EC210 – Solid State Electronics
Lab 2
Introduction to FreeMat (Cont.) & Binding Energy

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Class : Solid State Electronics - EC210, Spring 2015
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Outline

- Plotting techniques
- Binding Energy
- Assignment on Binding Energy !

Plotting

- The basic FreeMat graphing procedure:
  - Take a vector of $x = (x_1, x_2, \ldots, x_N)$.
  - Take a vector of $y = (y_1, y_2, \ldots, y_N)$.
  - Locate the points (x_i, y_i), where $i = 1,2, \ldots, N$.
  - Join them with straight lines.

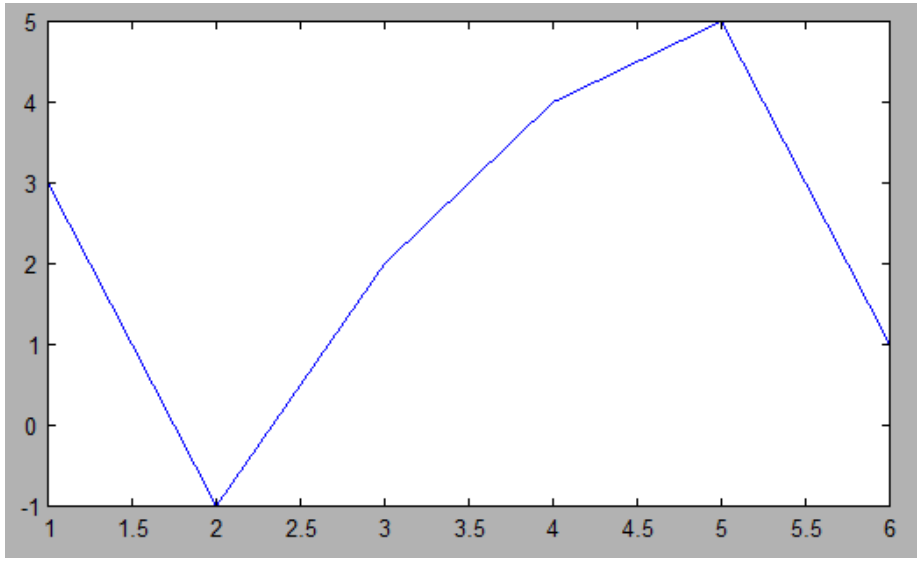
```
--> x=[1 2 3 4 5 6]

x =
 1 2 3 4 5 6

--> y=[3 -1 2  4 5 1]

y =
  3 -1  2  4  5  1

--> plot(x,y)
```



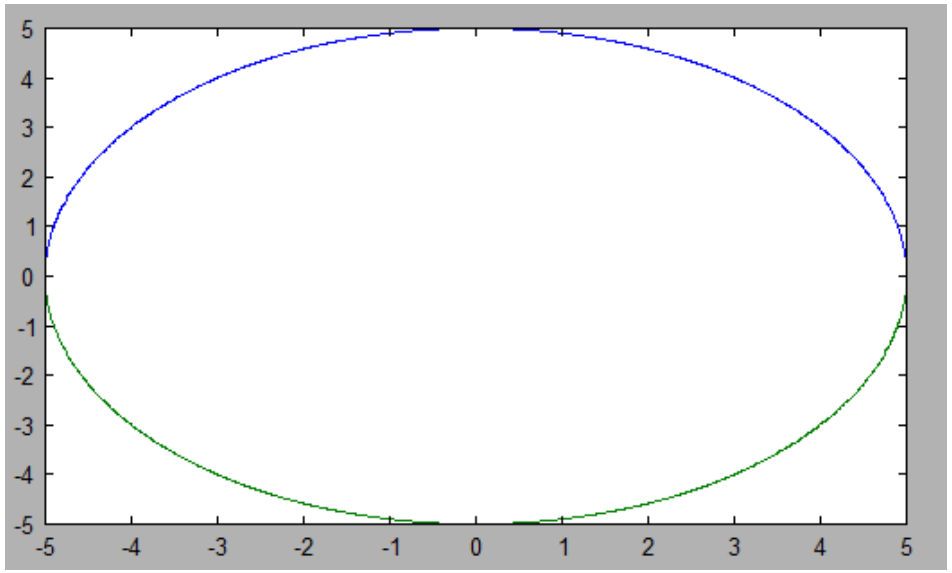
Plotting

- How to plot a circle:.
- Equation of a circle symmetric about origin :

