



COURSE OUTLINE

1. **Course:** PHYS 341, Classical Mechanics I - Fall 2023

Lecture 01 : MWF 09:00 - 09:50 in ST 141

Instructor	Email	Phone	Office	Hours
Dr. Jeroen Stil	jstil@ucalgary.ca	403 220-8015	SB 519	TBA

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

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:

To the extent permitted by COVID restrictions, lectures, exams and labs for PHYS 341 will be in-person. Attendance at regular lectures is not required. Attendance at in-person exams is required. Attendance at the five in-person labs is required.

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.

Course Site:

D2L: PHYS 341 L01-(Fall 2022)-Classical Mechanics I

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.gomesdarocho@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.

Antirequisite(s):

Credit for Physics 341 and Engineering 349 will not be allowed.

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
Labs (5) ¹	20%	Ongoing		
Assignments (4) ²	20%	Ongoing		
Tutorial ³	5%	Ongoing		
Midterm 1	10%	Oct 06 2023 at 09:00 am (50 Minutes)	in-person	ST141
Midterm 2	15%	Nov 06 2023 at 09:00 am (90 Minutes)	in-person	ST141
Registrar Scheduled Final Exam ⁴	30%	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 Lab schedule will be determined by the department of Physics and Astronomy

² Target due dates for assignments are: Assignment 1: Wednesday 20 September at 23:59, Assignment 2: Sunday 15 October at 23:59, Assignment 3: Sunday 29 October at 23:59, Assignment 4: Sunday 19 November at 23:59.

³ The tutorials on Wednesday mornings 9am - 10:50am will present questions and collect responses in TopHat. The tutorial grade is determined by participation as recorded in TopHat. See Section 13 for details.

⁴ A percentage grade consistent with the letter grade D or better for the final exam is required in order to pass the course. A lower score for the final exam results in a letter grade for the course that does not exceed D+.

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.

The percentage grades required to earn a particular letter grade for the course are strict 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 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 3 hours.

Students with a failing grade on the final exam, meaning a percentage grade that is lower than the threshold for a letter grade D, will receive at most a D+ for the course, irrespective of the weighted percentage grade.

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.

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 honored.

Requests for a brief extension for a lab report must be submitted to the lab TA. In exceptional circumstances, the instructor may decide.

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. Note that exams are closed-book, so there is no difference between use of a printed book or an electronic book.

Notes made by the instructor during lectures or tutorials will be posted on D2L after the lecture. These notes are intended as a supplement to the text book.

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.

Lab manuals will be posted on D2L in the folder "Labs".

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.

All PHYS 341 exams are closed book. A formula sheet will be provided with the exam. This formula sheet will be shared with the class by email a few days before the exam.

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. Students need not review the lab manuals for the exams, but they can be helpful.

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.

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 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.

In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. However, lab reports are not required to be complete essays (see also Section 13 of this course outline). Check with your lab TA if you have any questions.

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 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 (FOIPPA). 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.

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. New to PHYS 341 Fall 2023 with special attention to problem solving and time to ask questions. 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. The instructor will send an email to class when an assignment is posted.

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, at the tutorials, or by appointment.

Office hours are assumed to be in-person. TAs will be available to provide guidance about the labs 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.

This course includes 5 in-person labs. A detailed lab schedule will be made available by the Department of Physics and Astronomy. It is not permitted to change lab sections without prior approval of the instructor, because lab spaces are filled to capacity.

Lab manuals will be posted on D2L in the folder "Labs". At the time of writing of this course outline, the lab schedule had not yet been published.

The labs for PHYS 341 are:

- Inclined Atwood Machine. ID#0081, September 18-22, 2023 in ST 037. Lab report due October 1 at 23:59
- Drag forces. ID#0083, October 2-6 in **ST 034**. Lab report due October 15 at 23:59
- Hanging Chain. ID#0080, October 16-20, 2023 in ST 037. Lab report due October 29 at 23:59
- Driven Damped Mechanical Oscillations. ID#0086, October 30 - November 3, 2023 in ST 037. Lab report due November 19 at 23:59
- Double Pendulum ID#0085, November 20-24, 2023 in ST 037. Lab report due December 3 at 23:59

Note: Labs are normally in ST 037. Only the drag forces lab is scheduled in **ST 034** because this experiment requires resources that are available in that room.

Labs 4 and 5 are subject to re-development in Fall 2023. Students are encouraged to bring any questions or concerns about these labs or the lab manuals to the attention of the TA or the course instructor as soon as they arise.

