Plotting of Curves and Surfaces

(1) To Plot the Circle Matlab Code:

```
clc
clear all
syms r a b
r= input('Enter the radius of the circle')
a= input('Enter the x coordinate of the center')
b= input('Enter the  y coordinates of the  center')
t = linspace(0, 2*pi, 100);
x = a+r*cos(t);
y = b+r*sin(t);
axis equal
title('(x-a)^2+(y-b)^2=r^2')
plot(x, y)
xlabel('x-Coordinate')
ylabel('y-Coordinate')
title('(x-a)^2+(y-b)^2=r^2')
```

(2) Multiple plots using Hold on Matlab Code:

```
clc
clear all
x = linspace(0, 1, 100);
plot(x, x.^2,'r', 'LineWidth',2.0)
hold on
plot(x,  cos(x),'g', 'LineWidth',2.0)
hold on
plot(x,  sin(x),'b', 'LineWidth',2.0)
hold on
plot(x, exp(x),'c', 'LineWidth',2.0)
legend('x^2',  'cos(x)' , 'sin(x)' , 'e^{x}')
```

(3) Multiple plots without command “hold on" Matlab Code:

```
clc
clear all
x = linspace(0, 1, 200);
plot(x,sin(x),x,cos(x),x,x.^3,x,tan(x),'LineWidth',2.0)
legend('sin(x)','cos(x)','x^3','tan(x)')
```

(4) Multiple graphs in a Figure window through Matlab command -subplot

```
clc
clear all
x=0:0.1:2*pi;
subplot(2,2,1)
plot(x,sin(x));
title('sin(x)')
subplot(2,2,2)
plot(x,cos(x),'r-*');
title('cos(x)')
subplot(2,2,3)
plot(x,exp(-x),'go')
title('e^{-x}')
subplot(2,2,4);
plot(x,sin(3*x),'ms')
title('sin(3x)')
```

(5) Graph of the curve using "ezplot " Matlab Code:

```
clc
clear all
syms x  % Declaring the parameters as a symbolic object
f=sin(2*x)+cos(3*x)
figure(1)
ezplot(f)
figure(2)
ezplot(f,[0,3])
```

(6) Graph of a curve and its tangent line in the neighbourhood D of a point.

```
syms x
y=input('enter the function f in terms of x:')
x1 = input('Enter x value at which tangent  : ');
D=[x1-2 x1+2] % Region about x1 (or Neighbourhood of x1)
ezplot(y,D)   % graph of the curve in D
hold on
% Equation of the tgt line passing through x1.
yd = diff(y,x); % Differentiation in MATLAB
slope = subs(yd,x,x1); % Finding the slope at x1
y1 = subs(y,x,x1);     % Finding the value of the function at the given point
plot(x1,y1,'ko')       % plot the point
```

```
Tgt_line = slope*(x-x1)+y1 % Tangent Line Equation at the given point
h = ezplot(Tgt_line,D);    % Plotting the Tangent Line
set(h,'color','r')
```

(7) **To Plot the function and its derivatives Matlab Code**:

```
clc
clear all
syms x  real
f= input('Enter the function f(x):');
%Example, Try f=x^3-2*x+4 & x^3*(x-5)^2
fx= diff(f,x)
fxx= diff(fx,x)
% determine the critical points
 D = [0, 5];
l=ezplot(f,D)
set(l,'color','b');
hold on
h=ezplot(fx,D);
set(h,'color','r');
e=ezplot(fxx,D);
set(e,'color','g');
legend('f','f_x','f_x_x')
legend('Location','northeastoutside')
```

