

## MATLAB ASSIGNMENT-5

### SIMILARITY AND ORTHOGONAL TRANSFORMATION

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- SLOT: - L15 +L16
- SESSION: - WINTER SEMESTER 2018-2019
- FACULTY: - PROF. POORNIMA T

DATE: - 6<sup>th</sup> February, 2019

Q1. Find the general solution of the differential equation  $y'' - 2y' = e^x \sin x$ .

Soln: -

CODE: -

```

1 - clear all
2 - close all
3 - clc
4 - syms c1 c2 x m
5 - F=input('Enter the coefficients [a,b,c]: ');
6 - f=input('Enter the Non homogenous function f(x): ');
7 - a=F(1);b=F(2);c=F(3);
8 - AE=a*m^2+b*m+c; % Auxilliary Equation
9 - m=solve(AE);
10 - m1=m(1); m2=m(2);
11 - D=b^2-4*a*c;
12 - if(D>0) % Roots are real and different
13 - y1=exp(m1*x);y2=exp(m2*x);
14 - elseif (D==0)% Roots are real and equal
15 -
16 - y1=exp(m1*x);y2=x*exp(m1*x);
17 - else % Roots are complex
18 - alfa=real(m1);beta=imag(m1);
19 - y1=exp(alfa*x)*cos(beta*x);
20 - y2=exp(alfa*x)*sin(beta*x);
21 - end
22 - yc=c1*y1+c2*y2; % Complimentary Solution
23 - %%% Particular Integral by Method of variation of parameters.
24 - fx=f/a;
25 - W=y1*diff(y2,x)-y2*diff(y1,x); %%% Wronskian%%
26 - u=int(-y2*fx/W,x);
27 - v=int(y1*fx/W,x);
28 - yp=y1*u+y2*v; %%%Particular Integral%%
29 - y_gen=yc+yp; %%%General Solution%%
  
```

NAME	VALUE	SIZE	CLASS
a	1	1x1	double
AE	1x1 sym	1x1	sym
b	-2	1x1	double
c	0	1x1	double
c1	1x1 sym	1x1	sym
c2	1x1 sym	1x1	sym
check	2	1x1	double
D	4	1x1	double
F	[1,-2,0]	1x3	double
f	1x1 sym	1x1	sym

The MATLAB Editor shows a script for solving a differential equation. The script defines coefficients, the non-homogeneous function, and uses the variation of parameters method to find the general solution. The workspace shows variables a, b, c, c1, c2, check, D, F, and f.

```

18 -   alfa=real(m1);beta=imag(m1);
19 -   y1=exp(alfa*x)*cos(beta*x);
20 -   y2=exp(alfa*x)*sin(beta*x);
21 -   end
22 -   yc=c1*y1+c2*y2; % Complimentary Solution
23 -   %%% Particular Integral by Method of variation of parameters.
24 -   fx=f/a;
25 -   W=y1*diff(y2,x)-y2*diff(y1,x); %%% Wronskian%%
26 -   u=int(-y2*fx/W,x);
27 -   v=int(y1*fx/W,x);
28 -   yp=y1*u+y2*v; %%%Particular Integral%%
29 -   y_gen=yc+yp; %%%General Solution%%
30 -   check=input('If the problem has initial conditions then enter 1 else enter 2: ');
31 -   if(check==1)
32 -       cn=input('Enter the initial conditions [x0, y(x0), Dy(x0)]:');
33 -       dy_gen=diff(y_gen);
34 -       eq1=(subs(y_gen,x,cn(1))-cn(2));
35 -       eq2=(subs(dy_gen,x,cn(1))-cn(3));
36 -       [c1 c2]=solve(eq1,eq2);
37 -       y=simplify(subs(y_gen));
38 -       disp('The complete solution is');
39 -       disp(y);
40 -       ezplot(y, [cn(1),cn(1)+2]);
41 -   else
42 -       y=simplify(y_gen);
43 -       disp('The General Solution is ');
44 -       disp(y);
45 -   end