All lab students must sign their name on an attendance sheet supervised by the lab TA. Before leaving the lab space, every lab group emails an Excel spread sheet of their measurements to the lab TA. Any early departures must be reported to the lab TA and noted on the attendance sheet. Signing for someone else constitutes academic misconduct by the person signing and the person that is signed for.

Lab reports must answer all tasks assigned in the lab manual in order, clearly indicating which task is being answered. It will be sufficient to address the assigned tasks in the report on a point by point basis. Labs are graded for the quality of the work presented and the clarity and insights offered in the report, including the effectiveness of figures and tables.

Lab reports are submitted through a D2L dropbox by one representative of the lab group. Lab reports are due usually on Sunday the week after lab week, unless there is a holiday. Only one report per lab group of 4 students shall be submitted. The cover page of a lab report must state the lab section and all names of the lab group members with a summary of the contributions made by each member of the group. Removing one or more members of the lab group from the report for any reason without prior written permission from the instructor is cause for rejection of the lab report and a zero grade.

If members of a lab group have a concern about lack of participation of a team member during the in-person lab experiment, they must notify the lab TA immediately. If there is a concern about participation in writing the lab report, a reminder must be sent to this person **by email** well before the due date of the lab, **c.c. to the lab TA and the instructor**, stating the concern and a proposed solution to address the concern. All communication must be conducted in a constructive and respectful manner.

If in-person labs are prohibited due to emerging public health constraints, the instructor will assess the situation and decide on at-home labs as a possible substitution for the remaining labs. This decision will be communicated by email to class.

3. Tutorials.

Tutorials will usually be held on Wednesday mornings 9am - 10:50am with a break, with **participation credit starting September 13**. The instructor may occasionally decide to shift lecture time to Wednesday morning if this is required for the progression of the course. 5% of the course grade is assigned to **participation** in the tutorials. Participation is recorded in TopHat during the tutorial session. In order to stimulate participation, there is no marking for correctness of answers submitted during the tutorials. Students who wish to receive the full participation credit need to attend most (but not necessarily all) tutorials.

The calculation of the tutorial participation grade is designed to minimize the impact of an occasional issue that negatively affects someone's participation with equal weight for every tutorial session independent of the number of TopHat questions presented. For any tutorial session, let the number of questions not affected by technical problems during that session be N . Then all such questions receive a **participation mark** $10.0/N$ in TopHat. This means full participation in any tutorial earns 10 participation points. At the end of the term, the participation fraction is calculated as the number of participation points earned, divided by the number of tutorial sessions times 10. A participation fraction more than or equal to 0.75 earns 5%. Participation fraction more than or equal 0.6 earns 4%. Participation fraction more than or equal 0.5 earns 3%. Participation fraction more than or equal 0.4 earns 2%. Participation fraction more than or equal 0.3 earns 1%. Participation fraction less than 0.3 earns 0%. These thresholds are strictly enforced. **TopHat questions in the assignments are not included in the participation credit.**

Bring some paper and a calculator for the tutorials, because you will be working on problems during the tutorial.

Please review previously covered topics prior to the tutorials. There is no formal preparation required, but the instructor may post a problem on D2L before the tutorial. At the tutorials you will be presented with exercises and problems that may vary from short conceptual questions to more involved problems. Students are encouraged to work on the set problem with their peers, if necessary with assistance from the instructor or the TA. When prompted by the instructor or the TA, everybody enters their answers in TopHat.

It is important to keep a good pace during the tutorials. **If you do not have enough time to solve a numeric problem, please enter the number 999. This gives us instant feedback about the pace of the tutorial. Remember that the tutorial grade is calculated from participation only, so a 999 entry does not affect your grade.** To maintain an appropriate pace for all, the problems presented at the tutorials may be designed to focus on just a particular part of a longer problem.

Problems that suffer from significant technical issues will be removed from consideration for the participation grade. If you experience technical problems of your own, please contact TopHat support. **The participation grade will be calculated exclusively from information recorded by TopHat.**

The plan is to reserve the last 30 minutes (approximately) of a tutorial for questions and further explanation of questions that most people answered correctly. At the appropriate time, an announcement will be made that no more TopHat problems will be presented and a short break will be inserted to allow people to leave if they wish. The tutorial will then resume with those who desire further explanation.

4. TopHat.

We will use TopHat in this course 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 PHYS341F2023. The join code is 378039.

You must have registered for the course in TopHat by Monday, September 11, 2023. 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, allowing faster feedback for these assignments. 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 7)

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 19)

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 3)

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 21)

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 18)

- 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 - Aug 28 2023 16:58

Department Approval