

*Course Overview*

Fundamental principles of electrodynamics, including electrostatics, magnetostatics, electric potential, electric and magnetic fields in matter, simple behavior of time-dependent electric and magnetic fields, and Maxwell's equations.

Prerequisites: PHYS 1304, MATH 3302, MATH 3313. PHYS 4321 recommended.

This is a flipped active-learning class in which students can expect to do preparatory work before class and then work in small groups during class.

*Instructor Biography*

Prof. Dalley is a theoretical physicist who has worked in Oxford, Cambridge, Princeton and CERN. He has been teaching physics courses at SMU, from non-science majors to graduate students, since 2006. In 2013, Prof. Dalley received both an Outstanding Professor Rotunda Award and the Provost's Teaching Recognition Award. At SMU he also directs science outreach programs and professional development courses for high-school physics teachers.

**Course Learning Outcomes:** The student should be able to

- Calculate the electrostatic potential from a knowledge of the electrostatic electric field, by using the multipole expansion in tandem with a knowledge of the charge distribution, using the method of images, or the separation of variables technique to solve Laplace's equations.
- Understand the electrostatic properties of conductors and dielectrics, calculate static electric field with the differential and integral forms of Gauss' law and bound charge distributions in dielectrics.
- Calculate the static magnetic field in vacuum and in magnetic materials for a given time-independent current density
- Calculate time dependent behavior of electric and magnetic fields in vacuum using Maxwell's equations

**Class Meeting:** Tu/Th 2:00 p.m. – 3:20 p.m. FOSC 155

**Instructor:** S. Dalley, Room 207 Fondren Science, [sdalley@smu.edu](mailto:sdalley@smu.edu)

**Office Hours:** Tu/Th 1:00 – 2:00 & 4-5 pm or by appointment

**Text:** "Introduction to Electrodynamics" 4th edition by David. J. Griffiths, (Pearson) ISBN 978-0-321-85656-2. Other editions OK if you make the translation.

**Website:** <http://www.physics.smu.edu/sdalley/4392/S20.htm>

- I will use your official SMU e-mail address to communicate with you – please check it!
- Academic Dishonesty will result in a course F grade and filing with the Dean of Student Life.

	TOPIC	Pre-Class Prep	HW due
1/21	Introduction & Vector Algebra	Read 1.1	
1/23	Vector Calculus	Read 1.2-3 Do 1.20	
1/28	Curvilinear Coords, Dirac Delta, Field Theorems	Read 1.4-6 Do Warmup 1	1.7, 1.25, 1.33
1/30	Electrostatic Field & Gauss' Law	Read 2.1-2 Do Warmup 2	
2/4	Electrostatic Potential & Energy	Read 2.3-4 Do Warmup 3	1.43, 2.6, 2.16
2/6	Conductors	Read 2.5 Do Warmup 4	
2/11	<i>Review of 1.1 – 2.5</i>		2.27, 2.38, 2.43
2/13	<i>Test 1</i>	1.1 – 2.5	
2/18	Laplace's Equation & Method of Images	Read 3.1-3.2 Do 3.7	
2/20	Separation of Variables	Read 3.3 Do Warmup 5	
2/25	Electrostatic Multipole Expansion	Read 3.4 Do Warmup 6	3.9, 3.13, 3.19
2/27	Electric Polarization	Read 4.1-2 Do Warmup 7	
3/3	Electric Displacement and Linear Dielectrics	Read 4.3 – 4.4.1 Do Warmup 8	3.28, 3.31, 4.11
3/5	Boundaries and Energy in Dielectrics	Read 4.4.2 – 4.4.4. Do Warmup 9	
3/10	<i>Review of 3.1 - 4.4</i>		4.18, 4.21, 4.26
3/12	<i>Test 2</i>	3.1 - 4.4	
3/24	Lorentz Force & Current Density	Read 5.1 Do 5.3	
3/26	Biot-Savart Law & Div/Curl of B	Read 5.2 - 5.3.2 Warmup 10	
3/31	Ampere's Law & Maxwell's Static Equations	Read 5.3.3 – 5.3.4 Do Warmup 11	5.5, 5.10, 5.11
4/2	Magnetic Vector Potential	Read 5.4 Do Warmup 12	
4/7 (Drop)	Magnetization	Read 6.1 – 6.2 Do Warmup 13	5.15, 5.21, 5.35
4/9	H Field	Read 6.3-6.4 Do 6.14	
4/14	<i>Review of 5.1 – 6.4</i>	Practice Test 3	6.3, 6.8, 6.16
4/16	<i>Test 3</i>	5.1 – 6.4	
4/21	Electromotive Force	Read 7.1 Do Warmup 14	
4/23	Magnetic Induction	Read 7.2 Do Warmup 15	
4/28	Maxwell's Equations	Read 7.3 Do 7.36	7.8, 7.16, 7.22
4/30	<i>Review of 7.1 – 7.3</i>		
5/12	<i>Final Exam 11:30-2:30</i>	Chaps 1 – 7	

## Assessment

### WARMUPS (10%)

**Before each class** you are expected to read relevant sections of the textbook and attempt the problem from Griffiths or Warmup sheet as shown on the syllabus and linked on the course website. You are required to submit your attempt at the start of class. It is graded  $\frac{1}{2}$  for effort,  $\frac{1}{2}$  for correctness. Late Warmups are not accepted but the lowest warmup score will be dropped.

### HOMEWORKS (35%)

Post-class homework assignments, as shown on the syllabus, are due most weeks and must be turned in at the beginning of class on the due date to gain credit. Late homeworks are not counted for credit but the lowest homework score will be dropped.

### IN-CLASS TESTS (7% each)

There will be three 75-min in-class tests on the most recent topics. You may use a calculator and the course textbook during the tests.

### TEST REDOs (3% each)

You have the opportunity to correct your graded Tests in your own time. Redos must be submitted within one week of receiving your graded Test back. If no Redo is submitted, the original Test score will count for the Redo credit.

### FINAL EXAM (25%)

There will be a 3 hr comprehensive final exam. You may use a calculator and the course textbook during the exam.

### **Grade Boundaries are roughly defined as**

A > 90% > A- > 85% > B+ > 80% > B > 75% > B- > 70% > C+ > 65% > C > 60% > D > 50% > F

**Disability Accommodations:** Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/ALEC/DASS> to begin the process. Once

registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

**Religious Observance:** Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

**Excused Absences for University Extracurricular Activities:** Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

**Attendance:** If you are absent from class without valid reason for two consecutive weeks or for more than 6 classes total and are scoring a failing grade you will be administratively dropped from the course.