```

NAME	VALUE	SIZE	CLASS
a	1	1x1	double
AE	1x1 sym	1x1	sym
b	-2	1x1	double
c	0	1x1	double
c1	1x1 sym	1x1	sym
c2	1x1 sym	1x1	sym
check	2	1x1	double
D	4	1x1	double
F	[1,-2,0]	1x3	double
f	1x1 sym	1x1	sym

### INPUT AND OUTPUT: -

The MATLAB Command Window shows the input and output of the script. The user enters coefficients [1 -2 0], the non-homogeneous function exp(x)\*sin(x), and chooses to enter initial conditions. The output shows the general solution.

```

COMMAND WINDOW

Enter the coefficients [a,b,c]:
[1 -2 0]

Enter the Non homogenous function f(x):
exp(x)*sin(x)

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

▼ The General Solution is
c1 - (exp(x)*sin(x))/2 + c2*exp(2*x)

>>

```

## 2. Solve the initial value problem

$$y'' + 4y' + 20y = 23 \sin(x) - 15 \cos(x), \quad y(0) = 0, \quad y'(0) = -1$$

3. Find the current  $I(t)$  in an RLC circuit with  $R=11\Omega$ ,  $L=0.1\text{ H}$ ,  $C=10^{-2}\text{ F}$ , which is connected to a source of voltage  $E(t) = 100 \sin 400t$ . Assume that the current and the charge are zero when  $t=0$ .

4. A spring with mass of  $2\text{ kg}$  has damping constant  $14$ , and a force of  $6\text{ N}$  is required to keep the spring stretched  $0.5\text{ m}$  beyond its natural length. The spring is stretched  $1\text{ m}$  beyond its natural length and then released with zero velocity. Find the position of the mass at any time  $t$ .

CODE: -

```

18 - alfa=real(m1);beta=imag(m1);
19 - y1=exp(alfa*x)*cos(beta*x);
20 - y2=exp(alfa*x)*sin(beta*x);
21 - end
22 - yc=c1*y1+c2*y2; % Complimentary Solution
23 - %%% Particular Integral by Method of variation of parameters.
24 - fx=f/a;
25 - W=y1*diff(y2,x)-y2*diff(y1,x); %%% Wronskian%%
26 - u=int(-y2*fx/W,x);
27 - v=int(y1*fx/W,x);
28 - yp=y1*u+y2*v; %%%Particular Integral%%
29 - y_gen=yc+yp; %%%General Solution%%
30 - check=input('If the problem has initial conditions then enter 1 else enter 2: ');
31 - if(check==1)
32 - cn=input('Enter the initial conditions [x0, y(x0), Dy(x0)]:');
33 - dy_gen=diff(y_gen);
34 - eq1=(subs(y_gen,x,cn(1))-cn(2));
35 - eq2=(subs(dy_gen,x,cn(1))-cn(3));
36 - [c1 c2]=solve(eq1,eq2);
37 - y=simplify(subs(y_gen));
38 - disp('The complete solution is');
39 - disp(y);
40 - ezplot(y, [cn(1),cn(1)+2]);
41 - else
42 - y=simplify(y_gen);
43 - disp('The General solution is ');
44 - disp(y);
45 - end
46 -

