Practical 5

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Basic Plotting-2D and 3D

Part A: Theory

plot3 - plots curves in space,

stem3 - creates discrete data plot with stems in 3-D,

bar3 - plots 3-D bar graph,

bar3h - plots 3-D horizontal bar graph,

pie3 - makes 3-D pie chart,

comet3 - makes animated 3-D line plot,

fill3 - draws filled 3-D polygons,

contour3 - makes 3-D contour plots,

quivers - draws vector fields in 3-D,

scatter3 - makes scatter plots in 3-D,

mesh - draws 3-D mesh surfaces (wire-frame),

meshc - draws 3-D mesh surfaces along with contours,

meshz - draws 3-D mesh surfaces with reference plane curtains,

surf - creates 3-D surface plots,

surfc - creates 3-D surface plots along with contours,

surfl - creates 3-D surface plots with specified light source,

trimesh - mesh plot with triangles,

trisurf - surface plot with triangles,

slice - draws a volumetric surface with slices,

waterfall - creates a waterfall plot of 3-D data,

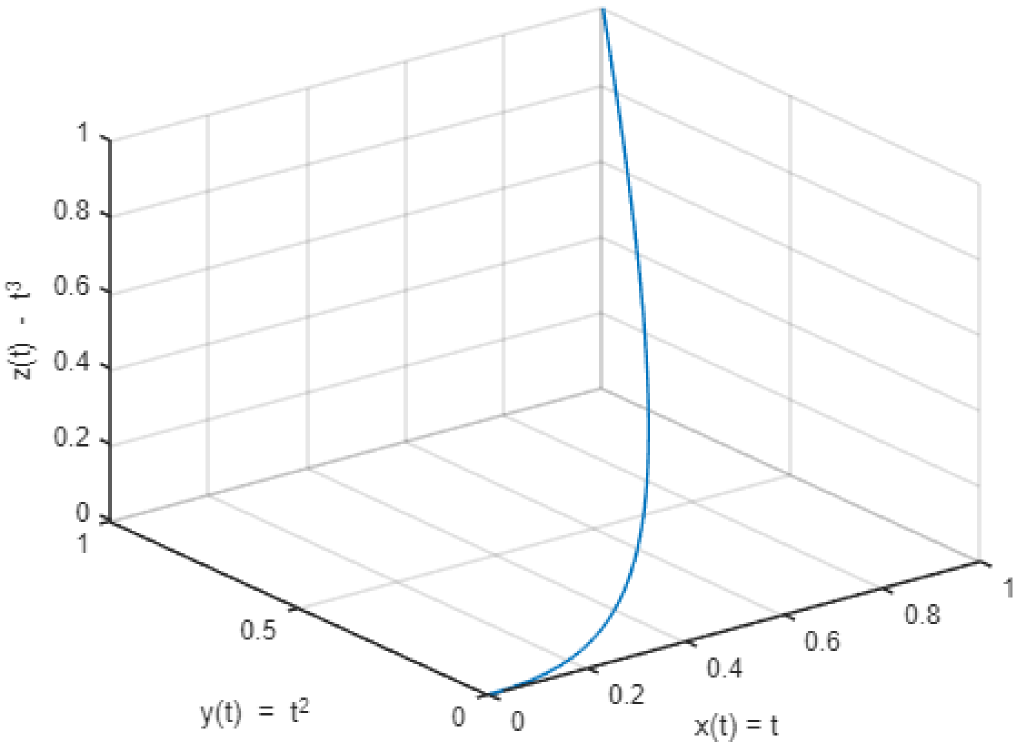
cylinder - generates a cylinder,

ellipsoid - generates an ellipsoid, and

sphere - generates a sphere.