$$x^2 + y^2 = r^2$$

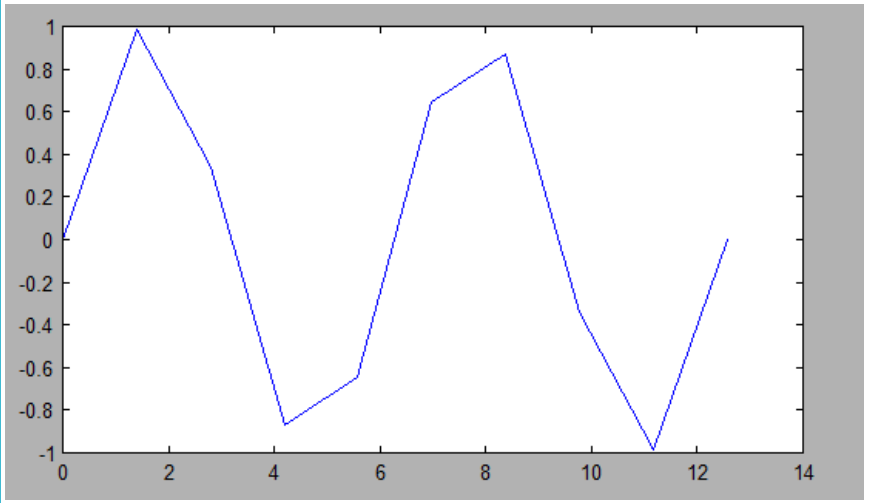
- Let's assume any value of x and radius!

```
--> x=linspace(-5,5,100);
--> r=5;
--> y=sqrt(r^2-(x.^2));
--> plot(x,y)
--> hold on
--> plot(x,-y)
```

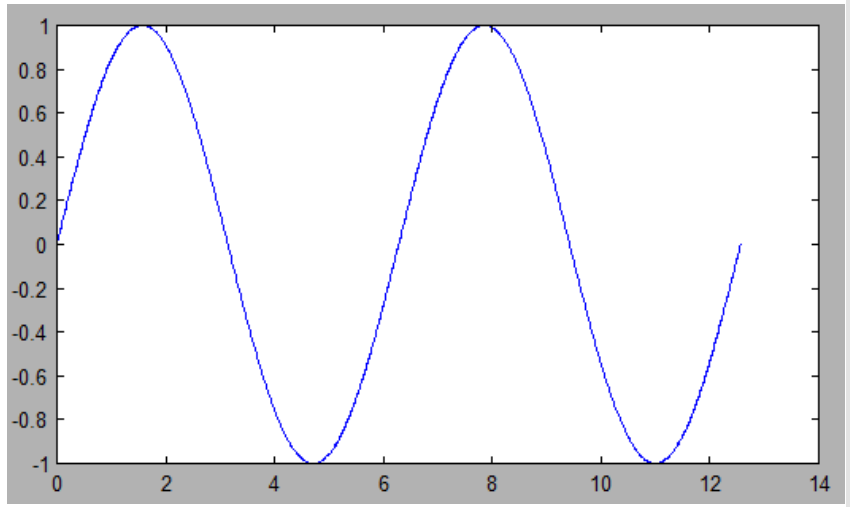


Plotting

```
-> t=linspace(0,4*pi,10);
-> y=sin(t);
-> plot(t,y)
```




```
--> t=linspace(0,4*pi,1000);
--> y=sin(t);
--> plot(t,y)
```

