

Department of Electrical and Computer Engineering
New Jersey Institute of Technology

ECE 361: **Electromagnetic Fields I** (3 credits, 3 contact hours, required course)

Instructor: Gerald Whitman; **E-mail:** whitman@njit.edu ; **Phone:** 973- 596 -3232

Text books:

D. C. Cheng, *Fields and Wave Electromagnetics*, 2nd ed., Addison-Wesley, 1989. ISBN 0-201-163235-5
J. Edminister and M. Nehvi-Dekhordi, *Electromagnetics*, 3rd ed., Schaum's Outlines, McGraw Hill, 2010. ISBN 978-0-07-163235-5

Course Description:

This course introduces the student to the fundamentals of static electric and magnetic fields. Topics covered include: (1) electric force field due to elementary stationary charge, (2) the magnetic force field due to electric charge moving at uniform velocity, (3) electric and magnetic forces, (4) stored electric and magnetic energy, (5) potential, i.e., voltage, (6) power loss, (7) the meaning of capacitance, resistance, and inductance, (8) electrical properties and characterization of materials (conductors, insulators and magnetic materials), (9) mathematical formulation of the physical laws governing electromagnetic fields in the time-independent case, and (10) the mathematics of vector analysis: vector algebra, orthogonal coordinate systems (rectangular, cylindrical and spherical) and vector calculus.

Prerequisite: ECE students – ECE 231, Math 213, Phys 234 **Co-requisite:** none

Specific course learning outcomes (CLO): The student will be able to

1. understand the basic definitions and physical concepts of static electromagnetism
2. understand the mathematical formulation of the basic laws governing static electromagnetism
3. understand and analysis geometrical configurations in rectangular, cylindrical and spherical coordinate systems
4. understand how to formulate solutions to electromagnetic problems using basic principles
5. understand how to use analytical techniques to solve problems and interpret results physically

Relevant student outcomes (ABET criterion 3):

- (1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1, 2, 3,4,5)
- (4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (CLO 4)
- (7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 4, 5)

Computer assisted design and course specific software: none

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.

Tenative Course Schedule	Weeks
Vector Calculus	1,2
Static Electric Fields	3
Electrostatics(cont.), Electric Potential	4
Conductors, Dielectrics, Polarization, Displacement	5,6
Capacitance, Electrostatic Energy	7,8
Steady Electric Currents	9
Static Magnetic Fields, Vector Magnetic Potential	10-11
Inductance	12
Magnetic Energy and Force	13,14

Changes in the syllabus are possible. Students will be informed of those changes in class announcements.

Grading policy: Three class Examinations (100 points each, 60%), Final Examination (100 points, 40%), Quizzes, Homework and Class Participation: 0 to 10% (add or subtract).

Attendance: Required at class lectures and problem solving sessions.

Lateness to class: Unacceptable.

Cellular phones and Beepers: Shut off or in quiet mode.

Formula Sheets: 2 for Exam I, 4 for Exam II, 6 for Exam III, 8 for Final.

In own handwriting, no derivations, no worked out examples, no calculations, no illustrative examples.

Permitted: definitions, units, formulas, geometry that define parameters in formulas; equivalent circuits.

Homework Policy

The problems will be assigned and checked. Students are expected to solve **all** assigned problems.

Solutions will be provided and discussed in class. The text contains numerous examples. Students are encouraged to study these examples for practice.

Updates and Assignments to be distributed via e-mail.

Office Hours: to be announced as well as by appointment.

Honor Code: The NJIT Honor Code will be upheld, and any violation will be brought to the immediate attention of the Dean of Students.

Office: MIC Bldg., Room 405 inside Room 403.

Prepared by: G. Whitman

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