UNIVERSITY OF CALGARY
FACULTY OF SCIENCE

Department of Physics & Astronomy
Science B 605
403 220-5385
phasoffice@ucalgary.ca

COURSE OUTLINE

1. **Course:** PHYS 321, Harmonic Motion, Waves, and Rotation - Winter 2021

   Lecture 01: MWF 09:00 - 09:50 - Online

Instructor	Email	Phone	Office	Hours
Dr Nasser Moazzen-Ahmadi	nmoazzen@ucalgary.ca	403 830-4053	SB 525	W 11:00-12:00 p.m.

Online Delivery Details:

This course is being offered online in real-time via scheduled meeting times, you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

This course has a registrar scheduled, synchronous final exam. The writing time is 2 hours + 50% buffer time.

Live lectures will be delivered on-line via zoom. The lectures will be recorded and posted (or their links) soon after the lecture. Lecture notes and solutions for midterms will be posted on D2L.

Course Site:

D2L: PHYS 321 L01-(Winter 2021)-Harmonic Motion, Waves, and Rotation

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

   See section 3.5.C in the Faculty of Science section of the online Calendar.

   Prerequisite(s):
   3 units from Physics 211, 221 or 227; and Mathematics 211 or 213; and Mathematics 267 or 277.

3. **Grading:**

   The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar.

   In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Assignments (6)	24%	See schedule at the end of the outline for details.
Mini quizzes (6)	12%	Mini quizzes will be done using D2L. Each quiz will consist of 10 multiple choice questions. Students will be given 30 min to complete each quiz.
Midterm tests (2)	28%	Out-of-Class online exams, 6:00-8:00 p.m. February 10, and 6:00-8:00 p.m. March 17, 2021 - Synchronous
Final Examination	36%	To be scheduled by the Registrar

The midterms are designed to take 80 minutes but students will be given 2 hrs to complete it. All students will start writing at the same time. Additional time will be granted to SAS students.

The final exam is designed to take 2 hrs to write but students will be given 3 hrs to complete it. All students will start writing at the same time. Additional time will be granted to SAS students.

Other accommodation will be done on a case-by-case basis in case of conflict or student location in different time zones.

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

This course will have a final exam that will be scheduled by the Registrar. The Final Examination Schedule will be published by the Registrar's Office approximately one month after the start of the term. The final exam for this course will be designed to be completed within 2 hours.

The final exam will be administered using an on-line platform. Per section G.5 of the online Academic Calendar, timed final exams administered using an on-line platform, such as D2L, will be available on the platform where the additional time will be added to the beginning of the registrar scheduled exam. E.g. If an exam is designed for 2 hours and the final exam is scheduled from 9-11am in your student centre, the additional time will be added to the start time of the exam. This means that if the exam has a 1 hour buffer time,

- a synchronous exam would start at 8 am and finish at 11am.

If the student obtains less than 50% on the combined mid-term and final exams, then the final grade will at most be a D+.

4. **Missed Components Of Term Work:**

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

5. **Scheduled Out-of-Class Activities:**

The following out of class activities are scheduled for this course.

Activity	Location	Date and Time	Duration
Midterm 1	Online	Wednesday, February 10, 2021 at 6:00 pm	2 Hours
Midterm 2	Online	Wednesday, March 17, 2021 at 6:00 pm	2 Hours

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

Out-of-Class online exams, 6:00-8:00 p.m. February 10, and 6:00-8:00 p.m. March 17, 2021 - Synchronous

6. **Course Materials:**

Required Textbook(s):

Randall A. Knight, *Physics for Scientists and Engineers*: Pearson, Fourth edition.

Online Course Components
MyLabandMastering is used for assignments. Students must register in https://www.pearsonmylabandmastering.com portal to do the homework assignments. Do not wait until the due date of the first assignment to do this! Access to MyLabandMastering is included with the purchase of a new textbook. You may already have access if you used the portal last year . Please check this before proceeding. You will be able to access only the assignments. If you have a Pearson account, Sign In at https://www.pearsonmylabandmastering.com and enter your Username and Password. If you cannot remember your username or your password, click Forgot your username or password? and enter the email address you used to register. Your login name and password will be sent to your email.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC ELearning online website.

7. **Examination Policy:**

Midterm 1 covers material from the beginning of the semester up to and including material covered on February 3rd, 2020.

Midterm 2 covers material from February 5th up to and including material covered on March 9th, 2020.

Final Exam is cumulative.

The use of books is not allowed on the exams. Use of a calculator is allowed and recommended. Use of a ruler is allowed, and may be recommended because exams can include problems with graphs.

All exams will include short-answer conceptual questions and quantitative problems that could have multiple parts. Exam regulations as outlined in the university calendar are also applicable to the midterm exams.

