MATLAB REPORT

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1. MATLAB ONRAMP CERTIFICATE :


MathWorks | Training Services

Course Completion Certificate

PRATHAPANI SATWIKA

has successfully completed 100% of the self-paced training course

MATLAB Onramp

DIRECTOR, TRAINING SERVICES

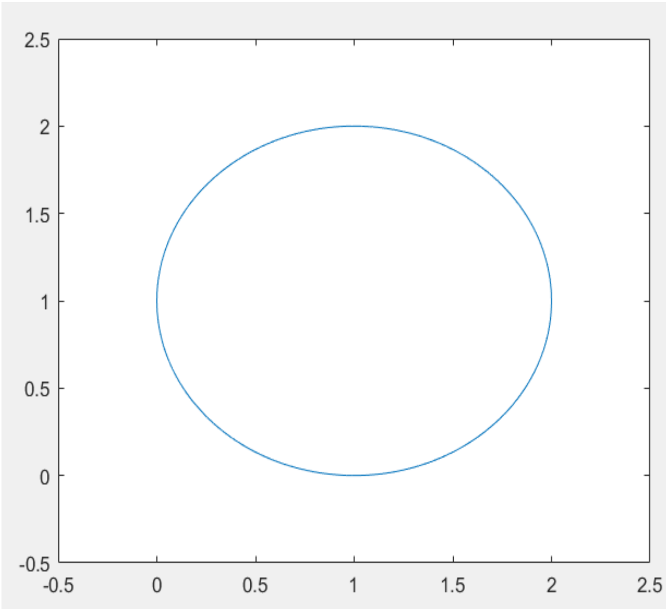
01 January 2021

EXPERIMENT NO. 1

FLOW CONTROL AND CONDITIONAL STATEMENTS

Q1. Plot a circle of given radius with center (h , k). Input the numerical values for h, k and r.

```
% Circle equation: (x-h)^2 + (y-k)^2 = r^2
% Center: (h,k)   Radius: r
h = 1;
k = 1;
r = 1;


xmin = h - r;
xmax = h + r;
x_res = 1e-3;
X = xmin:x_res:xmax;


N = length(X);
x = [X flip(X)];


ytemp1 = zeros(1,N);
ytemp2 = zeros(1,N);
for i = 1:1:N
    square = sqrt(r^2 - X(i)^2 + 2*X(i)*h - h^2);
    ytemp1(i) = k - square;
    ytemp2(N+1-i) = k + square;
end
y = [ytemp1 ytemp2];


c = 1.5;
figure(1)
plot(x,y)
axis([h-c*r h+c*r k-c*r k+c*r]);
```



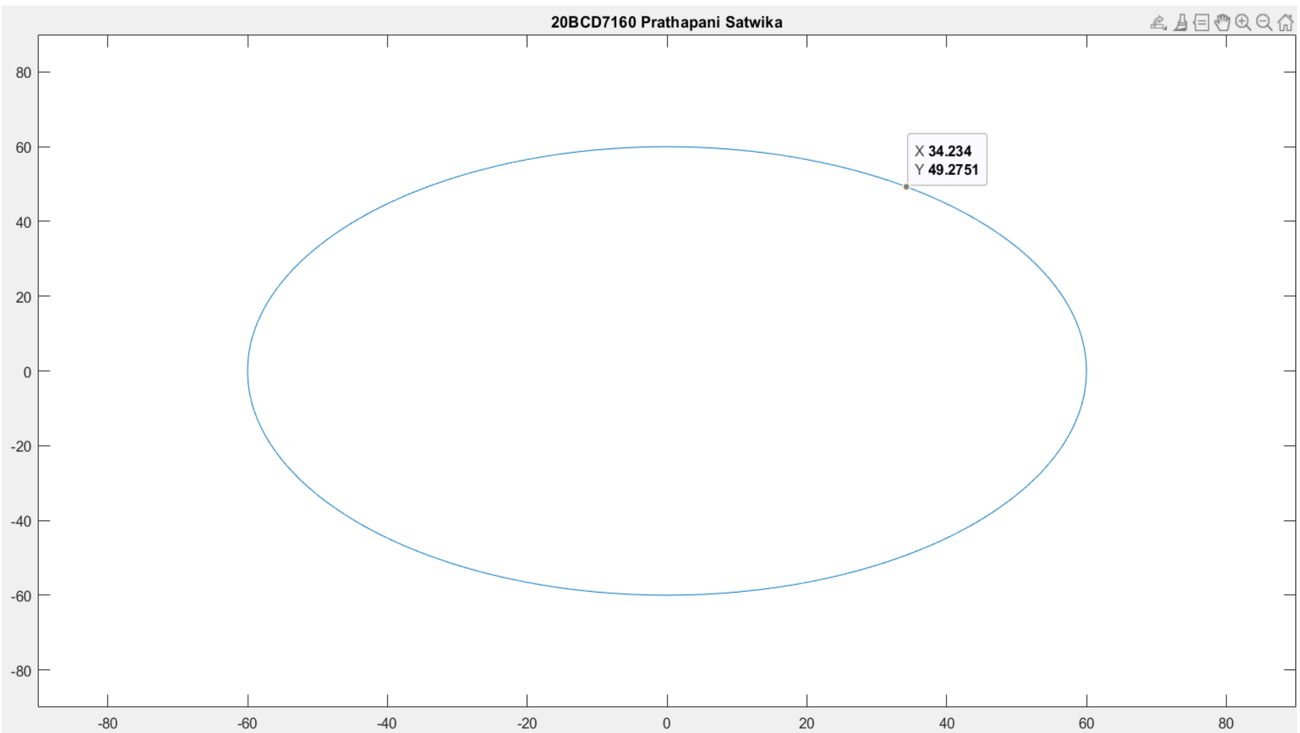
Q2. Write a matlab code to print your name if the last two digits of your roll number form an even number, otherwise plot a circle centered at origin having radius as the last two digits of your roll number.

