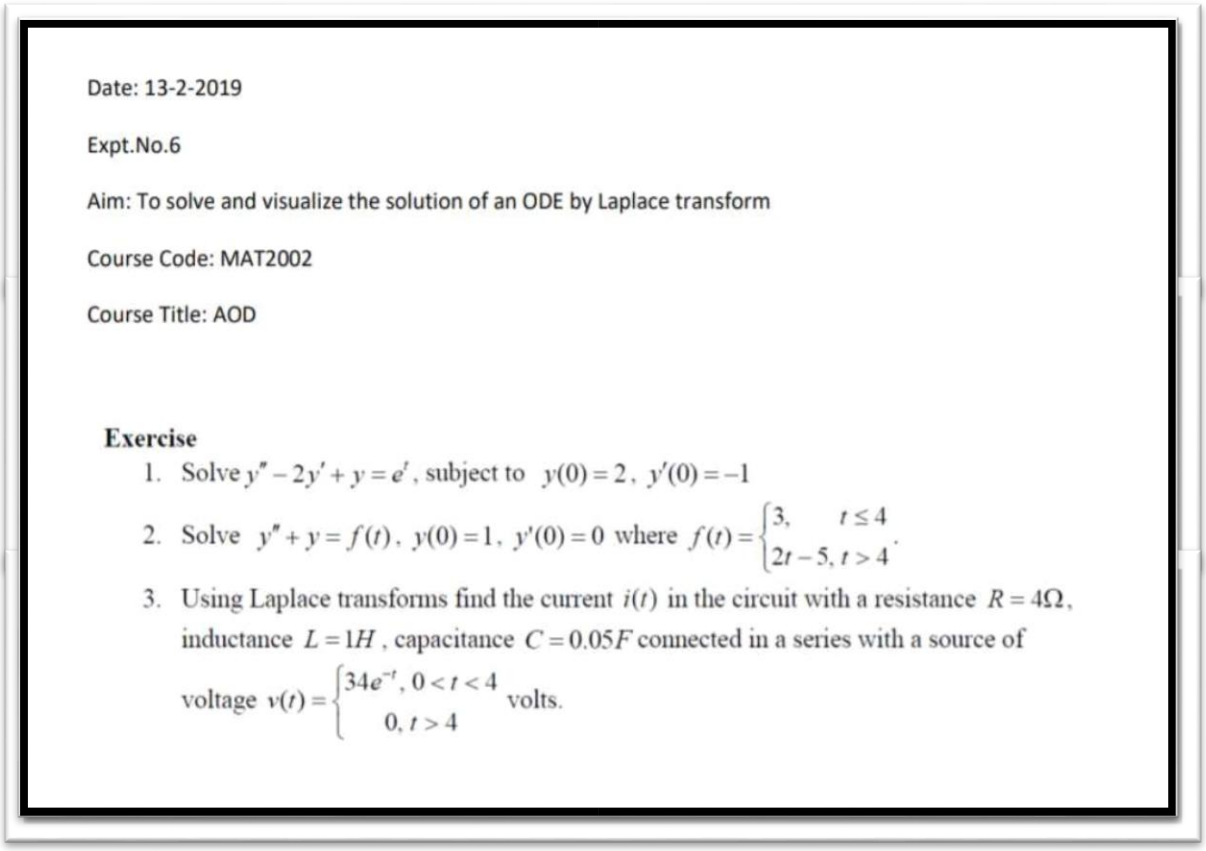
MATLAB ASSIGNMENT-7

DIFFRENTIAL EQUATIONS BY LAPLACE TRANSFORMS

- NAME: - ANSHIL SETH
- REG NO.: - 18BCI0173
- SLOT: - L15 +L16
- SESSION: - WINTER SEMESTER 2018-2019
- FACULTY: - PROF. POORNIMA T

DATE: - 13th February,2019

QUESTIONS:



Date: 13-2-2019

Expt.No.6

Aim: To solve and visualize the solution of an ODE by Laplace transform

Course Code: MAT2002

Course Title: AOD

Exercise

1. Solve $y'' - 2y' + y = e^t$, subject to $y(0) = 2,\ y'(0) = -1$
2. Solve $y'' + y = f(t),\ y(0) = 1,\ y'(0) = 0$ where $f(t) = \begin{cases} 3, & t \le 4 \\ 2t - 5, & t > 4 \end{cases}$.
3. Using Laplace transforms find the current $i(t)$ in the circuit with a resistance $R = 4\Omega$, inductance $L = 1H$, capacitance $C = 0.05F$ connected in a series with a source of voltage $v(t) = \begin{cases} 34e^{-t}, & 0 < t < 4 \\ 0, & t > 4 \end{cases}$ volts.