```

ANS 2: -

```

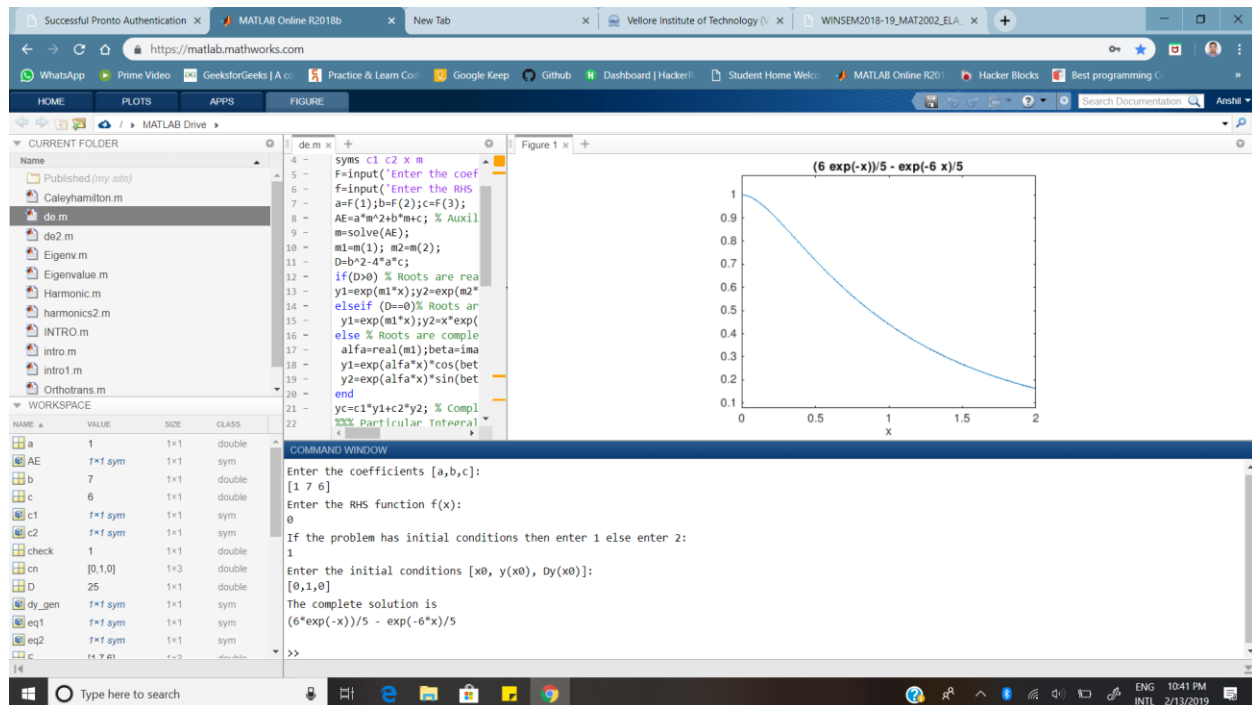
COMMAND WINDOW

Enter the coefficients [a,b,c]:
[1 4 20]
Enter the Non homogenous function f(x):
23*sin(x)-15*cos(x)
If the problem has initial conditions then enter 1 else enter 2:
1
Enter the initial conditions [x0, y(x0), Dy(x0)]:
