PHYSICS 542-01

Electromagnetic Radiation

Spring 2023
NS 306
MW 12:00 pm – 1:15 pm

Instructor:	Dr. C. L. Davis
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Office hours:	Monday, 11:00 am - 12:00 pm
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Web:	http://www.physics.louisville.edu/cldavis/phys542/spring23/index.html
Text:	Electromagnetic Fields by Roald K. Wangsness
	2nd edition. Published by Wiley

INTRODUCTION

This course is the second of two senior level electricity and magnetism courses. Both courses (541 and 542) are required for the Physics BS professional concentration. Only the first semester (541), is required for the Physics BA and all Physics BS concentrations. The material to be covered in these courses does not lend itself well to a 50/50 split. According to the UofL catalog, the first semester course (541) should cover all classical electricity and magnetism, up to and including the development of Maxwell's equations. This course should include the development of electromagnetic waves from Maxwell's equations followed by a description of certain properties of this radiation. In my opinion, attempting to cover all E&M up to and including Maxwell's equations to a level appropriate for a final year undergraduate course in a single 14 week semester is foolhardy. There is just too much material, much of which, although conceptually relatively easy, is practically quite difficult. Therefore, in developing this course I have treated the two-semester sequence as a single unit. Assuming all has gone according to plan, much of the formulation of Maxwell's equations (Chapters 1-19 excl. 11 of the text) will have been completed in Physics 541. This semester, Physics 542 will start with the completion of the formulation of Maxwell's equations, discuss some special methods in electrostatics and continue with a description of some of the properties of electromagnetic waves and radiation.

You are strongly urged to **read** the chapter or sections slated for coverage **before** each class. Ideally, you should treat the lectures as a review of what you have already read. You will gain most from the lectures if you can concentrate on what I am saying not on what I am writing and this can only be achieved if you have some idea of what I am talking about in the first place.

Most of the lectures will be spent in a formal development of the topic of discussion. Only on rare occasions will there be time to completely solve any of the homework (or other problems). You are encouraged to make use of worked examples in the text, discussion with fellow class members and the instructor's office hours to solve assigned problems.

A copy of this syllabus, lecture notes and problem solutions, together with important course announcements will be posted on the course home page at the address given above. Grades will be posted on the Blackboard page for the course.

GRADING

Grades will be determined from the overall percentage obtained by the following weighting.

	Undergraduate	Graduate
Test 1 (Feb. 13)	30%	22.5%
Test 2 (Mar. 27)	30%	22.5%
Test 3 (Apr. 24)	30%	22.5%
Final (Apr. 24)	-	22.5%
Homework	10%	10%

The dates given above are tentative. There will be no make-ups.

It is expected that letter grades will be assigned according to the scale indicated below. These grade boundaries will not be raised. However, the instructor reserves the right to lower the grade boundaries if deemed necessary.

		A	$\geq$	73%
73%	>	A-	$\geq$	68%
68%	>	B+	$\geq$	63%
63%	>	B	$\geq$	58%
58%	>	B-	$\geq$	53%
53%	>	C+	$\geq$	48%
48%	>	C	$\geq$	43%
43%	>	C-	$\geq$	38%
38%	>	D+	$\geq$	35%
35%	>	D	$\geq$	30%
30%	>	F		

TESTS

All tests will be primarily in-class. They will include only material covered during the regular class meetings, unless otherwise specified. Each test will comprise of three or four questions. Thus, by necessity, the questions will require less time to solve than many of the homework problems. But this does not mean that they will be easy, in order to solve them you will need to be completely familiar with the material. In other words, time may be a factor. You will be provided a sheet containing all the important basic formulas and any other critical information.

According to my projected timetable the first test will include all of the material described on the last page of this syllabus from Chapters 11, 20-22 and Appendix A, the second test will be based on material covered in Chapters 24 and 25 and the third test Chapters 28 and 29. As far as possible the second and third tests will include **only** material covered **since** the previous test. However, the nature of the subject means that in order to be successful in **any** test

you will need to be comfortable with **all** of the material covered to date.

If you are classified as a graduate student, or wish to earn graduate credit as an undergraduate, you will be required to take an additional comprehensive test (Chapters 11,20-22,24,25,28,29, Appendix A, inclusive) having equal weight to tests 1, 2 and 3.