(8) To find the maxima and minima of the single variable function and visualize it.

```
 clear
clc
syms x  real
f= input('Enter the function f(x):'); %Example, Try f=x^3-2*x+4 & x^3*(x-5)^2
fx= diff(f,x);
fxx= diff(fx,x);
c = solve(fx)
c=double(c);
  for i = 1:length(c)
    T1 = subs(fxx, x ,c(i) )
    T1=double(T1);
    T3= subs(f, x, c(i));
```

```
    T3=double(T3);
    if (T1==0)
        sprintf('The inflection point is x = %d.',c(i))
    else
        if (T1 < 0)
            sprintf('The maximum point x is %d', c(i))
            sprintf('and the maximum value of the function is %d.', T3)
        else
            sprintf('The minimum point x is %d', c(i))
            sprintf('and the minimum value of the function is %d', T3)
        end
    end
    cmin = min(c);
cmax = max(c);
D = [cmin-2, cmax+2];
ezplot(f,D)
hold on
    plot(c(i), T3, 'g*', 'markersize', 15);
end
```

Definite Integrals and its applications

(9) To find the area of the regions enclosed by curves and visualize it.

```
 clc
clear
syms x
y1=input('ENTER the upper curve as a function of x : ');
y2=input('ENTER the lower curve as a function of x : ');
 % Try the curves :  y=x and y=x^2-2*x;
 t=solve(y1-y2)
t=double(t);
 A=int(y1-y2,t(1),t(2))
 D=[t(1)-0.2 t(2)+0.2];
ez1=ezplot(y1,D);
set(ez1,'color','r')
hold on
ez2=ezplot(y2,D);
set(ez2,'color','g')
xv = linspace(t(1),t(2));
y1v =subs(y1,x,xv);
```

```
y2v = subs(y2,x,xv);
x = [xv,xv];
y = [y1v,y2v];
fill(x,y,'b')
```

(10) Volume of the Solid of Revolution

```
 clc
clear all
syms x
f = input('Enter the function: ');
fL = input('Enter the interval on which the function is defined: ');
yr = input('Enter the axis of rotation y = c (enter only c value): ');
iL = input('Enter the integration limits: ');
Volume = pi*int((f-yr)^2,iL(1),iL(2));
disp(['Volume is: ', num2str(double(Volume))])
fx = inline(vectorize(f));
xvals = linspace(fL(1),fL(2),201);
xvalsr = fliplr(xvals);
xivals = linspace(iL(1),iL(2),201);
xivalsr = fliplr(xivals);
xlim = [fL(1) fL(2)+0.5];
ylim = fx(xlim);
figure('Position',[100 200 560 420])
subplot(2,1,1)
hold on;
plot(xvals,fx(xvals),'-b','LineWidth',2);
fill([xvals xvalsr],[fx(xvals) ones(size(xvalsr))*yr],[0.8 0.8 0.8],'FaceAlpha',0.8)
plot([fL(1) fL(2)],[yr yr],'-r','LineWidth',2);
legend('Function Plot','Filled Region','Axis of Rotation','Location','Best');
title('Function y=f(x) and Region');
set(gca,'XLim',xlim)
xlabel('x-axis');
ylabel('y-axis');
subplot(2,1,2)
hold on;
plot(xivals,fx(xivals),'-b','LineWidth',2);
fill([xivals xivalsr],[fx(xivals) ones(size(xivalsr))*yr],[0.8 0.8 0.8],'FaceAlpha',0.8)
```

```
fill([xivals xivalsr], [ones(size(xivals))*yr  -fx(xivalsr)+2*yr], [1 0.8 0.8],
'FaceAlpha', 0.8)
plot(xivals, -fx(xivals)+2*yr, '-m','LineWidth',2);
plot([fL(1) fL(2)],[yr yr],'-r','LineWidth',2);
title('Rotated Region in xy-Plane');
set(gca,'XLim',xlim)
xlabel('x-axis');
ylabel('y-axis');
[X,Y,Z] = cylinder(fx(xivals)- yr,100);
figure('Position',[700 200 560 420])
Z = iL(1) + Z.*(iL(2)-iL(1));
surf(Z,Y+yr,X+yr,'EdgeColor','none','FaceColor','flat','FaceAlpha',0.6);
hold on;
plot3([iL(1) iL(2)],[yr yr],[yr yr],'-r','LineWidth',2);
xlabel('X-axis');
ylabel('Y-axis');
zlabel('Z-axis');
view(22,11);


%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```