IPS*1500 Fall 2022

Course Information

Instruction

Instructors

Name	Office	Email
Daniel Kraus (math)	MacNaughton 511	dkraus@uoguelph.ca
Eamonn Corrigan (physics)	MacNaughton	eamonn@uoguelph.ca

Teaching Assistants

Name	Email
Firaz Khan (math)	firaz@uoguelph.ca
Rocky Narang (math)	rnarang@uoguelph.ca
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Yasmeen El-Rayyes (physics)	yelrayye@uoguelph.ca
Josh Cadogan (physics)	jcadogan@uoguelph.ca

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: 1 of 4U Physics, PHYS*1020, PHYS*1300 or equivalent.

Restrictions: MATH*1080, MATH*1200, PHYS*1000, PHYS*1080. 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

Lectures

Class	Day	Time	Location
Math	Mo/Wed/Fr	10:30-11:20am	MCKN 117
Physics	Mo/Wed/Fr	1:30-2:20pm	MACN 113

Labs/Tutorials Times*

Physics Labs/Tutorials

Section	Time	Location
0101	Tues. 8:30-11:20am	MACN 414/415
0102	Thur. 8:30-11:20am	MACN 414/415
0103	Wed. 2:30-5:20pm	MACN 414/415
0104	Tues. 7:00-9:50pm	MACN 414/415
0105	Thur. 11:30am-2:20pm	MACN 414/415

Math Tutorials

Section	Time	Location
0102, 0103, 0105	Tues. 11:30-12:20	MAC 149
0101, 0104	Fri. 12:30-1:20	MCKN 225

Math & Physics quizzes are given during tutorials

Office Hours

Physics Office Hours (MacN 434):

Mondays 4:00-5:00pm

Thursday 11:30-12:30pm

Math Office Hours (MacN 511 or Zoom):

Monday/Wednesday 11:30–12:30

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 most readily available used from the University Bookstore.
- **Fast Start Calculus for Integrated Physics, Fourth Edition**, by D. Ashlock (this will also be used in IPS*1510 in Winter 2022). This book is available in the University Bookstore and the Co-op Bookstore.
- **Online Homework (Achieve (formerly FlipItPhysics))**. There will be assigned warm-up questions that will be graded online, i.e., on the web. *Research has shown that this software has a positive effect on students learning of physics.* To complete the online practice, you will need to purchase a stand-alone Student Access Kit for Achieve. The University Bookstore offers one semester access cards (or two semester cards for students going on to IPS*1510 in the Winter). This comes with an online textbook
- CourseLink

Recommended

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).

Course Themes

This course is divided into themes in order to emphasize some of the applications of physics and mathematics. The thematic approach is intended to give the material a grounding in the physical world outside of the classroom.

1. Becoming a Scientist (Weeks 1-2) This section will emphasize the scientific method, the importance of errors and error propagation in experiments, and introduce students to basic statistical quantities such as the mean and standard deviation. An inquiry-based laboratory exercise has been designed to allow students to explore the differences between random and systematic errors, and become familiar with calculating statistical quantities from experimental data.
2. Sport (Weeks 2-6) Physical activity is an important part of a healthy lifestyle; we will connect healthy living to physics and mathematics by showing examples of physics concepts such as kinematics, forces, circular motion, and torque in sports. A calculus-based approach will be used for solving problems.
3. Natural Phenomena (Weeks 6-10) An understanding and appreciation for the world and materials around us is the emphasis of this section. This section will discuss the

enormous energy provided by the sun, fluid dynamics and the flow of water through rivers, compare man-made and natural materials such as steel and spider-silk, and look at nanomaterials which are used to explain certain phenomena such as how geckos can climb walls.

4. Space travel (Weeks 11-12) People have always been fascinated by space: the planets, stars, galaxies, etc. In this part of the course, we explore circular motion and forces in terms of objects orbiting about one another. We also introduce the concept of special relativity (specifically time dilation, and length contraction) which was proposed by Albert Einstein in 1905.

Evaluation

Assessment	Weight
Math Quizzes (10)	10 %
Math Homework (10)	10 %
Physics Quizzes (3)	9 %
Online Prelectures & Practice (Achieve) (6-8)	7 %
Case Study	12 %
Laboratory Experiments (3)	12 %
Midterm (Oct. 14)	15 %
Final Exam (Dec. 16)	25 %
Total	100%

Math Quizzes

Mathematics tutorials will consist of a quiz 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

Assigned every other week, due on Fridays. No late homework is accepted without appropriate justification. Work is to be submitted at the end of the math lecture. Work can either be written or created digitally (writing on a tablet, using LATEX, etc.).

Physics Quizzes

During three of the physics tutorial periods (see schedule), after receiving help for 90 minutes you will write a short quiz first individually and then again in pairs. Details regarding what the quizzes will cover will be provided during the semester.

Physics Online Practice

During the course of the semester there will be 6-8 online practice (ACHIEVE) assignments for students to complete. There will also be short prelecture readings and quizzes throughout the semester.

