PHYSICS 3010
Modern Physics
Spring 2024
Lecture Section 001, TuTh 8:00 a.m.–9:20 a.m. in LANG 113
Recitation Section 201, Th 11:00–11:50 a.m. in LANG 315

Professor: Alex Barr
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Office Hours: M 11:00-Noon and Tu 2:00-3:00 and by appointment or any time my door is open

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Text: *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 sick, let me know as soon as possible.

Exams: There will be three exams during the semester and a comprehensive final exam. Exams will take place during our schedule class time. Exam questions will involve both mathematical calculations and conceptual explanations and will be based on lecture material, and material contained in the text, recitations, and in the 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 the you can ask questions and review your notes/textbook to 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 each exam you will 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.

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.

Grades: Your grade in this course will be based on homework and as follows:

Homework	19%
3 Unit Exams	17% each
Final Exam	30%
Total	**100%**

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable 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 reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office

hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

UNT's policy on **Academic Dishonesty** can be found at: https://policy.unt.edu/policy/06-003. Key dates can be found at https://registrar.unt.edu/registration/spring-registration-guide. The **last day for a student to drop a class with a W** is Friday, April 5, 2024.

Canvas will be used to post all relevant courses information. Canvas can be accessed from the UNT home page. You will find an electronic copy of this syllabus, and Modules containing copies of the lecture notes and homework.

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.

Tentative Lecture Schedule

Session	Date	Day	Chapter, Lecture Topic
1	Jan. 16	Tu	Ch. 1 - Review of classical physics
2	Jan. 18	Th	Ch. 1 - Failures of classical physics
3	Jan. 23	Tu	Ch. 2 - Introduction to special relativity
4	Jan. 25	Th	Ch. 2 - Relativistic kinematics and dynamics
5	Jan. 30	Tu	Ch. 2 - Relativistic conservation laws, experimental tests
6	Feb. 1	Th	Ch. 3 - EM waves and the photoelectric effect
7	Feb. 6	Tu	Ch. 3 - Other photon processes
8	Feb. 8	Th	Ch. 4 - Matter waves
9	Feb. 13	Tu	Ch. 4 - Uncertainty Principle
10	**Feb. 15**	**Th**	**Exam 1 - Chapters 1 - 3**
11	Feb. 20	Tu	Ch. 5 - The Schrödinger equation
12	Feb. 22	Th	Ch. 5 - Applications of the Schrödinger equation
13	Feb. 27	Tu	Ch. 6 - The nuclear atom
14	Feb. 29	Th	Ch. 6 - Bohr model of the atom
15	Mar. 5	Tu	Ch. 7 - Hydroden atom
16	**Mar. 7**	**Th**	**Exam 2 - Chapters 4 - 7.4**
NA	*Mar. 12*	*Tu*	*Spring Break*
NA	*Mar. 14*	*Th*	*Spring Break*
17	Mar. 19	Tu	Ch. 7 - Electron spin and atomic energy levels
18	Mar. 21	Th	Ch. 8 - Pauli exclusion principle and many-electron atoms
19	Mar. 26	Tu	Ch. 8 - Properties of many-electron atoms
20	Mar. 28	Th	Ch. 10 - Classical statistics
21	Apr. 2	Tu	Ch. 10 - Quantum statistics
22	Apr. 4	Th	Ch. 11 - Structure and properties of solids
23	Apr. 9	Tu	Ch. 11 - Band theory
24	Apr. 11	Th	Ch. 12 - Nuclear properties
25	Apr. 16	Tu	Ch. 12 - Radioactive decay
26	**Apr. 18**	**Th**	**Exam 3 - Chapters 7.5 - 8, 10 - 11**
27	Apr. 23	Tu	Ch. 13 - Nuclear reactions
28	Apr. 25	Th	Ch. 13 - Applications of nuclear physics
29	Apr. 30	Tu	Ch. 14 - Elementary particles
30	May 2	Th	Review

FINAL EXAM—Comprehensive—Tuesday, May 7, 8:00 a.m-10:00 a.m.