CODE :

```
% Circle equation: (x-h)^2 + (y-k)^2 = r^2
% Center: (h,k)   Radius: r
h = 0;
k = 0;
r = 60;

xmin = h - r;
xmax = h + r;
x_res = 1e-3;
X = xmin:x_res:xmax;

N = length(X);
x = [X flip(X)];

ytemp1 = zeros(1,N);
ytemp2 = zeros(1,N);
for i = 1:1:N
    square = sqrt(r^2 - X(i)^2 + 2*X(i)*h - h^2);
    ytemp1(i) = k - square;
    ytemp2(N+1-i) = k + square;
```

```
end
y = [ytemp1 ytemp2];

c = 1.5;
figure(1)
plot(x,y)
axis([h-c*r h+c*r k-c*r k+c*r]);
title('20BCD7160 Prathapani Satwika')
```

OUTPUT :



EXPERIMENT NO. : 2

APPLICATIONS TO DERIVATIVES

Question 1: A box with an open top is to be constructed from a rectangular piece of cardboard with dimensions 12 in. by 20 in. by cutting out equal squares of side x at each corner and then folding up the sides as in the figure. Find x so that the volume is maximum.

CODE :

```
%clc
%clear all
syms x
f=x*(12-2*x)*(20-2*x);
df=diff(f);
roots = solve(df==0);
ddf=diff(df);
ddfval=subs(ddf, x, roots);
for i=1:length(ddfval)
    if ddfval(i)<0
        fprintf('f is maximum')
        xmaxvalue=double(roots(i))
        fmax=subs(f, x, roots(i))
        maxvolume=double(fmax)
    else
        fprintf('f is minimum')
        xminvalue=double(roots(i))
        fmin=subs(f, x, roots(i))
        minvolume=double(fmin)
    end
end
```

OUTPUT :

f is maximum

xmaxvalue =

2.4274

fmax =

-((4*19^(1/2))/3 + 4/3)((2*19^(1/2))/3 - 16/3)((4*19^(1/2))/3 + 28/3)

maxvolume =

262.6823

f is minimum

xminvalue =

8.2393

fmin =

((4*19^(1/2))/3 - 4/3)((2*19^(1/2))/3 + 16/3)((4*19^(1/2))/3 - 28/3)

minvolume =

-129.9415

Question 2 : An open rectangular box with the square base is to be made from 48ft^2 of material. What dimensions will result in a box with the largest possible volume?

