Physics 2102B: Introduction to Modern Physics

1. Course Information

Physics 2102B, Winter 2024
Lectures: TBA
Tutorial: TBA

Calendar Description: Introduction to quantum mechanics, wave-particle duality, atomic physics, nuclear physics, particle physics and the origins of the universe.

Prerequisites: Physics 1201A/B or Physics 1401A/B or Physics 1501A/B or the former Physics 1301A/B, each with a minimum mark of 60%, or the former Physics 1028A/B with a minimum mark of 80%; Physics 1202A/B or Physics 1402A/B or Physics 1502A/B or the former Physics 1302A/B, each with a minimum mark of 60%, or the former Physics 1029A/B with a minimum mark of 80%; a minimum mark of 60% in each of (Calculus 1000A/B or Calculus 1500A/B or Numerical and Mathematical Methods 1412A/B or the former Applied Mathematics 1412A/B) and (Calculus 1301A/B or Calculus 1501A/B or Numerical and Mathematical Methods 1414A/B or the former Applied Mathematics 1414A/B), or in the former Applied Mathematics 1413. Integrated Science 1001X with a minimum mark of 60% can be used in place of Physics 1202A/B and Calculus 1301A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Course Instructor: Prof. Gonca Erdemci-Tandogan
(audio name pronunciation)
Pronouns: she/her/hers
Email: gerdemci@uwo.ca
If you have a question or would like to talk with me, you can send an email (must be from your Western email) or visit me during student hours. Please include "Physics 2102B" in the subject line of your email.
Student Hours: If any changes happen for certain weeks, it will be announced.

Phone: (519) 661-2111 ext. 82739

Course TA: John Adams
Pronouns: he/they
Email: jadam33@uwo.ca

What are 'Student Hours'?
Student hours are dedicated times through the week for the course instructor and TAs to meet with YOU. Pop in to introduce yourself, ask questions about the course, or discuss content from the course.

Inclusive teaching statement:
I am committed to fostering an environment for learning that is inclusive for everyone regardless of gender identity, gender expression, sex, sexual orientation, race, ethnicity, ability, age, class, etc. It is my hope that our class will support diversity of experience, thought, and perspective. Names/pronouns: I welcome emails or in-person communications to let me know your preferred name or pronouns.

Land Acknowledgement:
Western University is situated on the traditional territories of the Anishinaabeg, Haudenosaunee, Lunaapeewak and Attawandaron peoples, who have longstanding relationships to the land and region of southwestern Ontario and the City of London. The local First Nation communities of this area include Chippewas of the Thames First Nation, Oneida Nation of the Thames, and Munsee Delaware Nation. In the region, there are eleven First Nation communities and a growing Indigenous urban population. Western values the significant historical and contemporary contributions of local and regional First Nations and all of the Original peoples of Turtle Island (North America).

3. Course Syllabus, Schedule, Delivery Mode

Welcome to Physics 2102B – term four of our two-year introductory physics sequence. The main goals of this course are to:

- provide an overview of the development of modern physics.
- introduce quantum mechanics and some of its applications.
- introduce the special theory of relativity.
- study other topics such as atomic, condensed-matter, nuclear, and particle physics, time permitting.

By the end of this course, students should be able to:

- explain how quantum physics evolved from a classical description as new evidence came to light and as laws and theories were tested and subsequently restricted, revised, or replaced.
- explain the fundamental postulates and principles of special relativity and quantum physics.
- mathematically describe and derive the basic laws in special relativity and quantum physics.
- apply the principles of quantum mechanics to predict the results of measurements in simple systems such as e.g. a particle in a box and the hydrogen atom.
- use a step-by-step problem-solving strategy underpinned with conceptual understanding to logically work through complex problems.

Topic Outline

The ***tentative*** course content in the table below corresponds to the section in Thornton and Rex, *Modern Physics for Scientists and Engineers*, 4th edition. Note that this is a provisional list and includes more topics than we will have time to cover; an updated list of topics will be maintained on the OWL site.

Chapter	Sections	Topic
1	1-6	The Birth of Modern Physics
2	1–14	Special Theory of Relativity
3	1-8, (9)	The Experimental Basis of Quantum Physics
4	1, (2), 3-6, (7)	Structure of the Atom
5	(1), 2-8	Wave Properties of Matter and Quantum Mechanics I
6	1, (2), 3-5, (6-7)	Quantum Mechanics II
7	1-3, (4-5), 6	The Hydrogen Atom
8	1	Atomic Physics
9	-	Statistical Physics
10	TBD	Molecules, Lasers, and Solids
11	1, TBD	Semiconductor Theory and Devices
12	1-7, (8)	The Atomic Nucleus
13	TBD	Nuclear Interactions and Applications
14	1-2, TBD	Particle Physics
15	-	General Relativity
16	1-2, TBD	Cosmology and Modern Astrophysics

Classes begin: January 8, 2024
Reading Week: February 17-25, 2024
Holiday/No classes: March 29, 2024
Classes end: April 8, 2024
Final exam period: April 11-30, 2024

Contingency plan

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

4. Course Materials

Recommended textbook: S.T. Thornton and A. Rex, *Modern Physics for Scientists and Engineers*, 5th edition (Brooks/Cole, 2020).

