

PY313 - Modern Physics

Fall 2019

Instructor: Professor Kevin Smith;

Lecture: Tuesday and Thursday 11:00 – 12:15 PM, SCI B58.

Office: SCI 357. Phone: 3-6117. **e-mail:** ksmith@bu.edu

Office Hours: Tuesday and Thursday, 1:00 PM – 2:00 PM, and by appointment.

Texts:

1. Thornton and Rex, *Modern Physics for Scientists and Engineers*, 4th Edition, ISBN-13: 9781133103721
2. *Physics Laboratory Experiments for PY 313*; available on the physics department web site at http://physics.bu.edu/ulab/modern_labs.html

Calculator:

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

Syllabus:

Selections from Chapters 2 - 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 3, in class.*

Midterm Exam #2: *Thursday, November 14, in class.*

Final Exam: *Tuesday, December 17th, 12:30 PM*

REASONS FOR AUTOMATIC FAILURE:

- 1: Miss, or fail to turn in on time, 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 or discussion sections during the first week of class.
- 3: Office hours for Professors Smith are given on the previous page. Office hours for the TFs will be given in class. The TFs will be available during office hours and by appointment.
- 4: **All electronic devices are banned during lectures. This includes cell phones and audio/visual recording or playback devices of ANY kind.**
- 5: Electronic mail will be used to confirm course announcements made in class, so please check your mail regularly. **Your BU account will be used.**
- 6: Physics questions will **NOT** be answered by e-mail. E-mail should be used to set up an appointment to see Professor Smith.

Discussion Sections and Homework:

- 6: Homework is due in the TF boxes on the first floor of SCI by **5 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.**
- 7: 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.**
- 8: Numerical answers to the odd numbered problems are in the back of the textbook. The optional online solutions manual has complete solutions to selected problems.

Lecture Quizzes:

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

Labs:

10. The complete schedule of 6 experiments is included in the class schedule below. Labs will be held in the basement of SCI. The room assignments for each week will be prominently posted on all lab doors. 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.
11. You can only attend the lab for which you are registered. Attendance will be taken.
12. You must come to the lab prepared: read the appropriate section of the *PY313 Laboratory Experiments* book, and prepare as much of the Laboratory Report as possible.

***** **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, not just the exam.*

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 CAS Academic Conduct Code, which applies to this course.

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PY313: Modern Physics - Fall 2019 - Class Syllabus and Schedule

Week	Date	Lecture Topic	Chapter	Laboratory Topic
1	Tuesday 9/3	Expt. Basis of Quantum Theory	3	No Labs Week #1
	Thursday 9/5	Expt. Basis of Quantum Theory	3	
2	Tuesday 9/10	Expt. Basis of Quantum Theory	3	Milliken's Oil Drop
	Thursday 9/12	Structure of the Atom	4	
3	Tuesday 9/17	Structure of the Atom	4	No Labs Week #3
	Thursday 9/19	Wave Properties of Matter	5	
4	Tuesday 9/24	Wave Properties of Matter	5	Photoelectric Effect
	Thursday 9/26	Wave Properties of Matter	5	
5	Tuesday 10/1	Quantum Mechanics	6	No Labs Week #5
	Thursday 10/3	MIDTERM EXAM #1		
6	Tuesday 10/8	Quantum Mechanics	6	Electron Diffraction
	Thursday 10/10	Quantum Mechanics	6	
7	Tuesday 10/15	No Class - substitute Monday		No Labs Week #7
	Thursday 10/17	Quantum Mechanics	6	
8	Tuesday 10/22	The Hydrogen Atom	7	Atomic Spectra
	Thursday 10/24	The Hydrogen Atom	7	
9	Tuesday 10/29	Many-Electron Atoms & Statistical Physics	8 & 9	No Labs Week #9
	Thursday 10/31	Statistical Physics	9	
10	Tuesday 11/5	Molecules, Lasers, and Solids	10	Atomic Excitation Potential
	Thursday 11/7	Molecules, Lasers, and Solids	10	
11	Tuesday 11/12	Molecules, Lasers, and Solids	10	No Labs Week #11
	Thursday 11/14	MIDTERM EXAM #2		
12	Tuesday 11/19	Molecules, Lasers, and Solids	10	No Labs Week #12
	Thursday 11/21	Semiconductors	11	
13	Tuesday 11/26	Semiconductors	11	No Labs Week #13
	Thursday 11/28	THANKSGIVING		
14	Tuesday 12/3	Semiconductors	11	Diode Properties
	Thursday 12/5	Topics in Relativity	2	
15	Tuesday 12/10	Topics in Relativity	2	No Labs Week #15

FINAL EXAM: Tuesday, December 17th, 12:30 PM

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Homework Assignments

#	Homework Topic	Chapter	Due Date	Assignment
1	Expt. Basis of Quantum Theory	3	Friday, 9/13	Questions: 12, 23, 25 Problems: 2, 4, 6, 37, 43, 56, 65
2	Structure of the Atom	4	Friday, 9/20	Questions: 1, 8, 10 Problems: 3, 16, 20, 29, 46, 48
3	Wave Properties of Matter	5	Friday, 9/27	Questions: 2, 5, 6 Problems: 2, 14, 15, 20, 25, 38, 57
<i>Midterm Exam #1, in class, Thursday 10/3</i>				
4	Quantum Mechanics	6	Friday, 10/18	Questions: 5, 6, 13 Problems: 3, 15, 20, 27, 43, 44
5	The Hydrogen Atom	7	Friday, 10/25	Questions: 2, 5, 9 Problems: 1, 8, 10, 17, 23, 30, 33
6	Statistical Physics	9	Friday, 11/8	Questions: 4, 8, 11 Problems: 1, 7, 8, 15, 16, 24, 28
<i>Midterm Exam #2, in class, Thursday 11/14</i>				
7	Molecules, Lasers, and Solids	10	Friday, 11/22	Questions: 4, 6, 7 Problems: 3, 9, 10, 11, 20, 25, 26, 32
8	Semiconductors	11	Friday, 12/6	Questions: 3, 6, 7 Problems: 3, 5, 8, 9, 10, 14, 24
9	Relativity	2	Thursday, 12/12	Questions: 8, 12, 20 Problems: 19, 22, 29, 82, 93, 94
<i>Final Exam: Tuesday, December 17th, 12:30 PM – 2:30 PM</i>				

NOTE: Homeworks are due in the TF boxes on first floor of SCI by 5:00 PM on the day stated for the assignment. Make sure you use the slot marked "PY313 – Fall 2019". Homework handed in ANYWHERE else will not be accepted, and a zero grade will be given. Late homework will not be accepted, and will also be given a zero grade.

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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.
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.