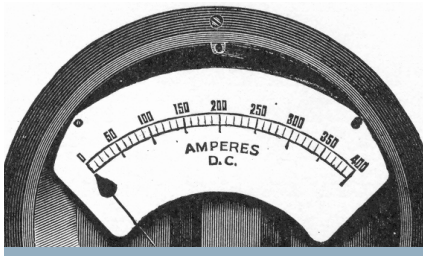
# Electricity and Magnetism




## Q & A

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Several essential components of this class are only available through the website.

**Be sure to check this site regularly.**

PHY 203 NYB

## Electricity and Magnetism

Students will become familiar with the basic laws and principles of electricity and magnetism such as Coulomb's Law, Gauss' Law, Ampère's Law, Biot-Savart Law, Faraday's Law, and Ohm's Law.

Students must then apply these laws to concrete situations such as the motion of charge particles in electric and magnetic fields, the nature of electric and magnetic fields, and the analysis of electrical current and circuits.

### Place in the program

Physics NYB is the last of three obligatory Ministerial Physics courses that have to be taken by all students in a Science Program. Students usually take this course during their third semester and after, or at least concurrently with, Mathematics 201-NYB (Calculus II—integrals). Following a trend established in Physics NYC, students are obliged to combine many of the concepts and techniques they have learned (principally in Physics, Chemistry, and Mathematics) so as to tackle new kinds of problems and applications that require a more comprehensive knowledge and set of abilities than previous courses.

Physics NYB deals with subject matter whose principles and applications form the basis of our understanding of an enormous number of fundamental phenomena, practical devices, and widely-used processes that pervade our technological society (see end of this course outline). Since all science students can be expected to spend most of their professional lives in environments where such phenomena, devices, and processes are an integral part of normal operations, it is essential that they acquire a thorough understanding of these things and that they be able to apply them to concrete situations.

### Contribution to exit profile

As described in the Science Program, students must possess certain attributes upon graduation. To varying degrees in this course, students will learn to:

- Demonstrate the attainment of the program specified competencies.
- Demonstrate the power as well as limitations of science and technology in society.
- Demonstrate the implications of scientific and technological change for society.
- Establish links between the various subjects of the program.
- Identify a problem.
- Decide on the best method of solving the problem.
- Gather and analyze data in a systematic manner.
- Execute experimental procedures with precision.
- Draw logical conclusions from data analysis.
- Integrate what has been learned and apply it to solving problems in new situations.
- Acquire the vocabulary appropriate to the scientific disciplines.
- Be able to create a scientific document such as an assignment, lab report or essay.
- Be able to use the principal types of data processing software: word processing, spreadsheets and graphing programs in the production of assignments or lab reports.
- Be able to use the computer for data input and analysis.
- Be able to use a computer to help in the acquisition of knowledge - i.e. computer aided learning.
- Be able to learn in an autonomous manner.
- Demonstrate the ability to work in a cooperative manner with other members of a group or team.

In addition, completion of this course is necessary to complete the Comprehensive Assessment (CA) of the Science Program.

# Course Content

### Teaching Schedule

We meet five hours a week. These are divided into three hours of theory and two hours of lab work or problem solving. Problem sessions are organized to develop problem solving skills and to promote team work. Students are expected to be in class on time, and to behave themselves in a dignified manner. Attendance is necessary but not sufficient to ensure success.

While it is suggested that students spend at least three hours every week to complete the requirements of the course, most students will require close to five hours. It is absolutely essential that students arrange their schedule to include this period of preparation.

### Textbooks

The textbook used in this course, is **Essential University Physics**, 2nd edition by Richard Wolfson (2 volumes), available at the bookstore.

All lab experiments, problem sessions, and other relevant documents and information, are available on your **class website**. It is **your responsibility** to download and print the documents **BEFORE** class.

