DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus (Section A) (revised April 2022)

Department of *Physics and Atmospheric Science*

PHYC2060

Oscillations and waves

Fall 2022

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor(s): *Laurent Kreplak kreplak@dal.ca Office hour: Dunn 225 Wednesdays 2:30 to 3:30 or by appointment*

Lectures: Dunn 101 *MWF 1:35-2:25*

Laboratories: *0*

Tutorials: Dunn 304 F *11:35-12:25*

Course delivery: *In-person*

Notes will be posted on Brightspace after each Lecture

Course Description

Oscillations and waves occur in a wide range of physical, chemical and biological systems. The objective of this course is to quantitatively explore the physics of oscillation and waves in a variety of classical systems such as mechanical and electrical oscillators, sound, and electromagnetic waves.

Course Prerequisites

PHYC 1190/1290 or PHYC 1310/1320, and MATH 1000/1010 or MATH 1280/1290

Course Exclusion

PHYC2140

Learning Objectives

- *Underdamped and overdamped free oscillations in mechanical and electrical systems.*
- *Quality factor and driven response of a damped oscillator*
- *Analyse the behaviour of coupled oscillators (2 and 3 degrees of freedom) in term of normal modes*
- *Normal modes of a continuous string*
- *Fourier series and Fourier transform*
- *1D wave equation*
- *Complex number notation for oscillations, complex impedance*
- *Solving 2nd order linear Differential equations in various regimes and for different initial conditions*

Course Materials

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- *Waves and Oscillations, A prelude to Quantum Mechanics (Walter Fox Smith)*
- https://bookstore.dal.ca/CourseSearch/?course[]=SUB,FALL22,PHYC,PHYC2060,01
- *Kit for at home experiments will be provided in class*
- *Course Brightspace page*

Course Assessment

Assessment	Weight (% of final grade)	Date
Assignments[1]	*4 (15 each)*	*Every 3 weeks*
Tests/quizzes[2,5]	*Mid-term 15 or 0*	*October 17th*
Final exam [3,4,5]	*25 or 40*	*(Scheduled exam period)*

Other course requirements

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	**B+** (77-79)	**C+** (65-69)	**D** (50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F** (<50)
A- (80-84)	**B-** (70-72)	**C-** (55-59)	

Course Policies on Missed or Late Academic Requirements

Assignment solutions are posted on Brightspace 1 week after the Assignment is due. There is no penalty for late assignments, but assignments received after the solution is posted will not be graded.

I do not offer make-ups for the assignments. For each assignment missed, the assignment weight (15%) will be shared equally between the students Mid-term and Final grades. The option of reducing the Mid-term weight by 15% to the benefice of the Final will remain, whichever scheme works best for the student.

*The Mid-term is set in class for **Monday October 17th**. Students should contact me as soon as possible if they are not able to attend that day.*

Course Policies related to Academic Integrity

Students are encouraged to work together as a group on all 4 assignments. They can share tips and tricks, explain answers to each other. Trying to explain a concept to someone else is an excellent way to judge whether you fully understand that concept. However full solutions of questions can't be copied verbatim within a group.

For Assignment 2 that requires students to perform two experiments at home and use their findings to answer a set of questions, students are encouraged to perform experiments together and to share the raw data. Each student must perform its own analysis and write their own answers to the questions.

Course Content

Week 1: Introduction (Math review)

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Week 2: Simple harmonic motion

Week 3: Using complex numbers to study harmonic motion

Week 4: Damped harmonic motion

Week 5&6: Driven oscillations

Week 7&8: Coupled oscillators

Week 9&10: Standing waves and Fourier analysis

Week 11&12: Travelling waves on a string, sound waves