Amrita School of Engineering, Bengluru-35
23MAT117-Linear Algebra
Lab Practice Sheet-3

(Revision of Curves and Surface Plots using parametric representations)

- x=-10:0.01:10; y=x.^2; plot(x, y)
- x=linspace(-10, 10, 2000); y=x.^2; plot(x, y)

➢ t=-10:0.01:10; plot(t, t.^2) — Plots the function $f(x)=x^2$ in [-10,10] using the parametric form of the function

➢ t=0:0.0001:2*pi, plot(cos(t), sin(t)) — Plots the unit circle with centre at origin using parametric form

➢ x=-10:1:10; y=x.^2; stem(x, y) — Gives the stem plot of the function $f(x)=x^2$ in [-10,10]

➢ ezplot('x^2', [-10,10]) — Plots the function $f(x)=x^2$ in [-10,10] But this command is not recommended much to be used

- **To Plot a line segment from a point A(a1, a2) to a point B(b1, b2)**

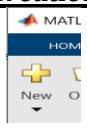
  ➢ plot([a1, b1],[a2, b2])

  ➢ plot([1, 3], [2, 4]) will plot a line from (1, 2) to (3, 4)

  ➢ plot([0, 10], [0, 0]) will plot X axis from (0, 0) to (10, 0)

  ➢ plot([0, 0], [-5, 5]) will plot Y axis from (0, -5) to (0, 5)

❖ ***Creation of a script file(M-file) for plotting***

Click on  on top left of the MATLAB window, to create a new script file(m-file) and type the following in it. After typing save the file and run it. Look out for the figure which appears in the figure window.

➢ Plot a circle with unit radius centred at the origin with title and labels for axes.

```
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 centred at the origin')
```

- Plot multiple curves in the same figure with different colours and linestyles also giving the length of the axes.

```
x=-4:0.001:4;
y=x;
plot(x, y, 'Color', 'red')
hold on
y=x.^2; plot(x, y, 'linestyle', '--')
hold on
plot(x, sin(x), 'Color', 'green', 'linestyle', '-.')
axis([-4 4 -4 4])
```

Command 'hold on' is used when multiple curves need to be plotted in the same figure

- Plots a three-dimensional curve-circular helix using parametric representation with labelling of axis and title for the figure

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

- **Plotting of segmented functions:**

% Code to plot the function: $f(x) = \begin{cases} 2-x, & 0 \le x \le 2 \\ x-2, & 2 < x \le 4 \end{cases}$

```
x=linspace(0,4,500);
y1=(x<=2).*(2-x);
y2=(x>2).*(-2+x);
y=y1+y2;
plot(x, y)
```

- **Plots to find the solution of the system:**

- $x + y = 5, 4x - y = 5$ (point of intersection of the two lines)

```
ezplot('5-x', [-10, 10])
hold on
ezplot('4*x-5', [-10, 10])
```

- $x + y - z = 0, 3x - y - z = 0, x - y + 2z = 4$ (point of intersection of all planes)

```
[X, Y] = meshgrid(-3:0.5:3);
mesh(X, Y, X+Y, 'EdgeColor', 'blue')
hold on
mesh(X, Y, 3*X-Y, 'EdgeColor', 'green')
hold on
mesh(X, Y, 2-0.5*X+0.5*Y, 'EdgeColor', 'red')
```

Practise Questions

1. Plot $y = sinx, x = -2\pi \; to \; 2\pi$.
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 $(x-3)^2 + 9(y-5)^2 = 9$. Use parametric representation).
5. Write a programme to plot the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ in the second quadrant.
6. Plot $y = sinx$ and $y = cosx$ in the same window with different colours and different line styles between -4π to 4π. Ensure that the X and Y axis are seen in the plot.
7. Plot the 3-dimensional curve given by $y = x$ and $z = x^2$ in the interval $x \; \epsilon \; (-100,100)$.
8. Plot the 3-dimensional curve given by $y = sinx$ and $z = x^2$ in the interval $x \; \epsilon \; (-100,100)$.
9. Plot the 3-dimensional elliptical helix, which has the parametric representation as $\overline{r(t)} = [5cost, 3sint, t+1], -4\pi < t < 4\pi$ along with the circular helix $\overline{r(t)} = [cost, sint, t], -4\pi < t < 4\pi$ in different colours in the same figure window.
10. Plot the function: $f(x) = \begin{Bmatrix} x, 0 \le x \le 1 \\ 1, \; 1 < x \le 2 \\ 3-x, 2 \le x \le 3 \end{Bmatrix}$.
11. Plot the function: $f(x) = \begin{Bmatrix} 1, -10 \le x \le -1 \\ -x, \; -1 < x \le 1 \\ x-2, \; 1 \le x \le 10 \end{Bmatrix}$,
12. Plot the function: $\mathrm{g}(x) = \begin{Bmatrix} \sin x, -\frac{3\pi}{2} \le x \le 0 \\ 2x, \; 0 < x \le \frac{\pi}{2} \\ \pi - \cos x, \frac{\pi}{2} \le x \le \frac{3\pi}{2} \end{Bmatrix}$
13. Draw a line segment from a point $A(x, y)$ to $B(y, z)$ using a single command in MATLAB, where x is the date, y is the month and z is the year (last two digits) in your date of birth. Also have the X-axis and Y-axis in the figure.
14. Solve the given linear system geometrically using MATLAB.
$$x + y = 6; 2x - y = 9.$$
15. Solve the given linear system geometrically as well as by using X= A\B in MATLAB.
$$x + y + z = 6; 2x - y + z = 5; 3x + 2y - 5z = 8.$$
16. Draw all the planes and then solve the given linear system of equations by finding the point of intersection. Also, solve the system using pinv command
$$x + y + z = 6; 2x - y + z = 3; 3x + 2y + z = 10.$$
17. Solve the given system using pinv command. Also plot the three planes. Are you able to get a single point of intersection. Explain the solution obtained with the intersection point/s.
$$x + y + z = 6; 2x + y + z = 7; 3x + 2y + 2z = 13.$$