University of Guelph
Department of Physics

Course Outline IPS*1500
Fall 2021

Course Information

Instruction

Instructors

Name	Office	Email
Daniel Kraus (math)	MacNaughton 511	dkraus@uoguelph.ca
Dennis Mücher (physics)	MacNaughton 224	dmuecher@uoguelph.ca

Teaching Assistants

Name	Email
Amanda Saunders (math)	asaunder@uoguelph.ca
Eamonn Corrigan (physics)	eamonn@uoguelph.ca
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Disclaimers

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 and circulated by email.

The University will not normally require verification of illness (doctor's notes) for fall 2021 or winter 2022 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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 user name and password
- Recording lectures without the permission of the instructor

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

Lectures

Class	Day	Time	Location
Math		asynchronous	(YouTube links provided on Courselink)
Physics	Mo/Wed/Fr	1:30p -2:20p	MACN 113 or Zoom (live)

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	Thurs. 11:30 - 2:20	MACN 414/415

Math Tutorials

Section	Time	Location
0102, 0103, 0105	Tues. 11:30-12:20	virtual (synchronous)
0101, 0104	Fri. 12:30-1:20	virtual (synchronous)

**Math & Physics quizzes are given during tutorials*

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.
- **Quick 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 (FlipItPhysics (formerly smartPHYSICS))**. There will be assigned warm-up questions that will be graded online, i.e., on the web, using FlipIt Physics (see handout for more details). *Research has shown that this software has a positive effect on students learning of physics.* To complete the online homework, you will need to purchase a stand-alone Student Access Kit for FlipItPhysics. The University Bookstore offers one semester access cards (or two semester cards for students going on to IPS*1510 in the Winter).
- **i-Clicker/Reef Student Response Systems** (commonly known as clickers): You can purchase a license for compatible smartphones through the University Bookstore. The use of the iClicker reef system is not mandatory this year.
- 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)	12 %
Online Homework (smartPHYSICS) (6-8)	5 %
Case Study	8 %
Laboratory Experiments (4)	15 %
Midterm	15 %
Final Exam	25 %
Total	100%

Math Quizzes

Mathematics tutorials will be run via live online meetings (links provided on Courselink) and will involve open-book group quizzes. You will all work together with the TA to solve various problems and answer questions in Courselink.

Math Homework

Assigned weekly, due on Monday (unless Monday is a holiday, in which case the homework will be due on the following Wednesday). No late homework is accepted without appropriate justification. Work is to be submitted via Courselink Dropbox. Work can either be written and scanned 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 via Courselink. Details regarding what the quizzes will cover will be provided during the semester.

Physics Online Homework

During the course of the semester there will be 6-8 online homework (FlipItPhysics) assignments for students to complete.

Case Study

There will be a case study exercise which will be completed individually. These integrated activities involve the 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 are to be completed and reports handed in during the lab period. All labs will be done in MacN 414. If you miss a quiz or a lab, you must provide your TA with a written explanation for possible academic consideration.

Midterm Examination

The midterm exam will be held outside of class time in week 6; **Friday, October 15, 2021, 6pm, MACN 105.** The midterm will consist of both multiple choice questions and problems. More details will be provided by your professors as the exam time approaches.

Final Examination

The final examination will be held on **Thursday, 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. All physics tutorials are held in MacN 415.

Course Topics, by Week

Week	Physics Topic	Young and Freedman	Math Topics	Quick-Start
Sept. 10 and 13-17	The scientific method, measurement and error, error analysis	Ch 1.1-1.6 Laboratory Manual Taylor (Error Analysis)	Math you should know	Chapter 1
Sept. 20-24	Motion, 1-D kinematics	Ch 1.3, 1.7-1.10, 2	Derivatives and derivative rules	Chapter 2
Sept. 27-Oct. 1	1-D kinematics, 2-D kinematics, causes of motion - forces	Ch 2, 3, 4	Curve sketching and Optimization	Chapters 2-3
Oct. 4-Oct.8	Newton's laws, friction	Ch 3, 4, 5	Optimization and Integration	Chapters 3-4
Oct. 13-15	relative motion, midterm review	Ch 3, 4, 5	Optimization and Integration, midterm review	Chapters 4-5

Week	Physics Topic	Young and Freedman	Math Topics	Quick-Start
Oct. 18-22	Circular motion, introduction to energy	Ch 3, 6	Vectors, parametric and polar curves	Chapter 5
Oct. 25-29	Conservation of energy, momentum, impulse and collisions	Ch 6, 7, 8	Polynomials, L'H^opital's rule	Chapters 5-6
Nov. 1-Nov. 5	Rotational motion, Rotational energy, moment of inertia	Ch 9	Methods of Integration, Definite integrals	Chapter 7
Nov. 8-12	Torque, angular momentum, equilibrium and elasticity, fluid statics	Ch 10, 11, 12	Derivatives and continuity; mean value theorem	Chapter 8
Nov. 15-19	Fluid mechanics, materials/nanomaterials	Ch 12	Review to this point, differential equations	Chapter 9
Nov. 22-26	Kinematics revisited-simple harmonic motion, special relativity	Ch 14, 37	Differential equations	Chapter 9
Nov. 29-Dec. 3	Special relativity, exam review	Ch 37, all chapters	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 offce 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 (Tu/Wed/Th)	Tutorial/Lab	Location
1	Sept. 13-17	Tutorial 1:Introduction to IO Labs	MACN414-415
2	Sept. 20-24	Lab 1: Motion and uncertainty	MACN414-415
3	Sept. 27-Oct. 1	Tutorial 2, Physics Quiz 1	MACN414-415

Week	Dates (Tu/Wed/Th)	Tutorial/Lab	Location
4	Oct. 4-8	Lab 2: Error propagation in a pendulum, Case Study handed out	MACN414-415
5	Oct. 11-Oct. 15	***Holiday Mon/Tue No Tutorial/Lab, Midterm Help Sessions***	MACN414-415
6	Oct. 18-Oct. 22	Midterm week, no Tutorial/Lab	MACN414-415
7	Oct. 25-29	Lab 3:Forces and Atwood's machine	MACN414-415
8	Nov. 1-5	Tutorial 3, Quiz 2	MACN414-415
9	Nov. 8-12	Case Study Help Session	MACN414-415
10	Nov. 15-19	Lab 4: Torque and Angular Momentum, Case Study Due	MACN414-415
11	Nov. 22-26	Tutorial 4, Quiz 3	MACN414-415
12	Nov. 29-Dec. 3	Final Exam Review Sessions (TBA)	MACN414-415

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

COVID-19 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website and circulated by email.

Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

Email Communication

As per university regulations, all students are required to check their 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. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary

Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars. Undergraduate Calendar - Dropping Courses

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 book their exams at least 7 days in advance and not later than the 40th Class Day.

Academic Integrity

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 encourages academic integrity. 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. Undergraduate Calendar - Academic Misconduct

Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, 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 that apply to undergraduate, graduate, and diploma programs. Academic Calendars