

# Physics 276 - Experimental Physics II: Electricity and Magnetism

## Prof. Roy – Spring 2016

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### Course information:

Experimental methods and tools related to circuits. Topics include inductance, capacitance, AC circuits, diodes, transistors, and amplifiers.

### Prerequisites:

- PHYS272 (Introductory Physics: Fields)
- PHYS275 (Experimental Physics I: Mechanics and Heat)
  - ... and associated math courses

### Instructor:

Prof. Rajarshi Roy, AV Williams 3347, Phone: 5-1636, e-mail: rroy@umd.edu.

### Office Hours:

By appointment; feel free to contact me to schedule a meeting. Please call my office to confirm that I am in before you trek over to AV Williams.

### Schedule:

- Section 0401: Wednesday 2:00pm-5:50 (PHYS 3120)
- Section 0201: Thursday 2:00pm-5:50 (PHYS 3120)

You must be on time for class. If you are late, you will not be allowed to start the lab, but instead must schedule a makeup. Please note that you cannot pass the class unless you complete all labs.

### Texts:

The lab manual has to be accessed through a commercial product called “Expert TA”. There is a fee you will need to pay. The department uses the money to pay for laboratory equipment. To sign up for access:

- Open <https://www.theexpertta.com/registration/>
- Enter the class code, listed below, based on your section number:
  - Section
  - 301
  - 401
  - Class registration Code
  - USH22MD-D18D62-1C6
  - USH22MD-09A0572-1C5
- Complete registration and payment.

Each week, I will post corrections if necessary to the labs into the “Documents” section on ELMS. We will download these corrections at the start of each lab. When there is a conflict between the version in Expert TA and the correction in ELMS, the correction in ELMS is always right.

### Optional Texts:

- A Practical Guide to Data Analysis for Physical Science Students; Louis Lyons, Cambridge Press
- An Introduction to Error Analysis; J. R. Taylor, University Science Books

### Website:

The materials for this course will be available in elms.

Submission of spreadsheets and formal lab reports to be graded will be via ELMS and for the prelabs via Expert TA.

**When there are contradictions between the syllabus and the material in Expert TA, the syllabus is always right.**

### Course policies:

Students are required to do all of the assigned experiments. If you are not able to attend a scheduled lab section, make an arrangement in advance by writing to the instructor to see if there is a possibility to get permission to attend another lab session in the same week. Only those with a valid written excuse for missing a lab will be considered. Students are responsible for notifying the instructor within the first two weeks of the semester about projected absences due to religious observances during the semester. Sometimes you can make-up the lab during meeting time of one of the other sections. However, you need explicit permission of the instructor for that section to do this. If you cannot schedule a makeup time during the same week in one of the existing sessions, you will need to schedule an individual makeup time with your instructor. Late arrival or the making of phone calls during the lab is not allowed.

### Course requirements:

Experiments: You will work with a partner. Your partner will be assigned, and will change each week. Students are required to submit a spreadsheet record of all that was done in the lab. You and your partner may upload one spreadsheet. **However, each person must do their own formal lab report for the labs which require this. You will use the same data, but the words should be your own.** Experimental science requires careful, well-documented, accurate data. Your spreadsheet will serve as a poor-man's log book. You need to treat it as such. You must include all information you might possibly need if somebody has a question about your result a year from now. This includes:

- Date
- Names of people working with you
- Drawings and pictures of apparatus (use your cell phone camera) and the model numbers of equipment used
- All numbers must have neat accompanying text describing the number
- Your data, including uncertainties (both statistical and systematic).
- Analysis of data with propagation of errors
- Plots and histograms when appropriate, with intelligible labels

You will not get full credit if this information is missing. The spreadsheet must be uploaded to elms before leaving class. You should seek as much advice as you need during the lab. To get a good grade, you should ask many questions of your instructor, TA, and other class mates.