### Problem Solving

This should become your mantra; **solve problems... solve problems...** This class is problem-solving oriented. I wish to see if you are able to translate a written problem into mathematical notation, and solve it using the techniques learned in class. A list of suggested problems from the textbook is available on the website, as well as additional problems will be presented during problem sessions. The more problems you solve the easier the tests and exams will be. As a rule of thumb, you should solve **at least two problems a day!**

### Experiments

Physics is an experimental science, and as such, experiments are of paramount importance to this class. The lab component of the course is divided into two sections: **reports** and **logbook**.

### Lab Reports

There will be three (3) evaluated lab reports during the semester, they must be typed using a software such as Microsoft word. Graphs must be computer generated. Further details regarding the format and content of lab reports will be given during the first lab session and are provided in your website (www.remi.poirier.com). Formal lab reports must be submitted within **two weeks** (at the latest by the beginning of the period). Late lab reports will be accepted with a penalty of -10% for the next day, and -25% for the day after the next. Lab reports submitted later than two days after the deadline receive a grade of zero for all the students of the group, even if they have attended and participated in the lab. It is imperative that you write lab reports in proper English. Poor English leads to a lack of clarity that negatively affects your grade.

### Lab Logbook

An experiment logbook is a bound notebook of comments, observations, procedural notes, collected raw data, hand-sketched graphs, calculations, processed data, and analytical insights gathered during an experiment; the date and time of each entry or group of entries is clearly indicated in a logbook. You may consider a logbook as a journal, but one in which you jot down event descriptions and thoughts immediately as they occur. You may also consider a logbook as a book of minutes like those taken by the secretary of some official meeting.

Each student will have to bring their personal logbook to every lab period. At the end of each lab period, each student will have to show their logbook before being allowed to leave. Newly logged entries will be briefly assessed and any sloppiness, omission, or absence will be penalized.

### Quizzes

These are 15-minutes questions requiring the solution of short problems, generally similar to those encountered in assignments. The two worst quizzes will be disregarded.

### Tests

These are 100-minutes tests, held during a lab period, requiring the solution of harder problems. There will be **Two tests** during the semester.

### Final Exam

A three-hour final exam will be held during the official final exam period. The final exam will consist of two sections covering all the material presented in the course, including labs; one section will consist of several multiple choice questions, the other of four to six long problems. The purpose of the final exam is to evaluate your overall understanding of the concepts presented in the course.

### Integrative Activity

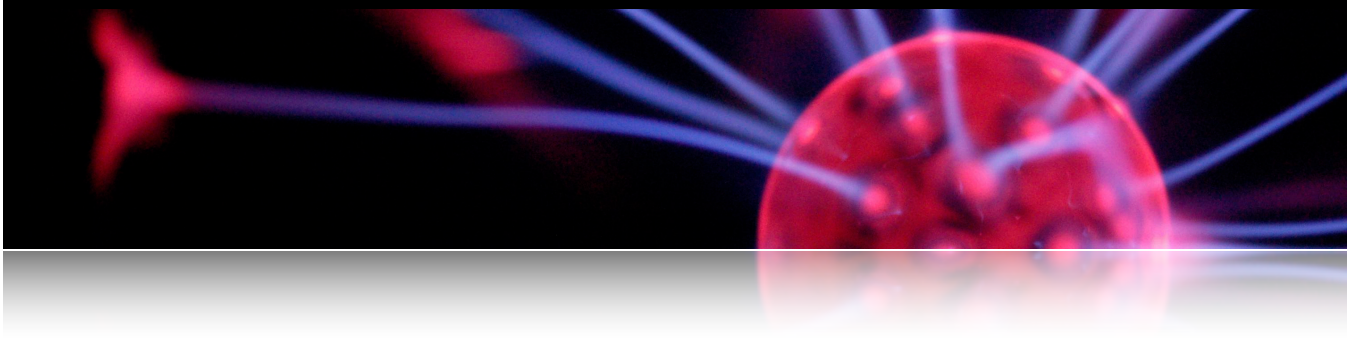
As required by the Science Program, an integrative activity (IA) in which you must integrate the physics concepts discussed in this class with concepts related to other sciences will be held at the end of the semester. This IA, will be an essay on a science topic. More information can be found on the class's website.

