

PHYS273/252: Fundamentals of Physics II: Electromagnetism

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CATALOGUE DESCRIPTION

Course Summary: Physical laws governing electricity and magnetism using calculus. Primarily for majors in the physical and mathematical sciences and engineering. One three-hour laboratory a week. Not available for credit to students with credit in PHYS 211, PHYS 251, or PHYS 251A.

Prerequisites: PRQ: PHYS 250A or PHYS 253, CRQ: MATH 230

INSTRUCTOR

Philippe Piot, Prof. of Physics

LaTourette Hall, room 226

Tel: 815 753 6473

e-mail: ppiot@niu.edu, The best way to reach me is via e-mail. **(Please use sensible e-mail subject-headings starting with PHYS273)**

CLASS MEETINGS & OFFICE HOURS

This class meets on Tuesdays and Thursdays from 9:30pm to 10:45pm in Faraday Hall, room 143.

I am available to answer your questions or discuss matter related to this course anytime from 11:00pm to 1:30pm on Tuesdays and Thursdays. For other times and/or days please send me an e-mail to schedule a meeting.

COURSE DESCRIPTION & OUTCOME

This course will enable students to learn about the electrical and magnetic properties of matter in terms of basic laws of nature. Students will develop problem-solving techniques and acquire skills to describe physical situations using mathematical descriptions to solve problems. The lectures will incorporate discussion/solving sessions and experimental demonstrations. A lab session will provide students with opportunities to develop experimental skills, learn how to use basic laboratory equipments, and gain experience

with redacting scientific reports summarizing their experiments. Students completing this course are expected to develop essential foundations in physical concepts that will prepare them for upper level courses in the sciences and engineering.

TEXTBOOK

The required textbook is *Physics for Scientist & Engineers* Volume 2, Fourth Edition, by Douglas Giancoli. ISBN-13: 978-0-13-149508-1 ISBN: 0-13-149508-9, published year: 2009 by Person Education, Inc, Person Prentice Hall.

ASSESSMENT & GRADING

The assessment will consist of weekly homework, three exam, and a final exam (on Wed. May 11, 8-9:50 a.m). The grading will be as follows:

Homework	10% of overall grade
Exams	45% of overall grade (each exam count for 15%)
Labs	25% of overall grade
Final exam	20% of overall grade

Students taking **PHYS252** will have their grades assigned given the following weights: Homework: 15%, Exams: 55%, Final exam: 30%.

The numeric averaged grade will be computed given the above Table and a letter grade will be assigned following the table below. The scale might be shifted in the direction that improves grades.

Letter grade	Percentage points.
A	$\geq 85\%$
A-	$\geq 80\%$
B+	$\geq 75\%$
B	$\geq 70\%$
B-	$\geq 65\%$
C+	$\geq 60\%$
C	$\geq 55\%$
D	$\geq 40\%$
F	$< 40\%$

Further information on NIU grading system can be found at:
<http://www.niu.edu/regrec/grading/gradingfaqs.shtml>

HOMEWORKS

The homework problems will be taken from the textbook. You are asked to return a paper version of your homework and fill an on-line GoogleForm with the answers. Your

grade will be based on the GoogleForm. In case of questions, disagreements, or errors in the automated grading, the paper version of your homework will be used. Additionally, I will also randomly check the paper version of your homework to ensure you have adequately documented the work [a poorly- or well-redacted paper version will affect (respectively lower or give extra credit) the grade obtained from the GoogleForm]. I also encourage you to come to my office to discuss your results and errors. The paper version of the homework will be useful to support these discussions. **Note that for the automated grade to count, you must have provided a paper version of your homework documenting all your derivations.**

LABS & LAB REPORTS

The lab syllabus is provided separately and will be discussed in your lab section by your respective TA during the first lab session. Students are expected to write a formal report due within a week after the lab session took place. **A minimum average lab grade of 60% is required to pass the course.**

STUDENT RESPONSIBILITIES

The students are expected to be engaged learners, to attend the lectures and participate in the problem solving and/or assist the instructor in experimental demos. Plagiarism and cheating are serious academic offenses and offenders will be directly referred to the University's judicial office.

ACCESSIBILITY

If you need an accommodation for this class, please contact the Disability Resource Center (RDC) as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu. Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

SYLLABUS

The lesson plan is as follows (one lesson corresponds approximately to one 1hr15-min class (there are 31 class meetings and 3 will be used for in-class exam)).

- Lesson 1, 01/19: general introduction - **I electrostatic:** static electricity, electric charges, Coulomb's law
- Lesson 2, 01/21: Electric field - field lines-
- Lesson 3, 01/26: electric dipoles - some applications
- Lesson 4, 01/28: electric flux & Gauss's law -
- Lesson 5, 02/02: application of Gauss's law

- Lesson 6, 02/04: Electric potential and potential difference
- Lesson 7, 02/09: Potential due to point charge & continuous charge distributions
- Lesson 8, 02/11: **Exam 1.**
- Lesson 9, 02/16: Equipotential surface - Electric-dipole potential
- Lesson 10, 02/18: relation between E-field and potential - applications: cathode-ray tubes
- Lesson 11, 02/23: capacitor & capacitance - electric-energy storage
- Lesson 12, 02/25: dielectrics
- Lesson 13, 03/01: Electric current - Ohm's law - resistivity - electric power
- Lesson 14, 03/03: microscopic view of electric current - superconductivity
- Lesson 15, 03/08: EMF - Kirchoff's rules - resistors in series and parallel, series and parallel EMF
- Lesson 17, 03/10: **Exam 2.**
- Lesson 18, 03/22: *RC* circuits
- Lesson 19, 03/24: **II magnetism:** magnet & magnetic fields, magnetic field from electric currents
- Lesson 20, 03/29: the B field - motion of charged particle in a magnetic field
- Lesson 21, 03/31: magnetic dipole moment - the Hall effects - applications: mass spectrometers
- Lesson 22, 04/05: Source of magnetic field
- Lesson 23, 04/07: Ampère law – Biot & Savart law
- Lesson 24, 04/12: **Exam 3.**
- Lesson 25, 04/14: magnetic materials - electromagnets
- Lesson 26: 04/18: **III electromagnetism:** Induced EMF, Faraday's law of induction
- Lesson 27: 04/21: Varying magnetic field and electric field
- Lesson 28: 04/25: Mutual inductance self inductance – energy stored in magnetic field
- Lesson 29: 04/27: LR, LC, and LRC circuits - impedance matching
- Lesson 30: 05/02: Maxwell's equations I
- Lesson 31: 05/05: Maxwell's equations II