Amrita School of Engineering, Bengluru-35
Department of Mathematics

National Workshop on Analytical and Numerical solutions of

Non-linear Differential Equations

Matlab Worksheet -2

- Type the following lines in the command window one at a time and observe the output.

(i) x1=1:10
(ii) x2=1:2:10
(iii) x3=5:3:26
(iv) x4=26:-3:5
(v) y1=linspace(1,10)
(vi) y2=linspace(1,10,15)
(vii) x=linspace(-2*pi,2*pi,10)
(viii) y=x.^2; plot(x,y)
(ix) y=x.^2; stem(x,y)
(x) p=[1 2 3 4 5 6 7 8 9]; q=log(p); plot(p,q)

xi=start : increment/decrement : final
default increment will be one

yi=linspace(start ,final, number of
equally spaced divisions)

- Create a script file(M-file), type the following in it, save the file as circle and execute it. Look out for the figure which appears in the figure window

```
theta = linspace(0,2*pi,100);
x=cos(theta);
y=sin(theta);
plot(x,y)
axis('equal')
xlabel('x')
ylabel('y')
title('Circle of unit radius')
```

plots a circle with unit radius

Exercise:

1. Plot y=sinx , x= -2π to 2π.
2. Plot y=tanx , x= -2 to 2.
3. Write a programme to plot a circle with radius 5 and centre at (1,1).
4. Write a programme to plot the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$.
5. Write a programme to plot the ellipse $(x-1)^2+9(y-5)^2=9$ in the first quadrant.

- Create a script file(M-file), type the following in it, save the file as multipleplot and execute it. Look out for the figure which appears in the figure window

```
x=0:0.1:2;
y=x;
plot(x,y,'Color','red')
hold on
```

plots multiple curves in the same figure
with different colours and linestyles

```
y=x.^2;plot(x,y,'linestyle','*')
hold on
plot(x,sin(x),'Color','black','linestyle','.')
axis([0 1 0 1])
```

- Create a script file(M-file), type the following in it, save the file as helix and execute it. Look out for the figure which appears in the figure window

```
t = -4*pi:pi/50:4*pi;
plot3(sin(t),cos(t),t)
grid on
axis square
xlabel('x')
ylabel('y')
zlabel('z')
title( 'Three-dimensional helix')
```

plots a circular helix with labelling of axis and title for the figure

Exercise:

6. Plot y=sinx and y=cosx in the same window with different colours and different linestyles between 0 to 4π.
7. Plot the 3-dimensional curve given by y=x and $z=x^2$ in the interval x ϵ (-100,100).
8. Plot the 3-dimensional curve given by y=sinx and $z=x^2$ in the interval x ϵ (-100,100).
9. Plot the 3-dimensional elliptical helix, which has the parametric representation as $\overrightarrow{r(t)} = [5cost, 3sint, t+1], -4\pi < t < 4\pi$
10. Plot the 3-dimensional elliptical helix in the previous problem along with the circular helix $\overrightarrow{r(t)} = [cost, sint, t], -4\pi < t < 4\pi$ in different colours in the same figure window.

- Create a script file(M-file), type the following in it, save the file as mesh and execute it. Look out for the figure which appears in the figure window

```
[X,Y] = meshgrid(-2:2:2);
Z=X.^2+Y.^2;
mesh(X,Y,Z)
```

plot surface $Z=X^2+Y^2$

- Create a script file(M-file), type the following in it, save the file as surf and execute it. Look out for the figure which appears in the figure window

```
[X,Y] = meshgrid(-2:.1:2);
surf(X,Y,X.^2)
xlabel('x')
ylabel('y')
zlabel('z')
title( 'surface y=x and z=x^2')
```

plot surface $Z=X^2$

- Create a script file(M-file), type the following in it, save the file as surface and execute it. Look out for the figure which appears in the figure window

```
[X,Y] = meshgrid(-8:.5:8);
R = sqrt(X.^2 + Y.^2) ;
Z = sin(R)./R;
mesh(X,Y,Z,'EdgeColor','red')
```

plot surface $Z = \frac{\sin(\sqrt{x^2+y^2})}{(\sqrt{x^2+y^2})}$

Exercise:

11. Plot the surface given by z = sin(x+y), -1≤x,y≤1.
12. Plot the surface of the paraboloid given by $z = x^2+y^2$, -1≤x,y≤1.
13. Plot the surface of the cone given by $z = -\sqrt{6x^2 + 9y^2}, -5 \leq x, y \leq 5.$
14. Plot the surface $z = \sin(x + y) - x^2 - xy + y^2, -2\pi \leq x, y \leq 2\pi.$
15. Plot the surface $g(x, y, z) = z + \cos(25x) - x^2 + y^3 = 5, -2\pi \leq x, y \leq 2\pi.$

Plot Commands

plot() 2D Plot X vs. Y
plot() 3D plot X vs. Y vs. Z
stem() Stem plot – line up to the point (for discrete functions)
surf() Surface plot-3D contour plot
xlabel(‘ ’) ylabel(‘ ’) zlabel(‘ ‘) Axis labelling
title(‘) Title labelling
axis([xmin xmax ymin ymax]) Define Axis Limits on plots
grid on/off Overlays/removes a grid on a plot
hold on/off Allows superimposing multiple plots on one figure
figure Open a new figure window [e.g. figure (1)]