### Marking Scheme

Two alternative marking schemes are used. The final mark is based on the scheme most beneficial to the student:

| | Scheme A | Scheme B |
|---|---|---|
| Lab Reports (3) | 15% | 15% |
| Logbook | 5% | 5% |
| Integrative Activity | 5% | 5% |
| Quizzes | 15% | 5% |
| Tests (2) | 25% | 10% |
| Final Exam | 35% | 60% |

*The Omnivox LEA system, will be used to communicate the grade to students. However the official grade is calculated in the professor's markbook. In case of disagreement between the LEA calculation and the professor's, the latter will be considered correct.*



## Topics discussed

The following lists the topics discussed during the course with the corresponding chapters in your textbook.

**Review**

Vectors and motion in 2D and 3D
Chapter 3
Scalar product and Vector product.
Sections 6.1 and 11.2
Dynamics, work and energy
Chapters 5 and 6

**Electric Fields**

Properties of Electric Charges; Insulators and Conductors; Coulomb's Law; Electric Fields: discrete and continuous charge distributions, field lines; Motion of Charged Particles in Uniform Electric Fields.

Chapter 20

**Gauss's Law**

Electric Flux; Application of Gauss's Law to Charged Insulators; Application of Gauss's Law to Conductors in Electrostatic Equilibrium.

Chapter 21

**Electric Potential**

Potential Difference and Electric Potential; Electrical Potential Energy; Potential due to discrete and continuous charge distributions.

Chapter 22

**Electrostatic Energy and Capacitors**

Capacitance and Capacitors; Energy stored in Capacitors; Dielectrics (brief); RC circuits.

Chapter 23

**Electric Current**

Electric Current; Resistance and Ohm's Law (the true form); Resistance and Temperature; Electrical Power.

Chapter 24

**Electric Circuits**

Electromotive Force and Batteries/ Power Supplies; Resistors in Series and Parallel; Kirchhoff's Rules; Electrical Instruments; RC circuits.

Chapter 25

**Magnetism: Force and Field**

Magnetic force and field; Charged particles in magnetic fields; Magnetic force on a current; Torque on current loops; Biot-Savart Law; Magnetic force between conductors; Magnetic dipoles; Magnetic matter; Ampère's Law; Solenoids and toroids.

Chapter 26

**Electromagnetic Induction**

Induced currents; Faraday's Law; Induction and energy; Inductance.

Chapter 27 Sections 1-4

**Alternating-current Circuits**

Alternating current; Power in AC circuits; Transformers and power supplies.

Chapter 28 Sections 1, 5 and 6

The use of cell phones is strictly prohibited during class. Using any communication device during an evaluation will result in a mark of zero for this evaluation.

## ABSENCE DURING AN EVALUATION

Students should be present for all classes and labs, unless there is a serious emergency. A student who is absent for a test, a quiz or a lab must provide a medical note to the **Office of the Registrar** to justify their absence.

The Office of the Registrar will notify the teacher of the validated absence once the medical note has been received and validated. Unless the teacher receives a confirmation from the Office of the Registrar in due time, the absent student gets a zero mark for the evaluation.

## PLAGIARISM

Cooperation between students during tests or quizzes is strictly prohibited; cases of cheating will be dealt with severely.

You may use the internet for research purposes when writing your lab reports. You may even use some figures or pictures from the web. However if you do so, you must state clearly below the image, the website where it was taken from. You must also state clearly in a reference section the list of websites you used in your research. You may not quote or copy from someone else's work on the internet or elsewhere. In cases where the text in the report is too close to another text, the report (***hence all members of the group***) will receive a mark of zero.