



MAT 2002 DA-3



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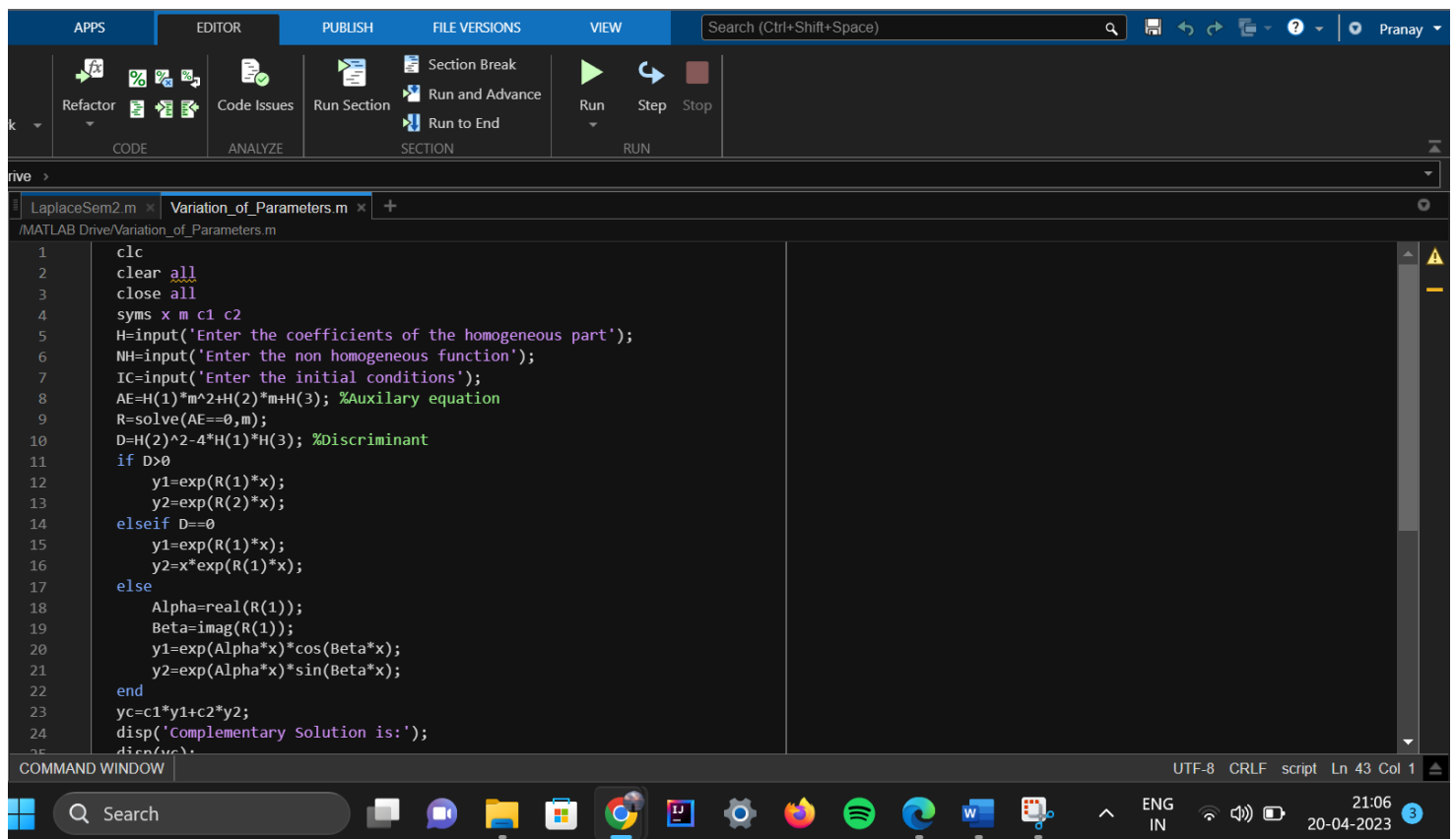
Experiment 3A:

Experiment:3A–Solution of linear differential equation by method of variation of parameters

Submit the e-record for the following.

