

Physics 2331: Modern Physics I (Fall 2022)

Instructor: Dr. M. C. Gallagher
Office: CB-4031
Research Lab: CB-2015
Telephone: 343-8226
Email: mark.gallagher@lakeheadu.ca (preferred method of contact)
Office Hours: Tues. & Thurs. 10:30AM to 12:00 PM.

Lectures: **Mon. & Wed., 2:30PM to 3:45 PM, in AT2021.**

Course description: This course follows the development of two revolutions in physics that took place at the beginning of the 20th Century: the theories of special relativity and quantum mechanics. We will survey the experiments whose surprising results shook the foundation of classical physics and forced physicists to adopt counter-intuitive views of the nature of space, time, matter and energy.

Course site: access D2L site through “**myCourselink**” using Lakehead username and password.

Text (eBook): Modern Physics for Scientists and Engineers, Fifth Edition, Stephen Thornton, Andrew Rex and Carol Hood.

Marking Scheme:

Problems (weekly, WebAssign)	20%
Mid-Term Test (Wed., Oct. 26th).....	25%
Term Paper (Fri., Dec. 2nd).....	15%
Final Exam (TBA)	40%

Topics

Thornton & Rex

State of Affairs before Modern Physics	Ch. 1
Special Relativity	Ch. 2
Quantum Behaviour	Ch. 3
Atomic Structure	Ch. 4
Wave Properties of Matter	Ch. 5
Quantum Mechanics	Ch. 6
The Hydrogen Atom	Ch. 7
Atomic Physics (time permitting)	Ch. 8

Course learning goals:

The student will gain an understanding of:

- relativistic dynamics and energy;
- quantum theory of light and the particle nature of matter;
- the basics of quantum mechanics:
 - wave functions and the Schrödinger equation,
 - solutions to Schrödinger equation for various potentials including the hydrogen atom;
- atomic physics and the periodic table.

Course Format and Expectations:

Lectures:

The slides associated with each lecture (pdf copies of the PowerPoint slides) will be made available prior to the lecture. It is recommended that students read through the slides prior to the lecture and come to class with any questions they might have. Posting the slides also allows students to annotate the slides during the lecture rather than having to worry about taking complete notes.

Lectures will include a question and answer time where students are encouraged to ask questions, i.e. on weekly assignment questions. In addition, the lectures will include breakout sessions in which students will work in groups to solve simple problems.

Online Discussion:

I will activate the discussion feature within *D2L* to allow students to post questions, to the class or make comments about the unit's topics.

Problem Sets (20%):

- Will be using *WebAssign* (Cengage) for the approximately weekly assignments.
- A license, which comes with the textbook and is required to access *WebAssign*.
- To access *WebAssign*, follow the instructions on the *D2L* course site.
- Assignments will (normally) be made accessible at 4:00PM on a Wednesday, and will be due at 9:00PM the following Wednesday.

Term Test (25%):

The midterm test will be taken during class time on the date indicated. The test will have problems similar to those in the weekly problem sets. The values of physical constants as well as a formula sheet will be provided with the test. Further details regarding the test will be posted later in the term, at least one week prior to the test.

Term Paper (15%):

Students are asked to submit a paper (4-5 single spaced pages in length) that addresses an important discovery in Modern Physics that is relevant to the course, and led to the awarding of a Nobel Prize.

More detailed expectations for the paper will be posted on the course *D2L* site after the Thanksgiving break. At that time students are asked to pick a topic and communicate it to me for approval. The paper is due Friday, December 2nd)

Final Examination (40%):

The Final exam will be cumulative (will contain material from the entire course). That said, most of the exam will focus on material covered since the second term test. Further details on the final exam will be posted on the *D2L* course site later in the term.

Accommodations:

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please visit: <http://studentaccessibility.lakeheadu.ca>.

