

IPS*1510 Interdisciplinary Mathematics and Physics
Department of Mathematics and Statistics; Department of Physics

Course Outline, Winter 2019

	Name	Office	e-mail
Professors:	Daniel Ashlock	MacNaughton 521	dashlock@uoguelph.ca
	Martin Williams	MacNaughton 213	martin.williams@uoguelph.ca
Tutorial Instructors:	Amanda Saunders (math)		asaunder@uoguelph.ca
	Christina Burbadge (phys.)		cburbagd@uoguelph@uoguelph.ca
	Matt Steffler (phys.)		stefflerm@uoguelph@uoguelph.ca

Course Description:

This is the second 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. Thermodynamics, integration, electrostatics, magnetism, partial derivatives, multidimensional integrals, waves, Taylor's series, and spectroscopy are presented in a harmonized fashion to ensure students have an improved understanding of these fundamentals.

Prerequisites: IPS*1500

Restrictions: MATH*1210, PHYS*1010. 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 topics is intended to make both sets of material easier to absorb. Specific topics are listed subsequently under the heading *Course Topics*.

Meeting Times

Lectures: **Math:** 2:30-3:20 in **LA 204**, **Physics:** 1:30-2:20 in **MACN 113**

Lab Times		
Section	Time	Location
0102	Wed. 7:00-9:20	MacNaughton 301/415
0103	Tues. 11:30-2:20	MacNaughton 301/415
0104	Thurs. 11:30-2:20	MacNaughton 301/415
0106	Thurs. 7:00-9:20	MacNaughton 301/415
0107	Tues. 11:30-2:20	MacNaughton 301/415
0108	Thurs. 11:30-2:20	MacNaughton 301/415
0109	Tues. 7:00-9:50	MacNaughton 301/415
0110	Tues. 7:00-9:50	MacNaughton 301/415
Mathematics Tutorial Times*		
Friday 8:30-9:20 MacDonald Institute 103 or Friday 9:30-10:20 MacDonald Institute 103		
The quiz bowls will be given during the math labs		

Course Materials

University Physics, 14th Edition, Volumes 1, 2, and 3, by *H. Young and R. Freedman* (this was also used in IPS*1500 in Fall 2016). This book is available in the University Bookstore.

Fast Start Calculus for Physics, 3rd Edition, by *D. Ashlock* This book is available in the University Bookstore and the Co-op Bookstore.

i-Clicker Student Response Units (commonly known as *clickers*) are available for purchase in the University Bookstore.

Library Reference Material

A copy of the course textbooks will be made available at the Reserve Desk in the Library, listed under Prof. D. Ashlock/M. Williams and course IPS*1510. 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 Quiz Bowl (10)	10 %
Math Homework (9)	10 %
Physics Homework (4-6)	10 %
Physics Reading/Class Quizzes	5 %
Lab Experiments (5)	10 %
Midterms (2)	25 %
Final Exam	30 %
Total	100%

Math Quizzes: Mathematics tutorials will be run as a quiz bowl this semester. The participants will be divided into two groups and compete. A deck of questions on current and review topics will be used. See the Courselink site for the quiz bowl rules.

Physics Homework: Problem sets will be regularly assigned; due dates will typically be on the Monday following tutorial weeks. Any variation to this will be announced in class at the time that assignments are released. Drop boxes for assignments can be found in the hallway of the 4th floor of the MacNaughton building; details will be provided in the first week of class.

Physics Reading/Class Quizzes: Throughout the semester regular readings will be assigned and accompanied by short online quizzes (Courselink). Additionally, regular in-class activities, such as i-Clicker quizzes, will be evaluated.

Laboratory Experiments: The laboratory experiments (see schedule) are described in detail in the Laboratory Manual. Experiments are to be completed and reports handed in during the laboratory period. The laboratory experiments will be done in MacN 301. If you miss a quiz or a lab, you must provide your TA with a written explanation for possible academic consideration.

Midterm Examinations: The midterm examination will be held outside of class time on Thur. Feb. 7 and Thur. Mar. 21 (time & location TBA). The midterms will consist of both multiple-choice questions, and longer problems. More details will be provided by the Professors as the semester progresses.

Final Examination: The final examination, time and date given in the university schedule, will cover the entire course.

Tutorial Periods: The tutorial periods will be largely be devoted to the development of problem-solving skills, but may also introduce additional new material which will complement topics provided in lecture. Additionally, Math Quizzes will be given in the math tutorial.

Course Topics, by Week

Week	Physics topics	Young and Freeman	Math topics	Fast Start Calculus
Jan. 7-11	Electric charges, forces and fields	Ch 21	Implicit differential and related rates	2.5
Jan. 14-18	Electric force and field calculations	Ch 21	Partial derivatives, gradients, directional derivatives	10.1, 10.2
Jan. 21-25	Work, Energy, Electric Potential	Ch 23	Tangent planes and optimization	10.3, 11.1
Jan 28-Feb 1	Dipoles, Electric Flux, Gauss' Law	Ch 21, 22, 24	The extreme value theorem, redux	11.2
Feb. 4-8	Capacitance, Dielectrics, Circuits	Ch 24, 25	Constrained optimization	Midterm 1 11.3
Feb. 11-15	Circuit analysis: Ohm's Law	Ch 25, 26	Volumes of rotation, arc length	12.1,12.2
Feb. 18-22	Winter Break			
Feb. 25-Mar. 1	Circuit analysis: Kirchhoff's Rules	Ch 26	Surface area and review of integration	12.2, 7.1-7.5
Mar. 4-7	Magnetism, Lorentz Force Law	Ch 27	Multiple integrals, center of mass	12.3
Mar. 11-15	Magnetic fields, Ampere's Law	Ch 28	Sequences and geometric series	13.1
Mar. 18-22	Induction, Faraday-Lenz Law	Ch 29	Series convergence tests	Midterm 2 13.2
Mar. 25-29	mechanical waves, interference	Ch 15, 32, 35, 36	Power series and Taylor series	13.3-13.4
Apr. 1-5	EM waves, modern physics	Ch 32, 38	Review and reflection	1.1-13.4