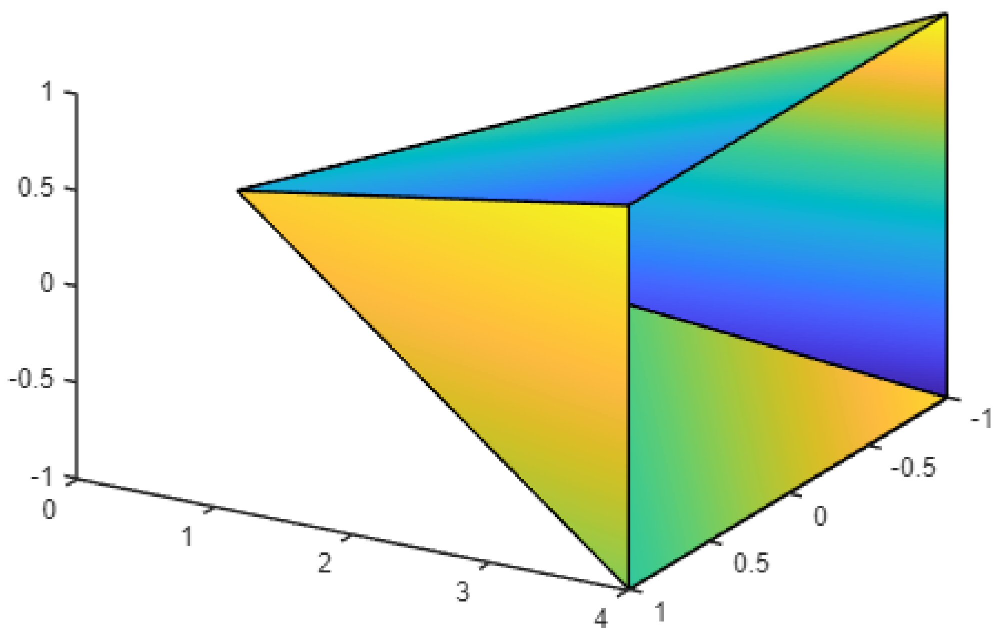
plot3

```
t = linspace (0, 1, 100);
x = t; y = t.^ 2; z = t.^ 3;
plot3(x, y,z), grid
xlabel ('x(t) = t' )
ylabel ('y(t) = t^2')
zlabel ('z(t) - t^3')
```



fill3

```
X = [0 0 0 0; 1 1 -1 1;1 -1 -1 -1] ;
Y = [0 0 0 0; 4 4 4 4;4 4 4 4] ;
Z = [0 0 0 0; 1 1 -1 -1;-1 1 1 -1];
fillcolor=rand(3,4);
fill3(X,Y,Z,fillcolor)
view(120,30)
```