HOMEWORK

Learning how to solve problems is an essential part of developing a complete understanding of the material. The complete list of homework problems you are encouraged to solve for the semester is provided in the table below. Homework will be assigned at the completion of each chapter of the text and, unless specified the required problems must be ready for collection one week later. Supplemental problems are for additional practice.

In a different era I would have collected and graded these problems in order to determine the homework grade for the course. I could be reasonably sure that submitted homework was a student's own work. However, in today's world it is possible to locate solutions to most problems in most textbooks within minutes and I have found that in many instances the work submitted is not entirely the student's own work. Therefore, I will not be grading homework for accuracy. When I collect homework, it will be more of a check that an attempt was made. One point will be assigned for a good faith attempt at each homework problem. This means that homework assignments will typically not be of equal weight. **Late homework will not be accepted.**

Don't be deceived. You may find it easy to convince me that you attempted the homework, but unless you truly understand how to solve the homework problems you will be unable to achieve a good score on the tests. By all means discuss the problems with fellow class members, this can be beneficial to all involved. When the due date for a homework assignment has passed, I will make available my written solutions on the course web site.

	Topic	Required Problems	Supplemental Problems
Chapter 20	Magnetism & Matter	3,5,9,17,19,25	7,27
Chapter 21	Maxwell's Equations	1,3,9	7,12
Appendix A	Charged Particle Motion	1,3,5,9	11
Chapter 11	Special Methods in Electrostatics	3,5,9,17,25,31	13,27, Ch.20#23
Chapter 22	Potentials	2,5,7	8
Chapter 24A	EM Waves in non-conductors	3,5,13,17,19	9,15,31
Chapter 25A	Reflection & Refraction of EM Waves	3,5,7,9	1
Chapter 24B	EM Waves in Conductors	7,11	
Chapter 25B	Reflection & Refraction in Conductors	11,12,16,17	13
Chapter 28	EM Radiation	1,3,5,6,7,8,11,16,17	4,9,12,13
Chapter 29A	Review of Special Relativity	3,5,7,15	9,13,17
Chapter 29B	EM and Relativity	21,23,25,27	29,31

CLASS PARTICIPATION

When a course follows a text closely, as is the case for this course, there is a tendency to think that lectures

are unnecessary. It is true that certain individuals are able to learn physics solely from a textbook. However, for most of us, more explanation is needed than that which appears in a typical textbook. When learning new material, lectures provide the opportunity to ask questions as well as clarifying explanations. In order to ensure that you avail yourself of this opportunity class participation will be monitored throughout the semester. Participation does not mean that you are required to ask questions or be otherwise vocal in class; attendance in and of itself is a type of participation.

The following criteria will be followed; your final grade will be reduced by one ± letter grade for every complete multiple of 5 (unexcused) class absences. If you arrive more than 15 minutes late for class you are deemed to be absent. For example, if at the end of the semester you earn a B+ from tests and homework, but missed a total of 12 class meetings, your grade will be reduced by 2 ± letter grades. Your final grade will be a B-.

Title IX/Clery Act Notification

Sexual misconduct (sexual harassment, sexual assault, and sexual/dating/domestic violence) and sex discrimination are violations of University policies. Anyone experiencing sexual misconduct and/or sex discrimination has the right to obtain confidential support from the PEACC Program 852-2663, Counseling Center 852-6585 and Campus Health Services 852-6479.

Reporting your experience or incident to any other University employee (including, but not limited to, professors and instructors) is an official, non-confidential report to the University. To file an official report, please contact the Dean of Student's Office 852- 5787 and/or the University of Louisville Police Department 852-6111. For more information regarding your rights as a victim of sexual misconduct, see the Sexual Misconduct Resource Guide (http://louisville.edu/hr/employeerelations/sexual- misconduct-brochure).

DISABILITY RESOURCE CENTER

Individuals with disabilities who need reasonable modifications to complete assignments and course criteria successfully are encouraged to meet with the instructor as early in the course as possible to identify and plan specific accommodations. Students requesting an accommodation will be asked to supply a letter from the Disability Resource Center (DRC) or other documentation that will assist in planning modifications. The instructor will not recognize requested accommodations without DRC approval/endorsement. The DRC is located in Stevenson Hall. Its staff can be reached by telephone at (502) 852-6938 or online at http://louisville.edu/disability/