Answer 1

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),dy(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 AND OUTPUT: -

```
Input the coefficients [a,b,c]:
[1   -2 1]
Enter the non-homogenous part f(x):
exp(t)
Enter the initial conditions in the form [y0,Dy(0)]:
[2   -1]
The solution of the differential equation y(t)=
(exp(t)*(t^2 - 6*t + 4))/2
```

```
COMMAND WINDOW

Input the coefficients [a,b,c]:
[1 -2 1]
Enter the non-homogenous part f(x):
exp(t)
Enter the initial conditions in the form [y0,Dy(0)]:
[2 -1]
The solution of the differential equation y(t)=
(exp(t)*(t^2 - 6*t + 4))/2

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```
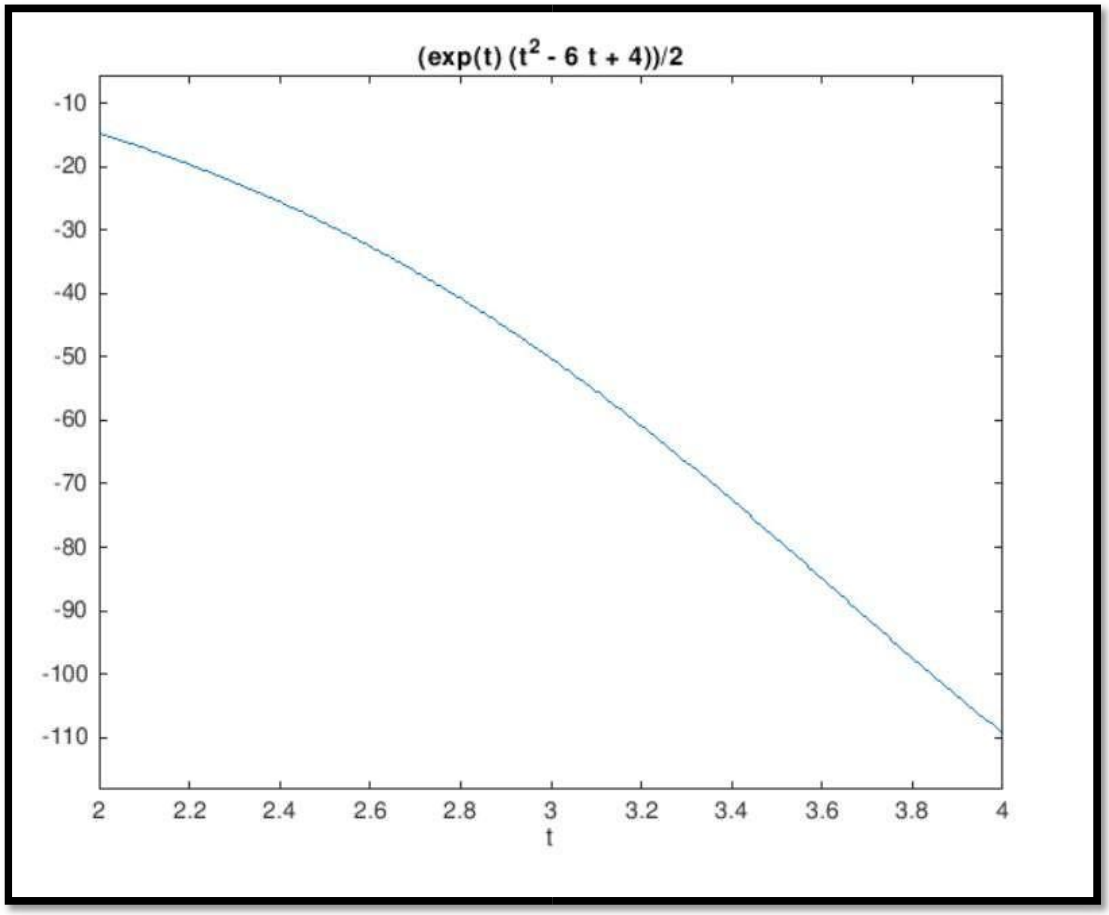
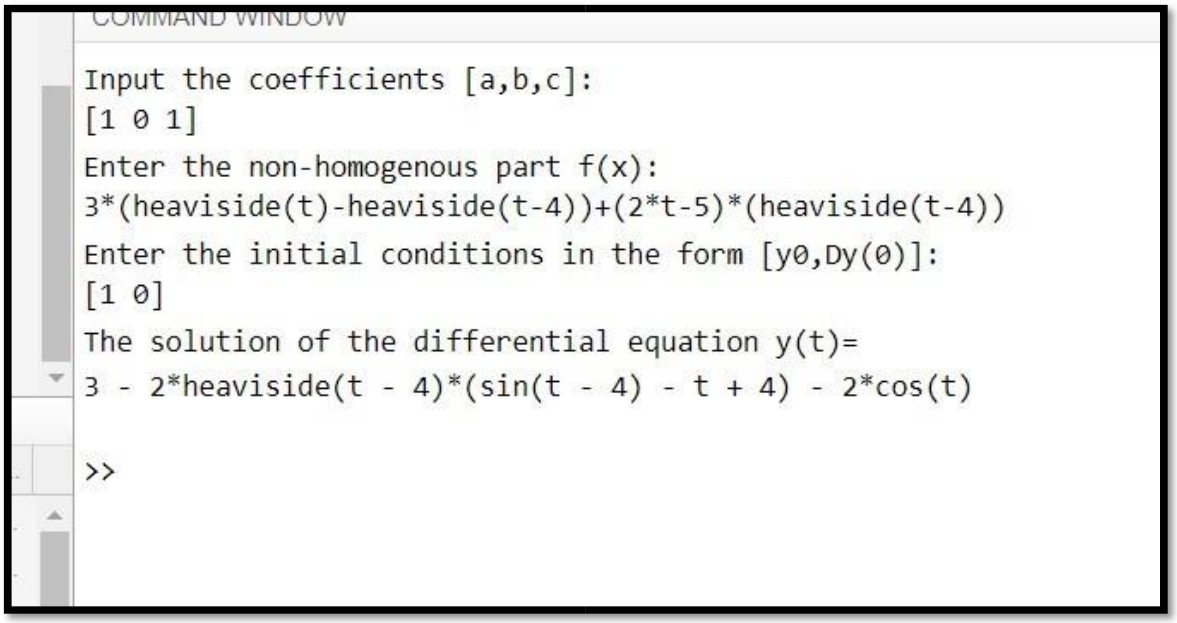



Answer 2: -

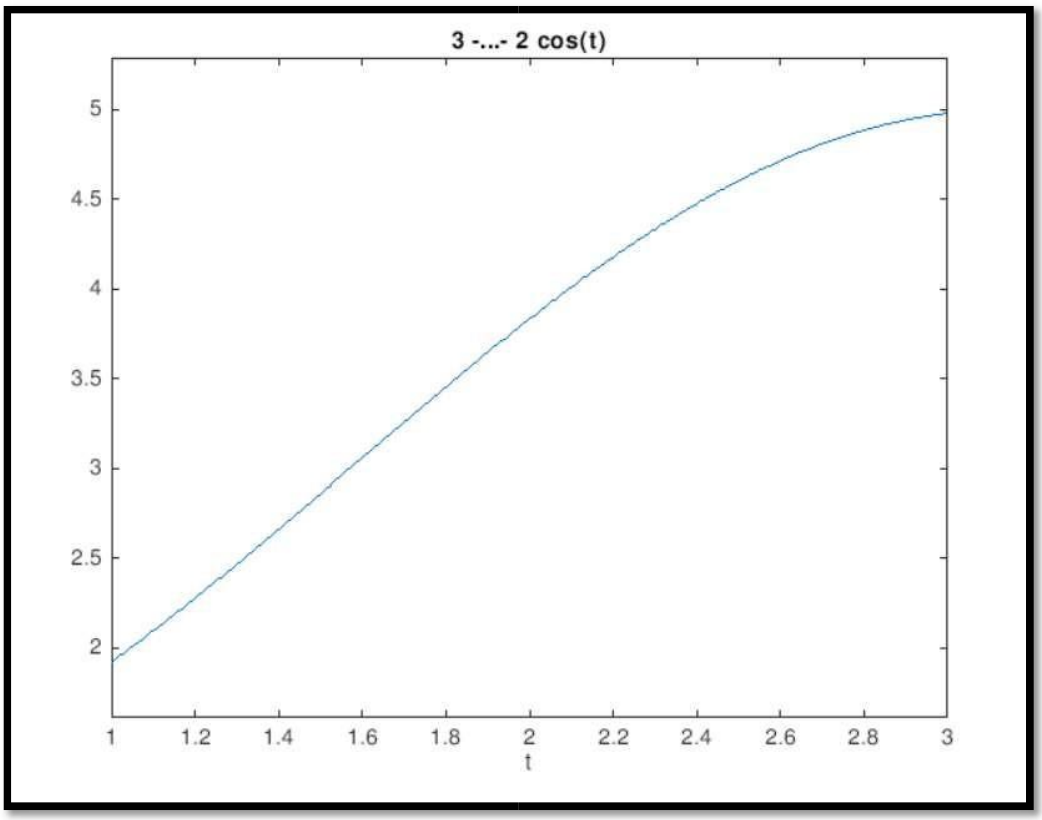
Code-:

```
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),dy(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]);
```

INPUTS AND OUTPUT: -



Input the coefficients [a,b,c]:
[1 0 1]
Enter the non-homogenous part f(x):
3*(heaviside(t)-heaviside(t-4))+(2*t-5)*(heaviside(t-4))
Enter the initial conditions in the form [y0,Dy(0)]:
[1 0]
The solution of the differential equation y(t)=
3 - 2*heaviside(t - 4)*(sin(t - 4) - t + 4) - 2*cos(t)



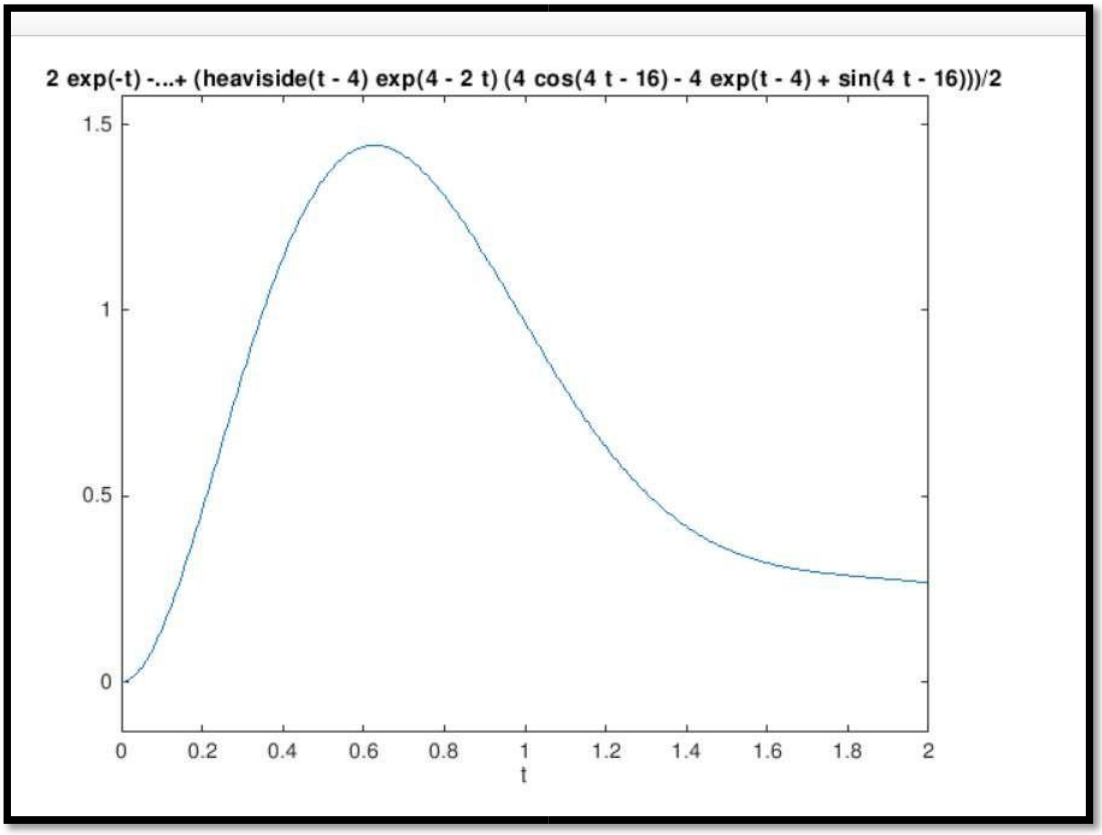
Answer 3-

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),dy(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);
i=diff(yt);
disp(i);
ezplot(yt,[y0,y0+2]);
```