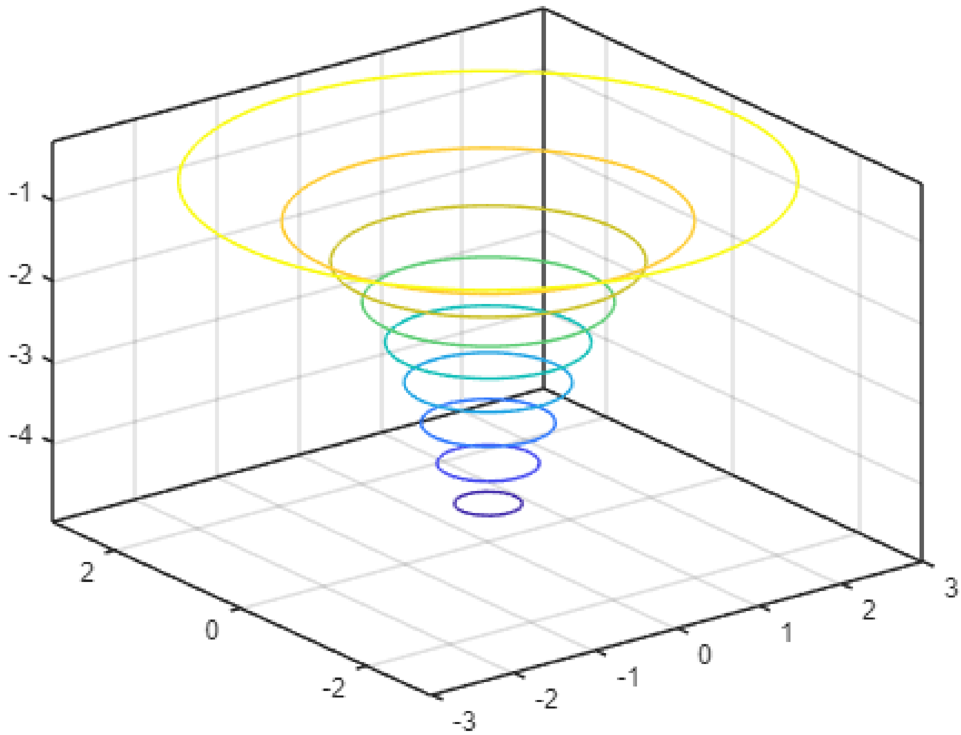


contour3

```
r = linspace(-3,3,50);
[x,y] = meshgrid(r,r);
z = -5./(1+ x.^2 + y.^2)
```

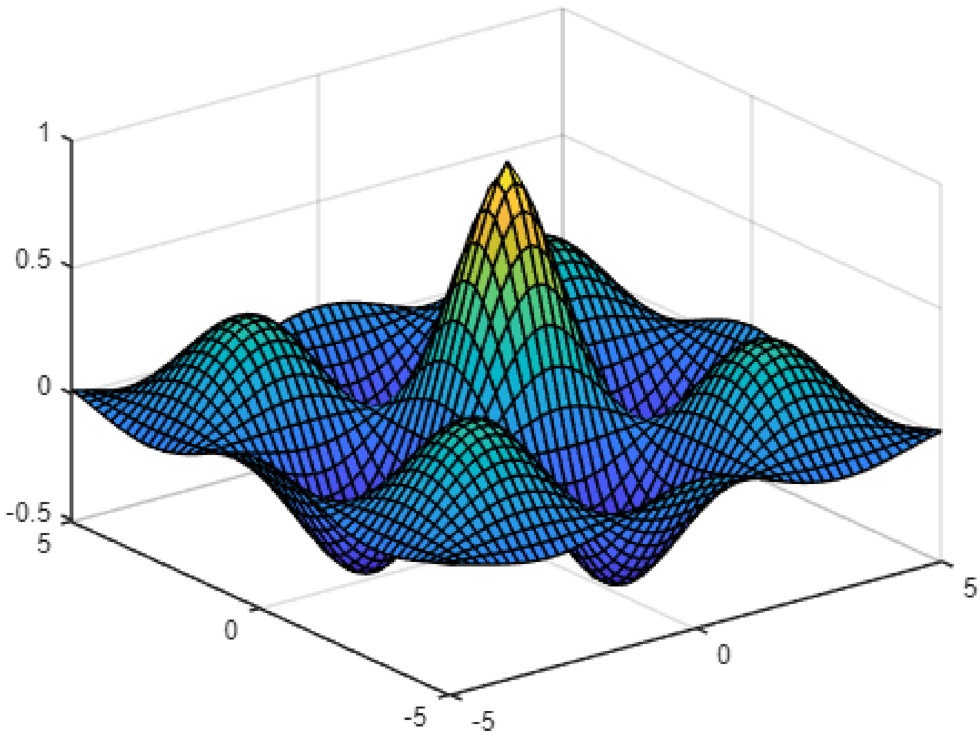
```
z = 50×50
   -0.2632   -0.2735   -0.2842   -0.2953   -0.3067   -0.3184   -0.3304   -0.3427 ···
   -0.2735   -0.2847   -0.2964   -0.3084   -0.3209   -0.3337   -0.3469   -0.3604
   -0.2842   -0.2964   -0.3090   -0.3221   -0.3358   -0.3498   -0.3644   -0.3793
   -0.2953   -0.3084   -0.3221   -0.3364   -0.3513   -0.3668   -0.3828   -0.3993
   -0.3067   -0.3209   -0.3358   -0.3513   -0.3676   -0.3845   -0.4022   -0.4204
   -0.3184   -0.3337   -0.3498   -0.3668   -0.3845   -0.4031   -0.4225   -0.4427
   -0.3304   -0.3469   -0.3644   -0.3828   -0.4022   -0.4225   -0.4439   -0.4663
   -0.3427   -0.3604   -0.3793   -0.3993   -0.4204   -0.4427   -0.4663   -0.4910
   -0.3551   -0.3742   -0.3946   -0.4162   -0.4392   -0.4637   -0.4895   -0.5169
   -0.3676   -0.3881   -0.4101   -0.4335   -0.4586   -0.4853   -0.5137   -0.5438
     ⋮
```

```
contour3(x,y,z)
```