CODE :

```
clc
clear all
syms x y L;
f=(x^2)*y;
diff_f=gradient(f, [x, y]);
fx=diff_f(1);
fy=diff_f(2);
g=(x^2+4*x*y)-67;
diff_g=L*gradient(g, [x, y]);
gx=diff_g(1);
gy=diff_g(2);
eqns=[fx-gx==0,fy-gy==0,g==0];
vars=[x y L]
[sol_x, sol_y, sol_L] = solve(eqns, vars);
xyL_Values= [sol_x(:), sol_y(:), sol_L(:)]
[m,n]=size(xyL_Values);
for i=1:m
    result(i)=subs(f,[x,y,L],xyL_Values(i,:))
end
result;
f_min=min(result);
ind_fmin=find(result==f_min);
f_max=max(result)
ind_fmax=find(result==f_max);
mvar=xyL_Values(ind_fmax,:)
```

OUTPUT :

```
vars =

[x, y, L]
```

```
xyL_Values =

[-201^(1/2)/3, -201^(1/2)/6, -201^(1/2)/12]
[ 201^(1/2)/3,  201^(1/2)/6,  201^(1/2)/12]


result =

-(67*201^(1/2))/18


result =

[-(67*201^(1/2))/18, (67*201^(1/2))/18]


f_max =

(67*201^(1/2))/18


mvar =

[201^(1/2)/3, 201^(1/2)/6, 201^(1/2)/12]
>>
```

EXPERIMENT NO. : 3

APPLICATION TO INTEGRALS

Q1. Find the mass of a plate bounded by $y = x$ and $x = 1$, with density $\mu(x, y) = 3 - x - y$. Print the output with your name and roll number.

CODE :

```
clc
clear all
syms x y
fprintf('20BCD7160 Prathapani Satwika')
int(int(3-x-y,x,y,1),y,0,1)
```

OUTPUT :

20BCD7160 Prathapani Satwika

ans =

1

>>

Q2. Find the volume of the region D enclosed by the surfaces $z = x^2 + 3y^2$ and $z = 8 - x^2 - y^2$.

CODE :

```
clc
clear all
syms x y z
fprintf('20BCD7160 Prathapani Satwika')
int(int(int(1,z,(x^2)+3*(y^2),8-(x^2)-(y^2)),...
    x,-sqrt(4-2*(y^2)),sqrt(4-2*(y^2))),y,-sqrt(2),sqrt(2))
```

OUTPUT :

20BCD7160 Prathapani Satwika

ans =

8*pi*2^(1/2)

>>

Q3. Find average value of $F(x, y, z) = xyz$ throughout the cubical region D bounded by the coordinate planes $x = 2$, $y = 2$, and $z = 2$ in the first octant.

CODE :

```
clc
clear all
syms x y z xyz
fprintf('20BCD7160 Prathapani Satwika')
vol=int(int(int(1,z,0,2),y,0,2),x,0,2)
avg=(1/vol)*int(int(int(x*y*z,z,0,2),y,0,2),x,0,2)
```

OUTPUT :

20BCD7160 Prathapani Satwika

vol =

8

avg =

1

>>

EXPERIMENT NO. : 4

VECTOR CALCULUS

Q1. Find the gradient of the function $f = xyz$ and curl and divergence of vector field $\boldsymbol{F} = x\,2y\boldsymbol{i} + y\boldsymbol{j} + xy\boldsymbol{k}$.

CODE :

```
clc
clear all
syms x y z
f=x*y*z;
F=[(x^2)*y,y,y*z];
vars=[x, y, z];
fprintf('20BCD7160 Prathapani Satwika')
grad=gradient(f, vars)
divf=divergence(F, vars)
curlf=curl(F, vars)
```

OUTPUT :

20BCD7160 Prathapani Satwika
grad =

y*z
x*z
x*y

divf =

y + 2*x*y + 1

curlf =

z
0
-x^2

>>

Q2. Find the directional derivative of the function $f = x\cos(yz)$ at point $(-1,2,1)$ in the direction of the vector, $2i + j + 3k$. Print the output with your roll number and name.