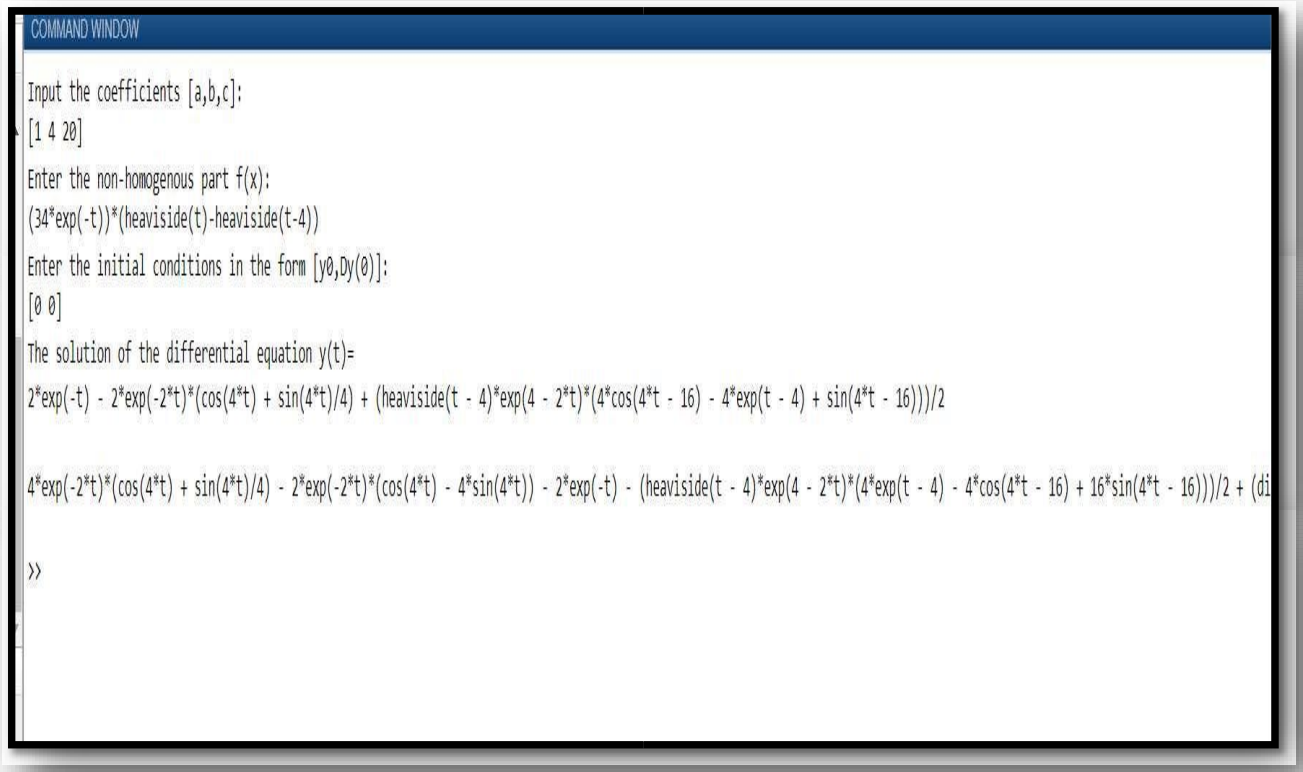
INPUTS AND OUTPUTS:-




```
Input the coefficients [a,b,c]:
[1 4 20]
Enter the non-homogenous part f(x):
```

(34*exp(-t))*(heaviside(t)-heaviside(t-4))
Enter the initial conditions in the form [y0,Dy(0)]:
[0 0]
The solution of the differential equation y(t)=
2*exp(-t) - 2*exp(-2*t)*(cos(4*t) + sin(4*t)/4) + (heaviside(t - 4)*exp(4 - 2*t)*(4*cos(4*t - 16) - 4*exp(t - 4) + sin(4*t - 16)))/2

4*exp(-2*t)*(cos(4*t) + sin(4*t)/4) - 2*exp(-2*t)*(cos(4*t) - 4*sin(4*t)) - 2*exp(-t) - (heaviside(t - 4)*exp(4 - 2*t)*(4*exp(t - 4) - 4*cos(4*t - 16) + 16*sin(4*t - 16)))/2 + (dirac(t - 4)*exp(4 - 2*t)*(4*cos(4*t - 16) - 4*exp(t - 4) + sin(4*t - 16)))/2 - heaviside(t - 4)*exp(4 - 2*t)*(4*cos(4*t - 16) - 4*exp(t - 4) + sin(4*t - 16))



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