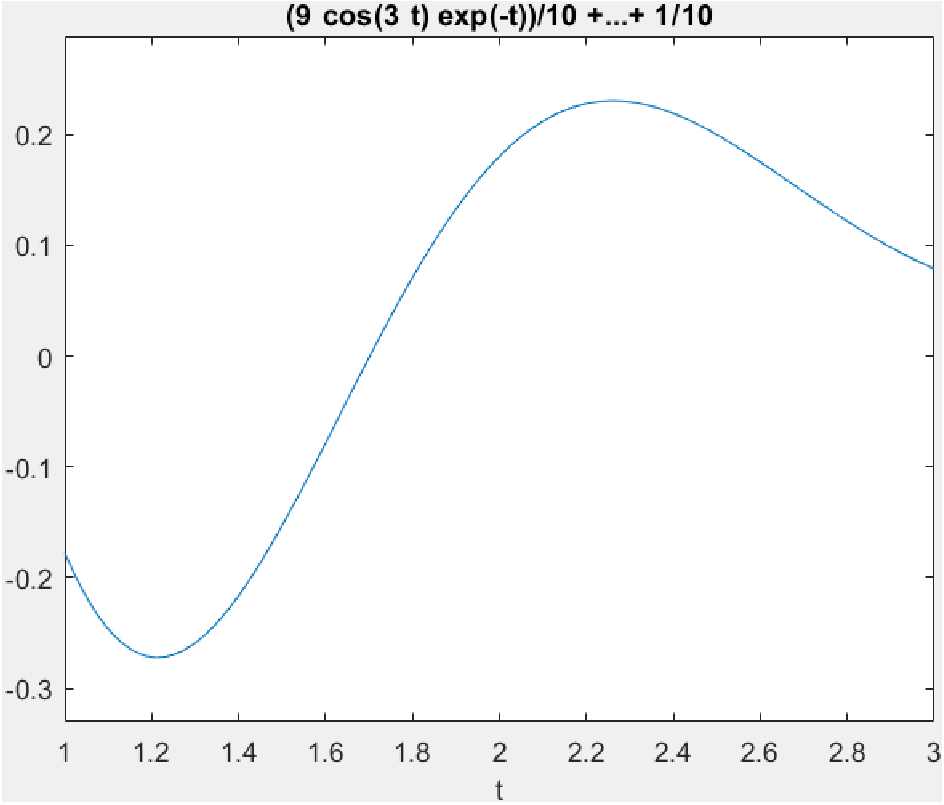
INPUT:-

```
Input the coefficients [a,b,c]: [1 2 10]
Enter the non-homogenous part f(x): 1+5*dirac(t-5)
Enter the initial conditions in the form [y0,Dy(0)]: [1,2]
```

OUTPUT:-

```
The solution of the differential equation y(t)=
(9*cos(3*t)*exp(-t))/10 + (29*sin(3*t)*exp(-t))/30 + (5*heaviside(t - 5)*exp(5 - t)*sin(3*t - 15))/3 + 1/10
```

FIGURE:-



EXPERIMENT 4(A): Solution of System of 2nd order differential equations of the form Y” + AY = 0 .

Q. Solve $y_1'' = -5 y_1 - 2 y_2$; $y_2'' = -2 y_1 - 2 y_2$ by Diagonalization

MATLAB CODE:-

```
clear all
clc
syms x t
A=input('Enter the coefficient matrix A: ');
lambda=eig(A);
n=length(lambda);
for i=1:n
    P(:,i)=null(A-lambda(i)*eye(size(A)),'r');
end
disp('The Modal Matrix is: ');
disp(P);
D=inv(P)*A*P;
sol1=dsolve(strcat('D2x=',num2str(D(1)),'*x'),'t');
sol2=dsolve(strcat('D2x=',num2str(D(4)),'*x'),'t');
disp('The solution of the decoupled system is: ');
disp(sol1); disp(sol2);
disp('The solution of the original system is: ');
Y=P*[sol1;sol2];
```

INPUT/OUTPUT:-

```
Enter the coefficient matrix A: [5 2;2 2]

lambda =

     1
     6


n =

     2

The Modal Matrix is:
   -0.5000    2.0000
    1.0000    1.0000

The solution of the decoupled system is:
C2*exp(t) + C1*exp(-t)

C3*exp(6^(1/2)*t) + C4*exp(-6^(1/2)*t)

The solution of the original system is:

Y =

 2*C3*exp(6^(1/2)*t) + 2*C4*exp(-6^(1/2)*t) - (C2*exp(t))/2 - (C1*exp(-t))/2
            C3*exp(6^(1/2)*t) + C4*exp(-6^(1/2)*t) + C2*exp(t) + C1*exp(-t)
```