

PY313 - Modern Physics

Fall 2001

Course Information

Instructor:

Professor Kevin Smith; Lecture: Tuesday and Thursday 11:00 - 12:30 pm, SCI 115.
Office: SCI 215. Phone: 3-6117. e-mail: ksmith@buphy.bu.edu
Office Hours: Wednesdays 9:30 - 11:30 AM; Thursdays 9:30 - 10:30 AM; or by appointment.

Texts:

1. Thornton and Rex, *Modern Physics for Scientists and Engineers*, Second Edition, Saunders College Publishing.
2. *Physics Laboratory Experiments for PY 313*; available at the BU Bookstore.
3. Required laboratory notebooks: **TWO** bound quadrille notebooks, \$ 60 pages - 5x5 Quad.
4. **Optional:** Student Solutions Manual to accompany Text #1, by A. Rex, Saunders College Publishing.

Calculator:

Access to a scientific calculator with trigonometric and exponential functions, is required.

Syllabus:

Selections from Chapters 1 - 11 in Thornton and Rex; a detailed syllabus is attached.

Grades:

| | |
|---|-----|
| Midterm Exam #1 | 20% |
| Midterm Exam #2 | 20% |
| Final Exam | 30% |
| Laboratory | 10% |
| Discussion Section (homework & quizzes) | 10% |
| Lecture (quizzes, attendance & class participation) | 10% |

Exam Dates:

Midterm Exam #1: *Thursday, October 4, in class.*
Midterm Exam #2: *Thursday, November 15, in class.*
Final Exam: 9:00 am to 11:00 am on **Friday, December 15**

REASONS FOR AUTOMATIC FAILURE:

- 1: Miss, or fail to turn in, **ANY** of the labs.
- 2: Hand in less than half the homeworks on time, or attend less than half the discussion sections.
- 3: Miss any of the midterm exams, or the final exam.

Course Prerequisites: PY211, PY212 and MA124. You **MUST** see the professor if you have not taken these courses. Note that it is assumed you **know** the content of these courses!

Notes on labs, homework, exams and grades.

General:

- 1: You must register for both a lab and a discussion section.
- 2: There are no labs during the first week of class. Discussion sections are held starting in the second week.
- 3: Office hours for Professors Smith are given on the previous page. Office hours for all TFs will be given in class. All instructors are available during office hours or by appointment. You are free to go to any TF.

Discussion Sections and Homework:

- 4: Homework is due in the TF boxes (near the vending machines in the basement of SCI) by **5:00 pm** on the day stated for the assignment. **Homework handed in ANYWHERE else will not be accepted, and a zero grade will be given. Late homeworks will not be accepted, and will also be given a zero grade.**
- 5: Each week during your assigned discussion section, one of the previous weeks homework problems will be selected and you will have the last 10 minutes of the section to complete this problem. You will have no access to the text or any notes. **You may only attend the section in which you are registered.**
- 6: Numerical answers to the odd numbered problems are in the back of the textbook. The optional solutions manual has complete solutions to selected problems.
- 7: Homework and exam solutions will be available on reserve in the Science and Engineering Library, and will be posted outside of room B58 (after due date or exam).

Lecture Quizzes:

- 8: Quizzes on current material will be randomly given during the lectures.

Labs:

- 9: Lab sections meet in **B11** as given in the class schedule (attached). Each lab is available in the assigned week only. **THERE ARE NO MAKEUP LABS.** Lab reports must be turned in at the next lab, or as required.
- 10: Lab information will be posted in the display case near B23.
- 11: You can only attend the lab for which you are registered. Attendance will be taken.

***** IMPORTANT *****

THERE ARE NO MAKEUPS FOR ANYTHING! No exams, no quizzes, no labs, no homeworks. There are **NO** alternate exam times. It is your responsibility to attend class and have your work done on time. Do not make travel plans that will cause you to miss **any** exams. Failure to attend the scheduled exams will result in an "F" grade for the course.

Possession of notes or other banned materials or devices during an exam will be considered *prima facie* evidence of plagiarism. Students violating the rules of an exam will be reported to the Academic Conduct Committee of the College of Arts and Sciences, and will receive a zero grade for the exam. Please read the Academic Conduct Code.

PY313: Modern Physics - Fall 2001 - Class Syllabus and Schedule

| Week | Date | Lecture Topic | Chapter | Laboratory Topic |
|---|-----------------------|-------------------------------|---------|-------------------------------------|
| 1 | Tuesday 9/4 | Expt. Basis of Quantum Theory | 3 | No Labs Week #1 |
| | Thursday 9/6 | Expt. Basis of Quantum Theory | 3 | |
| 2 | Tuesday 9/11 | Expt. Basis of Quantum Theory | 3 | Milliken's Oil Drop |
| | Thursday 9/13 | Structure of the Atom | 4 | |
| 3 | Tuesday 9/18 | Structure of the Atom | 4 | No Labs Week #3 |
| | Thursday 9/20 | Structure of the Atom | 4 | |
| 4 | Tuesday 9/25 | Wave Properties of Matter | 5 | Photoelectric Effect |
| | Thursday 9/27 | Wave Properties of Matter | 5 | |
| 5 | Tuesday 10/2 | Wave Properties of Matter | 5 | No Labs Week #5 |
| | Thursday 10/4 | MIDTERM EXAM #1 | | |
| 6 | Tuesday 10/9 | No Class - substitute Monday | | No Labs Week #6 |
| | Thursday 10/11 | The Quantum Theory | 6 | |
| 7 | Tuesday 10/16 | The Quantum Theory | 6 | Electron Diffraction |
| | Thursday 10/18 | The Quantum Theory | 6 | |
| 8 | Tuesday 10/23 | The Quantum Theory | 6 | No Labs Week #8 |
| | Thursday 10/25 | The Hydrogen Atom | 7 | |
| 9 | Tuesday 10/30 | The Hydrogen Atom | 7 | Atomic Spectra |
| | Thursday 11/1 | Many-Electron Atoms | 8 | |
| 10 | Tuesday 11/6 | Statistical Physics | 9 | Atomic Excitation Potentials |
| | Thursday 11/8 | Statistical Physics | 9 | |
| 11 | Tuesday 11/13 | Statistical Physics | 9 | No Labs Week #11 |
| | Thursday 11/15 | MIDTERM EXAM #2 | | |
| 12 | Tuesday 11/20 | Molecules and Solids | 10 | No Labs Week #10 |
| | Thursday 11/23 | TURKEY DAY (| | |
| 13 | Tuesday 11/27 | Molecules and Solids | 10 | No Labs Week #13 |
| | Thursday 11/29 | Molecules and Solids | 10 | |
| 14 | Tuesday 12/4 | Semiconductors | 11 | Diode Properties |
| | Thursday 12/6 | Semiconductors | 11 | |
| 15 | Tuesday 12/11 | Topics in Relativity | 2 | No Labs Week #15 |
| FINAL EXAM: 9:00 am - 6:11:00 am on Friday 12/15 | | | | |

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Homework Assignments

| # | Homework Topic | Chapter | Due Date | Content |
|---|-------------------------------|---------|------------------|---|
| 1 | Expt. Basis of Quantum Theory | 3 | Friday, 9/15 | Questions: 3, 18, 19, 20 Problems: 2, 4, 6, 27, 28, 32, 44 |
| 2 | Structure of the Atom | 4 | Friday, 9/22 | Questions: 3, 9, 11 Problems: 6, 7, 20, 24, 27, 42 |
| 3 | Wave Properties of Matter | 5 | Friday, 9/29 | Questions: 6,13, 15 Problems: 4, 12, 15, 18, 22, 38, 40 |
| Midterm Exam #1, in class, Tuesday 10/5 | | | | |
| 4 | The Quantum Theory | 6 | Friday, 10/20 | Questions: 4, 5, 13 Problems: 3, 15, 19, 24, 41, 44. |
| 5 | The Hydrogen Atom | 7 | Friday, 10/27 | Questions: 2, 6, 9 Problems:1, 9, 13, 17, 18, 24, 27 |
| 6 | Statistical Physics | 9 | Friday, 11/10 | Questions: 4, 8, 11 Problems: 1, 5, 8, 19, 21, 25, 26 |
| Midterm Exam #2, in class, Tuesday 11/14 | | | | |
| 7 | Molecules and Solids | 10 | Wednesday, 11/29 | Questions: 1, 6, 7 Problems: 3, 9, 10, 11, 22, 25, 26, 38 |
| 8 | Semiconductors | 11 | Wednesday, 12/6 | Questions: 3, 6, 7 Problems: 2, 3, 6, 10, 14, 17, 18 |
| 9 | Special Relativity | 2 | Wednesday, 12/13 | Questions: 5, 8, 12 Problems: 19, 22, 29, 57, 70, 76 |
| Final Exam: 9:00 - 11:00 am on Friday 12/15 | | | | |

NOTE: Homeworks are due in the TF boxes (near the vending machines in the basement) by 5:00 pm on the day stated for the assignment. Homework handed in ANYWHERE else will not be accepted, and a zero grade will be given. Late homeworks will not be accepted, and will also be given a zero grade. See the handout on course rules for full details.

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Procedures for Laboratory Operations and Write-ups

1. Each lab write-up is due at the start of the following lab. The schedule of labs is included in the syllabus.
2. No late labs will be accepted. A zero grade will be assigned.
3. Make sure that your data, be it recorded in your notebook or on the data sheet provided with the experiment, is initialed by the TF before you leave the Lab. Otherwise, no credit for the lab will be given and you will receive a zero for that experiment.

General Lab Guidelines and Technique

1. The goal of the labs is to learn the experimental techniques and to learn to compare data from an experiment to the predictions of physical laws. The goal is not to get a certain specific set of numbers listed properly. It is more important to try a different set of parameters or attempt a related experiment than it is to have all the data fit the theory.
2. Read the lab instruction prior to coming to lab. If you fail to read the lab ahead of time, you won't know what's happening and it will take much longer to complete. If we perceive that students arrive un-prepared for lab, pre-lab assignments will be instituted.
3. The lab TF will begin each lab recapping the important procedures, highlighting the purpose of each experiment and describing any relevant safety precautions. Pay attention during these first ten minutes, it will save you much time later on. Also, TF's will instruct you in any changes to the procedures and curtailment of the number of questions to be answered.
4. Write in the lab book as you perform the lab. Begin by listing the date, lab, partner(s), etc. Include diagrams, notes, data, descriptions, possible ideas you have along the way. This part need not be excessively neat and organized. On the other hand, messiness is not encouraged. Record impressions, mistakes made, and possible sources of errors. e.g. "The ball was thrown down instead of dropped, and might thereby affect the initial velocity and subsequent speed". Make tables of all numbers, either in the lab book itself or on the data sheet provided. In the latter case, the data sheet must be stapled into the lab book. Lab TF's are instructed to shake each lab book upon receipt, and throw away any loose paper.
5. The lab notebook, complete with the notes and data taken during the lab and the lab write-up, must be handed in to the TF at the beginning of the following class. The write-up section begins with a brief statement of purpose, and a brief description of the experiments. Following this the data analysis is included and questions about the lab are answered. Some labs have separate analysis and conclusions, while some incorporate the analysis in the questions. Then, a brief discussion of the errors, their sources and any problems with the experiment is made.