

## Physics 2110A (Fall 2024) Course Outline

### 1. Course Information

#### Physics 2110A, Fall 2024

**List of 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. Pre- or Corequisite(s): Mathematics 1600A/B or Mathematics 1700A/B or Numerical and Mathematical Methods 1411A/B or the former Applied Mathematics 1411A/B

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) 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

Instructors	Email	Office	Phone	Office Hours
Prof. Pauline Barmby (Course Coordinator)	<a href="mailto:pbarmby@uwo.ca">pbarmby@uwo.ca</a>		x81557	
Prof. Yu Shi				
Teaching assistant - TBA				

Students must use their Western ([@uwo.ca](mailto:@uwo.ca)) email addresses when contacting their instructors. Please allow 24 hours for a response Monday to Friday and 48 hours during the weekends.

### 3. Course Syllabus, Schedule, Delivery Mode

#### Course description:

A unified treatment of oscillatory and wave motion, with examples from mechanics, electromagnetism, optics and materials science. Topics include simple harmonic motion, forced oscillations and resonance, coupled oscillations, transverse waves on strings and in crystals, longitudinal waves in gases and solids, electromagnetic waves, Fourier methods, nonlinear oscillations and chaos.

#### Learning outcomes:

By the end of the course, the students will be able to

1. Understand the difference between free, damped and forced motion.
2. Understand the difference between oscillations and waves.
3. Understand the differences and similarities between standing and travelling waves.
4. Relate physical concepts to mathematical descriptions using concepts from linear algebra, complex analysis and differential equations.
5. Solve the relevant equations of motion for simple, damped and forced oscillators and interpret their physical meaning.
6. Perform simple calculations using Python and Jupyter notebooks.
7. Represent solutions to equations of motion both numerically and graphically in Python.

Course meetings are in-person and will involve three weekly lectures and one weekly lab/tutorial (see p1 for location and time). Lecture recordings will be made available on a best-effort basis.

The weekly lab/tutorial period is an essential part of the course: part of your course grade will be based on your completion of the tutorials/labs. As part of the lab/tutorials you will learn how to use Python to do calculations and plot solutions graphically. Some of the homework assignments will also require the use of Python. The tutorial periods will also provide you with an opportunity to discuss homework assignments with the course instructor and teaching assistant. These sessions will not be recorded.

#### Topic outline:

The general order of topics is as follows (see OWL for a week-by-week breakdown):

Review of simple harmonic motion

Damped oscillations

Forced oscillations and resonance

Coupled oscillations

Travelling and standing waves

Fourier series and normal modes

Wave properties: interference, diffraction, dispersion

Whenever possible, we will relate the topics to mechanical waves, electromagnetic waves, waves in quantum mechanics and finally waves in fluids. In addition to learning about oscillations and waves, part of the aim of this course is that you become familiar with some important mathematical tools that are important in all areas of physics. You will thus encounter complex numbers, matrices, integrals, and Fourier transforms, to name a few.

## 4. Course Materials

Textbook: Vibrations and Waves by George C. King (Wylie, Chichester, 2009). Available online via “Course Readings” tab on OWL. Additional reading material will be made available as needed.

Labs: Will use Jupyter notebooks and Python 3 freely available from <https://www.anaconda.com/products/individual>.

All course material will be posted to OWL: <https://westernu.brightspace.com/>

Students are responsible for checking the course OWL site (<https://westernu.brightspace.com/>) regularly for news and updates. 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 Brightspace Help](#) page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

### Technical Requirements

- a laptop computer running any of Windows, Linux or MacOS and with an Anaconda Python installation will best facilitate lab/tutorial participation, but is not mandatory.
- a non-programmable calculator for exams

## 5. Methods of Evaluation

### Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below:

	Weight	Date	Topics covered
Homework assignments, best 4 of 5	20%	Approx. bi-weekly; due dates and submission through OWL/Gradescope	Lectures since previous assignment
Lab/tutorial notebooks, best 6 of 8	10%	Approx weekly; due dates and submission through OWL/Gradescope	
Midterm 1	18%		Simple and damped harmonic oscillator
Midterm 2	17%		Forced and coupled oscillators; intro to waves
Final exam	35%	TBA, December exam period	cumulative

The Department of Physics and Astronomy may, in exceptional cases, adjust the final course marks in order to conform to Departmental policy.