The in-class spreadsheets will be graded out of 40 points as follows:

- +5: turn in spreadsheet
- +10: all data taken

- +5: errors assigned to all measured numbers (no partial credit)
- +10: all fits, calculations based on measured numbers, etc. done (partial credit possible)
- +5 :all errors on results of fits, calculations, etc. done (partial credit possible)
- +5: spreadsheet is neat and well labeled

**Laboratory Report:** You and your partner are required to submit separately your own written report of your results for two of the experiments. While the graphs and charts can be the same, **each person should write their own text**. The class schedule will indicate for which labs this is required. Lab reports should be submitted as a PDF file. The reports should be submitted electronically using the ELMS system (<http://elms.umd.edu/>), and will be due at the start of lab the following week. The lab report will automatically lose 5% of its maximum points per day for each day it is late. A missing lab report will cost one letter grade for the course. Missing a lab entirely and not making it up will result in failure of the course. A detailed rubric, describing the lab report requirements and how they will be graded will be linked to elms and provided in the first class.

**Pre-lab Homework:** Each lab on Expert TA has a set of prelab questions. These must be completed before the start of class and will be graded by Expert TA.

**Final exam:** The final exam will be based on material covered during the semester. Students are expected to take data following appropriate experimental procedures and explain the underlying physics. Knowledge of the workings of the instruments used in the lab can also be tested. Please note that the use of google or any other external resource during the exam is expressly forbidden. If you have any questions either before or during the exam as to what resources can be used, please raise your hand and ask.

**Discussion:** Part of a class meeting will be devoted to discussions of the physics and data analysis for the experiments. Participation in these sessions is just as important as the experiments themselves. Attendance is mandatory. However, this is not a lecture course, and the main way that you will learn experimental physics is to by doing and discussing, rather than just listening.

**Presentations:** Each student will give a 15 minute oral presentation relevant to AM radio and telecommunications. A list of suggested topics will be provided in ELMS. Other topics may also be chosen with permission of the instructor. The date for the presentations is given in the schedule on elms.

The presentation should be accompanied by electronic slides in pdf format. Your slides should be uploaded on elms no later than 24 hours in advance. Topics are chosen first come, first serve, so pick a topic early for the best selection. Please email Professor Eno with your top 3 in order of preference. A detailed grading rubric will be linked to the class web site and provided the first day of class.

#### **Grade:**

- 40%: In-class Spreadsheet
- 10%: Pre-lab Homework
- 20%: Lab reports
- 15%: Presentation
- 15%: Final Exam

#### **Laboratory Managers:**

- Mr. Allen Monroe, rm 3311, John S. Toll building, 5-6002, amonroe [at] umd.edu
- Mr. Thomas Baldwin, rm 3202, John S. Toll building, 5-6004, tbald [at] umd.edu

**T.A.:** Wed Joseph D. Hart; Th Mara Mishner

**Bad weather:**

Winter in the Washington Metro area can bring large snowstorms that make travel dangerous. Should this happen and the University is closed as a result during a scheduled lab, class will be cancelled, and we will most likely reschedule the lab for the following week. Closing is announced over local radio/TV and the University's homepage: <http://www.umd.edu/>.

**Academic Integrity:**

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.shc.umd.edu>.

**Disabilities:**

Students with documented disability should contact the instructor at the beginning of the semester to discuss accommodations.

**Disclaimer:**

The instructor reserves the right to make minor changes to this syllabus to meet the specific needs of the class during the semester.

## Schedule:

Week Starting On	LAB	Formal Lab Report Required?
25 Jan	Lab 1: review	no
2 Feb	Lab 2: input and output impedance	<b>yes</b>
8 Feb	Lab 3: diodes and rectification	no
15 Feb	Lab 4: capacitors and RC circuits	no
22 Feb	Lab 5: Magnetic Fields and Inductance	no
29 Feb	Lab 6: AC circuits, impedance and filters	<b>yes</b>
7 March	Lab 7: LRC Circuits and resonance	no
14 Mar	Spring Break	
21 Mar	Student Presentations	
28 Mar	Lab 9: Tuned crystal radio	no
4 April	Lab 10: The transistor	no
11 April	Lab 11: AM transistor radio	<b>yes</b>
18 April	Lab 12: Op-amp and multiplier	no
25 April	Practice for final	
2 May	Final	