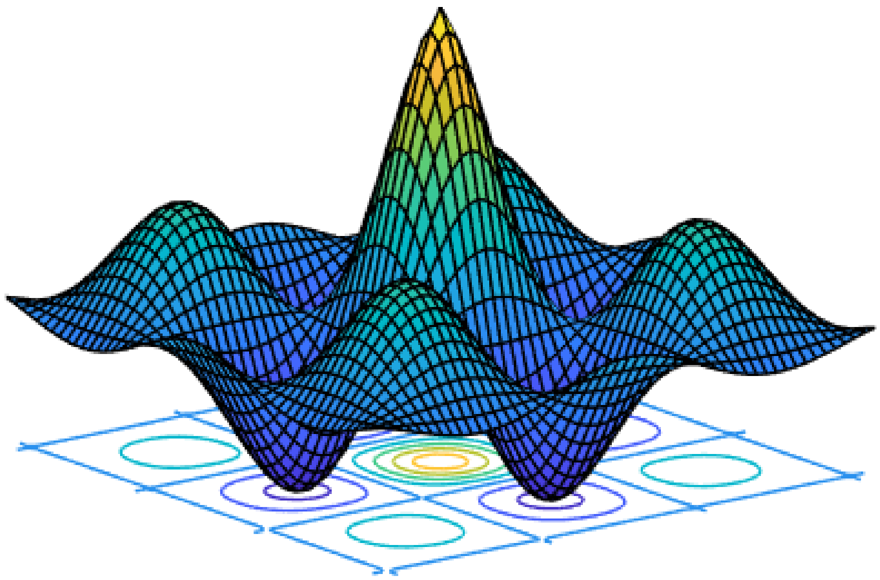
surf

```
u = -5:.2:5;
[X,Y] = meshgrid(u,u);
Z = cos(X) .* cos(Y) .* exp(-sqrt(X.^2+ Y.^2)/4);
surf(X,Y,Z)
```