Assignments are to be submitted through Gradescope: if the uploaded answers cannot be read or the right answer is not indicated and easily found, these answers will not be assigned points. Please make sure your assignment is complete and legible before finishing your upload to Gradescope. You may work on the homework together, but please submit individual answers and do not plagiarise from each other or Internet sources. You may include the names of the people you worked with.

Completed Jupyter notebooks from lab/tutorial sessions are to be submitted through Gradescope to be marked for effort and completion. These must be in .ipynb format.

### **General information about missed coursework**

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration\\_Sep24.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf),

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:

[https://registrar.uwo.ca/academics/academic\\_considerations/](https://registrar.uwo.ca/academics/academic_considerations/)

All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Examinations scheduled during official examination periods (Defined by policy)
- Midterm 1 (Designated by the instructor as the one assessment that always requires documentation when requesting Academic Consideration)

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

### **Evaluation Scheme for Missed Assessments**

Missed midterm 1: makeup exam

Missed midterm 1 makeup: weight transferred to midterm 2

Missed midterm 2: reweighted to final exam

Missed assignments/labs (with Academic Consideration, see below): reweighted to midterm total

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under [Special Examinations](#)), especially for those who miss multiple final exams within one examination period.

### **Essential Learning Requirements**

Even when Academic Considerations are granted for missed coursework, the following are deemed essential to earn a passing grade.

To pass the course, students must achieve a minimum weighted average of 40% on the midterms and final exams. A student who does not meet this criterion will receive a maximum grade of 45, regardless of marks in the other components of the course.

### **Coursework with Assessment Flexibility**

By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

#### **Flexible Completion**

**Assignments and Labs.** This course has 5 (8) assignments (labs), and the 4 (6) assignments (labs) with the highest marks are counted towards your final grade. Should extenuating circumstances arise, students do not need to request Academic Consideration for the first 1 (2) missed assignments (labs). Academic consideration requests will be denied for the first 1 (2) missed assignments (labs). Academic Consideration requests may be granted when students miss more than 1 (2) assignments (labs), and these additional missed assignments (labs) will be reweighted to the midterm exam total.

#### **Deadline with a No-Late-Penalty Period**

**Assignments and Labs.** Students are expected to submit all homework assignments and labs by the deadline listed. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit their assignment up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 10% per day (including weekends) will be applied, up to a maximum of five days. No assignments or labs will be accepted beyond 7 days after the due date. Acceptance of submissions beyond the No-Late-Penalty Period may be restricted for certain assignments (to be announced in advance) to allow for release of solutions before exams. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No-Late-Penalty Period (48 hours).

## **6. Additional Statements**

### **Religious Accommodation**

When 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 to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

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](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

## **Academic Policies**

The website for Registrar Services is <https://www.registrar.uwo.ca/>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](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.

## **Electronic devices**

During tests and exams, students may use a non-programmable calculator (eg, the Sharp EL-510Rtb calculator available from the Western bookstore). Laptop computers and cell phones may not be used.

**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:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## **Support Services**

Please visit the Science & Basic Medical Sciences Academic Advising 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](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](mailto: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](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (<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.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.

### **Copyright Statement**

Course material (e.g. lecture notes, assignment documents, videos) produced by faculty is copyrighted. Reproducing for any purposes other than your own educational use, including sharing on ‘homework’ platforms and websites, contravenes Canadian Copyright Laws.

### **Statement on the use of Generative Artificial Intelligence (AI) Platforms**

The use of generative AI tools (ChatGPT, etc) to complete assignments or lab/tutorial notebooks is *not permitted in this course*. Such tools may produce written material that looks authoritative but is factually incorrect or biased; their use will not develop your own understanding or enable you to achieve the learning outcomes of the course.