Physics 2110A Oscillations and Waves
Course Outline: Fall 2020

Version 1.0

Important Notice:
This course outline is a living document that may be updated throughout the course. Such updates will be announced and the latest version will be posted on `http://owl.uwo.ca`. *The version number can be found at the bottom of each page. It is your responsibility to ensure that you have the most recent version of this document. All students registered in Physics 2110A are expected to have read this course outline carefully.*

1 General Course Information

Course Information: (**0.5 course:**) 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.

Prerequisite(s): Physics 1301A/B or Physics 1401A/B or Physics 1501A/B with a minimum mark of 60% or Physics 1028A/B with a minimum mark of 80%; Physics 1302A/B or Physics 1402A/B or Physics 1502A/B with a minimum mark of 60% or Physics 1029A/B with a minimum mark of 80%; a minimum mark of 60% in each of (Calculus 1000A/B or Calculus 1500A/B) and (Calculus 1301A/B or Calculus 1501A/B), or in Applied Mathematics 1413. **Pre-or Corequisite(s):** Mathematics 1600A/B.

2 Timetable

All course content and evaluations will be done online, i.e. there is no face to face (in person) component to this course. The course material will be delivered using a combinations of methods involving both asynchronous content posted as notes and videos on OWL, as well as synchronous labs/tutorials using Zoom.

Note: You must be available for scheduled labs/tutorials 1 hour a week, *either* on Wednesday 9:30-10:30 a.m. *or* Tuesdays at 3:30-4:30 p.m.

3 Instructor Information

Instructor: Prof. Trichtchenko
email: `otrichtc@uwo.ca`
office hours: Mondays and Fridays 9:30-10:30 on Zoom
The simplest way to reach me is by email. Students must use their Western (`@uwo.ca`) email addresses when contacting their instructors.

TA: Claudia Tugulan
email: `ctugulan@uwo.ca`
office hours: to be decided

4 Resources

Video lectures: The instructor will post a series of videos with course content including theoretical concepts as well as worked examples. These will have accompanying notes in pdf format also posted.
Textbook: Vibrations and Waves by George C. King (Wylie, Chichester, 2009). Additional reading material will be made available as needed.
Labs: We will use Jupyter notebooks and Python 3.8 freely available from `https://www.anaconda.com/products/individual`, submitted weekly on Gradescope
Homework: These will be posted on Gradescope every other week.
Quizzes: These will be posted on OWL weekly.

4.1 Online Tools:

Aside from built in OWL tools, we will use the following tools with links available from the OWL sites:

1. **VoiceThread:** Instructional videos with course content will be posted on VoiceThread to facilitate comments and questions.
2. **Gradescope:** Assignments and labs will be submitted and returned using Gradescope.
3. **Zoom:** Tutorials/labs will take place on Zoom synchronously (live).

Students should check OWL (http://owl.uwo.ca) on a regular basis for news, updates, as well as a calendar and weekly checklist. This is the primary method

by which information will be disseminated to all students in the class.
Note: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you.

5 Methods of Evaluation

Your final grade in this course will be computed using the following scheme:

Assignments	30%
Labs/Tutorials	10%
Quizzes	10%
Midterm Exam	20%
Final Exam	25%
Participation	5%

Assignments: These will be posted online approximately every other week, generally due on Friday evenings, for a total of 6 assignments. Assignments not submitted by the due date will be lose 15% for every 24 hours after the due date and time it is due, unless the instructor is provided with a valid excuse.
Note: If the answers that are uploaded cannot be read or the right answer is not marked 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.

Labs/Tutorials: Students are expected to attend online labs/tutorials during the designated 1 hour periods and upload their completed Jupyter notebooks on Gradescope to be marked for completion.

Quizzes: To encourage students to keep up with course content weekly, short quizzes will be posted on OWL roughly every week for a total of 10 quizzes.

Midterm exam: The midterm exam will be a timed 2 hour take home exam. Tentatively, it is scheduled during the tutorial/lab hours for **everyone on October 20, 3:30-5:30 p.m.**.

Special Accommodations for timed tests: Please contact me if you require special accommodations for exams and tests.

Final exam: The final exam will be a 3 hour take home exam.

Participation: Students are encouraged to ask questions and post comments and answers on OWL Forums and VoiceThread. These will be moderated by the instructor as well as the TA.
Important: Final grades will be rounded to the nearest integer, and grades

ending in 9 (eg. 69) are not automatically "bumped up" by 1 mark. The Department of Physics and Astronomy may adjust the final course marks in order to conform to Departmental policy.

6 Course Content

Here are some of the topics we will cover in this class (not necessarily in this order). Whenever the topics are not covered in the course text, supplementary readings will be provided as required.

- Review of simple harmonic motion
- Damped oscillations
- Forced oscillations and resonance
- Coupled oscillations
- Travelling waves
- Standing waves
- Dispersion
- Depending on time: Introduction to Lagrangian mechanics

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.

7 Labs/Tutorials

The weekly lab/tutorial period is an essential part of the course. Note that 10% of your final grade will be based on your attendance, your active participation and 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 require the use of Python. Programming languages such as Python is also used in several later Physics courses. We will use the Anaconda distribution of Jupyter notebooks and Python 3.8, which is freely available from `https://www.anaconda.com/products/individual`.
The tutorial periods will also provide you with an opportunity to discuss homework assignments with the course instructor and teaching assistant.

8 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.

9 Accommodation and Accessibility

9.1 Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: `https://www.uwo.ca/univsec/pdf/academic_policies/appeals/AcademicAccommodation_disabilities.pdf`

9.2 Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30 % or less of the students final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30 % of the students final grade,

- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see: `https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf` and for the Student Medical Certificate (SMC), see: `http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf`

9.3 Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

10 Academic Policies

10.1 Scholastic Offenses

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`.

10.2 Academic Integrity

When completing online exams, please abide by the rules and regulations outlined by the instructor, i.e. complete the exam on your own only using the resources allowed for the exam or test.

10.3 Online Etiquette

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following

rules of etiquette:

- arrive to class on time
- use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- When in a larger course, in order to give us optimum bandwidth and web quality, turn off your video camera for the entire class unless you are invited to speak
- please be prepared to turn your video camera off at the instructors request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- If you wish to speak, use the raise hand function and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
- Self-identify when speaking.
- Please remember to mute your mic and turn off your video camera after speaking (unless directed otherwise).

General considerations of netiquette:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. Flaming is never appropriate.
- Be professional and scholarly in all online postings. Use proper grammar and spelling. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

10.4 Internet

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link: `https://support.zoom.us/hc/en-us`

Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

10.5 Recordings

All of the remote learning sessions for this course may be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

11 Support Services

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

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 Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

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/.`

Learning-skills counsellors at the Student Development Centre (`http://www.sdc.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.

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