



THE UNIVERSITY OF  
**TENNESSEE**  
KNOXVILLE

**BIG ORANGE. BIG IDEAS.**

## **PHYS 250 Modern Physics, Fall 2021**

University of Tennessee, Knoxville

**Meeting Time and Place:** Nielsen 203 TR 2:50 – 5:35

**Course Credit Hours:** 4

### **Faculty Contact Information**

Dr. Kate Jones: Nielsen 407B

Email: [kgrzywac@utk.edu](mailto:kgrzywac@utk.edu)

Webpage: <http://www.phys.utk.edu/people/faculty/faculty-jones.html>

**Course Description/Information:** Fundamental concepts of modern physics and their applications to atomic, nuclear, particle, and condensed matter physics, with lab.

Prerequisites: PHYS 136, or PHYS 138, or PHYS 231.

**Value Proposition:** This course is an introduction and overview of modern physics including the origins of quantum physics and relativity. The purpose of the course is both to introduce students broadly to concepts and applications of modern physics, and to prepare them for upper-division physics courses, such as PHYS 411 “Introduction to Quantum Mechanics I”.

**Learning Environment:** This is a studio class, meaning that students are responsible for reading the material ahead of class sessions and will be ready to take a short quiz before class, and to discuss in class. Each class will start with a quick review of the reading material, and an opportunity to ask questions relating to the current or previous reading assignments. There will be in class activities that students will work on in pairs, or small groups. We will reconvene either for the last 15-20 minutes of class, or for the first 15-20 minutes of the next class when each group will present a single slide with a short summary of the in-class activity findings.

**Course Communications:** Communication outside of class times will be through UTK email and Canvas. Please monitor your UTK email and Canvas regularly. For technical issues, contact the OIT HelpDesk via phone (865) 974-9900 or online at <http://help.utk.edu/>.

**How to Be Successful in This Course:** Being organized and keeping up with reading assignments is essential to success in this course. Come to class prepared to discuss the material and to work with other students. If you're willing to work and learn this should be a really fun course.

**Texts/Resources/Materials:**

There are three textbooks that are recommended for this course, you need to have access to at least one of them:

- “Modern Physics”, Tipler and Llewellyn, Freeman & Company, 2012.
- “Modern Physics”, Krane, Wiley & Sons, 2012.
- “Modern Physics”, Krane, Wiley & Sons, 2019.

Tipler may be difficult to get hold of, but it was used in previous years. If you can buy a copy from a student who has taken this class, this may be the cheapest option. The 2019 edition of Krane is listed as cheaper than the 2012 edition. Digital copies may be another low-cost option.

**Course Requirements, Assessments, and Evaluations:**

The final grade will be assigned from the weighted average based on the following *provisional* grading scale.

A	90 and above
A-	87 and above
B+	83 and above
B	80 and above
B-	77 and above
C+	73 and above
C	70 and above
C-	67 and above
D+	63 and above
D	60 and above
D-	57 and above
F	below 57

## Grade Breakdown

Homework	20%
Exams	45% (15% each for three exams)
Labs/ in class activities	20%
Pre-class quizzes	15%

## Modules:

<b>Module 1</b>	<b>Waves and Light</b>	Mechanical waves, EM waves, Photons, deBroglie hypothesis, matter waves.
<b>Module 2</b>	<b>Quantum Mechanics</b>	Schrödinger equation, 1-D problems
<b>Module 3</b>	<b>Atoms</b>	Hydrogen atom, electron spin, multielectron atoms
<b>Module 4</b>	<b>Quantum Effects in Large Systems</b>	Lasers, quantum effects in large systems, semiconductors
<b>Module 5</b>	<b>Nuclear Physics (and Particles)</b>	Properties of nuclei, nuclear decay, nuclear energy, the standard model
<b>Module 6</b>	<b>Relativity</b>	Classical relativity, Einstein's postulates, Lorentz transformation

