

PHYA21H
Introduction to Physics IIA
(*Physics for Physical Scientists*)

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COURSE DESCRIPTION:

This course covers the main concepts required for an understanding of Longitudinal and Transverse Waves, Electricity and Magnetism and Special Relativity. It provides an introduction to these topics with particular emphasis on developing a mathematical framework for problem solving and analysis. However, many important breakthroughs in the understanding of physics have resulted from observation. Consequently, there will be a substantial emphasis on empirical work in the weekly laboratories as well theoretical investigation.

Physics is, arguably, the most fundamental branch of science, and in some ways it is the most simple. Physicists start with a big, often complicated, problem and they first simplify it as much as they possibly can. Once simplified they try to analyze the situation. They then gradually introduce more complications, one at a time, until they eventually end up with a model that can be applied to situations encountered in nature.

LECTURES:

Lectures will be given online using Zoom. University of Toronto Zoom licences are required on the device being used to attend the online lecture. Instruction on how to install the Zoom software is given in a document posted on the PHYA21 Quercus homepage.

Lectures will occur starting at 4:10 and 5:10, Tuesdays, and 4:10 on Thursdays. Each week, lecture links will be posted on the course homepage in a Module on the course Quercus page. Lecture overheads will be posted online in pdf format. Lecture recordings will also be saved to the course website. Lecture attendance is encouraged but will not be monitored. There will not be any in-lecture component that will contribute to the final grade.

Lectures may switch to an in-person format in February or March. This will be determined by continual reappraisal of the University's COVID protocols.

Lectures will often be structured on the assumption that you have read the textbook before coming to lecture. Please see the lecture/reading schedule later in this document.

Note: Uploading the lecture recordings or slides prepared for students in this course to any publicly accessible website is a COPYRIGHT INFRINGEMENT. Publishers may choose to track copyright violators and prosecute. There is absolutely no reason for students in this course to re-post course notes on any site. Please consider the consequences and respect my effort to organize and annotate

the slides as well as the course text publisher's investment in producing the figures appearing on slides. Redistribution is illegal and also helps drive-up the cost of course materials (i.e., texts and ebooks).

PRACTICALS:

Practicals start in Week 2.

Students registered in the course are expected to enrol in one practical session. Online practicals will be two hours in duration, In person practicals may occur later in the course if permitted by health and safety guidelines. Unlike the lectures, attendance at the practicals is mandatory and unexcused absences will result in a penalty to your grade (see below for more details). Moreover, you must attend the practical that you are enrolled in, you can be and will be asked to leave practicals classes that you are not enrolled in. Some Practical will be like traditional labs where you have an experiment to perform (if online, this means to watch on video) and you must submit a formal report. Many, however, will be based on group exercises covering conceptual material from the lectures.

COURSE MATERIAL:

The course text is *Physics for Scientists and Engineers (5th edition)* by Knight. Copies are available at the UTSC bookstore but the suggested choice is an e-book copy. There are a variety of formats (including an e-book). If you already own another reference physics text for first year content, I recommend that you only consider subscribing to the e-book for the duration of this course. As we will not be using Mastering Physics in PHYA21, you do not need to get a package which includes it. If you get an older edition of the text that should also be adequate for supporting you in this course - and more economical (though page numbers and back of the chapter questions may differ from the 5th edition).

You do NOT need to purchase a lab manual for this course!

OFFICE HOURS:

The holding of office hours will be challenging due to the COVID protocol situation. In particular, office hours may need to be group events. In general, I will try to remain online to take questions at 5pm on Thursdays, after the preceding lecture. These discussions will necessarily be group chats.

There is also a course Discussion page where questions can be posted for a response within a few days, or less.

If students email me asking that I hold online office hours in a specific week, I will set this up via Zoom. Generally, the hours I'll be available are Tuesdays and Thursdays 1130-1230. If you cannot make these times due to a scheduling conflict it may be possible to schedule office hours at different times. However, you will be required to show me a copy of your time-table in order to verify the time-table conflict if you are asking for an appointment at another time. Please setup an appointment via e-mail (see next), and expect it to take a few days (so don't wait until the day

before your midterm to try to visit).

E-MAIL:

You must include “PHYA21” in the subject line. Only e-mail sent from official University of Toronto mail accounts will be acknowledged (i.e., no gmail etc). For questions about the course content and schedule, please use the Discussion Board on the course Quercus site. For one thing, another student might answer you more quickly than I do. However, in particular you can see each others questions with the posted answer. This means I won’t receive multiple e-mails asking the same question and it also means that all students will see the same answer - thus you won’t wonder if somebody else got a more thorough answer. A good idea is to post a question on Quercus and send me an e-mail saying “I’ve just posted a question”. In that case you’ll get a quicker response and the dialogue will remain transparent to the entire class.

For medical and other personal issues please contact me via e-mail. Don’t expect immediate responses, however, if I do not reply within 48 hours, you should send me a reminder e-mail - as my Inbox can get rather full (typically 60 new emails a day). Always include PHYA21 in the subject and your full name at the end of the e-mail.

ASSESSMENT:

FINAL EXAM:	40%
MIDTERM:	20%
FIVE PRACTICAL QUIZZES:	10% in total
FOUR PROBLEM ASSIGNMENTS:	10% in total
WEEKLY PRACTICAL GROUP WORK:	10% in total for notes in a group lab book
TWO FORMAL LAB REPORTS:	4% and 6%, 10% in total

MIDTERM AND EXAM:

Both the term test and final exam will draw from the lectures, practicals and textbook. This could include material presented in the lectures or practical material that is not covered in the textbook. It could also include assigned reading material that was covered in the textbook but not explicitly discussed in lectures.

All tests and exams are cumulative.

