Fall 2024

ECE 361 - ELECTROMAG FIELDS

Sumit Balguvhar

Helen and John C. Hartmann
Department of Electrical and Computer Engineering
New Jersey Institute of Technology
Academic Year: 2024-2025
Term: Fall 2024

Course Instructor: Dr Sumit Balguvhar
Email: sumit.balguvhar@njit.edu
Time: Thursday 6:00-10:05 PM (Culm 110)
Delivery Format: Face-to-Face
Office Hours: Thursday 4:00-5:30 PM (Rm. 326 ECEC, please email me ahead to confirm that I am in my office)

Course Number and Title: ECE 361 Electromagnetic Fields I
(3 credits, 3 contact hours, required course)
Textbook: (1) M. Sadiku, Elements of Electromagnetics, 7th Ed., Oxford University Press, 2018, ISBN: 9780190698614; (2) Lecture slides
Other reference material: D. C. Cheng, Fields and Wave Electromagnetics, 2nd ed., Addison-Wesley, 1989. ISBN 0-201-163235-5

Course Catalog Description (including prerequisites and co-requisites):
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.

Prerequisites: ECE 231, Math 213, Phy 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 ABET 1-7 Student Outcomes (SOs):

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics (CLOs 1-5).
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (CLOs 4-5).
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLOs 1-5).
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (CLOs 2-5).

Course Outline

Week	Topics	Homework
1	Lecture 1: Introduction, Vector algebra Lecture 2: Coordinate systems and transformation	
2	Lecture 2: Coordinate systems and transformation contd. Lecture 3: Vector calculus	
3	Lecture 3: Vector calculus contd. Lecture 4: Coulomb's law	
4	Lecture 5: Gauss's Law Lecture 6: Electric Potential	HW#1
5	Lecture 7: Electric Energy Lecture 8: REVIEW	
6	**Exam I (10/10/2024)**	
7	Lecture 9: Conductors Lecture 10: Dielectrics	
8	Lecture 11: Boundary Conditions Lecture 12: Resistance and Capacitance	
9	Lecture 13: Poisson's and Laplace's Equations I Lecture 14: Biot-Savart's law and Ampere's law	HW#2
10	Lecture 15: Magnetic Flux Density and Maxwell's Equations Lecture 16: Magnetic Forces	
11	**Exam II (11/14/2024)**	
12	Lecture 17: Magnetic Materials and Boundary Conditions Lecture 18: Inductors, Inductances, Magnetic Energy	Assignment
13	**Thanksgiving Break**	
14	Lecture 19: Magnetic Circuits and Force on Magnetic Materials Assignment, Review and Final Exam Preparation	
15/16	**Final Exam**	

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

Grading Policy:

Homework, class participation/effort:	5%
Two class examinations:	25%, 25%
Final examination:	35%
Home Assignments:	10%

All exams are closed notes and books, formula sheets allowed for Test 1 (one page), Test 2 (two pages), and Final (three pages). No solved numerical examples allowed in the note sheets. **Phones are NOT ALLOWED DURING EXAMS**. *Failure to adhere to these rules forfeits the test grade.*

Attendance: Required for lectures.

Academic Integrity:

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*