CODE :

```
clc
clear all
syms x y z
f=x*cos(y*z);
vars=[x, y, z];
P=[-1,2,1];
u=[2,1,3];
norm(u);
unitu =u./norm(u);
fprintf('20BCD7160 Prathapani Satwika')
grad = gradient(f, vars)
gradval=subs(grad, vars, P);
DirDer = double(dot(gradval,unitu))
```

OUTPUT :

20BCD7160 Prathapani Satwika
grad =

    cos(y*z)
-x*z*sin(y*z)
-x*y*sin(y*z)

DirDer =

   1.4787

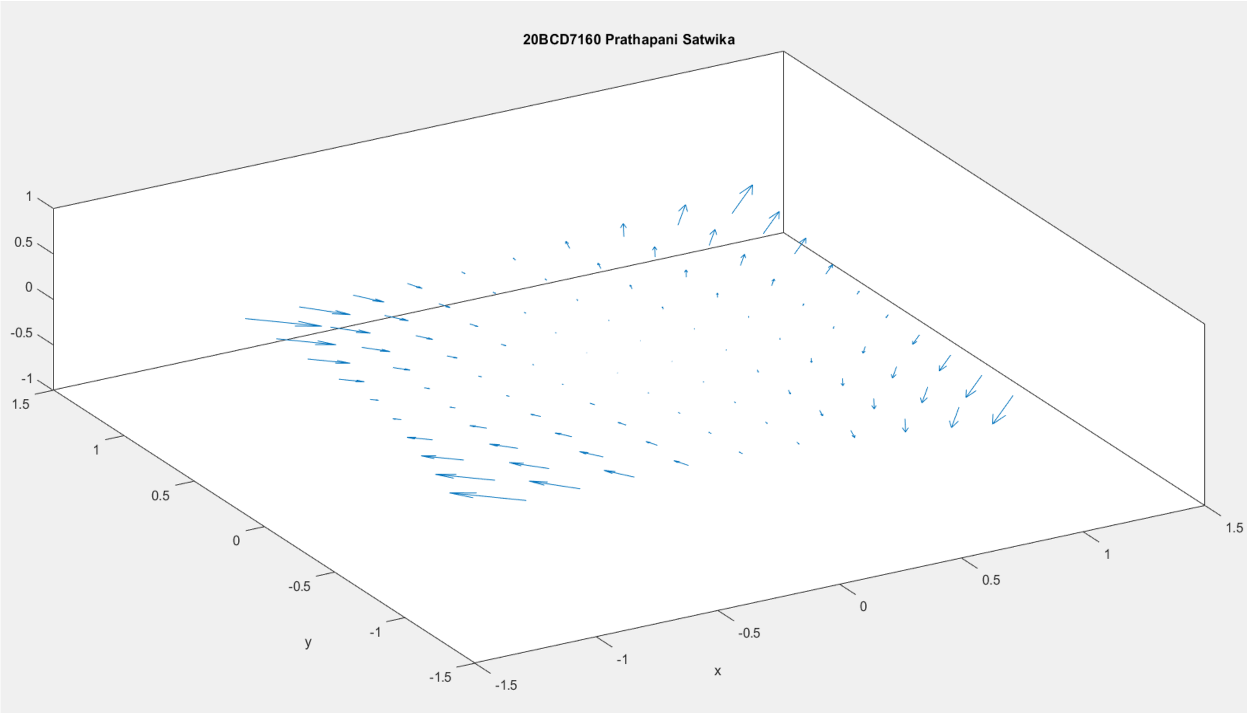
>>

Q3. Draw the two dimensional vector field for the vector $x\ 2y\boldsymbol{i} + xy\boldsymbol{j}$.

CODE :

```
clc
clear all
syms x y
f1 = inline((x^2)*y,'x','y');
f2 = inline(x*y,'x','y');
x = linspace(-1, 1, 10);
y = x;
[X,Y] = meshgrid(x,y);
U = f1(X,Y);
V = f2(X,Y);
quiver(X,Y,U,V,1)
view(-30,60);
axis on
xlabel('x')
ylabel('y')
title('20BCD7160 Prathapani Satwika')
```

OUTPUT :



EXPERIMENT NO . : 5

APPLICATION TO VECTOR INTEGRALS

Q1. Integrate $f\ (x, y, z) = x - 3y\ 2 + z$ over the line segment C joining the origin to

the point (1, 1, 1).

CODE :

```
clc
clear all
syms x y z t
f=x-3*(y^2)+z;
var=[x,y,z];
Par=[t,t,t];
F=subs(f,var,Par);
dr=[diff(Par(1),t),diff(Par(2),t),diff(Par(3),t)];
modr=norm(dr);
I = int(F*modr,t,0,1);
fprintf('20BCD7160 Prathapani Satwika \n')
disp('Line integral along the given curve is')
disp(I)
```

OUTPUT :

```
20BCD7160 Prathapani Satwika
Line integral along the given curve is
0

>>
```

Q2. Evaluate the line integral of $\boldsymbol{F}\ (x, y, z\ ) = z\boldsymbol{i} + xy\boldsymbol{j} - y\ 2\boldsymbol{k}$ along the curve C given by $\boldsymbol{r}\ t = t\ 2\ \boldsymbol{i} + t\boldsymbol{j} + t\ \boldsymbol{k}$, $0 \leq t \leq 1$.

