

Modern Physics for Non-Scientists

PHY B01 - Summer 2018

Lecture Tuesday 1 pm - 3 pm MW 120
Tutorial Wednesday 1 pm - 2 pm SW 505F

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Course Website: PHYB01 on Quercus/Canvas

Office Hours

Wednesday	10:30 am - 12:30 am	2:30 pm - 3:30 pm
Thursday	11:30 am - 1:30 pm	

Course Description

A conceptual overview of some of the most interesting advances in physics and the intellectual background in which they occurred. The interrelationship of the actual practice of physics and its cultural and intellectual context is emphasized. (Quantum Worlds; Spacetime; Symmetries; Chaos)

Primarily intended as a Natural Sciences Breadth Requirement for students in programs outside of the Physical Sciences, this course focuses on the study of *Modern Physics*, the change in our worldview of the physical universe that largely began with Einstein in 1905. It assumes no background in science.

Regarding the use of mathematics, note that we will not do any algebra or calculus-based problems. However, despite not using the language of mathematics, we will not shy away from delving into discussions concerning difficult questions about the key concepts and their implications. For some of these questions, the answers are unknown. Where appropriate and in place of mathematics, we will try to use analogies drawn from other fields and contexts to help us understand the material.

Required Readings

Given the broad range of subjects we will be discussing, we will not be using a printed textbook. Instead, we will refer to the notes from Dr. David Harrison as our guide. Access to each section of these notes will be made available on the course website at least two weeks in advance. You must read the notes in advance in order to profit the most from the lecture and tutorial discussions.

Grading Scheme

Component	%	Due Date
Homework	5	Ongoing (Tutorial)
Lecture Participation	5	Ongoing (Lecture)
Tutorial Work	5	Ongoing (Tutorial)
Term Paper	40	Various Dates (See Below)
Midterm Test	10	Wednesday, June 27 (Tutorial)
Final Examination	35	Exam Period (August 11 - 24)

Grade Components

Homework (5%)

We will have six (6) assignments throughout the term. Each assignment is worth **1 point** to be marked on a pass/fail basis. The deadlines will be indicated at the time these are assigned.

Lecture Participation (5%)

At the start of each lecture session a short quiz will be given based on the assigned readings. At the end of each lecture session you will write a mini-paper based on the discussions. Each quiz/min-paper is worth **1 point** and your final participation grade will be the sum of all quizzes/min-papers up to a maximum of **20 points**.

Tutorial Work (5%)

During the tutorial sessions we will discuss in more detail the material presented in the lectures. Here you will be able to engage in the difficult and interesting questions raised by the lectures and your readings, as well as talk about the assigned homework. Activities completed during the tutorials will make up this grade component. Please note that the tutorial will be the place where you submit any assigned homework and the hard-copy of your term paper.

Term Paper (40%)

Throughout the term you will work on a paper based on a topic that expands on the course material. There are three stages in the work you will complete towards the final submission:

- **Topic Selection (2%):** You must select and inform the course instructor of your idea for the topic of your term paper. Should the idea be appropriate for the course the topic will be approved, otherwise you will receive feedback on how to adjust it. You must have your topic selected and approved no later than the end of the office hours on **Wednesday, May 23**.
- **Paper Outline (8%):** Each student must submit electronically an outline for the term paper, no later than midnight on **Friday, June 22**. The outline must have the title of the paper, a brief abstract or an outline describing the topic, and an annotated bibliography. The penalty for late submission of the outline is of 10% per day of lateness.
- **Final Paper (30%):** The final paper must be ten (10) letter-sized pages in length, double-spaced with standard 12 point fonts and 2.5 cm margins on all sides. The paper must be submitted electronically to **turnitin.com** by **11:59 pm** on **Tuesday, July 31**. An identical hard-copy version of the paper must be handed-in during the tutorial session on **Wednesday, August 01**. The penalty for late submission of the paper is of 10% per day of lateness.

Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site..

Midterm Test (10%)

The midterm test will take place during the tutorial session of **Wednesday, June 27**. Material for this test will include all the topics from the assigned readings, lecture and tutorial discussions, as well as homework assignments, up to and including **Week 6**. The midterm test will be **1 hour** long and the format includes conceptual multiple-choice questions as well as short essay questions. No aids are allowed.

Final Examination (35%)

The final examination will be scheduled during the exam period of **August 11 - 24**. Material for the final examination will include all the topics from the assigned readings, lecture and tutorial discussions, as well as homework assignments. The final examination will be **3 hours** long and the format includes conceptual multiple-choice questions as well as short essay questions. No aids are allowed.

