UNIVERSITY OF CALGARY
FACULTY OF SCIENCE

Department of Physics & Astronomy
Science B 605
403 220-5385
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COURSE OUTLINE

1. **Course:** PHYS 321, Harmonic Motion, Waves, and Rotation - Winter 2024

   Lecture 01 : MWF 09:00 - 09:50 in EEEL 445

Instructor	Email	Phone	Office	Hours
Dr Nasser Moazzen-Ahmadi	nmoazzen@ucalgary.ca	403 830-4053	SB 525	

   To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

   In Person Delivery Details:

   Students are expected to attend lectures and tutorials in-person.

   Course Site:

   D2L: PHYS 321 L01-(Winter 2024)-Harmonic Motion, Waves, and Rotation

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

   Equity Diversity & Inclusion:

   The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

   The Physics and Astronomy EDI Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that enact necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Associate Head EDI, Claudia Gomes da Rocha (claudia.gomesdarocha@ucalgary.ca)

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:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
Mini quizzes (6)[1]	12%	Ongoing		
Assignments[2]	24%	Ongoing		
Midterm I	14%	Feb 15 2024 at 06:30 pm (2 Hours)	in-person	TBD
Midterm II	14%	Mar 21 2024 at 06:30 pm (2 Hours)	in-person	TBD
Registrar Scheduled Final Exam	36%	Will be available when the final exam schedule is released by the Registrar	in person	Will be available when the final exam schedule is released by the Registrar

   [1] Mini quizzes will be done using D2L. Each quiz will consist of 10 multiple choice questions. Students will be given 20 min to complete each quiz.Tentative dates: Jan 19, Feb 2, Feb 16, March 8, March 22, April 5

   [2] There will be six assignments in total. Problem sets will usually be assigned on a Friday every two weeks and be due at a date/time specified on the assignment.Tentative due dates: Jan 26, Feb 9, March 1, March 15, March 29, April 9

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 Registrar Scheduled Final exam that will be delivered in-person and on campus. 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 University of Calgary offers a flexible grade option, Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade

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

In the event that a student legitimately fails to submit any online or in-person assessment on time (e.g. due to illness, domestic affliction, 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, or possible exemption and reweighing of components. Absences not reported within 48 hours will not be accommodated. Students may be asked to provide supporting documentation (Section M.1) for an excused absence, See FAQ.

If an excused absence is approved, options for how the missed assessment is dealt with is at the discretion of the coordinator or course instructor. Some options such as an exemption and pro-rating among the components of the course may not be a viable option based on the design of this 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	On Campus, Exam Room TBA	Thursday, February 15, 2024 at 6:30 pm	2 Hours
Midterm 2	On Campus, Exam Room TBA	Thursday, March 21, 2024 at 6:30 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 in-person exams, 6:30-8:30 p.m. February 15, and 6:30-8:30 p.m. March 21, 2024

6. **Course Materials:**

Required Textbook(s):

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

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 9, 2024.

Midterm 2 covers material from February 12 up to and including material covered on March 8th, 2024.

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 a s 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 their website 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 here.

   d. **Student Ombuds Office:** A safe place for all students of the University of Calgary to discuss student related issues, interpersonal conflict, academic and non-academic concerns, and many other problems.

   e. **Student Union Information:** SU contact, Email your SU Science Reps: science1@su.ucalgary.ca,

science2@su.ucalgary.ca, science3@su.ucalgary.ca,

f. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the Request for Academic Accommodation Form and sending it to Dr. David Feder by email phas.ahugrd@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

g. **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
Faculty of Science Academic Misconduct Process
Research Integrity Policy

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

h. **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.

i. **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.

j. **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.

(a) Assignments

There will be six assignments in total. Problem sets will usually be assigned on Friday and be due 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 8 - Jan 12, 2024

Course introduction

12.1. Rotational Motion

12.2. Rotation About the Center of Mass

Jan 15 - Jan 19, 2024

12.3. Rotational Energy

12.4. Calculating Moment of Inertia

12.5. Torque

Jan 22 - Jan 26, 2024

12.5. Torque

12.6. Rotational Dynamics

12.7. Rotation About a Fixed Axis

12.8. Static Equilibrium

Jan 29 - Feb 2, 2024

12.8. Static Equilibrium

12.9. Rolling Motion

12.10. The Vector Description of Rotational Motion

Feb 5 - 9, 2024

Review and examples

12.11. Angular Momentum

Feb 12 - 16, 2024

15.1. Simple Harmonic Motion

15.2. SHM and Circular Motion

15.3. Energy in SHM

Feb 26 - Mar 1, 2024

15.4. The Dynamics of SHM

15.5. Vertical Oscillations

Mar 4 - 8, 2024

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 11 - 15, 2024

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 18 - 22, 2024

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 25 - 29, 2024

17.8. Beats

14.1. Fluids

14.2. Pressure

14.3. Measuring and Using Pressure

Apr 1 - Apr 12, 2024

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 08 2024 11:20

Department Approval

Electronically Approved - Jan 09 2024 14:12

Associate Dean's Approval