PHYSICS 3010
Modern Physics
Fall 2025

Lecture Section 001, TuTh 11:00 a.m.–12:20 p.m. in PHYS 104
Recitation Section 201, TuTh 1:00–1:50 p.m. in PHYS 112

Professor: Alex Barr
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Help Hours: M 1:00-3:00pm, Th 10:00-11:00am, by appointment, or any time my door is open

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Recommended ext: *Modern Physics*, 4th ed., by Kenneth Krane, Wiley, 2020

Topics and General Information: This course will cover special relativity, the foundations of quantum mechanics and its application to atomic physics, properties of matter, and nuclear physics.

Attendance and Participation: You are expected to attend and participate in all lectures and recitation sections as long as you are healthy**.** Lecture and recitation may involve graded activities that cannot be made up if you are absent. If you are absent, you should work through the slides and other materials posted to Canvas before the next class.

Homework: Homework sets will be assigned each week, and generally will be due a week after being assigned. Homework will be completed on paper or tablet - this course does not use an online homework service. Homework is intended as practice and a place to make mistakes, therefore homework will be graded based on effort, not correctness. Your solutions must be complete, legible, and clearly show your reasoning to receive full credit.

Exams: There will be three exams during the semester and a comprehensive final exam. **Exams will take place during our scheduled class time and may take place in both lecture and recitation**. Exam questions will involve both mathematical calculations and conceptual explanations and will be based on material from lecture, class readings, recitation, and homework assignments.

- Questions pertaining to the grading of exams must be directed to the instructor in writing within one week of receiving your graded exam.
- If you miss an exam for a valid reason, you need to contact the instructor via email within 24 hours to make arrangements to take a different, make-up exam.

Learning From Mistakes: Learning necessarily involves making mistakes. If you never make mistakes then you are not being sufficiently challenged. The goal is to make most of your mistakes in class and on the homework so that you can ask questions and learn from those mistakes before you get to the exam. When you make a mistake on an exam, your goal is still to understand what you did wrong and to learn from that mistake. After an exam you may have an opportunity to demonstrate that you have learned from your mistakes and raise your exam score. Details will be discussed as the exams approach.

Free help: In addition to visiting my office, physics tutors are available M-F 10 am - 4 pm in Hickory Hall 266. You can simply walk in with no reservation and ask questions about homework or examples from class. There are some specific hours designated for Modern Physics, but those hours are not yet posted.

Grades: Your semester grade in this course will be based on the following components:

Pre-Lectures	5%
Homework	20%
Recitation	10%
3 Unit Exams	15% each
Final Exam	20%
Total	**100%**

Course Evaluation: The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short survey will be made available to you on-line at the end of the semester and will provide you with an opportunity to provide feedback to your course instructor. SPOT is considered to be an important part of your participation in this class. You will receive an email from "UNT SPOT Course Evaluations" from no-reply@iasystem.org with the survey link. You will have separate SPOT evaluations for lecture, recitation, and lab. During fall and spring semesters SPOT surveys are open to students to complete two weeks prior to final exams.

Use of AI and Other Technologies: The use of computing tools such as Desmos or WolframAlpha to help you solve equations or compute integrals on homework is perfectly acceptable and can help you focus on the physics rather than getting bogged down in calculations. Use of ChatGPT or other generative AI tools to solve homework problems is strongly discouraged (this will not prepare you to solve problems on exams). Some students do find it useful to use generative AI to create additional practice problems when studying for exams or to summarize an example from class or a textbook section that is unclear.

UNT Policies

Academic Integrity Standards and Consequences: According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

ADA Accommodation Statement: UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time; however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

Emergency Notification & Procedures: UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

Sexual Assault Prevention: UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565- 2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759.

Tentative Schedule

#	Day	Topic	What's Due
1	Tu 8/19	Ch 1 - Failures of classical physics	
2	Th 8/21	Ch 2 - Time dilation & length contraction	
3	Tu 8/26	Ch 2 - Lorentz transformations	Pre-Lecture 1, HW 1
4	Th 8/28	Ch 2 - Relativistic kinematics	
5	Tu 9/2	Ch 2 - Relativistic conservation laws	Pre-Lecture 2, HW 2
6	Th 9/4	Ch 3 - EM waves & photoelectric effect	
7	Tu 9/9	Ch 3 - Compton scattering & blackbody radiation	Pre-Lecture 3, HW 3 (long)
8	Th 9/11	Ch 4 - Wave/particle duality	
9	Tu 9/16	Review	HW 4
10	**Th 9/18**	**Exam 1 (HW 1-4)**	
11	Tu 9/23	Ch 4 - Heisenberg uncertainty principle	Pre-Lecture 4
12	Th 9/25	Ch 5&6 - Particle in a well	HW 5
13	Tu 9/30	Ch 5 - Schrödinger equation	Pre-Lecture 5, HW 6
14	Th 10/2	Ch 7 - Hydrogen atom	
15	Tu 10/7	Ch 7 - Electron spin and the Zeeman effect	Pre-Lecture 6, HW 7
16	Th 10/9	Ch 8 - Atoms and lasers	
17	Tu 10/14	TBD	HW 8
18	**Th 10/16**	**Exam 2 (HW 5-8)**	
19	Tu 10/21	Ch 10 - Classical & quantum statistics	Pre-Lecture 7
20	Th 20/23	Ch 10 - Distribution functions	
21	Tu 10/28	Ch 11 - Structure and properties of solids	Pre-Lecture 8, HW 9
22	Th 10/30	Ch 11 - Band theory	
23	Tu 11/4	Ch 12 - Radioactive decay	Pre-Lecture 9, HW 10
24	Th 11/6	Ch 13 - Applications of nuclear physics	
25	Tu 11/11	TBD	HW 11
26	**Th 11/13**	**Exam 3 (HW 9-11)**	
27	Tu 11/18	Time dependence	
28	Th 11/20	Time dependence	
		FALL BREAK	
29	Tu 12/2	Ch 14 - Elementary particles & review	Pre-Lecture 10
30	Th 12/4	Review	

Comprehensive Final Exam: Tuesday December 9, 10:30 - 12:30 PM