Class Policies

Name and Student Number

Any work you hand in must clearly indicate your name and student number, this includes homework assignments, lecture participation quizzes/mini-papers, tutorial activities, term paper components, midterm tests, and the final exam. Any work you submit that fails to meet this requirement will be penalized with a 10% deduction, provided we are able to identify the work as yours. If we are unable to identify the work as yours, a grade of zero will be awarded.

In-class Conduct

- Class and tutorials starts at 1:10 pm, and end at 3:00 pm on Tuesday and 2:00 pm on Wednesday. Late arrival or early departure from class or tutorials is inappropriate and will negatively affect your participation grade.
- Regarding anything that you want to use in the classroom: if you are not using it to perform a task specifically related to what we are doing in class at that very moment, you must put it away. This includes but is not limited to cell phones, laptop computers, tablets, and other electronic devices.
- Do not bring food into the classroom as this creates unwanted distractions that will negatively affect the learning environment. Be considerate to your peers.

e-mail

If you want to ask a question via e-mail, please first check the **Discussions** section of the course website. Quite likely, you are not the only person with that same question, and if that question has already been asked, you will find the answer there. If the question has not been asked, go ahead and post it yourself instead of sending it by e-mail. This way you will also help other students facing the same issue. This section is monitored regularly by the course instructor and your peers, making it the best way of communicating for various queries of a diverse nature.

However, if you believe these electronic discussions are not the best place for your query, make sure you send your e-mail from an official **utoronto.ca** address (e.g., your UTmail+ account), as all other addresses will be filtered out automatically. Furthermore, include the code **PHYB01** somewhere in the subject line of your message, to ensure a quicker response time. I respond to e-mails within a period of 24 hours and I rarely reply to e-mails during weekends.

Absences

In order to ensure fairness in the assessment of all students, there will be no makeup options for homework assignments, lecture participation, tutorial work, or the midterm test. In the case of a **valid** and **documented** problem that supports an absence to a lecture or tutorial, the grade will be calculated on the basis of all other submitted work. In the case of a **valid** and **documented** problem that supports an absence to the midterm test, the final examination will have its weight increased accordingly. If the problem is health-related you must use the official form available [here](#) on the Registrar's Website.

Academic Integrity and Respect for the Academic Endeavor

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 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; using someone else's clicker or multiple clickers for participation grades.
- 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 <https://www.uts.utoronto.ca/vpdean/academic-integrity>).

Course Support

AccessAbility

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the *AccessAbility* Services Office as soon as possible.

I will work with you and *AccessAbility* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC *AccessAbility* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@uts.utoronto.ca

Website Discussions

The course website supports electronic forums useful for questions and discussions on course content, conceptual and detailed problems, assigned readings, as well as any issues relating to administrative details of the course such as deadlines, future topics, and scheduling.

It is recommended that you check these sections on a regular basis to keep on top of current issues. You can subscribe to the various discussions in order to receive notifications when new posts are available.

Class Topics

This is a *tentative* list of topics that I would like to discuss during the course; it might change during the term in order to accommodate variations in the lectures in response to feedback from students. Announcements will be made whenever needed. This list follows material discussed in previous years in a similar course offered by Dr. David Harrison, author of most of the documents we will be using as assigned readings.

SPACETIME

What is the structure of space and time? How does that structure interact with the matter that exists in both space and time? Why do people call it spacetime in one word?

SYMMETRY

What happens in the world that allows for symmetric structures? What happens in our minds that perceives symmetric structures? What do we really see when we look in a mirror? Mirrors are often not allowed in Zen monasteries. A discussion on symmetries will bring us to notions of antimatter.

THE ARROW OF TIME

What distinguishes the future from the past? Is there such a moment as the present? This topic can easily lead us to a discussion of the 2nd Law of Thermodynamics, or a discussion on the emergence of structures. Alternatively, we can talk about chaos and the effect of computing technology on the way science is done.

QUANTUM WORLDS

Is there a reality separate from its observation by sentient beings? Does the same cause necessarily lead to the same effect? If we have time in our discussions, we might be able to delve into the Einstein-Podolsky-Rosen paradox and Bell's theorem.

HIGH ENERGY

This topic is usually called Elementary Particle Physics, which is somewhat misleading in that it assumes that there are such things as elementary particles. In addition to discussing the quark model of elementary particle physics, we will discuss an alternative view often called the bootstrap model and string theory as one example.