Amrita School of Engineering, Bengluru-35 Department of Mathematics

National Workshop on Analytical and Numerical solutions of

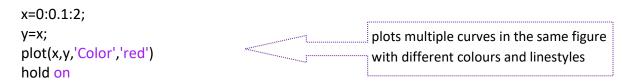
Non-linear Differential Equations Matlab Worksheet -2

- Type the following lines in the command window one at a time and observe the output.
 - (i) x1=1:10 xi=start: increment/decrement: final (ii) x2=1:2:10 default increment will be one x3=5:3:26 (iii) (iv) x4=26:-3:5 (v) y1=linspace(1,10)yi=linspace(start,final, number of (vi) y2=linspace(1,10,15) equally spaced divisions) (vii) x=linspace(-2*pi,2*pi,10) $y=x.^2$; plot(x,y) (viii) (ix) $y=x.^2$; stem(x,y) (x) p=[1 2 3 4 5 6 7 8 9]; q=log(p); plot(p,q)
- > 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')
```

Exercise:

- 1. Plot y=sinx, $x = -2\pi$ 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



```
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')
```

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 $x \in (-100,100)$.
- 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 $\overline{r(t)} = [5\cos t, 3\sin t, t + 1], -4\pi < t < 4\pi$
- 10. Plot the 3-dimensional elliptical helix in the previous problem along with the circular helix $\overline{r(t)} = [\cos t, \sin t, t], -4\pi < t < 4\pi$ 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=X²+Y²
```

> 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=x²')
```

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



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)]