

Syllabus for PHYS 122 - Section 002

Electricity and Magnetism for ECE Applications

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Spring, 2025

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Office Hours:

MIC 205, Tuesday 2:30 - 3:30 PM, Thursday 1:00 - 2:00 PM (other times by appointment)

Weekly Schedule:

Lecture - Kupfrian Hall 108

Tuesday 10:00 - 11:20 AM

Recitation - Kupfrian Hall 108

Thursday 10:00 - 11:20 AM

Course Description

This course is the second of the calculus-based introductory Physics (PHYS) series, covering topics in Electricity and Magnetism (EM, or E&M) at the introductory level. The principal Learning Outcomes are to demonstrate understanding and mastery of classical electricity and magnetism up to AC circuits, including Maxwell's Equations. The subject matter areas you will be assessed on include electric charge, electric and magnetic fields, forces on stationary and moving charges and currents due to electrostatic and magnetic fields, electrostatic potential and potential energy, Gauss' Law, capacitance, current, resistance, the Biot-Savart Law, Ampere's Law (w/ Maxwell's correction), Faraday's Law, inductance, DC, RC, LR, LCR, and AC circuits, including phasor diagrams and resonant oscillations if time permits.

In any/all of the subject areas noted in the first section of this syllabus, you should be able to:

1. Recall and use the conceptual and mathematical definitions and be able to explain them.
2. Explain the conceptual and mathematical relationships between quantities used.
3. Use symmetry arguments, sketches and diagrams, graphs, field maps, algebra, trigonometry, and basic integral and differential calculus methods in interpreting material using reasoned arguments and also in interpreting and setting up textbook-level problems.
4. Explain and manipulate equations and techniques developed in the text, lectures, problem examples, and in the course of working problems.
5. Apply the skills above to successfully solve textbook-level problems with numeric, symbolic, or conceptual answers.

6. Critically evaluate the soundness and precision of your own answers, explain and interpret your solutions to problems in a way that shows understanding, and identify and appraise the range of applicability of your results, and their limitations.
7. Apply conceptual and mathematical definitions including flux of vector fields, scalar potentials, and relevant line, surface and volume integral relationships to vector fields.
8. Utilize dimensional arguments, scaling arguments and, limits to determine the validity of calculations.
9. Solve symbolically labeled DC circuits with up to three independent currents.
10. Be able to carry out algebraic manipulations with complex numbers applied to multiple loop AC circuits.
11. Determine the solutions for first-order ordinary differential equations using integration.
12. Solve problems with nontrivial current or charge distributions by integration.
13. Determine approximate solutions for E and B for limiting cases by truncating a series expansion.
14. Solve problems with numeric, symbolic, or conceptual answers. Emphasis placed on symbolic solutions.

Required Materials

- Textbook (Abbreviation: Y&F): “University Physics”, 15th Edition, authors Young & Freedman (Pearson, 2020). We use Chapters 21 to 31 in Volume 2. Most students now buy the e-text, which is bundled with the Modified Mastering Physics homework system. The ISBN is 9780135206348. Students may also use the old 13th and 14th editions of the same text for reading assignments, as the section materials generally match. However, the end-of-chapter problems are numbered differently.
- **Mastering Physics Online Homework System:** Each student must obtain an access code kit that allows use of the online homework system. In addition to using the access code, each student must enroll in the Mastering Physics course using a course identifier code: **goodwin72571**
- **Canvas:** The syllabus and lecture material is on Canvas. However, the solutions to recitation and lecture problems are worked out in-person.

Physics 121/122 Tutoring:

Central King Building, Room G12, <https://physics.njit.edu/physics-tutoring-sign-sheet>

Prerequisites/Corequisites

Pre-requisites (all with C grade or better): Physics 111 (111H) and Math 111 (111H)

Co-requisites: Physics 121A (the lab course) and Math 112 (Calculus-II)

[Note: PHYS 121A Laboratory SHOULD be taken along with PHYS 122 unless you passed it previously or have an approved exemption. It is recommended that you take the PHYS 121A laboratory at the same time as the course since the laboratory reinforces the concepts learned in the

course. The Lab is otherwise a totally separate course from PHYS 122 in that the lab instructors set the requirements and grades.]

Grading Policy

Will be based on a term average for the semester's work that includes the common exam score, the final exam, in-class quizzes, and the term's homework score. The approximate weights to be used for calculating the term average score:

- 15% for Exam 1 (in-person exam, proctored, closed book/notes, no calculator needed)
 - Monday, 2/17/2025, 4:15 – 5:45 PM LT
- 15% for Exam 2 (in-person exam, proctored, closed book/notes, no calculator needed)
 - Monday, 4/2/2025, 4:15 – 5:45 PM LT
- 15% for Exam 3 (in-person exam, proctored, closed book/notes, no calculator needed)
 - Monday, 4/14/2025, 4:15 – 5:45 PM LT
- 25% for the Comprehensive Final Exam (in-person exam, proctored, closed book/notes, no calculator needed)
 - During Finals Week, 2.5 hours long
- 15% for homework (performed in Mastering Physics)
- 15% for class quizzes (during Recitation)

The term average values used as cutoffs for various letter grades will be in the approximate range of: 85% for A, 80% for B+, 70% for B, 65% for C+, 55% for C, 50% for D, and 50% for F.

In-class quizzes covering preceding or current work may also be given during recitations, and the grades will count toward your final course grade. There will be no make-up quizzes and normally no make-up common exams.

