Assignment-4 deadline: 29th February, 2015

Assignments must be submitted in the form of report along with MATLAB codes.

For all the problems below, **provide graphs in your report** (use "hold on" and "subplot" wherever necessary to generate the graphs) to support your observations and conclusions. Sample codes made during the lectures are placed in lecture folder for reference.

Instruction regarding submission of report will be provided by the Lab instructors.

Reference: Lecture15 slide

1. Charge Particle trajectories under Lorentz force:

Write a general MATLAB code to reproduce charge particle motions under Lorentz force in the following cases (as shown in Lecture-15 slide, choice of correct initial conditions is important to reproduce the trajectories).

Report on the initial conditions and the rationale behind observed motion. Support your answer with several supporting graphs. (Try different 3D plotting schemes in MATLAB for better visualization, other than "plot3" as discussed in the class). Analyze the motion for t=0 to a reasonable value of t=t_final.

(i) Static and uniform B field. (for +ve and –ve charges)

(ii) Static and uniform E and B. (ExB drift) (what happens when v=v0x; B=B0z; and E=E0y; and v0=E0/B0).

(iii) Static and non-uniform B field (grad B drift)

(iv) Static and uniform B, and under gravitational force (for different mass)

Investigate for at-least three different initial conditions for all the cases (i-iv). Compare the results for different cases.

2. Compute with your matlab code, the cyclotron frequency and the cyclotron radius for – an electron in the Earth's ionosphere at 300 km altitude, where the magnetic flux density B~.00005 Tesla, considering that the electron moves at the thermal velocity (kT/m), with T=1000 K, where "k" is Boltzmann's constant. Plot a graph to show the motion/results and compare your results with analytical calculations.

3. What will be the gravitational drift velocity "v_g" in the above case? Compare your computational result with theoretical result.