The textbook is on reserve at the Taylor Library.

OWL will be used to host class notes and supplementary materials and to communicate announcements and grades.

Students are responsible for checking the course OWL site on a regular basis. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Scientific calculator: required for quizzes, homework and exams. **Only a basic, non-programmable, non-graphing, non-wi-fi-enabled calculator will be allowed.**

Gradescope: Assignments will be submitted to Gradescope, accessible from the OWL site.

Technical requirements: In the (hopefully unlikely) event that the course must transition to online delivery, students will require a stable internet connection and a computer with a working webcam and microphone.

5. Methods of Evaluation

Research about learning strongly suggests that the most important factor in learning is doing the work of reading, writing, recalling, practicing, synthesizing, and analyzing. Learning happens best when people actively engage material on a consistent basis, and that is why we have high standards in this course. We are confident that, with appropriate effort, you *all* can meet those standards.

We also make an effort to reduce unintentional bias in grading by, for example, and when possible, grading assignments one question at a time (grading all of question 1 before grading any of question 2), grading anonymously, and using rubrics.

Your course grade will be computed as follows:

Component	Weight
Assignments (best 6 of 7)	25%
Quizzes (best 3 of 4)	10%
Midterm	25%
Final Exam	35%
Tutorial Attendance	5%

In order to receive a course grade >45%, students must obtain a grade of at least 50% overall course components AND a grade of at least 50% on the weighted average of the midterm test and final examination.

Note: The Department of Physics and Astronomy may, in exceptional cases, adjust the final course marks in order to conform to Departmental policy. Final grades will be rounded to the nearest integer, and grades ending in 9 (e,g. 69) are not automatically "bumped up" by 1 mark.

Assignments will be due at 11:59 pm on their posted due date (approximately every other Friday). Late assignments will be penalized 20%/day for up to two days, after which they will no longer be accepted. You are encouraged to discuss the course materials with your classmates, but **your explanations and derivations of the assignments must be yours only**. All the assignments that you submit for this course must be original work produced by the individual student. The assignments that you submit for this course may not include anything that was generated from AI tool prompt.

There is a bonus assignment assigned at the beginning of the term and due Sunday, Jan 14.

Quizzes will be held in class, approximately every two-three weeks.

Tutorial attendance: The weekly tutorials are an essential part of the course. 5% of your final grade will be based on your attendance and completion of the tutorials.

Midterm: There will be one midterm test, held in class (date and time: TBA).

Final exam: The final examination will take place during the university-scheduled exam period in April and will cover all material in the course.

6. Student Absences

Assignments will be due at 11:59 pm on their posted due date. Late assignments will be penalized 20%/day for up to two days, after which they will no longer be accepted. Your lowest assignment mark will be omitted from the calculation of your final grade. As a result, there will be no make-up for the assignments. Weekends count: an assignment due on Friday but submitted on Sunday is two days late.

Quizzes: Your lowest quiz mark will be omitted from the calculation of your final grade. If a student is prevented from writing a quiz for serious reasons such as medical illness, they must seek academic considerations from their Dean's Office Academic Counselling unit. If excused from a quiz, its weight will be distributed to the midterm test (quizzes 1 and 2) or final examination (quizzes 3 and 4).

Tutorial attendance: There will be no make-up for the missed tutorials.

Midterm: If you are unable to write the midterm, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

If you received permission for absence from the midterm, the missed midterm must be made up at a later date (TBD, Registrar's Office). If you received permission for absence for both the midterm and the make-up of the midterm, the weight of the midterm will be added to the weight of the final exam.

Final Examination:

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

7. Generative Artificial Intelligence (AI) Policy

The assignments that you submit for this course must be original work produced by the individual student. **The assignments that you submit for this course may not include anything that was generated from AI tool prompt.**

While generative AI tools (ChatGPT, etc.) can be useful for some tasks (e.g. Grammarly may be useful for revising text that YOU have written), it is not a replacement for critical thinking and writing. You must use them in a way that helps you learn, not hampers learning. Remember that these tools are not a replacement for your own learning of the material, critical thinking ability and writing skills.

Academic integrity involves claiming credit only for work that you performed. If you are found to have used AI tools inappropriately, this will be considered a violation of Western's academic integrity and scholastic offense policies. Please ask if you have questions about this topic or this policy.

8. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays: https://www.edi.uwo.ca.

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

9. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Only a basic, non-programmable, non-graphing, non-wi-fi-enabled calculator will be allowed on the midterm and final exams and quizzes. No other aids, including extra sheets, computers, tablets, cellular phones, advanced calculators, smart watches or other electronic devices are permitted.

You are encouraged to discuss the course materials with your classmates, but your explanations and derivations of the assignments must be yours only. **All the assignments that you submit for this course must be original work produced by the individual student. The assignments that you submit for this course may not include anything that was generated from AI tool prompt.**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

All required papers may be subject to submission for similarity review by other software such as MOSS or Gradescope.

If required, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

https://remoteproctoring.uwo.ca.

10. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC at

https://westernusc.ca/services/