PHYB21-2016: Electricity and Magnetism

Course Instructor:

Dr. Salam Tawfiq   Office: SW-511   Tel: 416-287-7243

e-mail: Tawfiq@utsc.utoronto.ca

Course Meeting Times

Lectures: 2 sessions / week, 1 hour / session

Tutorial: 1 sessions / week, 1 hour / session

Office hours: Wednesday 1.30-2.30 and Friday 11.30-12.30 or by appointment

Textbook and References

Introduction to Electrodynamics, by ***David J. Griffiths,*** 3rd or 4th edi**tion** *(Prentice Hall).*

This book is one of the best-written books in this subject. Most students like the language and the style of the book. We will follow the book very closely, any material, which is not covered in the book will be delivered by the instructor.

References:
Edward M. Purcell, Electricity and Magnetism, Second Edition (McGraw-Hill) (different approach than Griffiths);

G. Pollack and D. Stump, Electromagnetism, Addison-Wesley, 2002.

H.M. Schey, Div, Grad, Curl and All That, (Norton) (covers vector calculus in **the context** of electromagnetism);

Course Objectives

The primary objective of the course is for students to gain a working knowledge of electric and magnetic fields, potentials, and their sources using the language and tools of mathematics and to obtain physical insights into their behavior. More detailed objectives are listed below:

Understand and use vector algebra and calculus, including the del operator, gradient, divergence, and curl of vectors, as well as volume, surface and line integrals, to solve a variety of problems in electrostatics, magnetostatics, and electrodynamics.

Apply the above techniques to different coordinate systems, such as the Cartesian, cylindrical, and spherical coordinate systems. Therefore, students gain a working knowledge of other useful mathematical tools that will aid in solving a variety of problems in the course.

Understand and calculate static charge, Coulomb's law, electric fields, and potentials. Examples involving direct integration and Gauss's law will be studied, and applications using energy and capacitance will be investigated.

Develop an understanding of magnetostatics that includes the Lorentz force law, currents, magnetic fields, the Biot-Savart law, Ampère's law, and the magnetic vector potential. Examples and applications involving direct integration and Ampère's law will be studied.

Develop the concepts of electromotive force and Ohm's law. Understand electromagnetic induction and Faraday's law and apply these to inductors and energy in magnetic fields.

Derive Maxwell's equations and use them to solve problems in electrodynamics. Develop these equations for use in materials and apply the appropriate boundary conditions.

Academic Expectations: Collaboration

Attendance and Participation is expected to be mandatory were students are encouraged to attend for both tutorials and lectures, which is very important to better understand the material covered.

Adhering to high standards of academic integrity is an important part of your undergraduate experience. The standards are obvious when it comes to exams. Collaboration, such as working with others to conceptualize a problem, define approaches to the solution, or debug code, is often a gray area, and faculty in different courses may have different approaches to this issue.

In this course, discussion is allowed as long as it is identified. Plagiarism, such as copying someone else's solution or COMPUTER code, is not allowed. The write-ups must always be your own. Modifying someone else's Assignment or code to make it your "own" is unacceptable. In case of doubt, consult the course instructor.

If you choose to collaborate with other students on the homework problems, indicate their names and the nature of your joint work. Ensure that your collaborator does the same on his/her assignment. A useful discussion of these issues may be found at http://ctl.utsc.utoronto.ca/home/integrity. *(Also see attached document).*

Assignments, Tests & Exam

- There will be two midterm Tests to be held according to the Registrar's schedule.
- There will be 5 to 6 problem and some may require computer "Mathematica" code.
- There will be a comprehensive final exam during finals two weeks period as set by Registrar's office.

Problem Set Policy[1]

1. Each homework problem must be on a separate sheet of paper. If you need more than one sheet you should staple them together.
2. Turn paper copies in before class starts on the due date. No late work will be graded. If it is submitted the same day after the lecture, a penalty of 50% will be applied. Electronic copies of problem sets will NOT be accepted.
3. When collaborating, be sure to write the names of those you discuss with on the top of your homework.
    a. Collaboration is not sharing code files or copying someone's answers.
    b. Collaboration is asking questions to help clarify your own difficulties with the problem set.
4. If it is a Mathematica problem: Write up the problem and submit the answers in complete form;
    a. For an answer to be complete, you must explain the method you used to find the solution including the equations needed and explain the setup from the code.
    b. You also must include the solutions that the code generated with the appropriate comments about what these solutions indicate about the question posed.
    c. Submit the code that generates the answer and the due date is the same of the Assignment. It is your responsibility to make sure it has be gone through.

Grading:

ACTIVITIES	PERCENTAGES
Problem sets	30%
Two Midterm tests	25% (10% plus 15%)
Final exam	45%

Syllabus:

[1] Some problem sets might contain a Mathematica problem. Programming with Mathematica is not an end in itself but a means to investigate more complex phenomena using visual, analytic and numerical methods. The Mathematica code itself is not an adequate solution to the problem; you must interpret your results and answer the questions posed. You should approach the problem with the goal to understand and explain the physical phenomena investigated and the behavior of the system for variations of the parameters.

The tentative calendar below provides information about the Topics covered in this course. This schedule follows the textbook “Classical Mechanics” by John R Taylor. However, you may use other books that cover the same topics.

CHAPTER #	**TOPICS**	
Chapter-1	Vector Analysis	Week-1 & 2
Chapter-1	Differential Calculus	Week-3
Chapter-2	Electrostatic	Week-4
Chapter-2	Work and Energy in Electrostatics	Week-5
Chapter-5	Magnetic Fields, Lorentz Forces	Week-6
Chapter-5	Ampere’s Law & Magnetic Vector Potential	Week-7
Chapter-7	Ohm’s Law, Electromotive force & Motional EMF	Week-8
Chapter-7	Electromagnetic Induction, Inductance & Energy Stored in Magnetic Fields	Week-9
Chapter-7	Maxwell’s Equations	Week-10 & 11

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Access*ability* Services at UTSC as early as possible in the term. The Access*ability* Services will determine reasonable accommodations for this course.

GOOD LUCK