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University of Victoria
Department of Physics and Astronomy

Physics 422 - Electromagnetic Theory

Spring 2017 Syllabus
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General Information

Instructor: Travis Martin
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Office: Elliot 402B
Office Hours: Tuesday & Wednesday, 4:00-5:00pm
Office Phone: 250-721-6127
Course Webpage: http://coursespaces.uvic.ca

Lecture Schedule:

Monday and Thursday from 1:00pm - 2:20pm in **Elliot 161**.

Prerequisites:

PHYS 326; one of MATH 301, MATH 330B, MATH 438; and MATH 326 or MATH 346. Or permission of the department.

Required Materials:

Text: Griffiths, "Introduction to Electrodynamics" (any edition)

In addition, you should have access to a computer with either a MatLab or Python programming environment.

Course Overview

The end goal of this course is to understand the basics behind the relativistic treatment of electro-dynamics. The following material will be covered, time permitting.

1. Review
   (a) Laplace's Equation
   (b) Multipole Expansion
   (c) Electric and Magnetic Fields in Matter
   (d) Electric displacement and linear dielectrics
   (e) Auxiliary field and linear media
2. Maxwell's Equations
   (a) Maxwell's equations in matter
   (b) Boundary conditions
3. Conservation Laws
   (a) Continuity equation and Poynting's Theorem
   (b) Momentum and Maxwell's Stress Tensor
4. Electromagnetic Waves
   (a) Wave basics and waves in a vacuum
   (b) Waves in matter
   (c) Absorption and dispersion
   (d) Guided waves
5. Potentials and Fields
   (a) Potential formulation and gauge transformations
   (b) Retarded potentials
   (c) Point charges and Leinard-Wiechert Potentials
   (d) Fields of a moving point charge
6. Radiation
   (a) Dipole radiation
   (b) Point charges
7. Electrodynamics and Relativity
   (a) Relativistic mechanics
   (b) Relativistic electrodynamics

Grading

Assignments: 25%

Approximately each week there will be an assignment on the material discussed since the previous assignment. Assignments will be due at the start of class on the provided due date (generally Mondays).

Assignment Policy: You are allowed to collaborate on assignments, so long as your work and your solutions are your own. I take a very strict stance on copying and academic infringement, but I do understand the value in collaborative work. Discussing with a friend is no different from discussing with a professor, except it will likely help your friend learn the material better (teaching someone is the best way to learn material, trust me). But if you scribe their answers, I will know, and I will throw the metaphorical book at you!

Project Assignment: 10%

There will be a project that will be ongoing throughout the semester. The goal will be to write a program that can perform calculations and visualizations of electrodynamics simulations. This can be coded in either MatLab or Python (or another language, if you get permission). Along with some assignments, you will be given a separate question that instructs you to write a function, and test it in specific ways. At the end of the semester, you will be given a final project assignment that will put all of these functions together to produce an actual electrodynamics simulation.

Midterm Exam: 25%

The midterm is designed to encourage students to summarize their knowledge of the material in the first half of the course - namely, the quantum formalism and linear algebra. The midterm will be held in-class at a date that will be determined near the end of September (approximate date of exam will mid-October).

Final Exam: 40%

The final exam will be comprehensive in that it will require knowledge of all of the material of the course. However, the exam will focus primarily on the material after the midterm, while the pre-midterm material will be necessary tools/techniques in order to solve the problems of the final exam.

Accommodations:

Accommodations can be made for missed exams/assignments due to illness or other severe affliction, as well as conflicts with classes and religious observances. Accommodations will also be made for issues documented through RCSD.

If you miss an exam or assignment, I expect you to contact me as soon as possible. If you anticipate missing a course requirement, you must contact me a reasonable time in advance. If an emergency occurs during a test, please talk to me. I can't help if I don't know about the problem.

University Regulations on Academic Integrity

These regulations are reproduced from `http://web.uvic.ca/calendar2011/FACS/UnIn/UARe/PoAcI.html`. For full information, including procedures for dealing with academic integrity infringement, see the webpage linked above.

Academic integrity requires commitment to the values of honesty, trust, fairness, respect, and responsibility. Any action that contravenes this standard, including misrepresentation, falsification or deception, undermines the intention and worth of scholarly work and violates the fundamental academic rights of members of our community.

Several types of academic integrity violations are covered in brief below.

Plagiarism

A student commits plagiarism when he or she:

- submits the work of another person as original work
- gives inadequate attribution to an author or creator whose work is incorporated into the student's work, including failing to indicate clearly the inclusion of another individual's work
- paraphrases material from a source without sufficient acknowledgement as described above

Students who are in doubt as to what constitutes plagiarism in a particular instance should consult their course instructor.

Falsifying Material Subject to Academic Evaluation

Falsifying materials subject to academic evaluation includes, but is not limited to:

- fraudulently manipulating laboratory processes, electronic data or research data in order to achieve desired results
- using work prepared by someone else (e.g., commercially prepared essays) and submitting it as one's own
- citing a source from which material was not obtained
- using a quoted reference from a non-original source while implying reference to the original source
- submitting false records, information or data, in writing or orally

Cheating on Assignments, Tests/Quizzes and Examinations

Cheating includes, but is not limited to:

- copying the answers or other work of another person
- sharing information or answers when doing take-home assignments, tests and examinations except where the instructor has authorized collaborative work
- having in an examination or test any materials or equipment other than those authorized by the examiners impersonating a candidate on an examination or test, or being assigned the results of such impersonation
- *assisting others to engage in conduct that is considered cheating*