## Schedule:

Day	Date	Topic	Homework
Thursday	8/19/21	First day of class. Intro	
Tuesday	8/24/21	Module 1	
Thursday	8/26/21	Module 1 Lab 1 Standing waves	
Tuesday	8/31/21	Module 1	
Thursday	9/2/21	Lab 2 Photoelectric Effect	
Tuesday	9/7/21	Module 2	Homework 1 due
Thursday	9/9/21	Module 2	
Tuesday	9/14/21	Module 2	
Thursday	9/16/21	Module 3 + Lab 3 The Balmer Series	
Tuesday	9/21/21	Module 3	Homework 2 due
Thursday	9/23/21	Module 3 & Review Modules 1+2	
Tuesday	9/28/21	Exam 1	
Thursday	9/30/21	Fall Break	
Tuesday	10/5/21	Exam 1 solutions	
Thursday	10/7/21	Module 3	
Tuesday	10/12/21	Module 4	
Thursday	10/14/21	Lab 4 Light-emitting diodes	Homework 3 due
Tuesday	10/19/21	Module 4	

Thursday	10/21/21	Module 4	
Tuesday	10/26/21	Lab 5 Counting statistics	Homework 4 due
Thursday	10/28/21	Module 5 + Review Modules 3+4	
Tuesday	11/2/21	Exam 2	
Thursday	11/4/21	Exam 2 solutions and Module 5	
Tuesday	11/9/21	Module 5	
Thursday	11/11/21	Module 6 + Lab 6 Half-life of $^{137m}\text{Ba}$	
Tuesday	11/16/21	Module 6	
Thursday	11/18/21	Lab 7 Attenuation of radiation	HW 5 due
Tuesday	11/23/21	Module 6	
Thursday	11/25/21	Thanksgiving	
Tuesday	11/30/21	Review	HW 6 due
		Final Exam	

### University Policies:

**Academic Integrity:** “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.”

**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: <http://civility.utk.edu/>

**Physics and Astronomy Civility Statement:** As a department, we are 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.

**Reporting:** Anyone who experiences or observes any such incident is encouraged to report it to the Department Head or one of the Associate Heads. 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.

Additional resources and reporting available at: <http://www.phys.utk.edu/about/civility-community.html>

**Disability Services:** “Any student who feels s/he may need an accommodation based on the impact of a disability should contact Student Disability Services in Dunford Hall, at 865-974-6087, or by video relay at, 865-622-6566, to coordinate reasonable academic accommodations.”

**Your Role in Improving Teaching and Learning Through Course Assessment:**

At UT, it is our collective responsibility to improve the state of teaching and learning. During the semester, you may be requested to assess aspects of this course either during class or at the completion of the class. You are encouraged to respond to these various forms of assessment as a means of continuing to improve the quality of the UT learning experience.

**Key Campus Resources for Students:**

- [Center for Career Development](#) (Career counseling and resources; HIRE-A-VOL job search system)
- [Course Catalogs](#) (Listing of academic programs, courses, and policies)
- [Hilltopics](#) (Campus and academic policies, procedures and standards of conduct)
- [OIT HelpDesk](#) (865) 974-9900
- [Schedule of Classes/Timetable](#)
- [Student Health Center](#) (visit the site for a list of services)
- [Student Success Center](#) (Academic support resources)
- [Undergraduate Academic Advising](#) (Advising resources, course requirements, and major guides)
- [University Libraries](#) (Access to library resources, databases, course reserves, and services)

**COVID-19 Guidelines:** With the spread of the Delta variant of COVID-19, students, faculty, and staff will be required to wear masks in classrooms, labs, and for indoor academic events required for students such as orientation. This requirement will remain in place until conditions improve and the university communicates new instructions.

The university strongly 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](http://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.

If you think you are sick or have been exposed to COVID-19, you should contact the Student Health Center or your preferred health care provider. You 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](https://covidform.utk.edu).

You must not attend class if you have tested positive for COVID-19 and are in the isolation period, if you have COVID-19 symptoms and have not been cleared by a medical provider, or if you are an unvaccinated close contact in the quarantine period.

If you need to miss class for illness, please email: [kgrzywac@utk.edu](mailto:kgrzywac@utk.edu) as soon as possible.

You can find more information and updates at [utk.edu/coronavirus](https://utk.edu/coronavirus).

***The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.***

*Updated August 3, 2021*