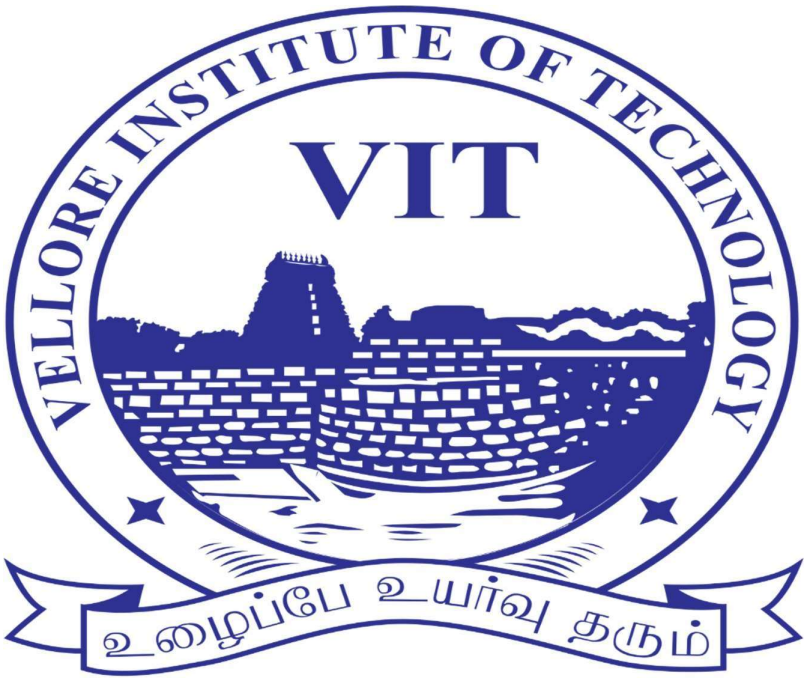

Application of Differential Equations

Lab – 3

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1. Using Matlab, solve the following

$(2x - 1)^2 \, d^2y/dx^2 + (2x - 1) \, dy/dx - 2y = 8x^2 - 2x + 3$

Code:

```
syms x r c1 c2 t
k1=input('Enter coefficient of (ax+b)^2 d^2y/dx^2:');
k2=input('Enter coefficient of (ax+b) dy/dx:');
k3=input('Enter coefficient of y:');
a=input('Enter the value of a:');
b=input('Enter the value of b:');
f1=input('Enter f in terms of x:');
f=simplify(subs(f1,x,(exp(t)-b)/a));
eq=k1*a^2*r^2+(a*k2-a^2*k1)*r+k3;
r=solve(eq,r);
p=real(r(1));
q=imag(r(1));
if q~=0
     y1=exp(p*t)*cos(q*t);
     y2=exp(p*t)*sin(q*t);
elseif r(1)==r(2)
     y1=exp(p*t);
     y2=t*exp(p*t);

else
     y1=exp(r(1)*t);
     y2=exp(r(2)*t);
end
yc=c1*y1+c2*y2
w=y1*diff(y2,t)-y2*diff(y1,t)
yp=-y1*int(y2*f/(a^2*k1*w),t)+y2*int(y1*f/(a^2*k1*w),t)
yy=yc+yp
y1=subs(yy,t,log(a*x+b))
disp('General solution of the given ODE is given by')
disp(simplify(y1))
```

Output –

```
yp =

exp(t)*(t/2 - (2*exp(-t))/3 + exp(t)/3) - exp(t)/3 - (2*exp(2*t))/15 - 4/3


yy =

exp(t)*(t/2 - (2*exp(-t))/3 + exp(t)/3) - exp(t)/3 - (2*exp(2*t))/15 + c2*exp(t) + c1*exp(-t/2) - 4/3


y1 =

c1/(2*x - 1)^(1/2) - (2*x)/3 - (2*(2*x - 1)^2)/15 + (2*x - 1)*((2*x)/3 + log(2*x - 1)/2 - 2/(3*(2*x - 1)) - 1/3) + c2*(2*x - 1)

General solution of the given ODE is given by
2*c2*x - (22*x)/15 - log(2*x - 1)/2 - c2 + c1/(2*x - 1)^(1/2) + x*log(2*x - 1) + (4*x^2)/5 - 22/15

>> %19BCE1740
>> %PRANAO VIVEK
```

Input –

```
>> Mar_04
Enter coefficient of (ax+b)^2 d^2y/dx^2:
1
Enter coefficient of (ax+b) dy/dx:
1
Enter coefficient of y:
-2
Enter the value of a:
2
Enter the value of b:
-1
Enter f in terms of x:
8*x^2 - 2*x + 3
```

Lab – 4

Q1)

Solve the following initial value problem using Laplace Transform

$$\frac{dy}{dt} + 2y = 12e^t, y(0) = 3$$

Code:

```
syms s t Y
a = input('The Coefficient of D2y = ');
b = input('The Coefficient of Dy = ');
c = input('The Coefficient of y = ');
nh = input('Enter the non homogenous part = ');
F = laplace(nh, t, s);
if (a==0)
d = input('The initial value of y at 0 is ');
Y1 = s*Y - d;
Sol = solve(b*Y1 + c*Y - F, Y);
else
d = input('The initial value of y at 0 is ');
e = input('The initial value of Dy at 0 is ');
Y1 = s*Y - d;
Y2 = s*Y1 - e;
Sol = solve(a*Y2+b*Y1 + c*Y - F, Y);
end
originalsol = ilaplace(Sol,s,t);
y = simplify(originalsol)
ezplot(y)
```