CODE :

```
clc
clear all
syms t
```

```
x = t^2;
y = t;
z = sqrt(t);
f=[z,x*y, -(y^2)];
r = [x,y,z];
dr = [diff(r(1),t),diff(r(2),t),diff(r(3),t)];
F =  dot(f,dr);
I = int(F,t,0,1);
fprintf('20BCD7160 Prathapani Satwika\n');
disp('Line integral along the given curve is')
disp(I)
```

OUTPUT :

20BCD7160 Prathapani Satwika
Line integral along the given curve is
17/20

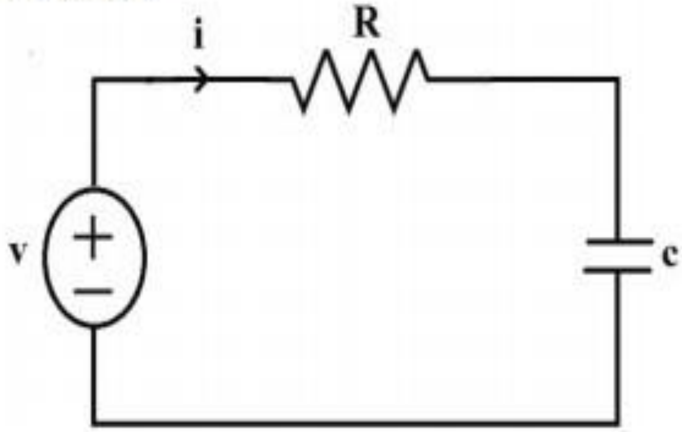
>>

EXPERIMENT NO. : 6

SOLVING DIFFERENTIAL EQUATIONS

Q1.

A condenser of capacity $C = 5 \times 10^{-5}$ farad is charged through a resistance $R = 200$ ohms by steady voltage $E = 2000$ volts. Calculate the current at the instant of closing the switch.



Hint: Let i be the current flowing in the circuit at any time t. Then by Kirchhoff's first law, we have sum of voltage drops across R and $C = E$.
i.e. $Ri + \frac{q}{C} = E \implies \frac{dQ}{dt} + \frac{1}{RC}Q = \frac{E}{R}$.
From the given data, we obtain the following eqaution

$$\frac{dQ}{dt} + 100Q = 10, Q(0) = 0.$$

CODE :

```
clc
clear all
syms Q(t)
ode=diff(Q,t,1)+100*Q==10;
cond1 = Q(0) == 0;
fprintf('20BCD7160 Prathapani Satwika')
QSol(t)=dsolve(ode,cond1)
current=diff(QSol(t))
```

OUTPUT :

20BCD7160 Prathapani Satwika
QSol(t) =

1/10 - exp(-100*t)/10

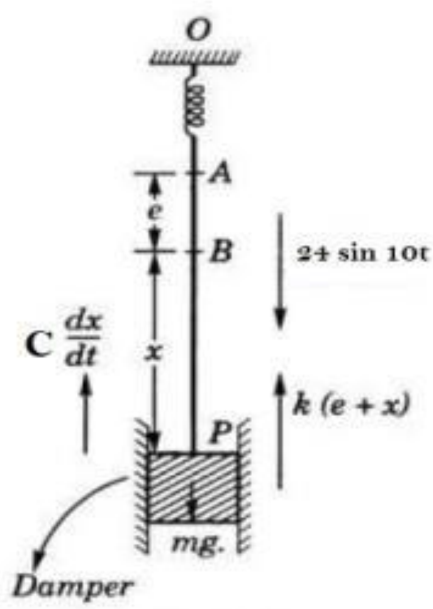
current =

10*exp(-100*t)

>>

Q2.

Example A $16lb$ weight is suspended from a spring having a constant $5lb/ft$. Assume that an external force given by $24\sin 10t$ and a damping force $4v$ are acting on the spring. Initially the weight is at rest as its equilibrium position. Find the position of the weight at any time.



