IPS*1500 Fall 2023

Course Information

Course Description

Credit Weight: 1.0 This weighting should be reflected in your efforts and apportioned study time.

This is a foundational course for students in B.Sc. mathematical and physical sciences majors. The disciplines of Mathematics and Physics are taught in an integrated fashion that demonstrates how they support and enrich one another. Measurement and uncertainty, algebra and trigonometry, forces and Newton's laws, functions and graphing, differentiation, angular momentum and energy conservation, limits, integration, kinematics, simple harmonic motion, and special relativity are presented in a harmonized fashion to ensure students have an improved understanding of these fundamentals.

Prerequisites: 4U Calculus and Vectors or equivalent, 4U Physics or PHYS*1020 or equivalent.

Restrictions: MATH*1080, MATH*1200, PHYS*1000. Restricted to B.Sc. students in APMS:C, BPCH, BPCH:C, BMPH, BMPH:C, CHPY, CHPY:C, CHEM, CHEM:C, MATH, NANO, NANO:C, PSCI, PHYS, PHYS:C, STAT, THPY

Course Objectives

The course is intended to give a student a grounding in topics in physics and calculus in a manner that uses the physics as an example to ground the calculus and provides the calculus needed for the topics in physics. This integration of the two courses is intended to make both sets of material easier to absorb. Specific topics are listed subsequently under the heading Course Topics.

Meeting Times

**Physics quizzes are given during tutorials. The Math Lab grade is based on attendance.*

Office Hours

Information about instructor office hours will be provided during the first week of the semester.

Course Materials

Required

- University Physics, 14th or 15th Edition, Volumes 1, 2, and 3, by H. Young and R. Freedman (this will also be used in IPS*1510 in Winter 2022). This book is available in the University Bookstore.
- Courselink

Recommended

- Fast Start Calculus for Integrated Physics, Fourth Edition, by D. Ashlock (this will also be used as a reference in IPS*1510 in Winter 2022). Copies of this book are NOT available in the University Bookstore and the Co-op Bookstore but can be found on amazon.ca.
- Library Reference Material: There are many additional reference texts available on the library shelves. Look for call numbers beginning with QC21 or QC23 (Physics), QA155, QA303 (Math).

Evaluation

Assessment	**Weight**
Math Labs (10)	10 %
Math Homework (5)	10 %
Physics pre-lectures/engagement	5 %
Physics Quizzes (8-10)	10 %
Physics Experiments & Case Study	15 %
Tests (3)	25 %
Final Exam (Dec. 5)	25 %
Total	100%

Course Elements

Math Labs

Mathematics tutorials (50 minutes) will consist of an component in which you will work together with the TA to solve various math problems. More details are provided on the Courselink page.

Math Homework

Due on select Fridays and announced at least a week in advance of the due date. No late homework is accepted without appropriate justification. Work is to be submitted by 11:59pm on the due date. Work can either be written or created digitally (writing on a tablet, using LATEX, etc.) and must be submitted digitally via Gradescope. Instructions and more details about Gradescope will be announced in class and on Courselink.

Physics Practice – Pre-lecture Material, Engagement and Weekly Guides

Weekly guides will be provided, with recommended textbook readings and practice problems. Short pre-lecture readings will be assigned prior to most physics lectures: These will provide an introduction to upcoming lecture content, self-checks for understanding, and solicit feedback that will be used to

tailor the lectures to meet student needs. Occasional in-class activities/self-checks will also occur during lectures. These course activities are intended to provide on-going diagnostic of student learning; this evaluation will focus on student participation.

Physics Lab/Tutorials

The weekly physics lab/tutorial periods (170 minutes) will include both an experimental component and a guided practice of the lecture content, followed by a short quiz. Weekly readings will provide readings and practice problems to prepare students for the tutorial content and quiz.