[0 0 -1]
The complete solution is
cos(4*x)*exp(-2*x) - 2^(1/2)*cos(x + pi/4)
>>

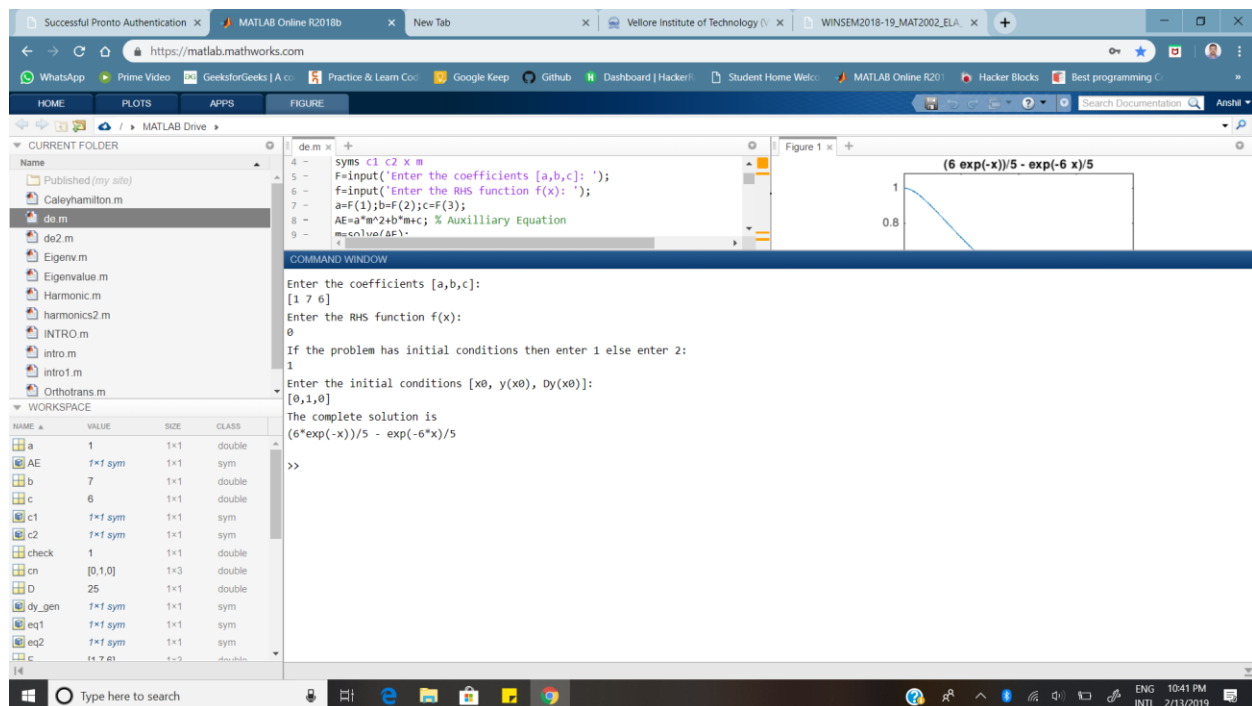
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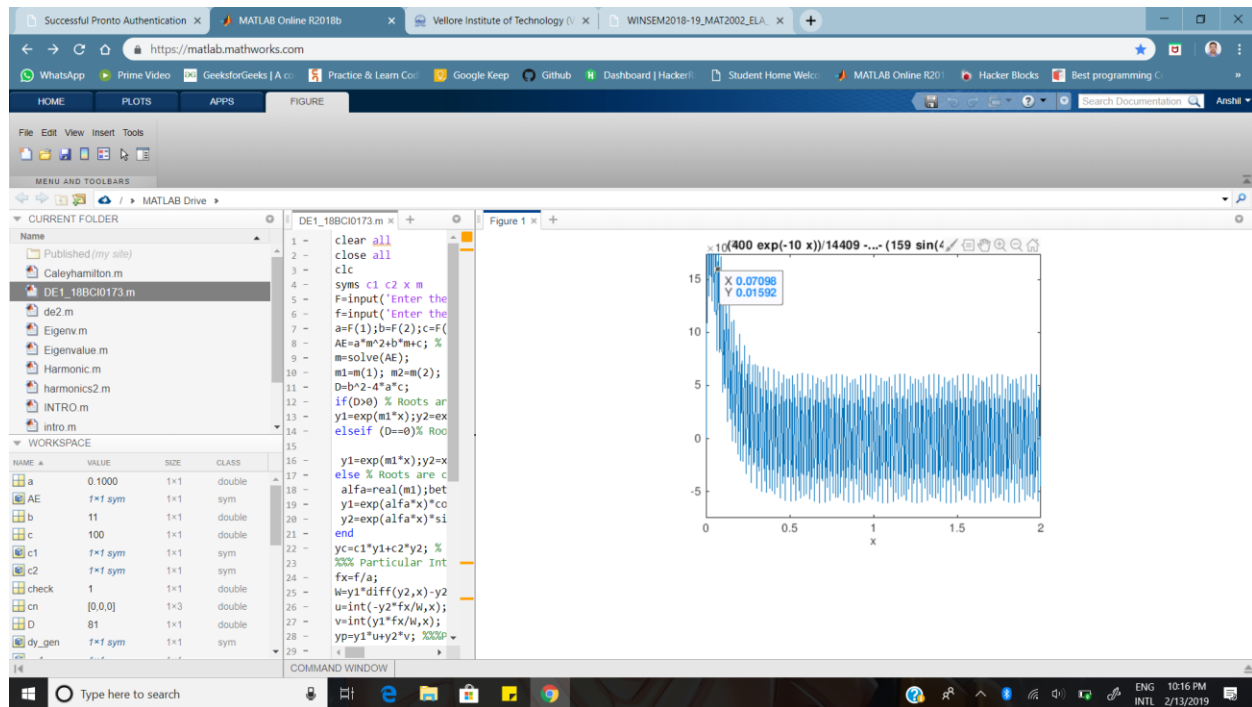
ANS 4: -

GRAPH



INPUT AND OUTPUT: -



**GRAPH: -****OUTPUT AND INPUT: -**