Hint: $\frac{d^2x}{dt^2} + \frac{C}{m}\frac{dx}{dt} + \frac{k}{m}x = \frac{F(t)}{m}$. Here $m = w/g = 16/32 = 1/2, C = 4v, k = 5lb/ft, F(t) = 24\sin 10t, x(0) = 0, x'(0) = 0$.

by using we get $\frac{d^2x}{dt^2} + 8\frac{dx}{dt} + 10x = 48\sin 10t$.

CODE :

```
clc
clear all
syms x(t)
```

```
ode=diff(x,t,2) + 8*diff(x,t,1) + 10*x == 48*sin(10*t);
m = diff(x,t,1);
cond1 = x(0)==0;
cond2 = m(0)==0;
Array = [cond1, cond2];
fprintf('20BCD7160 Prathapani Satwika')
position(t) = dsolve(ode,Array)
```

OUTPUT :

20BCD7160 Prathapani Satwika

position(t) =

(4*6^(1/2)*exp(4*t + 6^(1/2)*t)*exp(-t*(6^(1/2) + 4))*(10*cos(10*t) - sin(10*t)*(6^(1/2) + 4)))/((6^(1/2) + 4)^2 + 100) - (4*6^(1/2)*exp(4*t - 6^(1/2)*t)*exp(t*(6^(1/2) - 4))*(10*cos(10*t) + sin(10*t)*(6^(1/2) - 4)))/((6^(1/2) - 4)^2 + 100) - (20*6^(1/2)*exp(t*(6^(1/2) - 4)))/(4*6^(1/2) - 61) + (20*6^(1/2)*exp(-t*(6^(1/2) + 4))*(488*6^(1/2) - 3817))/((4*6^(1/2) - 61)^2*(4*6^(1/2) + 61))

>>

EXPERIMENT NO. : 7

SOLVING ODE'S USING LAPLACE TRANSFORM

Q1. Find the Laplace Transform of the following functions

a). $f\ x = 1 - x + 2x\ 2$

b). $f\ x = 4e\ {-3t} - 10\sin\ 2$

CODE :

```
clc
clear all
syms f1(t) f2(t) s a
f1(t)= 1-t+2*(t^2);
f2(t)= 4*exp(-3*t)-10*sin(2*t);
fprintf('20BCD7160 Prathapani Satwika')
F1 = laplace(f1,t,s)
F2 = laplace(f2,t,s)
```

OUTPUT :

20BCD7160 Prathapani Satwika

F1 =

(s - 1)/s^2 + 4/s^3

F2 =

4/(s + 3) - 20/(s^2 + 4)

>>

Q2. Solve the ordinary differential equation $y'' + 2y' = 8t$, $y\,0 = 1$, $y'\,0 = 0$, using Laplace transform.

CODE :

```
clc
clear all
syms t s Y y(t) Dy(t)
Df=diff(y(t),t,1);
DDf=diff(y(t),t,2);
Eqn=DDf+2*Df==8*t;
LEQN=laplace(Eqn,t,s);
LT_Y=subs(LEQN,laplace(y,t,s),Y);
LT_Y=subs(LT_Y, y(0), 1);
LT_Y=subs(LT_Y, subs(diff(y(t), t), t, 0), 0);
ys=solve(LT_Y,Y);
fprintf('20BCD7160 Prathapani Satwika');
y=ilaplace(ys,s,t)
```

OUTPUT :

20BCD7160 Prathapani Satwika

y =

2*t^2 - exp(-2*t) - 2*t + 2

>>

Q3. Solve the equation y’’+ 16y = 16sin(2t) with the initial conditions that y(0) = 1, and y ‘ (0) = 0.

CODE :

```
clc
clear all
syms t s Y y(t) Dy(t)
Df=diff(y(t),t,1);
DDf=diff(y(t),t,2);
Eqn = DDf+16*y==16*sin(2*t);
LEQN = laplace(Eqn,t,s);
LT_Y =subs(LEQN,laplace(y,t,s),Y);
LT_Y=subs(LT_Y, y(0), 1);
LT_Y=subs(LT_Y, subs(diff(y(t), t), t, 0), 0);
ys=solve(LT_Y,Y);
fprintf('20BCD7160 Prathapani Satwika \n');
y = ilaplace(ys,s,t)
```

OUTPUT :

20BCD7160 Prathapani Satwika

y =

cos(4*t) + (4*sin(2*t))/3 - (2*sin(4*t))/3

>>