Physics 342: Electromagnetic Fields
Professor: Lyle Hoffman
Fall 2019

Month	Date	Topic	Reading	Work Due
Aug.	26	Introduction		
	28	Electric Field	Ch. 2.1 (& 1.1)	
	28	No 4th Hour		
	30	Gauss' Law	Ch. 2.2 (& 1.2-3)	
Sept.	2	Electric Potential	Ch. 2.3 (& 1.4)	
	4	Boundary Conditions	Ch. 2.3.5 (& 1.5)	
	6	Energy and Conductors	Ch. 2.4-5	
	6	Problem Session		HW1
	9	Laplace's Equation	Ch. 3.1 (& 1.6)	
	11	Method of Images	Ch. 3.2	
	13	Separation of Variables: Cartesian	Ch. 3.3.1	
	13	Problem Session		HW2
	16	Separation of Variables: Spherical	Ch. 3.3.2	
	18	Separation of Variables: Cylindrical	Ch. 1.4.2	
	20	Multipole Expansions	Ch. 3.4	
	20	Problem Session		HW3
	23	Dipole Field	Ch. 3.4.4	

	25	Polarization	Ch. 4.1	
	27	Bound Charges	Ch. 4.2	
	27	Problem Session		HW4
	30	Electric Displacement	Ch. 4.3	
Oct.	2	Review	Chs. 1-4.3	
	2	No 4th Hour		
	4	**Hour Exam 1**		
	7	Linear Dielectrics	Ch. 4.4	
	9	Boundary Value Problems in Dielectrics	Ch. 4.4	
	11	Lorentz Force	Ch. 5.1	
	11	Problem Session		HW5
	14	*Fall Break*		
	16	Currents	Ch. 5.1.3	
	18	Biot-Savart Law	Ch. 5.2	
	18	Problem Session		HW6
	21	Ampere's Law	Ch. 5.3	
	23	Vector Potential	Ch. 5.4	
	25	Multipole Expansion of the Vector Potential	Ch. 5.4.3	
	25	Problem Session		HW7
	28	Magnetization	Ch. 6.1	
	30	Bound Currents	Ch. 6.2	
Nov.	1	H Field	Ch. 6.3	
	1	Problem Session		HW8
	4	Linear and Nonlinear Media	Ch. 6.4	
	6	EMF	Ch. 7.1	
	8	Induction	Ch. 7.2	
	8	Problem Session		HW9
	11	Maxwell's Equations in Vacuum	Ch. 7.3.1-3	

	13	Review	Chs. 4.4-7.3.3	
	15	**Hour Exam 2**		
	15	*No 4th Hour*		
	18	Maxwell Equations in Matter	Ch. 7.3.4-6	
	20	Poynting's Theorem	Ch. 8.1	
	22	Maxwell Stress Tensor	Ch. 8.2-3	
	22	Problem Session		HW10
	25	Relativistic Mechanics	Ch. 12.1-2	
	27-29	*Thanksgiving*		
Dec.	2	Electrodynamic Field Tensor	Ch. 12.3	
	4	Catchup		
	6	Review	Chs. 1-8,12	
	6	Problem Session		HW11
		Final Exam (cumulative)	Scheduled by Registrar	

Texts:

- Griffiths, *introduction to Electrodynamics, 4th Ed.*

Your grade will be based on:

- Written homework: 30%
- Oral presentations: 10%
- Hour exams: 15% each
- Final exam: 30%

Learning goals. Upon completion of this course, each student should:

- Understand the principles of electrostatics and magnetostatics;
- Be able to solve boundary value problems in rectilinear, spherical and cylindrical geometries;
- Be able to solve for the electric field in and around dielectric materials;
- Be able to solve for magnetic fields in and around magnetized materials;
- Understand and be able to work with Maxwell's Equations in vacuo and in

matter;
- Have gained skill in problem-solving.

Office Hours:

- Office hours will be posted on my online schedule. Please feel free to call or email with your questions also.

Requirements:

- Homework problems: A full understanding of how to apply the mathematical formalisms comes only with much practise. Therefore homework problems are a crucial, probably the most crucial, part of this course. Assignments will be made weekly, due each Friday. It is essential to read the relevant sections of the text and review lecture notes thoroughly *before* you start to think about the homework problems. Feel free to discuss the problems with one another or (especially) with your instructor, but the paper you submit should represent your own understanding of the problems, written up independently after all discussions are complete. Group solutions are not acceptable. Papers that appear to have been copied from one another will be treated as academic dishonesty.

  One homework set may be submitted late without penalty, but any additional sets submitted late will be down-rated by 10% for each week day following the due date. Homework sets submitted after the start of class on the due date will be considered one day late.

- Problem Discussion Sessions: Learning to think clearly "under fire" and to respond to unanticipated questions is critical for any career path that will require you to explain your work to co-workers or employers, and discussion with others is an important part of the process of grappling with difficult problems in physics. Students are encouraged to start the homework problems early so that they can find time to discuss difficult points with the instructor **before the problems are due**. In addition, students will be called on to present one or more problems orally to the class during the ``4th hour'' each week. The intent is that you will have the problem written up in nearly final form before the presentations start; then you will present the problem at the blackboard, consulting your written solution, and respond to questions from the other students and from the instructor. Then you may amend your written solution as a result of the in-class discussion.

  You may on one occasion state that you are not prepared when your name is called to present a problem. Subsequent absences or failures to respond when called on will result in a 0 being recorded for that presentation.

- Computer Programs and Simulations: More and more, physicists must use

numerical techniques to solve problems. In many cases, it is their facility with incorporating the use of computers into a large-scale problem solution which makes physicists attractive to potential employers. So there will be occasional programming and/or simulation exercises, assigned as part of the weekly homework.

- Exams: There will be two midterm exams at times indicated on the syllabus and a comprehensive final exam scheduled by the registrar. These are intended to give you incentive to make thorough reviews of the material at critical stages in the semester, and to give you practise at thinking under pressure as you will be required to do in the future no matter what field or career path you choose. The best preparation for the exams is the weekly homework; without exception students who have neglected the homework have done poorly on the exams.

- Attendance: Regular class attendance is expected. A couple of absences can be tolerated, but if you miss class more than a couple of times you will find it very difficult to catch up. While my lectures will follow the general outline of the text, I will give more detail in many of the derivations and will choose different examples on occasion; and I will offer a substantially different approach to some topics. In addition, most students find it necessary to see derivations worked out "live" to complement their reading; neither alone suffices. Most students find it best to read the relevant sections of the text *before* the lecture, and then review those sections again carefully after the lecture (before starting the homework problems).

Registrar's Mandatory Privacy Statement:

- Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Federal Credit Hour Compliance Statement:

- The student work in this course is in full compliance with the federal definition of a four credit hour course.

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