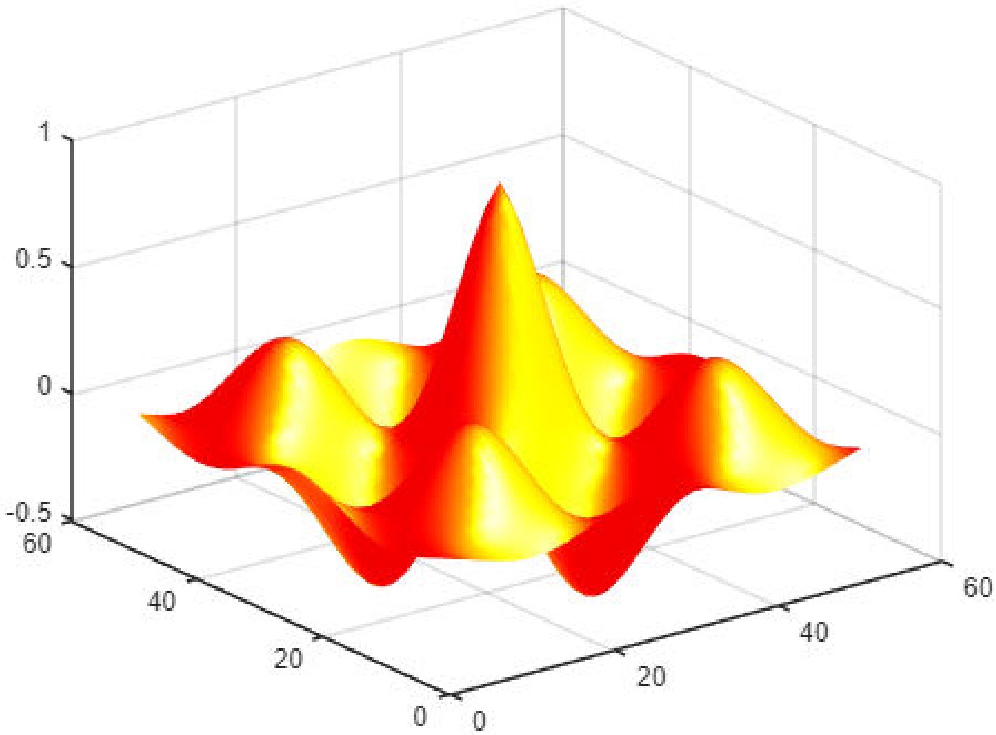
surfc

```
u = -5:.2:5;
[X,Y] = meshgrid(u,u);
Z = cos(X) .* cos(Y) .* exp(-sqrt(X.^2+ Y.^2)/4);
surfc(Z)
view(-37.5,20)
axis('off')
```



surfl

```
u = -5:.2:5;
[X,Y] = meshgrid(u,u);
z = cos(X) .* cos(Y) .* exp(-sqrt(X.^2+ Y.^2)/4);
surfl(Z)
shading interp
colormap hot
```