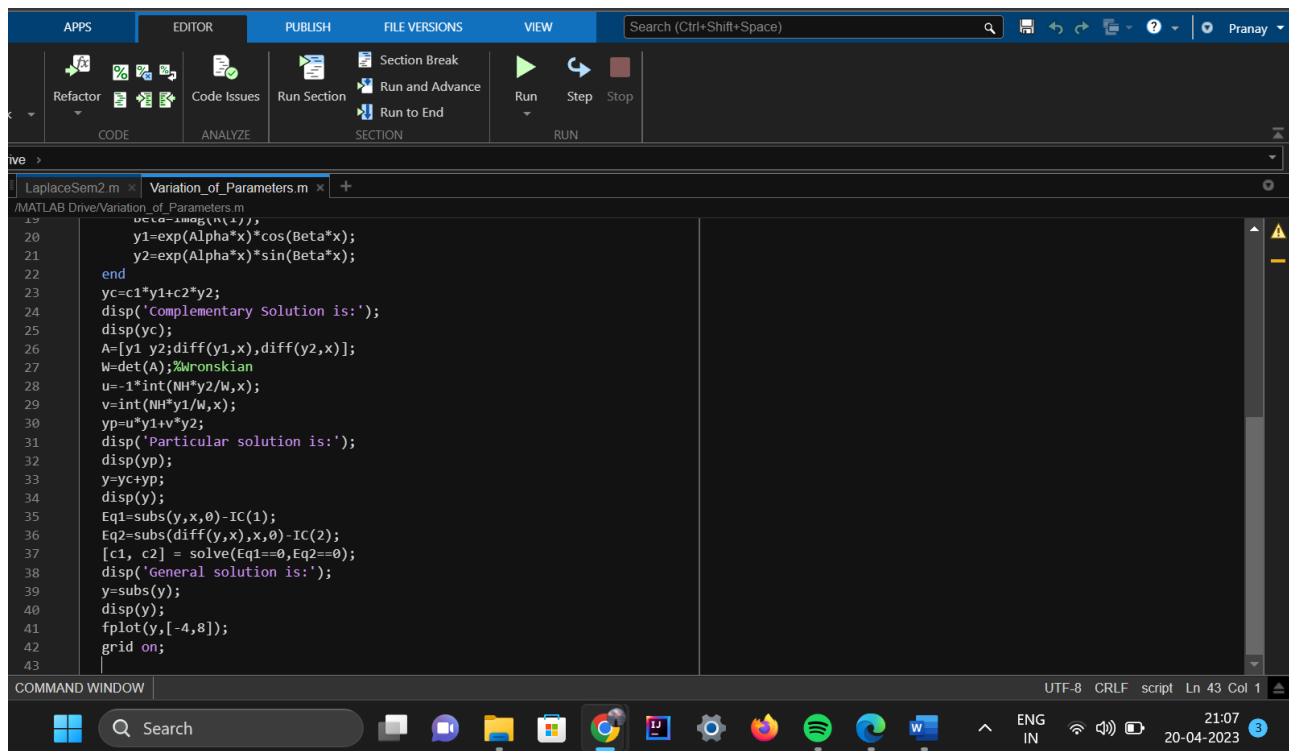
1. Consider the problem of suspension cable $\frac{d^2y}{dx^2} = \frac{w(x)}{T_H}$ with the conditions $y(0) = 0$, $y'(0) = 0$, where $w(x) = x^2, T_H = 100$. Plot shape of the cable in the range $[-4, 8]$.

Code:



```
1 clc
2 clear all
3 close all
4 syms x m c1 c2
5 H=input('Enter the coefficients of the homogeneous part');
6 NH=input('Enter the non homogeneous function');
7 IC=input('Enter the initial conditions');
8 AE=H(1)*m^2+H(2)*m+H(3); %Auxiliary equation
9 R=solve(AE==0,m);
10 D=H(2)^2-4*H(1)*H(3); %Discriminant
11 if D>0
12     y1=exp(R(1)*x);
13     y2=exp(R(2)*x);
14 elseif D==0
15     y1=exp(R(1)*x);
16     y2=x*exp(R(1)*x);
17 else
18     Alpha=real(R(1));
19     Beta=imag(R(1));
20     y1=exp(Alpha*x)*cos(Beta*x);
21     y2=exp(Alpha*x)*sin(Beta*x);
22 end
23 yc=c1*y1+c2*y2;
24 disp('Complementary Solution is:');
25 disp(yc);
```

