



COURSE OUTLINE

1. **Course:** PHYS 341, Classical Mechanics I - Fall 2021

Lecture 01: MWF 09:00 - 09:50 in ENA 103

Instructor	Email	Phone	Office	Hours
Dr. Jeroen Stil	jstil@ucalgary.ca	403 220-8015	SB 519	Wednesday, 3pm - 4pm (in person) and Zoom hours to be announced.

In order to be successful in this course, it is important to read the text book alongside the lectures. Lecture notes are intended to support studying from the text book.

In Person Delivery Details:

To the extent permitted by COVID restrictions, lectures and exams for PHYS 341 will be in-person. Attendance at regular lectures is not required, with the exception of midterm exams written in-person. There is also an in-person practice midterm for a small participation bonus credit.

If conditions arise that force a temporary or permanent return to on-line teaching, details of this change to on-line learning will be communicated by email to class at the earliest possible moment. If a return to on-line is required within 3 days of a midterm exam, the instructor may delay writing of the midterm by up to a week to ensure an orderly examination process for all.

The use of electronic devices during lectures is not allowed, unless expressly permitted by the instructor, for example for the use of TopHat. Anyone engaging in distracting others may be asked to leave the room.

Re-Entry Protocol for Labs and Classrooms:

To limit the spread of COVID-19 on campus, the University of Calgary has implemented safety measures to ensure the campus is a safe and welcoming space for students, faculty and staff. The most current safety information for campus can be found [here](#). **Online Delivery Details:**

This course does not follow a scheduled meeting pattern.

This course does follow a regular lecture schedule as listed in Section 1 of this course outline.

Although this course is offered as an in-person course, the instructor will do what is possible to allow students to follow lectures through Zoom, live or by watching the recorded lecture at a later time. Connection details for Zoom are available on the PHYS 341 D2L site. This is offered on an experimental basis to the extent possible with available equipment.

There are four PHYS 341 labs that will be done collaboratively in groups of 4 students, with contributions from all team members. Students will have the opportunity to collaborate with their lab group on-line and in-person. When collaborating, it is important to follow instructions for individual contributions to a lab. It is permitted to pool resources to do the lab, **every member of a lab group must build their own experiment and contribute their own measurements**. Analysis of systematic differences between independent measurements is an essential part of the labs. A tentative schedule for the at-home labs is given in Section 13 of this course outline.

Course Site:

D2L: PHYS 341 L01-(Fall 2021)-Classical Mechanics I

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 (%)
Practice midterm (October 1, 2021, class time)	2% participation bonus
Midterm exam 1 (October 15, 2021 class time)	10%
Midterm exam 2 (November 19, 2021, class time)	10%
Labs (4 at home; dates in Section 13 of this course outline)	20%
Assignments	30%
Final Exam (Registrar Scheduled)	30%

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	93 %	85 %	80 %	75%	70%	65 %	60 %	55%	50%	45 %	40 %

Grading of individual course components depends in part on completeness, clarity and conciseness of the solution provided. Illegible responses or responses that are not offered in a logical, structured way will receive a lower or even a zero grade.

Attendance is taken at the practice midterm for the purpose of familiarizing students with in-person exam procedures and for administration of the bonus credit. Students who participate in the practice midterm exam, earn a 2% bonus credit that will be added to their percentage grade for the course when their final course grade is calculated at the end of the term. This bonus credit will not be visible in D2L.

The percentage grades required to earn a particular letter grade for the course are restrict minimum thresholds applied to the weighted mean percentage course grade plus any applicable bonus credit. There is no rounding. For example, a percentage grade of 79.99% for the course translates into a letter grade B+.

Any missed component of course work receives a zero grade. Students who missed a due date for a lab or an assignment should contact their assigned lab TA to make arrangements.

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 3 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:

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, one possible arrangement is that the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course. This option is at the discretion of the coordinator and may not be a viable option based on the design of this course.

PHYS 341 will follow any special regulations for missed term work defined by University or the Faculty of Science for the Fall 2021 term. Please refer to relevant announcements and web pages.

Missed components of term work receive a zero grade. If you have a valid reason for missing course work, contact the course instructor or your TA to make arrangements. Accommodation will only be considered if the request is made at the earliest possible opportunity. Late requests for arrangements about missed course work will not be honoured.

Credit for the labs will not be transferred to other course components.

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

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Required Textbook(s):

John R. Taylor, *Classical Mechanics*: University Science Books.

Recommended Textbook(s):

John R. Taylor, *Classical Mechanics Student Solutions Manual*: University Science Books.

A digital version of the textbook is also available.

Notes made by the instructor during lectures will be posted on D2L. These notes are intended as a supplement to the text book. If technology permits, lectures will be recorded and links will be posted on D2L.

Answers to odd-numbered problems are printed at the end of the text book. Complete solutions to these problems are available in the Student Solutions Manual, which is sold separately. Some students may find this book helpful. The solutions manual is not required.