Students who miss an Exam usually receive a score of zero for that exam. Students who expect to be absent from an exam should discuss their situation with their instructor PRIOR TO their absence. In order to qualify for a (rare) "make-up" Exam, a student needs to document the reason for not being able to take the test as scheduled. Under NJIT standard policy, the documentation should be presented to the student's PHYS 122 instructor AND to the Dean of Students. BOTH the PHYS 122 instructor and the Dean of Students must concur in permitting a "make-up" Exam. Students who miss Exams and do not contact and present documentation to their instructor within 7 days of the Exam will receive a score of zero for the Exam.

Mastering Physics Homework System:

You will have to create an account on the Mastering Physics system if you do not have one already. You may not be able to sign up for the course your instructor is using until you have a valid Mastering Physics access code. Therefore, acquire one early and contact your instructor if this is a problem. Your instructor will announce a Mastering Physics course identifier (**goodwin72571**) for you to use when enrolling in your specific class. Use your NJIT email address as the logon ID for your account.

The Mastering Physics login is <http://www.masteringphysics.com>. See instructions at end of document to sign-up for homework. The assignments are/will be labeled HW1 to ~ HW14.

Withdrawal:

If you must withdraw from the course, do it officially through the Registrar before the last withdrawal date. If you simply stop attending and stop taking exams, your instructor will have no option other than to assign a course grade of “F”.

Honor Code Violations:

NJIT has a zero-tolerance policy for cheating of any kind and for disruptive student behavior. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable.

General Class Expectations:

- Students are required to agree to the NJIT Honor Code at all times.
- College Rule of Thumb: You should expect to spend a minimum of 2 hours in outside work for each hour spent in class each week. That means 6 hours outside of lecture spent on this class alone.
- You should expect to be assessed on learning outcomes by means of three Common Exams, a Final Exam, in-class quizzes, and scores on homework assignments.
- You are expected to make the time to attend the Common Exams in addition to the scheduled lectures/recitation.
- Do not create distractions in class that interfere with the work of other students or instructors.
- The schedule below lists the topics covered and text readings. Do the homework problems: it is almost impossible to succeed in physics courses without working a lot of problems. The last column provides additional recommended problems to be covered in the recitation. Please work them out BEFORE the recitation.
- In General:
 - Read the assigned sections of the text before the lecture covering that material.
 - Do the recitation problems BEFORE the recitation.
 - Submit the weekly homework assignments before they are due.

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.

Generative AI

The usage of artificial intelligence (AI) is permitted in this course and no citation is necessary. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

Student Absences for Religious Observance:

NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence. For questions or additional guidance, please review the policy (<https://www.njit.edu/registrar/njit-policy-student-absences-religious-observances>) or contact the Office of Inclusive Excellence at inclusivexcellence@njit.edu.

Approximate Schedule

Topic	Text Chapters	Recitation Problems
Jan 19: Intro to class and settling in	Chap. 1 Vector Material	1.26, 1.36, 1.37, 1.40, 1.82, 1.86
Jan 26: Intro to Fields, Electric Charge, and Force	Chap. 21.1-21.3	21.7, 21.11, 21.16, 21.22, 21.26, 21.27, 21.35, 21.50, 21.54, 21.55, 21.75, 21.79, 21.84
Feb 2: Electric Fields	Chap. 21.4-21.7	Continue
Feb 9: Gauss' Law	Chap. 22.1-22.5	22.4, 22.7, 22.8, 22.9, 22.13, 22.16, 22.19, 22.23, 22.31, 22.33, 22.37
Feb 16: Electric Potential	Chap. 23.1-23.6	23.2, 23.11, 23.16, 23.22, 23.34, 23.44, 23.59, 23.62, 23.71, 23.80
Feb 17, 4:15 - 5:45 pm	COMMON EXAM 1	
Feb 23: Capacitance and Dielectrics	Chap. 24.1-24.6	24.5, 24.7, 24.12, 24.18, 24.21, 24.25, 24.28, 24.30, 24.39, 24.60, 24.74
Mar 2: Current, Resistance, basic DC Circuits	Chap. 25.1-25.5	25.2, 25.9, 25.15, 25.19, 25.28, 25.32, 25.37, 25.43
Mar 9: Kirchhoff's Rules (nodal/mesh analysis)	Chap. 26.1-26.5	26.2, 26.8, 26.11, 26.20, 26.22, 26.23, 26.25, 26.29, 26.34, 26.42, 26.51, 26.59, 26.83
Mar 16: Spring Recess	No Classes	
Mar 23: Charges and Currents in Magnetic Fields	Chap. 27.1-27.8	27.3, 27.6, 27.9, 27.14, 27.17, 27.22, 27.25, 27.30, 27.31, 27.45, 27.47
Mar 30: Sources of Magnetic Fields, Biot-Savart Law, Ampere's Law	Chap. 28.1-28.7	28.1, 28.4, 28.9, 28.13, 28.16, 28.23, 28.29, 28.33, 28.37, 28.41
Apr 2, 4:15 - 5:45 pm	COMMON EXAM 2	
Apr 3: Wellness Day	No Classes	
Apr 6: Faraday's Law of Induction	Chap. 29.1-29.5	29.1, 29.6, 29.9, 29.14, 29.20, 29.22, 29.29, 29.32, 29.35, 29.37
Apr 13: Inductance and RL Circuits	Chap. 30.1-30.6	30.2, 30.3, 30.6, 30.7, 30.11, 30.16, 30.19, 30.33, 30.34, 30.36, 30.37, 30.52, 30.59
Apr 14, 4:15 - 5:45 pm	COMMON EXAM 3	
Apr 20: LC and LCR Circuits, EM Oscillations, AC Circuits	Chap. 31.1-31.2+	31.1, 31.4, 31.7, 31.11, 31.12
Apr 27 + May 4: Final Class	Summary and Maxwell's Equations	