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```
19 beta=log(1+beta);
20 y1=exp(Alpha*x)*cos(Beta*x);
21 y2=exp(Alpha*x)*sin(Beta*x);
22 end
23 yc=c1*y1+c2*y2;
24 disp('Complementary Solution is:');
25 disp(yc);
26 A=[y1 y2;diff(y1,x),diff(y2,x)];
27 W=det(A);%Wronskian
28 u=-1*int(NH*y2/W,x);
29 v=int(NH*y1/W,x);
30 yp=u*y1+v*y2;
31 disp('Particular solution is:');
32 disp(yp);
33 y=yc+yp;
34 disp(y);
35 Eq1=subs(y,x,0)-IC(1);
36 Eq2=subs(diff(y,x),x,0)-IC(2);
37 [c1, c2] = solve(Eq1==0,Eq2==0);
38 disp('General solution is:');
39 y=subs(y);
40 disp(y);
41 fplot(y,[-4,8]);
42 grid on;
```

Output:

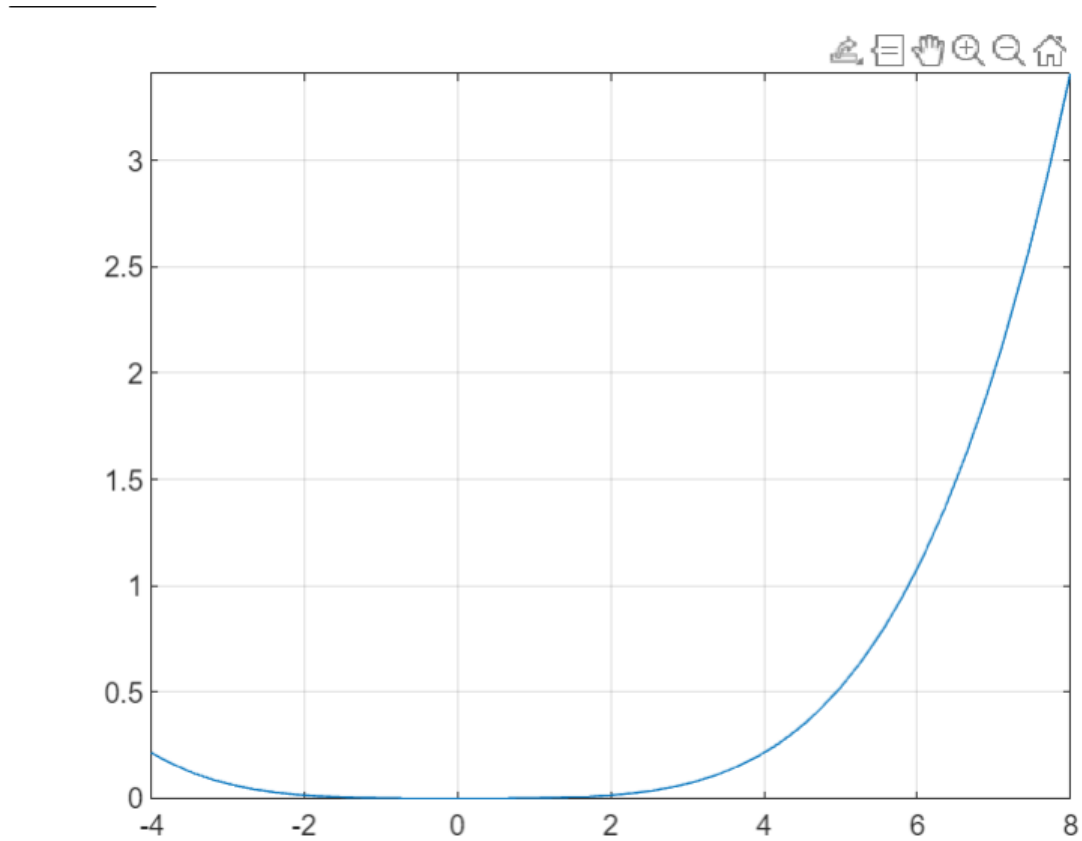
```
Enter the coefficients of the homogeneous part
[1 0 0]
Enter the non homogeneous function
(x^2)/100
Enter the initial conditions
[0 0]
Complementary Solution is:
c1 + c2*x