For the labs, it is expected that students have access to a smart phone, tablet, or other device that allows them to record their experiment in a movie file for analysis with the on-line analysis tool provided by the department. Students who experience technical difficulties must contact their lab TA or the instructor immediately.

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:

If permitted by COVID-19 restrictions, midterm exams and the final exam will be written in person. The midterm exams will be written during regular class time as listed in Section 1 of this course outline. The final exam will be scheduled by the registrar.

The exams are graded for completeness and correctness of the methodology of answers to problems. Illegible answers will receive zero marks.

The exams can include subjects covered in set sections from the text book, course notes posted on D2L, and related assignments.

PHYS 341 teaches methods to solve a broad class of physics problems. Exams can contain applications that were not explicitly covered in lectures, assignments or the text book for the purpose of testing your ability to apply the problem solving methodology taught in this course.

Communication with anyone about an exam as the exam is in progress constitutes academic misconduct. Suspected cases of academic misconduct will be reported.

Students who experience a problem during an exam, or anticipate a situation that inhibits them from writing an exam at the set time must contact the instructor as soon as possible to make arrangements.

All exams are cumulative.

Students should also read the Calendar, [Section G](#), on Examinations.

8. Approved Mandatory And Optional Course Supplemental Fees:

There are no mandatory or optional 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.

In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports.

Grading of labs and exams depends in part on clarity and conciseness of the answers provided. This includes the structure and logic progression of solutions. No points are awarded for unclear or illegible answers. No points will be subtracted for minor grammatical, style, or spelling errors.

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](tel: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 (syva@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208). The complete University of Calgary policy on sexual violence can be viewed at (<https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-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:**

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.

- 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](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel: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.

1. If you need assistance.

Part of the challenge of PHYS 341 is the amount of material that must be covered in a single term. Time to practice problems during lectures is extremely limited. If you need clarification on something, contact the instructor or your TA immediately. Do not wait until the last moment before an exam or an assignment due date.

Detailed course information will be posted on D2L. Check D2L for important dates like due dates for assignments, midterm information, etc.

Email to the instructor is strictly for issues related to the organization of the course, or to book an appointment. Questions about course material cannot be effectively answered by email. Do not send scanned notes by email.

Questions about course material can be asked immediately after class, during office hours, or by appointment.

Office hours are assumed to be in-person. Watch for announcements for on-line office hours through Zoom. TAs will be available to provide guidance about the at-home lab experiments and the assignments.

Students are advised to allow for some delay in response to email. Unpredictable delays in response time may be caused by meetings and other obligations of the instructor or the TAs. Especially outside office hours students should not expect an immediate response.

2. Labs.

There will be four **at-home labs** associated with PHYS 341. Students are required to complete all four labs. If you have a documented valid reason (as outlined in the University Calendar) for a missed lab, contact your lab TA as soon as possible to arrange a make-up lab.

Lab groups will consist of four students, to ensure marking work for the labs is kept within reasonable bounds and equally divided between the TAs. Students who wish to form their own lab group of 4 can do so until the end of day on Wednesday, September 15. **To establish your own lab group, send an email to the instructor, c.c. to all group members, before the end of day on September 15.** Incomplete groups can be supplemented with other students at the discretion of the instructor. **Those who cannot or choose not to form a lab group will be assigned to a lab group automatically by the instructor after September 15 and before September 20, 2021.**

Lab experiments (data collection) are done by individual students at home during the week assigned for the lab experiment. There will be one lab report per lab group of 4 students. The labs are structured in **lab weeks**, in which the actual experiment is done. It is important that all group members complete their experiment at the end of the designated lab week. Lab reports from the group are due one week after the end of the lab week. Each student will contribute their own data to be included in the lab report. Analysis and interpretation of the measurements will be done as a group in the week following the experiment. Lab reports must discuss the differences and similarities of the contributions in relation to the error estimates.

Labs are performed following instructions in a lab manual that will be posted on D2L in the labs folder. The lab report must show work on every task specified for the lab. Contributed data will be marked on an individual basis. The lab reports may strictly follow the points outlined in the lab report for full marks, but additional information on your experience on what worked and what did not, or other details pertinent to the experiment may help to raise your lab grade. Lab reports must include original images of each individual experiment. Selfies with your experiment are allowed but not required.

Lab reports must be delivered electronically as a PDF file, **one per lab group**, in a designated D2L dropbox. The first page of the lab report must state the names and student IDs of the students who contributed to the report, and the name of the lab TA. The lab marks can be differentiated between group members depending on the quality of individual contributions to defined sections of the lab (mainly the individual contributed data).

The lab schedule below gives the weeks in which students are expected to work on their lab experiment. The lab work is asynchronous as students can do their experiment at home, and collaborate on line or schedule their own meeting times. Due dates for lab reports are usually at the end of the following week.

If you have difficulties performing your lab experiment or if you experience a delay, talk to your lab TA to find a solution.