Input –

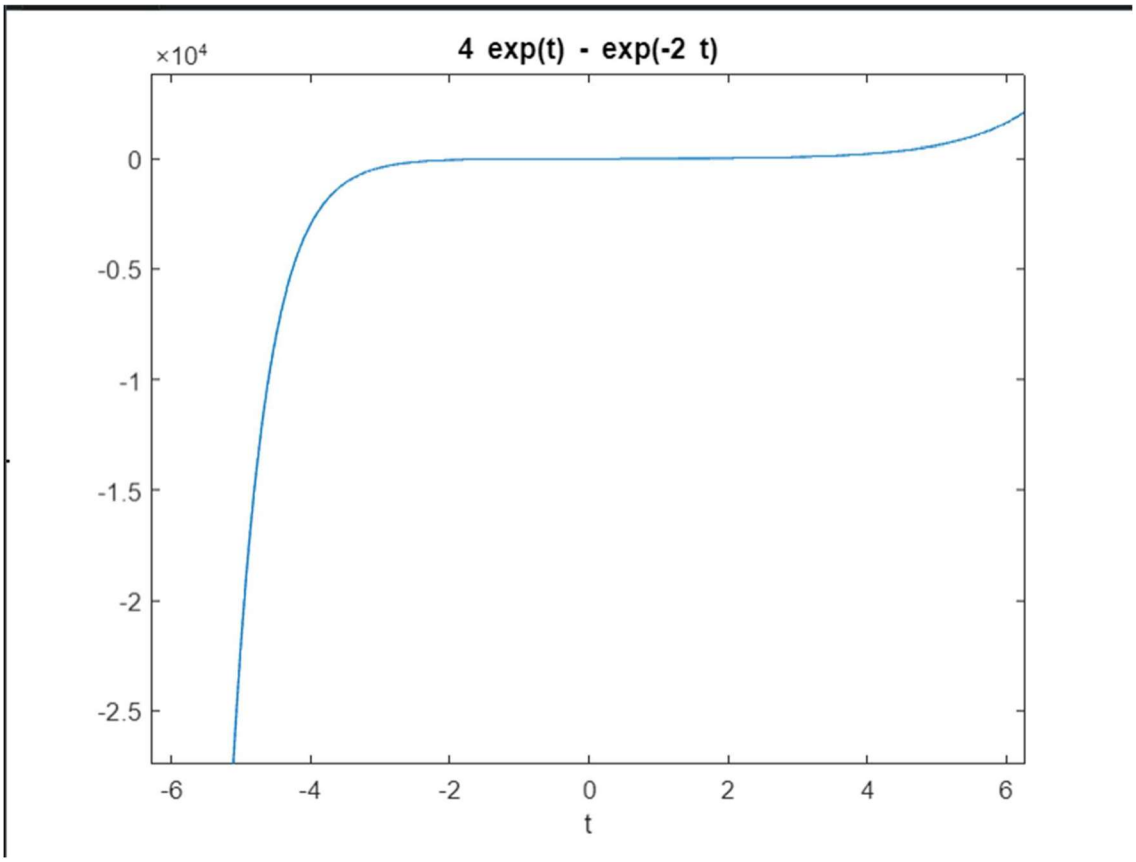
```
>> laplace1
The Coefficient of D2y =
0
The Coefficient of Dy =
1
The Coefficient of y =
2
Enter the non homogenous part =
12*exp(t)
The initial value of y at 0 is
3

y =

4*exp(t) - exp(-2*t)

>>
```

Plot –



Q2)

Solve the following initial value problem using Laplace Transform

$$\frac{d^2y}{dt^2} + 2y = 0, y(0) = 1, y'(0) = 1$$

Code-

```
clc
clear all
syms t s Y y(t)%%%%y=y(t) is the dependent variable given in the DE%%%%Y=Y(s) is the Laplace transform of y(t)
%y=sym('y(t)')
a = input('The Coefficient of D2y = ');
b = input('The Coefficient of Dy = ');
c = input('The Coefficient of y = ');
nh = input('Enter the non homogenous part = ');
%eqn=a*diff(sym('y(t)'),2)+b*diff(sym('y(t)'),1)+c*sym('y(t)')-nh
eqn=a*diff(y,2)+b*diff(y,1)+c*y-nh
LTY=laplace(eqn,t,s);
if (a==0)
d = input('The initial value of y at 0 is ');
LTY=subs(LTY,{laplace(y(t), t, s),y(0)},{Y,d});
else
d = input('The initial value of y at 0 is ');
e = input('The initial value of Dy at 0 is ');
LTY=subs(LTY,{laplace(y(t), t, s),y(0),subs(diff(y),t,0)},{Y,d,e}); %%%%Dy=diff(y, t),Dy(t),Dy(0)%%%%
end
eq=collect(LTY,Y); %%%%% Y*4+Y*x===collect=== Y*(4+x)
Y=simplify(solve(eq,Y));
y=simplify(ilaplace(Y,s,t))
ezplot(y)
```

Input-

```
The Coefficient of D2y =
1
The Coefficient of Dy =
0
The Coefficient of y =
2
Enter the non homogenous part =
0

eqn(t) =

2*y(t) + diff(y(t), t, t)

The initial value of y at 0 is
1
The initial value of Dy at 0 is
1

y =

cos(2^(1/2)*t) + (2^(1/2)*sin(2^(1/2)*t))/2

>>
```

Plot-