DIGITAL ASSIGNMENT 3

NAME-Eeshan Pandey

Register No-18BIT0389

Course code: MAT2002

Slot L11+L12

Ques 1. Solve the following differential equation by using the method of variation of parameter.

$$\frac{d^2y}{dx^2} + 4y = \tan 2x.$$

MATLAB code:

```
clear all
close all
clc
syms c1 c2 x m
F=input('Enter the coefficients [a,b,c]: ');
f=input('Enter the RHS function f(x): ');
a=F(1);b=F(2);c=F(3);
AE=a*m^2+b*m+c; % Auxilliary Equation
m=solve(AE);
m1=m(1); m2=m(2);
D=b^2-4*a*c;
if(D>0) % Roots are real and different
y1=exp(m1*x);y2=exp(m2*x);
elseif (D==0)% Roots are real and equal
    y1=exp(m1*x);y2=x*exp(m1*x);
else % Roots are complex
 alfa=real(m1);beta=imag(m1);
 y1=exp(alfa*x)*cos(beta*x);
 y2=exp(alfa*x)*sin(beta*x);
end
yc=c1*y1+c2*y2; % Complimentary Solution
%%% Particular Integral by Method of variation of parameters.
fx=f/a;
W=y1*diff(y2,x)-y2*diff(y1,x); %%% Wronskian%%%
u=int(-y2*fx/W,x);
v=int(y1*fx/W,x);
yp=y1*u+y2*v; %%%Particular Integral%%%
y_gen=yc+yp; %%%General Solution%%%
check=input('If the problem has initial conditions then enter 1 else enter
2: ');
if(check==1)
cn=input('Enter the initial conditions [x0, y(x0), Dy(x0)]:');
dy_gen=diff(y_gen);
eq1=(subs(y_gen,x,cn(1))-cn(2));
eq2=(subs(dy_gen,x,cn(1))-cn(3));
[c1 c2]=solve(eq1,eq2);
y=simplify(subs(y_gen));
disp('The complete solution is');
disp(y);
ezplot(y, [cn(1),cn(1)+2]);
```

```
else
y=simplify(y_gen);
disp('The General Solution is ');
disp(y);
end
```

Input:

```
Enter the coefficients [a,b,c]: [1 0 1]

Enter the RHS function f(x): tan(2*x)

If the problem has initial conditions then enter 1 else enter 2: 2
```

Output:

```
The General Solution is

c1*cos(x) - sin(x) - c2*sin(x) -
(2^(1/2)*atanh(2^(1/2)*sin(x))*cos(x))/2 -
(2^(1/2)*atanh((2^(1/2)*(cos(x) - 1))/(2*cos(x) - 1))*sin(x))/2
```

Ques 2. Solve the following differential equation by using Laplace Transformation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}.$$

MATLAB Code

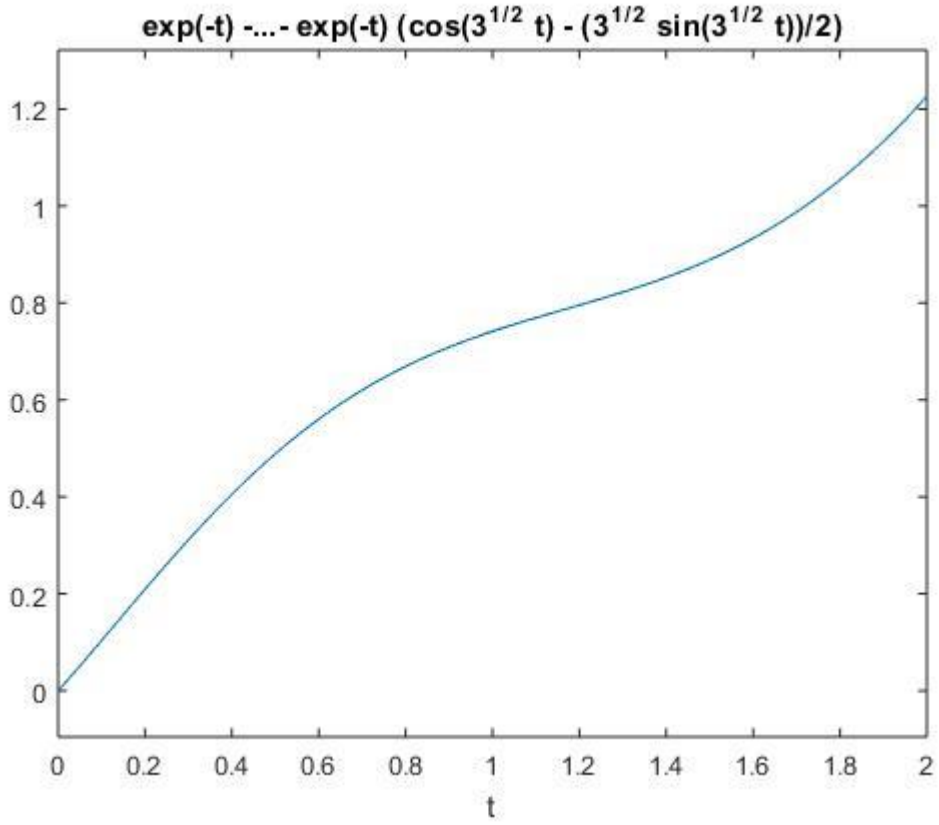
```
clear all
clc
syms t s y(x) Y
dy(t)=diff(y(x));
d2y(t)=diff(y(x),2);
F = input('Input the coefficients [a,b,c]: ');
a=F(1);b=F(2);c=F(3);
nh = input('Enter the non-homogenous part f(x): ');
eqn=a*d2y(x)+b*dy(x)+c*y(x)-nh;
LTY=laplace(eqn,t,s);
IC = input('Enter the initial conditions in the form [y0,Dy(0)]: ');
y0=IC(1);dy0=IC(2);
LTY=subs(LTY,{'laplace(y(x), t, s)','y(0)','D(y)(0)'},{Y,y0,dy0});
eq=collect(LTY,Y);
Y=simplify(solve(eq,Y));
yt=simplify(ilaplace(Y,s,x));
disp('The solution of the differential equation y(x)=')
disp(yx);
ezplot(yx,[y0,y0+2]);
```

Input

```
Input the coefficients [a,b,c]: [1 2 4]

Enter the non-homogenous part f(x): 2*(x^2)+3*exp(-x)

Enter the initial conditions in the form [y0,Dy(0)]: [0,1]
```

Output

```
The solution of the differential equation y(x)=

exp(-x) - x/2 + x^2/2 - exp(-x)*(cos(3^(1/2)*x) -
(3^(1/2)*sin(3^(1/2)*x))/2)
```


exp(-t) -...- exp(-t) (cos(3^1/2 t) - (3^1/2 sin(3^1/2 t))/2)
1.2
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
t