For in-person tests, you will be allowed to bring a single 8.5” by 11” aid-sheet, double sided, and hand-written (no photocopies) to the midterm and exam. This aid sheet can feature whatever you wish. **The same size restrictions apply for the midterm and exam - ONE SHEET ONLY** - so you will have to redo your aid sheet for each test.

There will be no make-up midterm. If you miss the test for an excusable reason (usually medical) the weighting of the missed test will be added to the formal labs and exam (each increased by 10%). If you miss the midterm for an invalid reason you will receive a zero with no make-up opportunity.

PRACTICAL QUIZZES:

Every other week a list of suggested problems from the textbook will be identified. During alternating practical sessions there will be a quiz. These single question quizzes will be based on the suggested problems. The 10 minute quizzes should also be simple if you practice problems given in the course text. Questions on the tests and exam will likely be more challenging than the quiz questions.

ASSIGNMENTS:

There will be four assignments handed out during the term. These will feature slightly more involved problems than those you will be doing in the practicals or on the quizzes. You will be given two weeks for each assignment and, most importantly, this must be your own work. That is, each student will receive a mark as an individual. Of course, it is fine to discuss the problems with your classmates but solutions must not be copied. Plagiarism will incur strict penalties as provided by the University's policy on Academic Dishonesty. Of course, sharing your answers can effectively drive down your own mark by bringing up the relative course average (i.e., encouraging a more difficult exam).

Assignments will be handed-in to an electronic drop box and must be submitted by 5pm on the day they are due. Photographed hand-written pages submitted in pdf format are sufficient but typed solutions are of course most welcome. Hand-written work must be neat. (A TA marking the same question 175 times may quickly lose patience and assign a poor mark if they cannot read your work. This course will employ six TAs responsible for all marking but the final exam.) Assignments that arrive late will receive a penalty of 50% after 5pm on the due date up until 5pm the next day. Assignments received after this will get a mark of zero. Thus it is probably best for your grade to submit an incomplete assignment on time, rather than continuing to work on a late assignment.

PRACTICALS:

There will be ten (11) weeks of Practicals. Two of those weeks will be Lab based (or feature virtual experiments) and will require you to produce a formal lab report. The first Lab formal report will be worth 4% of your final grade. The final Lab formal report will be worth 6% of your final grade. Please make sure you submit original work! If you are caught plagiarizing, the situation will be dealt with.

All Practical work, including the labs, will be done in groups (two or three students per group, not more not less). Lab reports will be submitted one per group. **A consistent STYLE is important!** If you submit a Frankenpaper (three sections written in three very different ways and then crudely stitched together) your grades will suffer. Make sure you get organized and hand in a report that is well written! I recommend nominating one person to be the editor and have them do a little less writing and more editing so that the final report reads uniformly and is polished.

The non-Lab Practicals will include problem-solving in groups. One member of your team will be required to record your work. Each week, **two** of the activities you do will be graded. During the lab Practicals, the notes you take will count as activities and will be similarly graded with similar weights to the other Practical sessions. Thus every week's Practical will generate grades. These

marks will sum up to your 10% grade for Practical work.

Finally, since the Practicals are team-based, it is important that you show up every week. To encourage this, a penalty to your Practical Group Work **and** Formal Lab grades will be applied. So you stand to lose up to 20% of your final grade for absences from Practicals. This penalty will be the **CUBE** of the number of absences, as a percent. If you miss four Practicals, your grade for the practicals will suffer by 64%. This is in addition to not getting credit for the group work which you missed.

If you are more than 10 minutes late (arrive at 9:20, say, instead of 9:10) you will be counted as absent, but will still get credit for the group work. Similarly, if you leave early (before your group has handed in their work) you will also be counted as absent. In other words, a time commitment to your practical work is expected.

PROBLEMS?

If you see a potential problem with your ability to participate in the course, or the assessment methods, you can speak with me or the people at ACCESS *Ability* Services who can advise us both.

TENTATIVE

LECTURE SCHEDULE

- Week 1 – Wave Speed, Interference, Standing Waves (Chapter 16)
- Week 2 – Sound Waves, Intensity, Beats & Doppler Effect (Chapter 17)
- Week 3 – Electric Charges, Forces and Fields (Chapter 22)
- Week 4 – Continuous Distributions, Potential and Motion (Chapter 23)
- Week 5 – Electrical Potential and Potential Energy, Multiple Charges (Chapter 25)
- Week 6 – Capacitance, Dielectrics, Resistance and Current (Chapters 26, 27)
- READING WEEK
- Week 7 – Circuit Laws, Circuits with Resistors and Capacitors (Chapter 28)
- Week 8 – Magnetism, Currents, Magnetic Fields and Forces (Chapter 29)
- Week 9 – Induction, Magnetic Flux, Electromagnetic Waves (Chapters 30, 31)
- Week 10 – Interference of Light, Diffraction, Time (Chapters 33)
- Week 11 – Time Dilation, Length Contraction, Lorentz Transformations (Chapter 36)
- Week 12 – Doppler for Light, Relativistic Momentum and Energy (Chapter 36)

ACADEMIC INTEGRITY AND RESPECT FOR THE ACADEMIC ENDEAVOUR

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's *Code of Behaviour on Academic Matters*:

<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>

outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- In papers and assignments: Using someone else's ideas or words without appropriate acknowledgment; submitting a piece of your own work in more than one course without the permission of the instructor; making up sources or facts; obtaining or providing unauthorized assistance on any assignment.
- On tests and exams: Using or possessing unauthorized aids; looking at someone else's answers during an exam or test; misrepresenting your identity.
- In academic work: Falsifying institutional documents or grades; falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the *Code of Behaviour on Academic Matters*. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>).