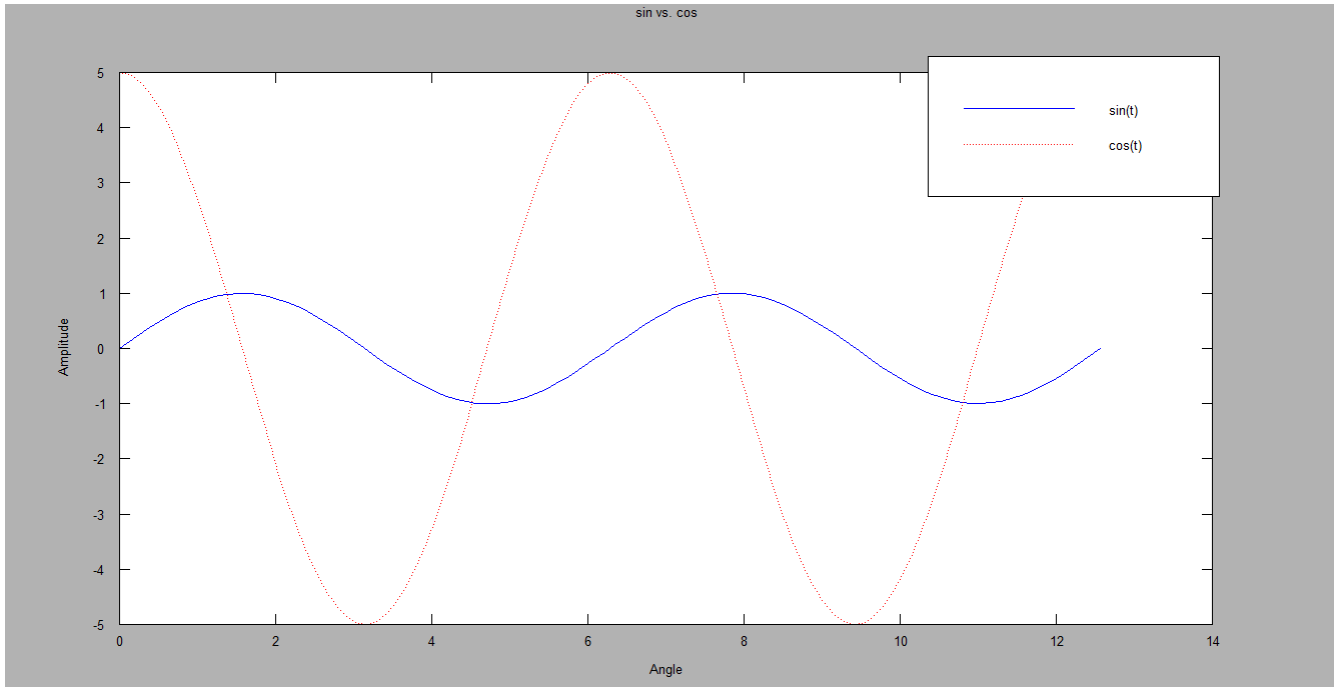


Plotting

- Using M-File scripts

Lab_02.m

```
1   clc
2   close all
3   clear all
4   t=linspace(0,4*pi,100);
5   y1=sin(t);
6   y2=5*cos(t);
7   figure(1)
8   plot(t,y1,'b')
9   hold on
10  plot(t,y2,':r')
11  title('sin vs. cos')
12  xlabel('Angle')
13  ylabel('Amplitude')
14  legend('sin(t)','cos(t)')
15
```



Binding Energy

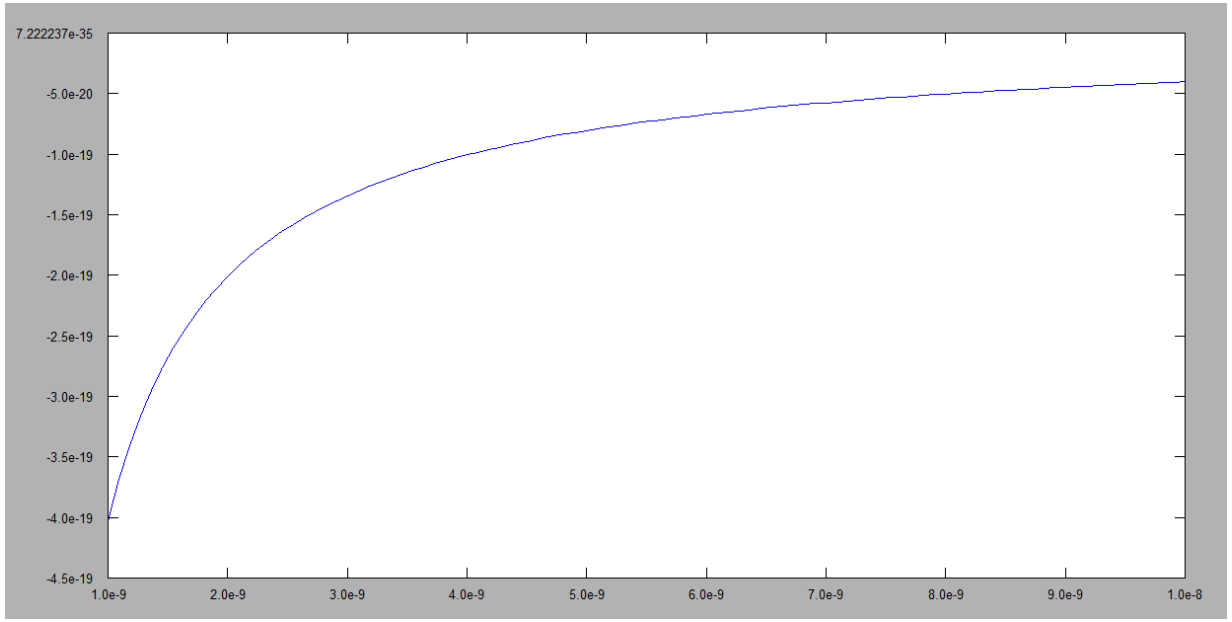
- Sheet 2 - Problem 1

```
figure(2)

q=1.6e-19;
M=1.748;
e0=8.85e-12;
B=6.972e-96;
m=8;

r=linspace(1e-9,10e-9,100);

E=-((((q^2)*M)/(4*pi*e0))./r)+(B./(r.^m));
plot(r,E)
```