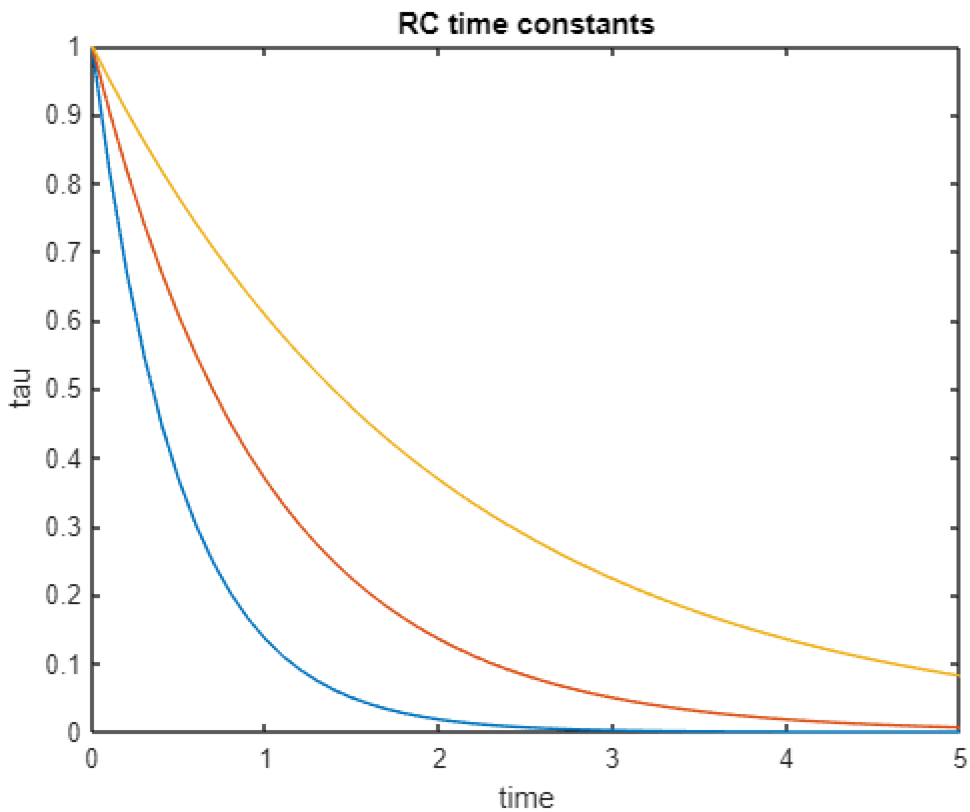


Part B: Practical

1. Plot voltage vs time for various RC time constants

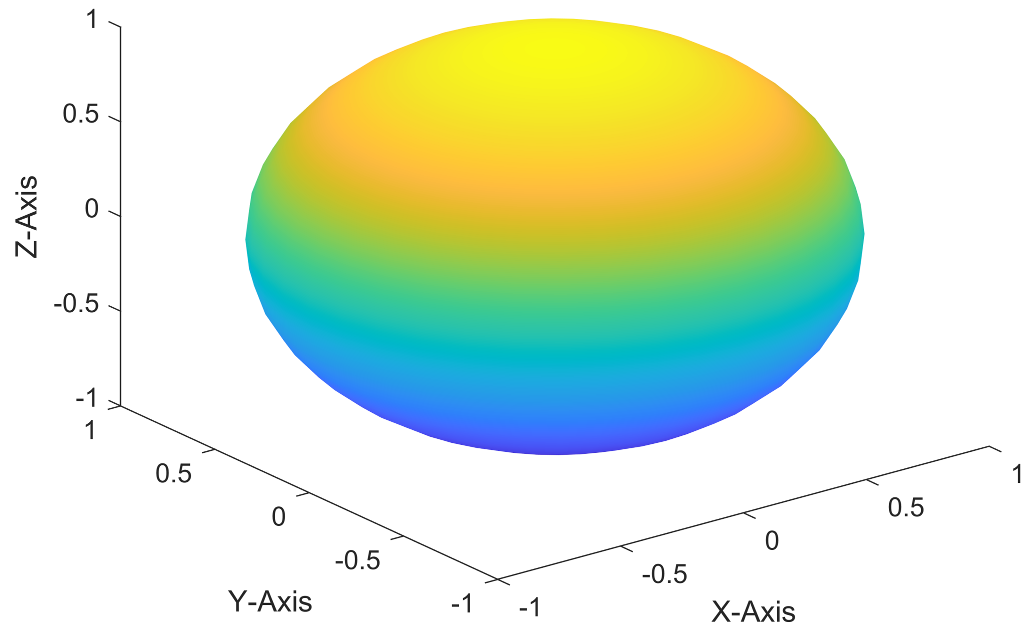
$$\frac{v}{V} = e^{-\frac{t}{\tau}}$$

```
time = 0:0.1:5;
tau = [0.5 1.0 2.0];
[TIME TAU] = meshgrid(time,tau);
V = exp(-TIME./TAU);
plot(time,V)
xlabel('time')
ylabel('tau')
title('RC time constants')
```



2. Plot a sphere, which is defined as [x(t, s), y(t, s), z(t, s)] = [cos(t) cos(s), cos(t) sin(s), sin(t)] (use ‘surf’). for t, s = [0, 2π] .Make first equal axes, then remove them. Use ‘shading interp’ to remove black lines.

```
[s,t] = meshgrid(0:0.05*pi:2*pi,0:0.05*pi:2*pi);
x = cos(t) .* cos(s);
y = cos(t) .* sin(s);
z = sin(t);
surf(x,y,z)
xlabel('X-Axis')
ylabel('Y-Axis')
zlabel('Z-Axis')
grid off
shading interp
```


1
0.5
0
-0.5
-1
Z-Axis
1
0.5
0
-0.5
-1
Y-Axis
-1
-0.5
0
0.5
1
X-Axis