Grading of exams will be based on clarity and completeness of the method used to derive the answer, and correctness of the answer including correct units. Illegible text will not be marked. Scratched-out sections of exam papers will not be marked.No aids are allowed on tests or examinations.

Students should also read the Calendar, Section G, on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

10. **Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also Section E.5 of the University Calendar.

11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request

a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections I.1 and I.2 of the University Calendar

b. **Final Exam:**The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **Other Important Information For Students:**

a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).

b. **SU Wellness Services:** For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.

c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208. The complete University of Calgary policy on sexual violence can be viewed at (https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf)

d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional Code of Conduct and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

Student Handbook on Academic Integrity
Student Academic Misconduct Policy and Procedure
Research Integrity Policy

Additional information is available on the Student Success Centre Academic Integrity page

e. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at procedure-for-accommodations-for-students-with-disabilities.pdf.

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email phas.ahugrd@ucalgary.ca or phone 403-220-8127. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.

f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.

g. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty

Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: ombuds@ucalgary.ca.

h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

(a) Assignments

There will be six assignments in total. Problem sets will usually be assigned on Friday and be due the following Friday or at a date/time specified on the assignment.

(b) Course Description
Newtonian mechanics of rigid body rotation. Simple harmonic oscillations. Progressive waves in one dimension. Energy of a wave. Superposition. Standing waves. Static and dynamic fluids. Elasticity.

(c) Syllabus

Jan 11 - Jan 15, 2021

Course introduction

12.1. Rotational Motion

12.2. Rotation About the Center of Mass

Jan 18 - Jan 22, 2021

12.3. Rotational Energy

12.4. Calculating Moment of Inertia

12.5. Torque

Jan 25 - Jan 29, 2021

12.5. Torque

12.6. Rotational Dynamics

12.7. Rotation About a Fixed Axis

12.8. Static Equilibrium

Feb 1 - Feb 5, 2021

12.8. Static Equilibrium

12.9. Rolling Motion

12.10. The Vector Description of Rotational Motion

Feb 8 - 12, 2021

Review and examples

12.11. Angular Momentum

Feb 22 - 26, 2021

15.1. Simple Harmonic Motion

15.2. SHM and Circular Motion

15.3. Energy in SHM

Mar 1 - 5, 2021

15.4. The Dynamics of SHM

15.5. Vertical Oscillations

Mar 8 - 12, 2021

15.6. The Pendulum

15.7. Damped Oscillations

15.8. Driven Oscillations and Resonance

16.1. The Wave Model

16.2. One-Dimensional Waves

16.3. Sinusoidal Waves

Mar 15 - 19, 2021

Review and examples

16.4. Advanced Topic: The Wave Equation on a String

16.5. Sound and Light

16.6. Advanced Topic: The Wave Equation in a Fluid

16.7. Waves in Two and Three Dimensions

16.8. Power, Intensity, and Decibels

Mar 22 - 26, 2021

16.9. The Doppler Effect

17.1. The Principle of Superposition

17.2. Standing Waves

17.3. Standing Waves on a String

17.4. Standing Sound Waves and Musical Acoustics

17.5. Interference in One Dimension

17.6. The Mathematics of Interference

17.7. Interference in Two and Three Dimensions

Mar 29 - Apr 2, 2021

17.8. Beats

14.1. Fluids

14.2. Pressure

14.3. Measuring and Using Pressure

Apr 5 - Apr 14, 2021

14.4. Buoyancy

14.5. Fluid Dynamics

14.6. Elasticity

Review and examples

Course Learning Incomes

a. Students can describe and analyze motion of a particle in one and two dimensions.

b. Students are able to define Newton’s Laws and state conditions of static equilibrium.

c. Students are able to apply kinematic equations, Newton’s Laws and conservation of momentum and mechanical energy principles to solve quantitative and qualitative problems.

d. Students are able to solve systems of algebraic equations.

e. Students are able to recognize and manipulate vectorial variables.

f. Students can apply calculus to solve quantitative problems.

Course Outcomes:

- Students will be able to define and characterize rotational, oscillatory, wave and fluid motion.
- Students will be able to recognize and explain forces governing rotational, oscillatory and fluid motion as well as forces acting on an object in fluids.
- Students will be able to identify and mathematically describe rotational, oscillatory, wave, and fluid motion.
- Students will be able to give examples of oscillations, waves, as well as statics and dynamics of rigid bodies and fluids in real systems.
- Students will be able to apply calculus to solve quantitative and qualitative problems on rigid body rotation, oscillations, travelling and standing waves, and static and dynamic fluids.
- Students will be able to analyze real systems and apply appropriate models to simplify and evaluate them.

Electronically Approved - Jan 07 2021 11:04

Department Approval

Electronically Approved - Jan 07 2021 15:57

Associate Dean's Approval