Particular solution is:
x^4/1200

x^4/1200 + c2*x + c1

General solution is:
x^4/1200
```

Function Plot:



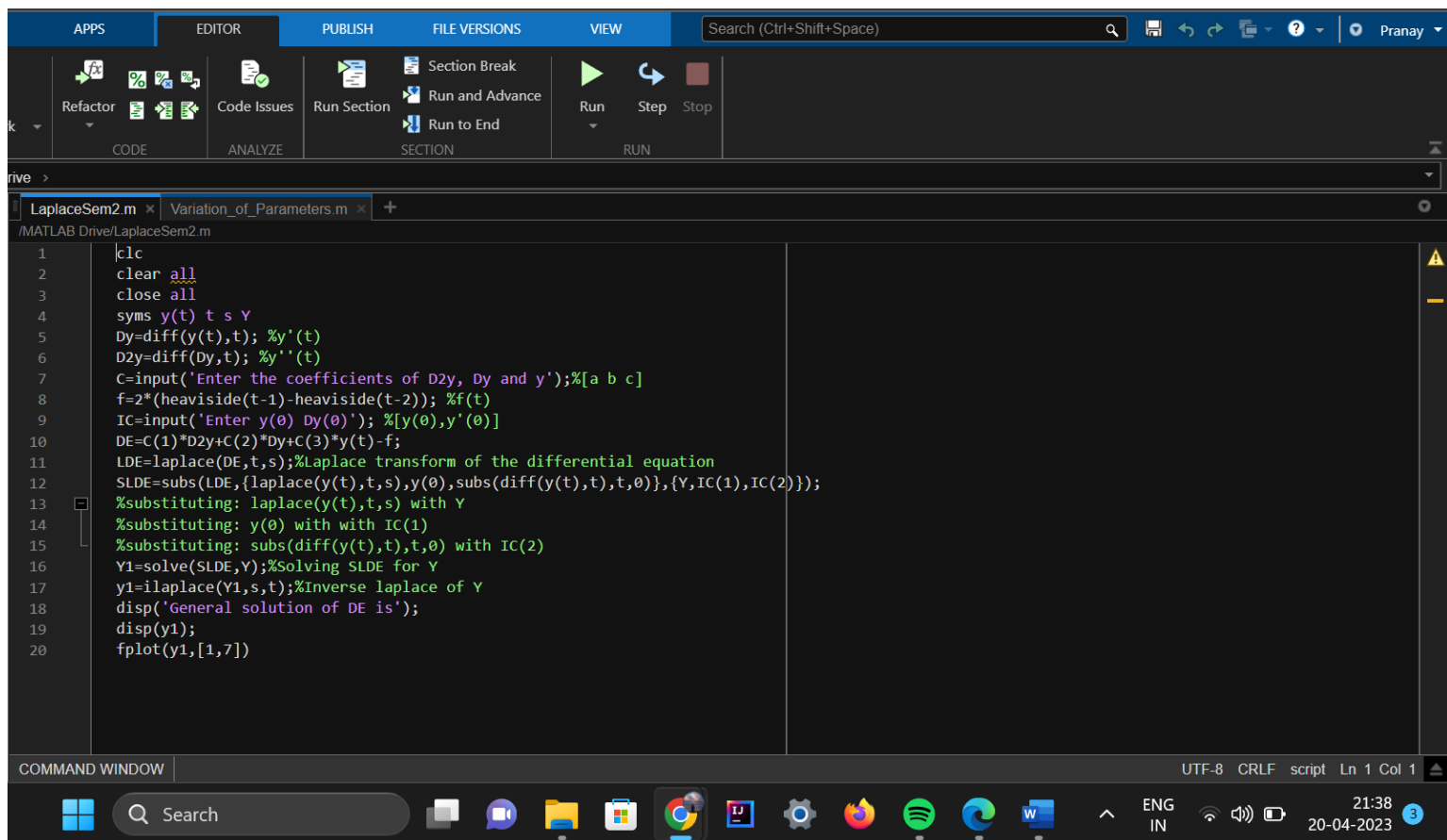
Experiment 3B:

Experiment:3B–Solution of linear differential equation by Laplace Transforms

1. Determine the response of the damped mass- spring system under a square wave, modeled

$$\text{by } y'' + 3y' + 2y = r(t), \text{ where } r(t) = \begin{cases} 0, & 0 < t < 1 \\ 2, & 1 < t < 2 \\ 0, & t \geq 2 \end{cases} \text{ . Subject to the initial conditions } y(0) = y'(0) = 0. \text{ Plot the solution.}$$

Code:



```
1 clc
2 clear all
3 close all
4 syms y(t) t s Y
5 Dy=diff(y(t),t); %y'(t)
6 D2y=diff(Dy,t); %y''(t)
7 C=input('Enter the coefficients of D2y, Dy and y');%[a b c]
8 f=2*(heaviside(t-1)-heaviside(t-2)); %f(t)
9 IC=input('Enter y(0) Dy(0)'); %[y(0),y'(0)]
10 DE=C(1)*D2y+C(2)*Dy+C(3)*y(t)-f;
11 LDE=laplace(DE,t,s);%Laplace transform of the differential equation
12 SLDE=subs(LDE,{laplace(y(t),t,s),y(0),subs(diff(y(t),t),t,0)},{Y,IC(1),IC(2)});
13 %substituting: laplace(y(t),t,s) with Y
14 %substituting: y(0) with IC(1)
15 %substituting: subs(diff(y(t),t),t,0) with IC(2)
16 Y1=solve(SLDE,Y);%Solving SLDE for Y
17 y1=ilaplace(Y1,s,t);%Inverse laplace of Y
18 disp('General solution of DE is');
19 disp(y1);
20 fplot(y1,[1,7])
```

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Output:

```
Enter the coefficients of D2y, Dy and y
[1 3 2]
Enter y(0) Dy(0)
[0 0]
General solution of DE is
2*heaviside(t - 1)*(exp(2 - 2*t)/2 - exp(1 - t) + 1/2) - 2*heaviside(t - 2)*(exp(4 - 2*t)/2 - exp(2 - t) + 1/2)
```

Function Plot:

