Physics 250 (4 credit hours)

Spring 2022 Semester

Fundamentals of Physics: Modern Physics

The instructor reserves the right to revise, alter, or amend this Syllabus as necessary. Students will be notified in writing of any such changes. Updated January 19, 2022.

Logistics

Instructor	Dr. Norman Mannella
Office	Nielsen 210 / IAMM 313
Phone (Both UT and IAMM)	(865) 974 - 6123
Email	nmannell@utk.edu
Lecture Time and Location	Tuesday and Thursday, 2:50 – 5:35, Nielsen 203
Office Hours	To be decided

General Course Description

Fundamental concepts of modern physics (special relativity and quantum mechanics) and their applications to atomic, condensed matter, nuclear, and particle physics.

Course Objectives

The course objectives are:
1) Introduce students to concepts in modern physics.
2) Introduce some major experiments in modern physics.
3) Perform basic calculations in modern physics.
4) Improve laboratory skills.
5) Introduce mathematical concepts useful for advanced physics classes and hone problem solving skills.

Prerequisites

An introductory physics sequence (PHYS 135/136, or PHYS 137/138, or EF150/151 & PHYS 231). The course and adopted text presume a familiarity with calculus and calculus concepts. A background in mathematics up to the level of Math 141-142, or equivalent, is highly recommended and is probably necessary for success in the course.

Textbook

Physics for Scientists & Engineers with Modern Physics, 5th Edition
By: Douglas C. Giancoli

ISBN: 9780134296074

The textbook is accessible in Canvas for $27.84.

Further reading assignments from other sources will be provided to you on Canvas.

List of Topics

Fundamentals
Review of Interference and Diffraction (Ch. 34 – 35)
The special Theory of Relativity (Ch. 36)
Early Quantum Theory (Ch. 37)
Quantum Mechanics (Ch. 38)

Applications
Atoms (Ch. 39)
Molecules and Solids (Ch. 40)
Nuclear Physics (Ch. 41 – 42)

Class Format and Course Material

Usually, PHYS 250 is taught in a "Studio" format, rather than traditional lectures. I will try to maintain this style. I will use a combination of lectures, problem solving sessions, exercises based on on-line modules, and engage you in discussions. **Attendance is therefore STRONGLY encouraged**. Is is **mandatory for the Lab. Sessions**, as explained below. Class will probably be dismissed before 5:35, but the entire slot will be used if some students need more to finish some "in-class" work, or need further clarifications on the material.

This course consists of several components: lectures, laboratories, homework problems, reading assignments, and on-line quizzes. The material you will be expected to learn and will be tested on during the exams will be taught to you as part of all of these course components. In particular, I stress the importance of problem solving and carefully working (not just reading) your way through all the parts of the textbook. Reading the relevant chapter or sections for each class (i.e. Reading assignments) is a compulsory and vital part of the course. **The lectures will NOT necessarily repeat the material in the textbook**, but will be used to discuss the course material in a variety of ways. Some lectures will follow the textbook, some other will discuss topics not covered in the textbook, and/or discuss them in a different manner.

Reading Assignments and working out the assigned examples/exercises/problems are a compulsory and vital part of the course. I stress the importance of "Reading": This means carefully working your way through all the parts of the assigned document(s), including examples. You must read carefully and assimilate the concepts, work through the derivations of the equations, follows and work out the examples, and then test your knowledge by doing exercises and problems. This is what "reading" means and this is the meaning of the word in this course.

I will expect you to come to class having done the assigned readings and prepared to discuss suggested examples/exercises/problems. You do not have to turn in the solutions to these examples/exercises/problems, but be conscientious and do as many of them as you can.

It is extremely important to keep up with the work, since the material builds on itself. Each day, preview the topics for the next class; after class, study the topics in detail and work on the suggested examples/exercises/problems.

Make sure to check the web the evening before class. Have a copy of the material on your desk when you attend class. By doing so, instead of spending your time copying from the board, you can think about the material as it is presented.

Laboratory

There is a laboratory (Lab) component to the class, which is **mandatory**! The laboratory exercises are an important and integral part of this course and have to be completed before a final grade will be assigned. The score assigned by the Lab instructor will count 25% of the final Semester Grade. You must complete all of the Laboratory assignments. Laboratory make-ups are entirely at the Lab. instructor's discretion and arrangements for such must be made with the Lab instructor. Please note: **If you fail the Laboratory part of the course, you automatically fail the entire course.**

The labs occur at the same TR time slot of 2:50-5:35 PM. The labs will align with the lecture material. Each lab will be scheduled after the pertinent material is covered.

Homework

There will be approximately 6-8 problem sets, for which you will have to write out full solutions. Your homework grade will be based on the scores of these problem sets. You will be notified in Canvas when the HW is available. **Homework will always be collected at the beginning of the class session**, with due date specified on the HW itself and communicated in Canvas when the HW is made available.

When writing solutions keep in mind that there is also a large difference in sketching a solution and writing up a solution so that someone can read. Be clear in your writing! Clearly state the issue or problem, outline the tools needed, and proceed providing information when needed.

I generally encourage students to work together as far as homework is concerned. The goal is to use homework as one of the most effective ways of assimilating the material. Do not take advantage of the work of other people, and do not let anybody take advantage of your own work: efforts should be shared. You must write up your own solutions to the homework problems. In other words, do NOT just copy someone else's solution since this constitutes plagiarism and will have grave consequences.

Please note the following policies, which are quite strict:

No extensions or make-up problem sets will be given. If there are extremely serious circumstances supported by proper documentation, exception to this policy may be considered at my discretion.

Due dates and time for HW are firm. I post all assignments at least one week in advance, so please plan ahead. Problem sets turned in 1 day late will receive 90% of the maximum score. Your work will receive 0 points if turned in later than 1 day.

Each problem will be graded on a 0 - 5 scale (0 = no work, 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent), or similarly if worth more points (e.g. 0 = no work, 2 = poor, etc.). Solutions to the HW will be posted on Canvas. Note that answers, even if correct, not supported by work will received 0 points.

NB.: ***A point is a point***: this means that different HW sets might have different total scores, and your total score will be given by the sum of the points that you will collect.

For each HW set, I will make available for you a **Forum in Canvas** where you can discuss among yourself. Questions regarding the HW problems may be asked in lecture, during office hours, or in the Forum, but NOT by email.

Tests and Final Exam

There will be two Short Tests (1 hour-long), and one comprehensive, Final Exam (2 hours-long). The Final Exam is comprehensive, i.e. you will be tested on the whole material covered in class, homework, labs and previous tests. Short Test and Final questions will generally be similar in character to example problems in the book and example problems given in lectures. *If needed,* you will receive a handout containing information on Physical Constants, Units, selected tables of physical properties, and selected mathematical and physics formulas. The handouts will be posted on Canvas before Tests and Final Exam. Students are expected to perform all work in conformance with the University policies regarding Academic Honesty. In particular, all work submitted by a student during Tests and Final Exam is expected to represent his/her own work. Violation of the Academic Honesty policies will result in disciplinary actions according to the University rules.

Appeals

You are welcome to discuss the grading of a given assignment, be it Homework, Lab score, Short Tests, or Final Exam. Appeals must be dropped in my mailbox, with a brief explanation of the issue. Any appeal will be given consideration if it is raised **no later than one week** after the date on which the graded Exam/Lab/Tests/HW are made available for return to the class. After this "appeal period" of one week, scores will be considered final and will not be altered. Any appeal concerning a grade in the Laboratory should directly be discussed with your Lab. instructor.

Grading Policy and Grading Scale

The semester Grade will be based on a Weighted Averages of the scores in the Final Exam grade, Short Tests, Laboratory, Homework, and Quizzes as follows:

Quizzes: 10%
Homework: 25%
Lab. (you must pass the Lab to pass the course): 25%
Short Tests: 20%

Final Exam: 20%

No score will be dropped, and ordinarily make-up Short Tests, Homework sets will NOT be given, unless there are extremely serious circumstances supported by proper documentation.

The scores will be converted to the grading scale as follows:

> 90	A
86 – 89	A –
80 – 85	B +
75 – 79	B
70 – 74	B –
65 – 69	C +
60 – 64	C
55 – 59	C –
50 – 54	D+
45 – 49	D
40 – 44	D-
< 40	F

Announcements, Lecture Notes, Course Material, and Course Updates

Lectures and Canvas (Online@UT) are my primary modes of communication with the class. Announcements, Lecture Notes, additional Course Material, Homework, solutions to Homework, and Course Updates including definite dates for exams etc. will be posted on Canvas. Please note that it will be your responsibility to be aware of the content of any communication taking place in class, be it an announcement or anything related to the course material, in case you are not present. You are required to have an official UT email address and read announcements on Canvas and your email on a daily basis. Information that cannot be transmitted to you during the lectures or on Canvas, or any personal communication, will be given to you via email.

Contacting the Instructor

I prefer personal contact to e-mail contact, and therefore encourage you to come to office hours, or schedule an appointment. As another alternative, I am going to be in my office most of the time, if you show up chances are that I might see you, unless I am really in the middle of something. Call me in the office to check. **Anyhow, I strongly encourage you to see me.** As a general rule, I do NOT address homework problems by e-mail. On the other hand, if you have a personal emergency, e-mail is fine. If you send an email to me, **please include "PHYS 250" in the subject.**

Tentative Timeline

Week 1 – Jan25/27	Intro, Review of Interference and Diffraction (Ch. 34 – 35)
Week 2 – Feb 1/3	Interference and Diffraction, Special Theory of Relativity (Ch. 36)

Week 3 – Feb 8/10 Special Theory of Relativity (Ch. 36)
Week 4 – Feb 15/17 Early Quantum Theory (Ch. 37)
Week 5 – Feb 22/24 Early Quantum Theory (Ch. 37)
Week 6 – Mar 1/3 Early Quantum Theory (Ch. 37), Quantum Mechanics (Ch. 38)
Week 7 – Mar 8 Quantum Mechanics (Ch. 38)

Week 7 – Mar 10, 1st TEST

Week 8 – Mar 22/24 Quantum Mechanics (Ch. 38)
Week 9 – Mar 29/31 Quantum Mechanics (Ch. 38), Atoms (Ch. 39)
Week 10 – Apr 5/7 Atoms (Ch. 39)

Week 11 - Apr. 12, 2nd TEST

Week 12 – Apr 19/21 Molecules and Solids (Ch. 40)
Week 13 – Apr 26/28 Molecules and Solids (Ch. 40), Nuclear Physics (Ch. 41)
Week 14 – May 3/5 Nuclear Physics (Ch. 41 - 42)
Week 15 – May 10 Nuclear Physics (Ch. 41 - 42)

Final Exam – Tuesday, May 17, 3:30 – 6:00

Cheating and Plagiarism will not be tolerated

Cheating will not be tolerated. Everyone must have an equal chance to do well. The penalty for cheating on any aspect of this course will be an "**F**" for the course.

Plagiarism of any kind will not be tolerated. Working together on homework does not count as plagiarism. A line by line copy of another student's homework does. If you use a source (book, articles, internet material etc.), you must quote it. Use of a source without citation is plagiarism.

Cheating and/or plagiarism cases found to be in Violation of the Academic Honesty policies will result in disciplinary actions according to the University rules, without exception.

Department of Physics and Astronomy Statement on Civility & Community

The Department of Physics & Astronomy at the University of Tennessee is committed to creating an environment that welcomes all people, regardless of their identities. We value the diversity that enriches our department. We understand the importance of free and open dialogue that includes the free exchange of ideas. We do not tolerate uncivil speech or any form of discourse that infringes on others' rights to express themselves, or has a negative impact on their education, or work environment. We actively promote an environment of collegiality and an atmosphere of mutual respect and civility. We understand that respect includes being considerate of others' feelings, circumstances, and their individuality. We recognize the necessity of a civil community in realizing the potential of individuals in teaching, learning, research, and service. We believe these values extend

beyond the department into our work within physics regionally, nationally, and internationally, as well as work and studies in the university, and the broader community. We encourage all members of the department to intervene and report any incidents involving bigotry, or that violate the university code of conduct. http://www.phys.utk.edu/about/civility-community.html 3

Reporting

Anyone who experiences or observes any such incident is encouraged to report it to the Department Head (Prof. H. Weitering) or one of the Associate Heads (Prof. M. Breinig and Prof. K. Jones). Students can also speak to any faculty or staff member with whom they feel comfortable. Incidents that involve sexual harassment or stalking will be reported to the office of Title IX under mandatory reporting requirements.

http://www.phys.utk.edu/about/civility-community.html 3

University Civility Statement

"Civility is genuine respect and regard for others: politeness, consideration, tact, good manners, graciousness, cordiality, affability, amiability and courteousness. Civility enhances academic freedom and integrity and is a prerequisite to the free exchange of ideas and knowledge in the learning community. Our community consists of students, faculty, staff, alumni, and campus visitors. Community members affect each other's well-being and have a shared interest in creating and sustaining an environment where all community members and their points of view are valued and respected. Affirming the value of each member of the university community, the campus asks that all its members adhere to the principles of civility and community adopted by the campus" https://civility.utk.edu/

Academic Integrity

Each student is responsible for his/her personal integrity in academic life and for adhering to UT's Honor Statement. The Honor Statement reads: "An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

For students with disabilities

Students needing an accommodation based on the impact of a disability should contact me privately to discuss specific needs. Students are also responsible to contact the Office of Disability Services at 865-974-6087 in Hoskins Library to coordinate reasonable accommodations for students with documented disabilities. https://sds.utk.edu/

Wellness

The Student Counseling Center is the university's primary facility for personal counseling, psychotherapy, and psychological outreach and consultation services. The Center for Health Education and Wellness manages 974-HELP, the distressed student protocol, case management, the Sexual Assault Response Team, and the Threat Assessment Task Force. https://counselingcenter.utk.edu/ and https://wellness.utk.edu/

COVID-19 Guidelines

Masking -- According to public health authorities, in areas where there is substantial or high COVID transmission, wearing masks in indoor spaces can help reduce transmission of the virus and keep communities healthy. Any individual can choose to wear a mask anywhere on campus, even when it is not required. The university expects everyone to protect others from the spread of COVID-19 and strongly recommends wearing masks in academic and administrative spaces.
For the most current information on masks, please check the COVID-19 website at utk.edu/coronavirus.

Vaccines -- The university recommends that all members of the campus community be vaccinated for their own protection, to prevent disruption to the semester, and to prevent the spread of COVID-19. Vaccination information and appointment signups are available at tiny.utk.edu/vaccine. The Student Health Center medical staff is available to students to answer questions or discuss concerns about vaccines, and the center provides vaccines free of charge for anyone 18 years or older who would like one.

Sickness or Exposure -- If students think they are sick or have been exposed to COVID-19, they should contact the Student Health Center or their preferred health care provider. Students can also contact the university's COVID-19 support team for guidance by filling out the COVID-19 self-isolation form at covidform.utk.edu.
Students are advised not to attend class in-person if they have tested positive for COVID-19 and are in the isolation period, if they have COVID-19 symptoms and have not been cleared by a medical provider, or if they are an unvaccinated close contact in the quarantine period. The university recommends that students and employees stay home anytime they do not feel well. **If you need to miss class for illness, please email me as soon as possible.**

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