The lab experiments for PHYS 341 are:

- Hanging Chain. ID#0080, Lab week Sep 27 - Oct 3, Lab report due at 23:59 on October 10
- Tumbling Object, Lab week Oct 18 - Oct 24, Lab report due at 23:59 on October 31
- Drag force with conic pendulum, Lab week Nov 1 - Nov 7, Lab report due at 23:59 on November 21 (extra week)
- Damped Harmonic Oscillator, Lab week Nov 22 - Nov 28, Lab report due at 23:59 on December 5

3. TopHat.

We will use TopHat in this course for learning activities and for some assignments. TopHat is available free of charge for registered students. The instructor will assume that you are familiar with TopHat. If you have any questions or problems, please ask the instructor.

The course ID for TopHat is PHYS341F2021. The join code is 675984.

You must have registered for the course in TopHat by Wednesday, September 15, 2021. Students are required to enter their name and student ID in the appropriate field when registering with TopHat. Failure to do so will result in delayed posting of grades and possibly a zero grade if their information cannot be linked to D2L.

Some assignments for PHYS 341 will be administered through TopHat. For these assignments, only solutions entered in TopHat will be accepted. A PDF file with the assignment questions will be posted on D2L for your convenience. When you log in to TopHat, you will find each question of the assignment. For numeric answers, enter a number in the units specified in the question, but do not enter the units. Each question will give instructions on the units in which the answer must be specified. You may change your answer as often as you like before the due date. Only the final answer will be graded. Assignments will be announced by email to the class, approximately a week before the due date. **It is highly recommended to speak to the instructor or your lab TA if anything is unclear about an assignment question.** This is a good reason to start working on an assignment well before the due date.

4. Syllabus

Topics to be covered in this course include those listed below. The dates are approximate dates for the start of a chapter. Specific information about set topic (sections) for exams will be communicated by email to the class.

Chapter 1. Newton's Laws of Motion (September 8)

We will treat Chapter 1 mainly as a review of selected essential topics, with self-study expected to make up deficiencies:

Review of essential vector algebra

Derivatives of vectors and vector products

Newton's laws in three dimensions

Inertial frames

Multi-particle systems, interactions

Newton's laws in polar coordinates

Chapter 2. Projectiles and Charged Particles (September 22)

2.1. Air resistance

2.2/2.3 Linear resistance

2.4 Quadratic resistance

2.5/2.7 Motion of a charge in a uniform magnetic field

2.6 Complex exponentials and hyperbolic functions

Chapter 3. Momentum and Angular Momentum (October 4)

- 3.1 Conservation of momentum/collision of two particles
- 3.2 Rocket motion
- 3.3 Centre of mass
- 3.4 Angular momentum of a single particle
- 3.5 Angular momentum of a system of particles

Chapter 4. Energy (October 25)

- 4.1 Kinetic energy and Work in Three Dimensions
- 4.2 Potential Energy and Conservative Forces
- 4.3 Force as a gradient of Potential Energy. The Del/Nabla/gradient Operator
- 4.4 Another Condition to Test for Conservative Force
- 4.6 Energy for linear One-dimensional Systems. Separable Forces
- 4.8 Central Forces
- 4.9 Energy of Interaction of Two Particles
- 4.10 Energy of a multi-particle system. Rigid bodies

Chapter 5. Oscillations (November 25)

- 5.1 Hooke's Law
- 5.2 Simple Harmonic Motion. Exponential Solutions. Energy
- 5.4 Damped Oscillations. Decay Time. Phase Space
- 5.5 Driven Damped Oscillations
- 5.6 Resonance

Chapter 9. Non-inertial Frames (time permitting)

- 9.1 Acceleration without Rotation
- 9.3 Angular Velocity Vector
- 9.4 Time Derivatives in a Rotating Frame
- 9.5 Newton's Second Law in a Rotating Frame
- 9.6 Centrifugal Force
- 9.7 Coriolis Force

5. Course Learning Incomes

Students taking PHYS 341 are expected to have prior knowledge in algebra, trigonometry, integration and differentiation, vector algebra and how it is used in physical systems, Newton's laws, solutions of accelerated motion of a particle in 1 and 2 dimensions.

Experience shows that many students starting PHYS 341 should review vector algebra. In particular the relation of the vector dot product to the projection of a vector on another vector, and the vector cross product in terms of a vector that is perpendicular to each of the originating vectors. We will use these principles frequently in PHYS 341 in a various applications.

Course Outcomes:

- understand relations among coordinate systems
- present Newton's 2nd law as a first order ODE and solve
- understand the use and meaning of potential energy
- use the concept of velocity dependent dissipative forces
- recognize equations that govern oscillatory behaviour
- able to compute equilibrium states and their stability
- recognize central force laws and use effective potentials
- understand the behaviour and use of non-inertial systems
- develop familiarity with lab techniques

Electronically Approved - Sep 06 2021 19:13

Department Approval

Electronically Approved - Sep 07 2021 09:37

Associate Dean's Approval