

Electromagnetic Fields (PHY 4438)

TEXT: Introduction to Electrodynamics by David J. Griffiths, 4th edition

INSTRUCTOR: *Dr. Govind Menon* (gmenon@troy.edu)
Professor of Physics
Director, School of Science and Technology
Chair, Dept. of Chemistry and Physics
Office: MSCX 315
Telephone number: 334 670-3924

OFFICE HOURS: 9:00 –11: 00 a.m. (M TU W F) If you try to see me at my office and do not find me in, leave a note and make sure you see me the next class period.

TOPICS COVERED
Magnetostatics
Magnetic Fields in matter
Electrodynamics
Conservation Laws
Electromagnetic Waves
Electromagnetic Radiation

ASSIGNMENTS: There will be take home problems given on a regular basis. It is up to the student to complete the assigned problems in a timely manner. Additionally, the student is expected to attend all classes and to participate in-class discussion and ask questions regarding any aspect of the course that is unclear.

TEST SCHEDULE:

TEST TYPE	ADVANCE NOTICE	POINT VALUE	NO. OF TESTS
Major exam	1 week	80%	4
Final Exam	12/10/19 (8:00-10:00 a.m.)	20%	1

GRADE SCALE

90-100%	A
80-89.9%	B
70- 79.9%	C
60-69.9%	D
Less than 60%	F

MAKING UP MISSED EXAMS: If you have a university excused absence for the missed day of exam, and if you notify me at least one week in advance, I will reschedule the exam for you at an earlier time and date. Under no circumstance will the exam be given after the originally scheduled time.

AMERICANS WITH DISABILITY ACT (ADA): Troy University supports Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, which insure that postsecondary students with disabilities have equal access to all academic programs, physical access to all buildings, facilities and events, and are not discriminated against on the basis of disability. Eligible students, with appropriate documentation, will be provided equal opportunity to demonstrate their academic skills and potential through the provision of academic adaptations and reasonable accommodations. Further information, including appropriate contact information, can be found at the link for Troy University's Office of Human Resources at <http://www.troy.edu/humanresources/index.html>.

ADDITIONAL SERVICES: Students who have or may be dealing with a disability or learning difficulty should speak with the instructor, contact the Office of Adaptive Needs Program, or call 670-3220/3221. Various accommodations are available through the Adaptive Needs Program.

DISCLAIMER: The syllabus is only tentative and is subject to change.

The daily lecture schedule below is rough in that I may need an extra day or two to cover the material. Nonetheless, this is exactly how the course will progress.

Lecture Schedule

Chapter 5: Magnetostatics

Day 1 Assignment:

1. Line, surface and volume current density
2. Biot-Savart's Law

Day 2: Divergence and Curl of B (section 5.3.1)

Day 3: Divergence and Curl of B (section 5.3.2)

Day 4: Ampere's Law 5.3.3, ex 5.8

Day 5:

1. Show by explicit construction that the z component of the Magnetic field goes to 0 infinitely far away from a solenoid.
2. Ex. 5.9
3. Assign problem 5.46
4. Ask students to read example 5.10.

Day 6: Vector potential (5.4.1)

Day 7: Vector potential continued assign ex 5.12

Day 8: Boundary Conditions

Hint for problem 5.33 (the partial derivatives of A are continuous on the surface)

Day 9: Multipole Expansion

Chapter 6: Magnetic Fields in Matter

- Day 1:** Torque on a dipole (in a uniform field), assign problem 6.3
(There is a nice teach spin lab for this)
- Day 2:** The field of a magnetized object
- Day 3:** The field of a magnetized object + Introduction to H.
- Day 4:** Parallels between H and B, boundary conditions, linear media.
- Day 5:** Do problem 6.16, and Chapter 7

Chapter 7: Electrodynamics

- Day 1:** The electromotive force
- Day 2:** Motional *emf*
- Day 3:** Faraday's Law
- Day 4:** Finish Faraday's Law
- Day 5:** Inductance
- Day 6:** Finish Inductance
- Day 7:** Finish Inductance start Magnetic Energy
- Day 8:** Finish Magnetic Energy, Start Maxwell's equations
- Day 9:** Maxwell's equations in matter
- Day 10:** Boundary Conditions
- Day 11:** Superconductivity

Chapter 8: Conservation Laws

- Day 1:** Conservation of Energy
- Day 2:** Maxwell Stress Tensor
- Day 3:** Maxwell Stress Tensor
- Day 4:** Conservation of Momentum
- Day 5:** Conservation of Angular Momentum
- Day 6:** The work ethic of magnetic fields

Chapter 9: Electromagnetic Waves

- Day 1:** Introduction to Waves
- Day 2:** Reflection Transmission
- Day 3:** Electromagnetic waves
- Day 4:** Electromagnetic waves: Energy, Momentum and Pressure
- Day 5:** Reflection and Transmission (Normal Incidence)
- Day 6:** Reflection and Transmission (Oblique Incidence)
- Day 7:** Reflection and Transmission (Oblique Incidence continued)
- Day 8:** Absorption and Dispersion
- Day 9:** Absorption and Dispersion
- Day 10:** Absorption and Dispersion

Chapter 10: Potentials and Fields

In the time that remains, cover as much as possible.