Case Study (Due Nov 25th)

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.

Laboratory Experiments

The physics lab experiments (see schedule) are described in detail in the Lab handouts posted on CourseLink. Experiments will be conducted using "IOLab" devices. These will be provided during lab periods. Reports must be handed in using Jupyter Notebooks (Python).

Midterm Examination

The midterm exam will be held on Friday, October 14, at 5:00pm (CRSC 116/117). The midterm may consist of both multiple-choice questions and written problems. More details will be provided by your professors as the exam time approaches.

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Final Examination

The final examination will be held on Friday, Dec. 16 from 8:30am-10:30am. Details will be discussed during the semester. The exam will cover the entire course.

Tutorial Periods

The tutorial periods will be devoted to the development of problem-solving skills and involve regular hands-on practice. All tutorials will be given in MacN 415.

Course Topics, by Week

Week	Physics Topic	Young and Freedman (Chapters)	Math Topics	Quick-Start
1	The scientific method, measurement and error, error analysis	1.1-1.6 Laboratory Manual Taylor (Error Analysis)	Math you should know	Chapter 1
2	Motion, 1-D kinematics	1.3, 1.7-1.10, 2	Derivatives and derivative rules	Chapter 2

3	1-D kinematics, 2-D kinematics, causes of motion - forces	2, 3, 4	Curve sketching and Optimization	Chapters 2-3
4	Newton's laws, friction	3, 4, 5	Optimization and Integration	Chapters 3-4
5	relative motion, midterm review	3, 4, 5	Optimization and Integration, midterm review	Chapters 4-5
6	Circular motion, introduction to energy	3, 6	Vectors, parametric and polar curves	Chapter 5
7	Conservation of energy, momentum, impulse and collisions	6, 7, 8	Polynomials, L'Hôpital's rule	Chapters 5-6
8	Rotational motion, Rotational energy, moment of inertia	9	Methods of Integration, Definite integrals	Chapter 7
9	Torque, angular momentum, equilibrium and elasticity, fluid statics	10, 11, 12	Derivatives and continuity; mean value theorem	Chapter 8
10	Fluid mechanics, materials/nanomaterials	12	Review to this point, differential equations	Chapter 9
11	Kinematics revisited-simple harmonic motion, special relativity	14, 37	Differential equations	Chapter 9
12	Special relativity, exam review	37	Review and reflection	all chapters

Getting Help

1. Your best source of help is your tutorial/lab instructor during the tutorial/lab period.
2. The course professors will be available to provide help (online for math, online or in person for physics) during their posted office hours. These will be announced in class and are posted on Courselink. If you wish to obtain help from your professor at another time, please arrange a mutually convenient time via e-mail .
3. [Physics Tutorials](#)

   Of particular usefulness in this course are the tutorials on: Algebra (review), Significant Digits Unit Conversions Trigonometry (review), Free-Body Diagrams Graphing Log Paper Vectors (review), Torque and Rotational Motion, Dimensional Analysis, and Simple Harmonic Motion

Tentative Physics Tutorial/Lab Schedule

Week	Dates	Tutorial/Lab	Location
0	Sept. 8-9	No Lab/Tutorial	**N/A**
1	Sept. 12-16	Tutorial/Lab 0: Introduction to IO Labs	**MACN 414**
2	Sept. 19-23	Tutorial 1, No Quiz	MACN 415
3	Sept. 26-30	Lab 1: Motion and uncertainty, Case Study Handed Out	**MACN 414**
4	Oct. 3-7	Tutorial 2, Physics Quiz 1	MACN 415
5	Oct. 10-14	**Holiday Mon/Tue, No Tutorial/Lab,** Midterm Help Sessions, Midterm on Friday	MACN 415
6	Oct. 17-21	Post-Midterm break	**N/A**
7	Oct. 24-28	Lab 2: Error propagation in a pendulum	**MACN 414**
8	Oct. 31-Nov. 4	Case Study Studio Lab #1	MACN 415
9	Nov. 7-11	Tutorial 3, Physics Quiz 2, Case Study Early Bird Due	MACN 415
10	Nov. 14-18	Case Study Studio Lab #2, Prelab 3 due (in tutorial/lab time)	MACN 415
11	Nov. 21-25	Lab 3: Atwood Machine, Case Study Due (Fri, Nov 25th)	**MACN 414**
12	Nov. 28-Dec. 2	Tutorial 4, Physics Quiz 3	MACN 415

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 in the area of 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 or not 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).

COVID-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, that these guidelines may be updated as required in response to evolving University, Public Health or government directives.

Online Behaviour

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote. If a student prefers not to be distinguishable during a recording, they may:

- turn off their camera
- mute their microphone
- edit their name (e.g., initials only) upon entry to each session

- use the chat function to pose questions.

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Stating false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors and/or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your username and password
- Recording lectures without the permission of the instructor