Classwork

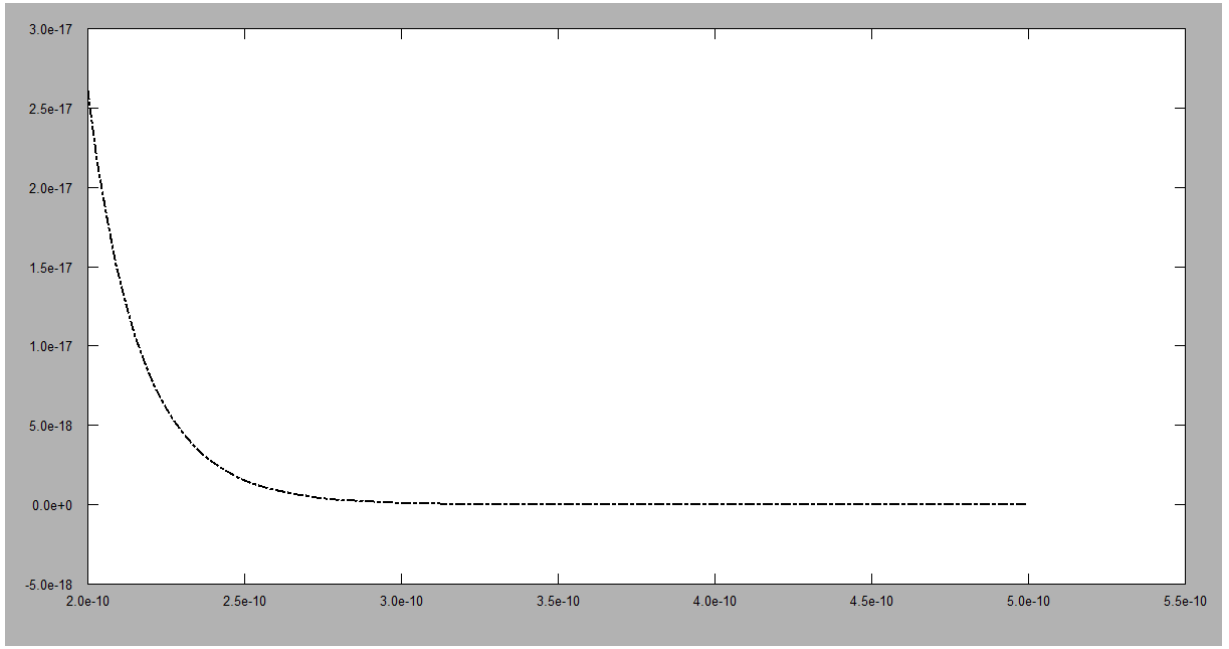
1. Plot the expression in sheet 2 – problem 2.

$$E(r) = -Ar^{-6} + Br^{-12}$$

Where $A = 8 \times 10^{-77}\ Jm^6$ and $B = 1.12 \times 10^{-133}\ Jm^{12}$.

The range: $2\dot{A} \rightarrow 5\dot{A}$

LineWidth 2



Assignment

1. Plot the expression in sheet 2 – problem 1for two values of B.

$$B_1 = 6.972 \times 10^{-96} \quad ; \quad B_2 = 9.854 \times 10^{-92}$$

$$E_1 = -\frac{q^2 M}{4\pi\epsilon_o r} + \frac{B_1}{r^m} \quad ; \quad E_2 = \frac{q^2 M}{4\pi\epsilon_o r} + \frac{B_2}{r^m} \quad ;$$

$$E_3 = E_1 + E_2$$

Include a title, x-label, y-label, different line colors, different linewidth and legend.

Due Date : 23-Feb-15

Thank you for your attention