

University of Colorado's Upper-Division Electricity & Magnetism Materials

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What is in the resource: Mathematical Fundamentals

The Mathematical Fundamentals materials for Electricity and Magnetism are available as the Primary Document, a .zip file, at:

<http://www.compadre.org/psrc/items/detail.cfm?ID=10143>.

PLEASE GO TO THAT URL TO DOWNLOAD THE RESOURCES.

These materials cover Chapter 1, "Vector Analysis" from *Introduction to Electrodynamics* by D. J. Griffiths. They include:

- Clicker questions
- Homework
- Student difficulties

Since most instructors cover the mathematical procedures of E&M during the course of Griffiths Chapter 2 (Electrostatics), the bulk of homework and clicker questions on this material can be found throughout the relevant sections of Electrostatics.

Other topics in this course:

Our materials cover the following topics:

1. Mathematical Fundamentals
2. Electrostatics
 1. Coulomb's Law and E fields
 2. Gauss' Law and Divergence
 3. Curl of E and Electric Potential
 4. Work and Energy
 5. Conductors and Capacitors
 6. Poisson and Laplace
 7. Method of Images
 8. Separation of Variables
 9. Multipole Expansion
3. Electric Fields in Matter
 1. Polarization, Fields, Dielectrics
 2. Electric Displacement (D)
 3. Boundary Value Problems
4. Magnetostatics
 1. Lorentz Force
 2. Charge Density and Current
 3. Biot-Savart

4. Divergence and Curl of \mathbf{B} ; Ampere's Law
5. Vector Potential (\mathbf{A})
5. Magnetic fields in Matter
 1. Magnetization and Dipoles
 2. Bound Current and Fields
 3. Auxiliary Field (\mathbf{H}) and Linear Media
6. Electrodynamics
 1. EMF
 2. Inductance
 3. Maxwell's Equations
 4. Relativity

Types of materials available

All of the above topics contain the following types of materials.

- a. Concept Tests (a.k.a. Clicker Questions). *These are questions intended to be used with a personal response system (PRS) and peer instruction*
- b. Homework banks . *These documents provide a broad range of homework questions from various instructors and texts.*
- c. Student Difficulties. *These "resource documents" include common student difficulties observed during the course of our research, as well as learning goals and classroom activities for individual topics.*

Some topics also contain:

- d. Tutorials. *These small-group activities are intended to last 1-2 hours and help students grapple with the core concepts in the course.*

These resources can also be downloaded by type (e.g., all Concept Tests) as well as by topic.

About the development of these materials:

The University of Colorado undertook a 3-year effort to research and transform our upper-division courses. Here you will find our research-based materials on junior-level Electricity and Magnetism. This course is the first semester of a two-semester course covering electro- and magneto-statics and closely follows the standard text by David Griffiths, "Introduction to Electrodynamics." In this record, you will find a number of materials that we have developed during the course of these efforts.

Assessments

To help hide sensitive materials from students, these online materials do NOT include the assessments developed as part of the course: Midterm and final exams, solutions to homework and exams and, particularly, the conceptual diagnostic developed to probe student understanding of key concepts in the course (The Colorado Upper-division Electrostatics diagnostic, or CUE). If you would like access to those materials, please email Steven Pollock at steven.pollock@colorado.edu.

Complete Download

All of these materials, organized by topic and material type, can be accessed and downloaded in a single file from the main SEI E&M page: http://www.colorado.edu/sei/departments/physics_3310.htm or the main SEI E&M listing on ComPADRE: <http://compadre.org/psrc/items/detail.cfm?ID=7891>

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