Physics Tutorial/Lab Schedule:

1	Jan 7-11	No Lab or Tutorial	
2	Jan 14-18	Tutorial	MacN 401
3	Jan 21-25	Lab 1: Electrostatic field mapping	MacN 301
4	Jan 28- Feb 1	Tutorial	MacN 401
5	Feb 4-8	Lab 2: Ohm's law	Midterm 1 MacN 301
6	Feb 11-15	Tutorial	MacN 401
	Feb 18-22	Winter break No classes/tutorials/labs	
7	Feb 25 - Mar 1	Lab 3: Kirchoffs laws	MacN 301
8	Mar 4-8	Tutorial	MacN 401
9	Mar 11-15	Lab 4: charge-mass ratio of electron	MacN 301
10	Mar 18-22	Tutorial	Midterm 2 MacN 401
11	Mar 25-29	Lab 5: Photoelectric effect	MacN 301
12	Apr 1-5	Tutorial	MacN 401

Getting Help

1. Your best source of help is your tutorial/lab instructor during the tutorial/lab period and, in math, the instructors office hours.
2. In most of the ten physics lab/tutorial periods, the activities are completed in the first two and a half hours, and hence the lab/tutorial instructor usually has a great deal of time in the final 30 minutes to help students. Please feel free to drop in during the final 30 minutes of any of the tutorial periods to obtain help.
3. The math-stats and physics learning centers on the 3rd floor of the library is available for help during their posted hours.
4. The course professors will be available to provide help in their offices (Physics: MacN 213, Math: MacN 521) during their posted office hours. These are given on courselink. If you wish to obtain help from your professor at another time, please see him before or after lectures to arrange a mutually convenient time. Short questions can often be handled in the lecture room just before or after lectures.
5. Computer Tutorials: There are a number of physics tutorials available for you on the Physics Department tutorial webpage ([www.physics.uoguelph.ca /tutorials/tutorials.html](http://www.physics.uoguelph.ca/tutorials/tutorials.html)). 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

Rights and Responsibilities

Conflicts with Midterms in Other Courses. Sometimes students will have a conflict between a midterm exam in another course and either a lecture or a lab in this course. The University has a very clear policy to cover this situation: the regularly-scheduled lecture or lab holds priority. In other words, it is the responsibility of the faculty member who has scheduled the midterm exam to make special arrangements with students who have conflicts. This policy is stated explicitly in the 2016-2017 Undergraduate Calendar <http://www.uoguelph.ca/registrar/calendars/undergraduate/2016-2017/> in Section VIII–Undergraduate Degree Regulations and Procedures under the heading *Examinations* (sub-heading *Mid-Term Examinations*).

Collaboration: This course encourages collaborative teamwork, a skill that is an essential feature of science, and valued by most employers. Scientists and engineers work in groups as well as alone. Social interactions are critical to their success! Most good ideas grow out of discussions with colleagues. As you study together, help your partners to get over confusions, ask each other questions, and critique your assignments and lab write-ups. Teach each other. You can learn a great deal by teaching. While students are encouraged to share ideas, all material submitted for grading must be each student's own work. Plagiarism is a form of academic misconduct, and will not be tolerated.

Attendance: Illness, etc.: Attendance at the tutorial/lab periods is, of course, very important. If you miss a tutorial quiz or laboratory experiment because of illness or for compassionate reasons, please see your laboratory/tutorial instructor for possible academic consideration. If you miss the midterm exam, please see a course professor. If you miss the final exam, please see your Program Counsellor.

For more details, refer to the Undergraduate Calendar: <http://www.uoguelph.ca/registrar/calendars/undergraduate/2016-2017/>

– go to *Section VIII Undergraduate Degree Regulations and Procedures*, and click on the heading *Academic Consideration, Appeals and Petitions*.

Formula Sheet. You may bring a single normal sheet of printer or notebook paper with notes and formulas on both side to examinations including the math quiz bowl. A formula sheet will not be provided as part of the examinations.

Course Feedback: Both sponsoring departments 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's 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's Tenure and Promotions Committee **only considers comments signed by students (choosing "I agree" in question 14)**. 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.

Electronic Recording of Classes: The electronic recording of classes is expressly forbidden without the prior consent of the instructor. This prohibition extends to all components of the course, including, but not limited to, lectures, tutorials, and lab instruction, whether conducted by the instructor or teaching assistant, or other designated person. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

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 detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08>

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact SAS at **519-824-4120 ext. 56208** or email accessibility@uoguelph.ca or see the website: <https://wellness.uoguelph.ca/accessibility>

Drop date

The last date to drop one-semester courses, without academic penalty, is Friday March 8th, 2019. For regulations and procedures for Dropping Courses, see the Academic Calendar:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/2018-2019/>