The lab portion of the tutorial will introduce students to a variety of measurement tools and software (including iOLabs, Phyphox-app, and Python). Experiments will focus on developing methods to explore physical phenomena, assessing experimental results, and refining/improving your methods. Lab outlines and preparatory materials will be posted on Courselink in advance of your scheduled period.

Case Study

There will be a case study exercise which will be completed individually. These integrated activities involve mathematically modelling a simple and gradually more complex depictions of physical situations.

Tests

Tests will include questions from both math and physics content as well as integrated problems that combine learning from the two fields. Tests may include both multiple-choice questions and written problems. Details on the number, format, and scope of content for each test will be provided by your professors well in advance of the scheduled dates. All tests will take place in [redacted], unless otherwise updated during the semester.

Test 1 (5%)

Test 2 (10%)

Test 3 (10%)

Final Examination

The final examination will be held on [redacted]. Details will be discussed during the semester. The exam will cover the entire course.

Lecture schedule of Course Topics by Week

Note: Detailed readings from Young and Freedman will be provided in the Weekly Guides

Week	Physics Topic	Young and Freedman	Math Topics	Quick-Start
1	Unit conversion, dimensional analysis, order of magnitude estimation	Chapter 1	Math you should know	Chapter 1
2	Kinematics, vectors, relative motion	Chapters 2, 3	Derivatives and derivative rules	Chapter 2
3	Forces & Newton's laws	4, 5	Curve sketching and Optimization	Chapters 2-3
4	Forces, Work & Energy	5, 6	Optimization and Integration	Chapters 3-4
5	Energy	6, 7	Optimization and Integration, midterm review	Chapters 4-5
6	Momentum	8	Vectors, parametric and polar curves	Chapter 5
7	Rotational motion	9	Polynomials, L'Hôpital's rule	Chapters 5-6
8	Rotational dynamics	10	Methods of Integration, Definite integrals	Chapter 7
9	Periodic motion	14	Derivatives and continuity; mean value theorem	Chapter 8
10	waves	15	Review to this point, differential equations	Chapter 9
11	Fluids	12	Differential equations	Chapter 9
12	Fluids, exam review	12	Review and reflection	all chapters

Note: The information in the "Lecture Topic" column is provided as a rough guide for the term. Future announcements about changes to the table or of any kind will be made in class and posted on CourseLink; these announcements take precedence over the original course outline!

Course Statements

Collaboration versus Copying

Scientists work alone or in groups, very often consulting fellow scientists and discussing their research problems with peers. Collaboration is a feature of scientific activity and there are many benefits to working with others. However, no ethical scientist would ever publish or claim the work of others as his or her own and generally scientists give reference to the appropriate source of ideas or techniques which are not their own.

You are a young scientist, and, in this spirit, I encourage you to discuss with others as you learn the material and work on the problem assignments. However, the work that you submit as your assignment must be your own and not a copy of someone else's work. Identical scripts will be given a mark of zero and plagiarism will be dealt with severely. I encourage you to cite your references, citing books and other articles when they are used and acknowledging discussions with those who have helped you in your understanding and completion of the problem. This is good scientific practice.

Course Evaluation Information

The Department of Physics requires student assessment of all courses taught by the Department. These assessments provide essential feedback to faculty on their teaching by identifying both strengths and possible areas of improvement. In addition, annual student assessment of teaching provides part of the information used by the Department Tenure and Promotion Committee in evaluating the faculty member's contribution around teaching. The Department's teaching evaluation questionnaire invites student response both through numerically quantifiable data, and written student comments. In conformity with University of Guelph Faculty Policy, the Department Tenure and Promotions Committee only considers comments signed by students. Your instructor will see all signed and unsigned comments after final grades are submitted. Written student comments may also be used in support of a nomination for internal and external teaching awards.

NOTE: No information will be passed on to the instructor until after the final grades have been submitted.

University Statements

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration.

Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: www.uoguelph.ca/sas

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is outlined in the Undergraduate Calendar.

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email.

This includes on-campus scheduling during the semester, mid-terms, and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).